

**A. Azamov, B. Haydarov, E. Sariqov,  
A. Qo'chqorov, U. Sag'diyev**

# **GEOMETRIYA**



**7**

**TASHKENT  
"YANGIYUL POLIGRAPH SERVICE"  
2013**

22.151  
G35

**Geometriya. 7:** Uli'wma orta bilim beriw mekteplerinin' 7-klasi' ushi'n sabaqli'q/A. Azamov, B. Haydarov, E. Sariqov ha'm basq. – Tashkent: Yangiyul poligraph service, 2013. – 160 b.

I. Azamov, Abdulla

BBK 22.151ya72

P i k i r b i l d i r i w s h i l e r:

- A. Ya. Normanov,** fizika-matematika pa'nlerinin' doktori', professor, O'zbekstan Milliy Universiteti geometriya ha'm a'meliy matematika kafedras'i basli'g'i';
- S. X. Saidaliyeva,** pedagogika pa'nlerinin' kandidati', matematika ha'm woni' oqi'ti'w metodikasi' kafedras'i' dotsenti;
- B. Q. Eshmamatov,** fizika-matematika pa'nlerinin' kandidati', Tashkent qalasi' №6 ga'nigelestilgen maktab direktori';
- M. M. Shaniyazova,** Tashkent qalasi' №300 mekteptin' matematika mug'allimi.

7-klasta geometriyani'n' planimetriya bo'limin – tegis geometriyalig' figuralarin' qasiyetlerin u'zliksiz tu'rde u'yreniwge kirisiledi. Bunda siz a'piwayi' geometriyalig' figuralar ha'm wolardin' tiykarg'i' qasiyetleri, geometriyalig' wolshemler, u'shmu'yeshlikler, wolardin' tu'rleri ha'm qasiyetleri, u'shmu'yeshliklerdin' ten'lik belgileri, parallel tuwri'lar ha'm wolardi'n' qasiyetleri, u'shmu'yeshliktin' ta'repleri ha'm mu'yeshleri arasi'ndag'i' qatnaslar ha'mde jasawg'a tiyisli ma'seleler menen tani'sasi'z.

“Geometriya-7” sabaqli'g'i'ni'n' mazmuni' aksiomatikalig'q sistema tiykari'nda du'zilgen bolsa da, teoriyalig'q materiallardi' yerkin tu'rde, a'piwayi' ha'm tu'sinikli tilde an'lati'wg'a ha'reket yetilgen. Barli'q tema ha'm tu'sinikler turmi'stag'i' ushi'rasatug'i'n tu'rli mi'sallar menen ashi'p beriledi. Ha'r temadan son' keltirilgen sorawlar, da'lillewge, yesaplawg'a ha'm jasawg'a tiyisli ko'plep ma'sele ha'm mi'sallar sizdi do'retiwshilik pikirlawge iytirmeleydi, wo'zlestirilgen bilimlerde teren'lestiriwge ha'm bekemlep bari'wg'a ja'rdem beredi.

Sabaqli'q wo'zine say dizayi'n ha'm sabaqli'q materiallari'ni'n' ko'rgizbeli yetip usi'ni'li'wi' menen aji'rali'p turadi'. Bunda berilgen su'wret ha'm si'zi'lmalar sabaqli'q materiallari'n jaqsi'lap ug'i'p ali'wi'n'i'zg'a xi'zmet yetedi.

“Geometriya-7” sabaqli'g'i' uli'wma bilim беретug'i'n mekteplerdin' 7-klass woqi'wshi'lari'na arnalg'an, wonnan geometriyani' wo'z betinshe u'yrenbekshi ha'm ta'kirarlamaqshi' bolg'an kitapqumarlar da paydalani'wi' mu'mkin.

**“Ma'mleketlik byudjet qarji'lari' esabi'nan basi'p shi'g'ari'ldi'”. Biypul.**

## M A Z M U N I'

### I bap. Planimetriya. Baslang'i'sh geometriyalig' mag'li'wmatlar

|                                                                                      |    |
|--------------------------------------------------------------------------------------|----|
| 1. Geometriya pa'ni ha'm predmeti. Geometriya pa'ninin' wazi'ypalari' .....          | 6  |
| 2. Yen' a'piwayi' geometriyalig' figuralar: noqat, tuwri' ha'm tegislik .....        | 11 |
| 3. Kesindi ha'm nur .....                                                            | 14 |
| 4. Kesindilerdi sali'sti'ri'w .....                                                  | 16 |
| 5. Kesindinin' uzi'nli'g'i' ha'm woni'n' qa'siyetleri. Kesindilerdi wo'lshe'w .....  | 20 |
| 6. Shen'ber ha'm do'n'gelek .....                                                    | 24 |
| 7. A'meliy shi'ni'g'i'w .....                                                        | 26 |
| 8. Mu'yesh. Mu'yeshlerdi sali'sti'ri'w. Bissektrisa .....                            | 28 |
| 9. Mu'yeshlerdi wo'lshe'w. Transportir .....                                         | 31 |
| 10. 1-baqlaw jumi'si' .....                                                          | 31 |
| 11. Mu'yeshin' tu'rleri: tuwri', su'yir ha'm dog'al mu'yeshler .....                 | 36 |
| 12. Qon'si'las ha'm vertikal mu'yeshler ha'mde wolardi'n' qa'siyetleri .....         | 37 |
| 13. Geometriyani' u'yreniwde pikirlerdin' izbe-izligi ha'm baylani'sli'li'g'i' ..... | 39 |
| 14. Perpendikulyar tuwri'lar .....                                                   | 42 |
| 15. Kerisinshe'sin wo'ylap da'lillew usi'li' .....                                   | 44 |
| 16. A'meliy shi'ni'g'i'w .....                                                       | 48 |
| 17. Bilimin'izdi si'nap ko'rin' .....                                                | 51 |
| 18. 2-baqlaw jumi'si' .....                                                          | 57 |

### II bap. U'shmu'yeshlikler

|                                                                                         |    |
|-----------------------------------------------------------------------------------------|----|
| 19. Si'ni'q si'zi'q. Ko'pmu'yeshlik .....                                               | 59 |
| 20. U'shmu'yeshlik. U'shmu'yeshlikin' tu'rleri .....                                    | 62 |
| 21. U'shmu'yeshlikin' tiykarg'i' yelementleri: mediana, biyiklik ha'm bissektrisa ..... | 64 |
| 22. U'shmu'yeshliklerdin' ten'luginin' birinshi (TMT) belgisi .....                     | 67 |
| 23. Ten' qaptalli' u'shmu'yeshlikin' qa'siyetleri .....                                 | 70 |
| 24. U'shmu'yeshliklerdin' ten'luginin' yekinshi (MTM) belgisi .....                     | 73 |
| 25. U'shmu'yeshliklerdin' ten'luginin' u'shinshi (TTT) belgisi .....                    | 75 |
| 26. Kesindinin' orta perpendikulyari'ni'n' qa'siyeti .....                              | 77 |
| 27. A'meliy shi'ni'g'i'w .....                                                          | 78 |
| 28. Bilimin'izdi si'nap ko'rin' .....                                                   | 80 |
| 29. 3-baqlaw jumi'si' .....                                                             | 85 |

### III bap. Parallel tuwri'lar

|                                                             |    |
|-------------------------------------------------------------|----|
| 30. Tuwri'lardi'n' parallelligi .....                       | 87 |
| 31. Yeki tuwri' ha'm kesiwshi payda yetken mu'yeshler ..... | 89 |
| 32. Yeki tuwri'ni'n' parallellik belgileri .....            | 91 |
| 33. Yeki tuwri'n' parallellik belgileri (dawami') .....     | 93 |

|                                                                         |     |
|-------------------------------------------------------------------------|-----|
| 34. Keri teorema .....                                                  | 95  |
| 35. Yeki parallel tuwri' ha'm kesiwshi payda yetken mu'yeshler .....    | 97  |
| 43. Sa'ykes ta'repleri wo'z-ara parallel bolg'an mu'yeshler .....       | 106 |
| 44. Sa'ykes ta'repleri wo'z-ara perpendikulyar bolg'an mu'yeshler ..... | 107 |
| 35. Bilimin'izdi si'nap ko'rin' .....                                   | 100 |
| 37. 4-baqlaw jumi'si' .....                                             | 113 |

#### **IV bap. U'shmu'yeshliktin' ta'repleri ha'm mu'yeshleri arasi'ndag'i qati'naslar**

|                                                                                       |     |
|---------------------------------------------------------------------------------------|-----|
| 38. U'shmu'yeshliktin' ishki mu'yeshlerinin' qosi'ndi'si' haqqi'ndag'i' teorema ..... | 106 |
| 39. U'shmu'yeshliktin' si'rtqi' mu'yeshinin' qa'siyeti .....                          | 109 |
| 40. Ma'selelerdi sheshiw .....                                                        | 111 |
| 41. Tuwri' mu'yshli u'shmu'yeshliktin' qa'siyetleri .....                             | 112 |
| 42. Tuwri' mu'yeshli u'shmu'yeshliklerdin' ten'lik belgileri .....                    | 115 |
| 43. Mu'yesh bissektrisasi'ni'n' qa'siyeti .....                                       | 118 |
| 44. U'shmu'yeshliktin' ta'repleri ha'm mu'yeshleri arasi'ndag'i' qatnaslar .....      | 120 |
| 45. U'shmu'yeshliktin' ten'sizligi .....                                              | 122 |
| 46. Bilimin'izdi si'nap ko'rin' .....                                                 | 123 |
| 47. 5-baqlaw jumi'si' .....                                                           | 128 |

#### **V bap. Jasawg'a tiyisli ma'seleler**

|                                                                                        |     |
|----------------------------------------------------------------------------------------|-----|
| 48. Sirkul ha'm si'zg'i'sh ja'rdeminde jasawg'a tiyisli ma'seleler .....               | 130 |
| 49. Berilgen mu'yeshke ten' mu'yeshi jasaw .....                                       | 133 |
| 50. Mu'yesh bissektrisasi'n jasaw .....                                                | 134 |
| 51. Berilgen tuwri'g'a perpendikulyar tuwri' jasaw. Kesindini ten' yekige bo'liw ..... | 136 |
| 52. U'shmu'yeshlikti berilgen u'sh ta'repi boyi'nsha jasaw .....                       | 139 |
| 53. Bilimin'izdi si'nap ko'rin' .....                                                  | 141 |
| 54. 6-baqlaw jumi'si' .....                                                            | 141 |

#### **VI bap. Ta'kirarlaw**

|                                                 |     |
|-------------------------------------------------|-----|
| 55. Geometriyalig' ma'selelerdi sheshiw .....   | 143 |
| 56. Yesaplawg'a tiyisli ma'seleler .....        | 145 |
| 57. Da'lillewge tiyisli ma'seleler .....        | 147 |
| 58 – 59. Ta'kirarlawg'a tiyisli ma'selele ..... | 149 |
| 60 – 61. Bilimin'izdi si'nap ko'rin' .....      | 150 |
| 62 – 63. Juwmaqlawshi' baqlaw jumi'si' .....    | 155 |
| Juwaplar ha'm ko'rsetpeler .....                | 156 |

# I BAP



*Axmad Farg'aniy-  
din' qayta qurg'an  
Nil da'riyasi'  
suwi'ni'n' qa'ddin  
wo'lshew quri'lmasi'  
(IX a.)*

## PLANİMETRIYA. BASLANG'ISH GEOMETRIYALI'Q MAG'LIWMATLAR

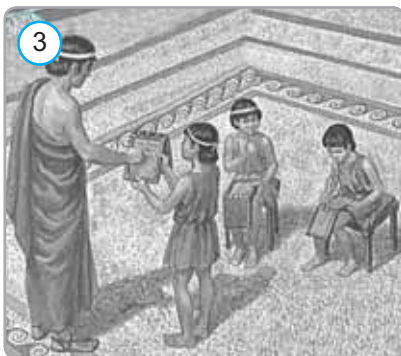
Bul bapti' u'yrenip shi'qqannan keyin, to'mendegi bilim ha'm a'meliy ko'nlikpelerga iye bolasi'z:

### Bilimler:

- Geometriya tariyxi'na tiyisli tiykarg'i' mag'li'wmatlardi' biliw;
- noqat, tuwri', tegislik, kesindi, nur, mu'yesh si'yaqli' da'slepki geometriyali'q tu'siniklerge iye boli'w;
- da'slepki geometriyali'q tu'siniklerdin' tiykarg'i' qa'siyetlerin biliw;
- geometriya ha'm planimetriya ta'riyplemesin biliw;
- tuwri', su'yir ha'm dog'al mu'yeshlerdi aji'rata biliw;
- qon'si'las ha'm vertikal mu'yeshler ha'm de wolardi'n' qa'siyetlerin biliw;
- ani'qlama, aksioma, teoriya ha'm da'lillew tu'siniklerini'n' a'hmiyetine tu'sinip jetiw;
- kerisinshe woylap da'lillew usi'li'n biliw.

### A'meliy ko'nlikpeler:

- Tiykarg'i' geometriyali'q figuralardi' tegislikte su'wretlew, belgilew, aji'rata ali'w ha'm belgileri boyi'nsha oqi'w;
- kesindilerdi ko'shirip qoyi'w, wo'z-ara sali'sti'ri'w ha'm wolardi'n' uzi'nli'qlari'n wo'lshep biliw;
- mu'yeshlerdi ko'shirip qoyi'w, sali'sti'ri'w ha'm wolardi'n' gradus wo'lsheplerin taba biliw;
- geometriyali'q figuralardi' jasaw ha'm wo'lshew islerinde si'zg'i'sh, sirkul, transportir si'yaqli' oqi'w qurallari'nan paydalana ali'w.



Geometriyag'a tiyisli da'slepki tu'sinikler, bunnan 4-5 mi'n' ji'l buri'n a'yyemgi Mi'srda payda bolg'an. Sol ji'llari' Nil dariyasi'ni'n' suwi' ha'r ji'li' tasi'p, egislik maydanlari'n juwi'p turg'an. Soni'n' ushi'n, egislik jerlerdi qayta bo'listiriw ha'm sali'q mug'dari'n ani'qlaw ushi'n bul maydanlarda belgilew ha'm wo'lshew islerin wori'nlawg'a tuwra kelgen (1-su'wret). A'yyemgi grek ali'mlari' jer wo'lshew usi'llari'n mi'srli'lardan u'yrenip, woni' geometriya dep atag'an. "Geometriya" grek so'zi boli'p, "geo" – jer, "metriya" – wo'lshew degen ma'nisti an'lati'wshi' bo'limlerden du'zilgen.

Geometriyag'a tiyisli da'slepki tu'sinikler, a'yyemgi Vovilde de payda bolg'an. Sonday-aq, tariyxshi'lar Pifagor teoremasi' Vovilde tabi'lg'an dep esaplaydi'. Erami'zdan aldi'n'g'i' VII – VI a'sirlerde A'yyemgi Xarezmda de Mi'srdag'i' si'yaqli' A'miwda'riyani'n' to'mengi bo'liminde jer wo'lshew isleri ali'p barilg'an.

A'yyemgi Mi'srda geometriya ba'lent piramidalar, saraylar ha'm turaq jaylardi' quri'wda za'ru'r bolg'an. Grekler ushi'n geometriya quri'li'stan ti'sqari', ten'izde ju'ziwde de za'ru'r bolg'an (2-su'wret). Mine usi'nday a'meliy za'ru'rlikler insandi' tu'rli figuralardi' ha'm wolardi'n' qa'siyetlerin u'yreniwge iytermelegen.

A'yyemgi Gretsiyani'n' 7 dani'shpanlari'ni'n' biri bolg'an Miletlik Fales geometriyani'n' da'slepki teoremalari'n da'lillegen.

Erami'zdan aldi'n'g'i' IV a'sirge kelip, geometriyag'a baylani'sli' u'yrenilgen ko'plep tu'sinikler ha'm wolardi'n' qa'siyetleri ji'ynali'p qalg'an. Grek ali'mi' Platon geometriyada a'jayi'p bir ni'zamli'qti' bayqag'an: aldi'n' u'yrenilgen, duri'sli'g'i' tasti'yqlang'an qa'siyetlerden logikali'q pikirlew, talqi'law arqali' jan'a qa'siyetlerdi keltirip shi'g'ari'wg'a boladi' yeken. Bunday shi'ni'g'i'w oqi'wshi'lardi'n' pikirlew qa'bilyetin artti'rg'ani' ushi'n

geometriya mekteplerde tiykarg'i' pa'nge aylang'an. Ha'tteki, Platon akademiyasi'ni'n' man'layshasi'na "Geometriyani' bilmeytug'i'nlar ushi'n bul mektepke jol joq!" degen shaqi'ri'q so'zi ildirilip qoyi'lg'an yeken (3-su'wret).

A'yyemgi grek ali'mi' Evklid sol waqi'tqa shekem belgili bolg'an geometriyalig' tu'sinik ha'm qa'siyetlerdi ta'rtipke keltirip, "Negizler" dep atalg'an kitabi'nda bayan yetken. Bul kitap yeki mi'n' ji'l dawami'nda mektepler ushi'n yen' a'hmiyetli sabaqli'q wazi'ypasi'n atqardi' ha'm pa'nnin' rawajlani'wi'nda u'lken a'hmiyetke iye boldi'. Geometriyani' woqi'ti'wda ha'zirde usi' kitaptag'i' qag'i'ydalarg'a su'yenedi.

Yertede jasap wo'tken derlik barli'q ali'mlar geometriya menen shug'i'llang'an. Ulli' jerlesimiz Mammad ibn Musa al-Xarezmiy, Axmad Farg'aniy, Abu Rayxan Beruniy, Abu Ali ibn Sino, Umar Hayyam da Evklid "Negizler" in puqta u'yrenip, bul pa'nnin' rawajlani'wi'na wo'z u'lesin qosqan. Shi'g'i's ma'mleketlerinde geometriya *handasa* dep atalg'an ha'm wog'an u'lken a'hmiyet berilgen. Bul pikirdi, injener so'zinin' negizi "handasa" yekenligi de tasti'yqlap turadi'.

Bizdi qorshap turg'an ha'r bir predmet qanday da bir formag'a iye. Ma'selen gerbishti alayi'q. Wol 5-klastan sizge tani's bolg'an tuwri' mu'yeshli parallelepiped formasi'nda boladi' (4-su'wret). Bunnan basqa woni'n' 8 to'besi bar – bular noqatlar boladi', 12 qi'ri' bar – bular kesindiler boladi', 6 qaptal (ta'repi) jag'i' bar – bular tuwri'mu'yeshlikler boladi'.

Noqat, tuwri', kesindi, mu'yesh, u'shmu'yeshlik, kvadrat, shen'ber, kub, shar, si'yaqli' qatar geometriyalig' figuralar menen siz to'mengi klaslarda



Geometriya — geometriyalig' figuralar ha'm wolardi'n' qa'siyetleri haqqi'ndag'i' pa'n.

tani'sqansi'z (5–7- su'wretler).

7-su'wrette ko'rsetilgen figuralar ta'biyattag'i'

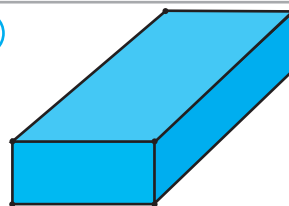


**Evklid**

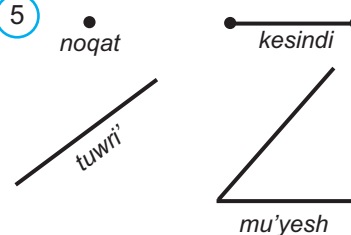
(erami'zdan aldi'n'g'i' III a'sir)

A'yyemgi grek ali'mi', geometriya pa'ninin' qa'liplesiwinde u'lken wori'n tutqan – "Negizler" miyneti menen tani'lg'an.

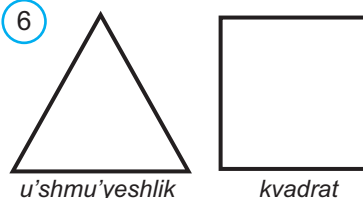
4



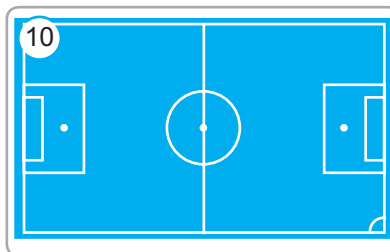
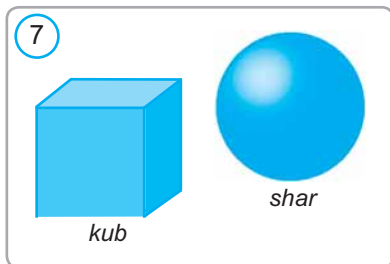
5



6







tu'rli denelerdin' geometriyali'q formasi'nan ibarat. Denelerdi geometriyali'q ko'z qarastan u'yengenimizde wolardi'n' tek g'ana formasi'n esapqa alami'z.

Biz noqat, kesindi, mu'yesh, u'shmu'yeshlik si'yaqli' tegis figuralardi' da'pterdin' betine si'za alami'z. Kub, piramida, shar si'yaqli' ken'isliktegi geometriyali'q figuralardi' bolsa si'za almaymi'z. Biraq wolardi'n' ko'rinisin da'pterde su'wretlewimiz mu'mkin.

*Planimetriya* geometriyani'n' baslang'i'sh bo'limi boli'p, wol tegisliktegi geometriyali'q figuralardi'n' qa'siyetlerin u'yrenedi. Ken'isliktegi figuralardi'n' qa'siyetlerin bolsa geometriyani'n' *stereometriya* dep atalatug'i'n bo'limi u'yrenedi. Biz geometriyani' u'yreniwdi planimetriyadan baslaymi'z.



Planimetriya — geometriyani'n' baslang'i'sh bo'limi boli'p, wol tegisliktegi geometriyali'q figuralardi'n' qa'siyetlerin u'yrenedi.



### **Soraw, ma'sele ha'm tapsi'rmalar**

1. Geometriyag'a tiyisli da'slepki mag'li'wmatlar qay jerde ha'm qalay payda bolg'an?
2. Geometriya so'zinin' ma'nisi ne ha'm wol ne ushi'n usi' at penen atalg'an?
3. Geometriyag'a tiykar salg'an ha'm woni'n' rawaj-lani'wi'na u'les qosqan qaysi' ali'mlardi' bilesiz?
4. Samarqandtag'i' tarixi'y yeskertkishler ha'm ha'-zirgi da'wirge tiyisli imaratlar (8–9 -su'wretler) quri'li'si'nda geometriyag'a tiyisli bilimlar qanshellik kerek bolg'an?
5. Geometriya pa'ni neni u'yrenedi?
6. Planimetriya geometriyani'n' qanday bo'limi? Stereometriya-she?
7. Do'gerek a'tirapi'mi'zdan geometriyali'q figuralardi' yesletiwshi predmetlerge mi'sallar keltirin' ha'm wolardi' da'pterin'izge si'zi'n'.



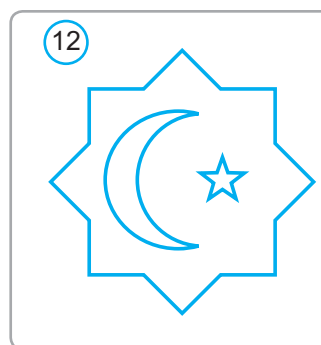
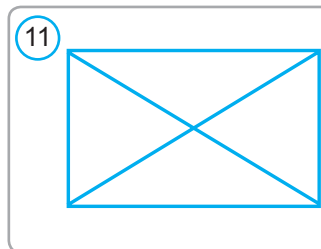
8. 5–7- su'wretlerde ko'rsetilgen figuralardi'n' qay-si' o'zgesheliklerine qarap toparlarga aji'rati'w mu'mkin? Bul wo'zgeshelikler qanday?
9. Planimetriya 5–7- su'wretlerde ko'rsetilgen figuralardi'n' qaysi'lari'ni'n' qa'siyetlerin u'yrenedi?
10. 10-su'wrette futbol maydanshasi' ko'rsetilgen. Bul su'wretlewde qanday geometriyalig' figuralardi' ko'rip tursi'z?
11. 11-su'wrette berilgen figurada neshe u'shmu'yeshlik bar?
12. 12-su'wrette ma'mleketimiz gerbindegi ti'msal ko'rsetilgen. Wol qanday figuralardan du'zilgen?



### **Tariyxtan u'zindiler**

#### **Nildi ji'lawlag'an farg'anali' dani'shpan.**

Tariyxi'y mag'li'wmatlar boyi'nsha, jurti'mi'zda jetisip shi'qqan Axmad al-Farg'aniy (13-su'wret) 861-ji'li'Qaqi'ra qalasi' jani'ndag'i' Nil da'riyasi'ndag'i' suw qa'ddin wo'lsheyitug'i'n "Nilometr" (yag'ni'y "Nil wo'lshegish") dep atalg'an quri'lmani' payda yetken (14-su'wret). Ilimiy-texnikali'q ha'm arxitekturali'q jaqtan ju'da' jetik esaplang'an ha'mde o'zinde a'jayi'p geometriyalig' sheshimlerde ja'mlegen bul quri'lmada ali'p bari'lg'an wo'lshe'w isleri uzaqji'llar dawami'nda di'yqanshi'li'q ushi'n ju'da' za'ru'r bolg'an ha'm wol ha'zirge shekem saqlani'p qalg'an. Axmad Farg'aniy wo'zinin' "Usturlob yasash haqida risola" atamasi'ndag'i' miynetinde astranomiya ushi'n za'ru'rli'q qa'siyet ~ Ptolomey teoremasi'ni'n' a'jayi'p da'lillemesin bergen. Axmad al-Farg'aniydi'n' hu'rmetine Ayda tabi'lg'an krater atalg'an ha'm Qaqi'ra qalasi'nda estelik wornati'lg'an.



#### **Axmad al-Farg'aniy**

(shama menen 797–875 ji'llarda jasap do'retiwshilik yetken)

Ulli' astranom, matematik ha'm geograf.

## Matematikali'q ma'seler g'aziynesi!

Keyingi waqi'tlari' informatsiya kommunikatsiya texnologiyalari' ju'da' tez rawajlanbaqta ha'm tez pa't penen bilimlendiriw sistemasi'na da kirip barati'rg'ani' bizge belgili. Usi' ku'nge kelip, internetin' Word-Wide-Web – Jer ju'zi informatsiya tarmag'i'nda sonsheli ko'p informatsiya dereklari' jaylasti'ri'lg'an, bul g'aziyheden paydalani'w ha'r bir jas a'wlad ushi'n ju'da' za'ru'r ha'm paydali'. Bul Web-betlerinen siz wo'zbek, rus, ingliz ha'm basqa tillerde matematika a'lemindegi yen' son'g'i' jan'ali'qlar, yelektron kitapxanalar qoymasi'nda saqlani'p



ati'rg'an ko'plep yelektron sabaqli'qlardi' tabi'wi'n'i'z mu'mkin. Sonday-aq, wolar arqali' tu'rli teoriyali'q materiallar, metodikali'q usi'ni'slar, san-sanaqsi'z ma'seleler, mi'sallar ha'm wolardi'n' sheshimlari, tu'rli ma'mleketlerde wo'tkerilip ati'rg'an matematikali'q ko'rik tan'law ha'm olimpiadalar tuwrali' mag'li'wmatlar ha'm olarda usi'ni'lg'an ma'seleler, qi'zi'g'arli' matematikali'q ma'seleler ha'm wolardi'n' sheshimlari menen tani'si'wi'n'i'z mu'mkin.

Tiykari'nan, [www.uzedu.uz](http://www.uzedu.uz), [www.eduportal.uz](http://www.eduportal.uz) – xali'q bilimlendiriw ministriliginin' informatsiya bilim beriw portali'nan da geometriyag'a baylani'sli' wo'zin'izdi qi'zi'qti'rg'an tu'rli mag'li'wmatlardi' ali'p ko'riwdi usi'ni's yetemiz.



To'memde ja'ne bir qatar informatsiya resurs dereklerinin' ma'nzillari berilmekte:  
[www.edu.uz](http://www.edu.uz) – informatsiya bilim beriw portali' (wo'zbek, rus, ingliz tilinde);  
[www.pedagog.uz](http://www.pedagog.uz) – ta'jiriybe asi'ri'w mekemeleri sayti' (wo'zbek ha'm rus tilinde);  
[www.school.edu.ru](http://www.school.edu.ru) – Uli'wma bilim beriw portali' (rus tilinde);  
[www.allbest.ru](http://www.allbest.ru) – Internet resurslari' yelektron kitapxanasi' (rus tilinde);  
[www.schulen-ans-netz.de](http://www.schulen-ans-netz.de) – Germaniya "Internet-Mektep" sayti';  
[www.studienkreis.de](http://www.studienkreis.de) – Germaniya woqi'w do'gereklerinin' sayti';  
[www.educasource.education.fr](http://www.educasource.education.fr) – Fransiya bilimlendiriw sayti';  
[www.educmath.inrp.fr](http://www.educmath.inrp.fr) – Fransiya matematikadan bilim beriw csifrl'i' resurslari';  
<http://mat-game.narod.ru/> – Matematikali'q gimnastika. Matematikali'q ma'seleler ha'm basqati'rmalar;  
<http://mathproblem.narod.ru/> – Matematika do'gerekleri, mektepler ha'm olimpiadalar (rus tilinde);  
<http://mathtest.narod.ru/> – Matematikadan testler (rus tilinde);  
<http://www.ams.org/mathweb/> – Math on the Web – Internette matematika (ingliz tilinde);  
<http://www.sch57.msk.ru/collect/smogl.htm> – Matematika tari'yxi'na tiyisli materiallar (rus tilinde);  
<http://www.exponenta.ru> – Matematikadan bilim beriw sayti' (rus tilinde);  
<http://zadachi.mccme.ru> – Geometriyali'q ma'seleler sayti' (rus tilinde);  
<http://www.math-on-line.com> – Qi'zi'g'arli' matematikali'q ma'seleler (rus tilinde).

## 2

### Yen' a'piwayi' geometriyalı'q figuralar: noqat, tuwri' ha'm tegislik

*Noqat, tuwri' ha'm tegislik* – geometriyani'n' tiyqarg'i' tu'siniklari boladi'.

Qa'lemnin' ushi'n qag'azg'a, pordi' taxtag'a tiygizgende qalg'an iz yamasa aspandag'i' juld'i'zlardi' (1-su'wret) ali'p qaraytug'i'n bolsaq, wolar ko'zimizge sonday kishi boli'p ko'rinedi, wolardi'n' wo'lshe'mlerin yesapqa almasaq ta boladi'. *Noqat* – a'ne usi'nday, wo'lshe'mlerin esapqa almasa da bolatug'i'n na'rselerdin' geometriyalı'q ko'rinishi boladi'. Evklid "Negizler" dep atalg'an miynetinde noqatti' hesh bir bo'limge iye bolmag'an figura si'pati'nda ta'riyplegen.

Sho'ide tegis jatqari'lg'an temir jol relslari (2-su'wret), si'm ag'ashqa kerip tarti'lg'an elektr si'mlari', aspang'a qarap bag'darlang'an lazer nuri', kerip tarti'lg'an darwaz si'mi' si'yaqli' denelerdin' geometriyalı'q ko'rinishi – tuwri' boladi'. Jaqti'li'q nurlari' da tuwri' boylap tarqaladi'. Tiykari'nda tuwri' sheksiz dawam etetug'i'n figura boladi'. Biz woni' qag'az, klass taxtasi'nda su'wretlegende kishi bo'legin si'zami'z. Biraq tuwri' barqulla ha'r yeki ta'repke sheksiz dawam yetken boladi' (4-su'wret).

Pol, stoldi'n' u'stin'gi beti, diywal, potalok, da'pter-din' beti, ti'ni'q ko'ldagi suw beti (3-su'wret), usi' si'yaqli'lardi'n' geometriyalı'q ko'rinishi *tegislik* boladi'.

Noqatlar u'lken lati'n ha'ripleri  $A, B, C, D, \dots$ , tuwri'lar kishi lati'n ha'ripleri  $a, b, c, d, \dots$  menen belgilenedi ha'm "*A noqati*", "*a tuwri'si*" tu'rinde oqi'ladi' (4-su'wret).

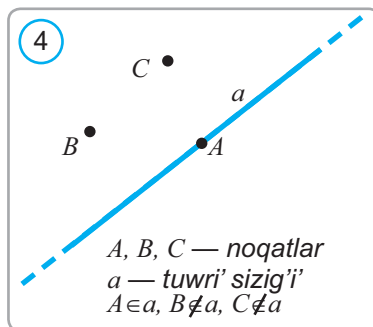
**A**

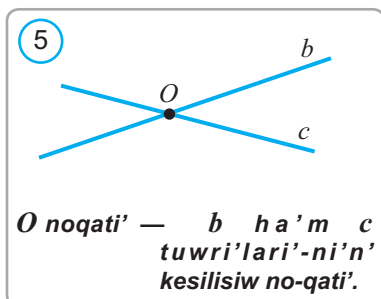
*Tegislikten qanday tuwri' ali'n basi'n, bul tuwri'g'a tiyisli bolg'an noqatlar da, tiyisli bolmag'an noqatlar da bar boladi'.*

Ma'selen, 4-su'wrette *A noqati* *a* tuwri'si'na tiyisli, *B* ha'm *C* noqati' *a* tuwri'si'na tiyisli yemes. Buni' qi'sqasha

$$A \in a \text{ ha'm } B \notin a, C \notin a$$

tu'rinde belgileymiz ha'm "*A tiyisli a*" ha'm "*B tiyisli yemes a*" dep woqi'ymi'z.

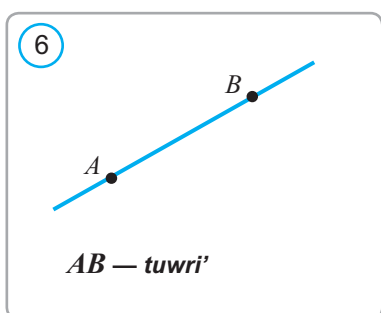




Yeger  $O$  noqati'  $b$  tuwri'si'na da,  $c$  tuwri'si'na da tiyisli bolsa,  $b$  ha'm  $c$  tuwri'lari'  $O$  noqati'nda kesilisedi (5-su'wret) ha'm  $O$  noqati'  $b$  menen  $c$  tuwri'lari'ni'n' kesilisiw noqati' dep ataladi'.

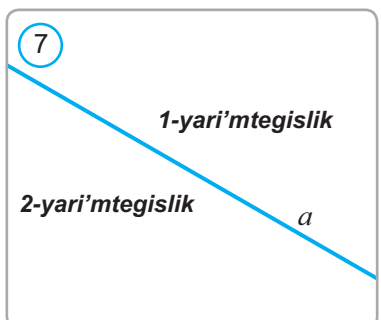
6-su'wrette ko'rsetilgen tuwri'  $A$  ha'm  $B$  noqatlari'nan wo'tedi.

**A** Ha'r qanday yeki noqattan tek bir tuwri' wo'tedi.



Bul qa'siyet boyi'nsha, tuwri'ni'n' yeki noqati' ko'rsetilse, bul tuwri' ani'qlang'an boladi'. Soni'n' ushi'n ani'qlang'an tuwri'ni' wonda jatqan yeki noqat ja'rdeminde de belgilew mu'mkin. 6-su'wrette  $AB$  tuwri'si' ko'rsetilgen.

**A** Ha'r bir tuwri' tegislikti yeki bo'lekke: yeki yari'm-tegislikke aji'ratadi'.



Qarali'p ati'rg'an tuwri' yari'm tegisliklardin' ha'r yekewine de tiyisli dep qaraladi'. Wol wo'zi aji'rati'p bo'lgan yari'm tegisliklardin' uli'wma shegarasi' boladi', 7-su'wrette  $a$  tuwri'si' tegislikti yeki yari'm tegislikke aji'rati'wi' su'wretlengen.

**Yeskertiw:** Aldag'i' waqi'tta yeki tuwri' ( yeki noqat, yeki yari'mtegislik, ...) dep ayti'lg'anda yeki ha'r qi'yli' tuwri' (yeku noqat, yeki yari'm tegislik, ...) tu'siniledi.



**1-ma'sele.**  $a$  ha'm  $b$  tuwri'lari'  $A$  noqati'nda kesilisedi.  $a$  tuwri'si'  $B$  noqati'nan wo'tedi.  $b$  tuwri'si' da  $B$  noqati'nan wo'te me?

**Sheshiliwi.**  $b$  tuwri'si'  $B$  noqati'nan wo'te almaydi'. Keri jag'dayda  $a$  ha'm  $b$  tuwri'lari'ni'n' yekewi de  $A$  ha'm  $B$  noqatlari'nan wo'tken bolar yedi. Bul bolsa, yeki noqattan tek bir tuwri' wo'tkeriw mu'mkin degen qa'siyetke qarsi' keledi. Sol sebepli,  $b$  tuwri'si'  $B$  noqati'nan wo'tiwi mu'mkin yemes.

Bul ma'seleni sheship, tuwri'lardi'n' to'mendegi ja'ne bir a'hmiyetli qa'siyetin bilip aldi'q.

**Na'tiyje.** Yeger yeki tuwri' kesilisse, Wolar tek g'ana bir noqatta kesilisedi.



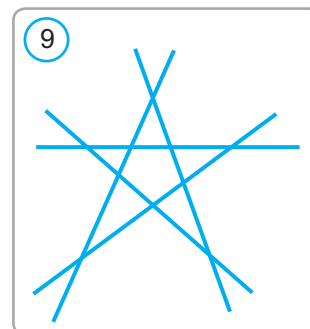
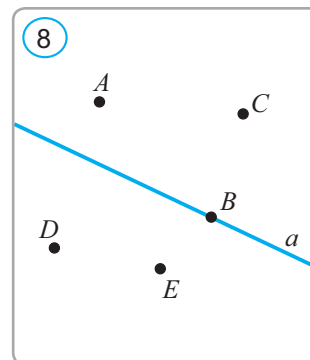
**2 -ma'sele.**  $C$  noqati'  $AB$  tuwri'si'na tiyisli.  $AB$  ha'm  $AC$  tuwri'lari' ha'r tu'rli boli'wi' mu'mkin be?

**Sheshiliwi.**  $AB$  ha'm  $AC$  tuwri'lari'ni'n' ha'r yekewi de  $A$  ha'm  $C$  noqatlari'nan wo'tedi. Bizge belgili, yeki noqattan tek bir tuwri' wo'tiwi mu'mkin. Sol sebepli bul tuwri'lar u'stpe-u'st tu'sedi, yag'ni'y ha'r tu'rli bola almaydi'.



### **Soraw, ma'sele ha'm tapsi'rmalar**

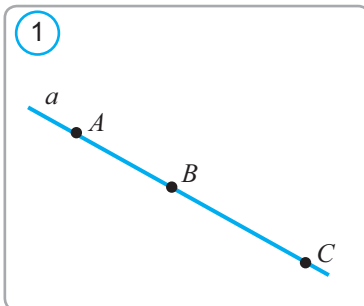
1. Yeki tuwri' yeki noqatta kesilisiwi mu'mkin be?
2. Da'pterin'izge yeki noqat belgilen'. Wolar arqali' qoli'n'i'z benen, yag'ni'y si'zg'i'shtan paydalanbastan tuwri' ju'r-gizin'. Su'wrettin' tuwri'li'g'i'n' si'zg'i'sh ja'rdeminde tekserin'. Shi'ni'g'i'wdi' ta'kirarlan'.
3.  $a$ ,  $A$ ,  $AB$  tu'rinde qaysi' geometriyalig' figuralar belgilenedi?
4. To'mendegi an'latpalardi' woqi'n' ha'm talqi'lan': a)  $A \in b$ ; b)  $C \notin b$ ; c)  $C \in AB$ . Bul an'latpalarg'a sa'ykes si'zi'lmalar jasan'.
5. 8-su'wretten mu'mkinshiligi bolg'ansha ko'birek noqat, tuwri', tegislik ha'm yari'm tegislikler arasi'ndag'i' qatnaslardi' ayti'p berin' ha'm wolardi' kirgizilgen belgiler ja'r-deminde jazi'n'.
6.  $A$  ha'm  $B$  noqatlari'  $c$  tuwri'si'na tiyisli,  $C$  noqati' bolsa  $c$  tuwri'si'na tiyisli yemes.  $AB$  ha'm  $AC$  tuwri'lari' haqqi'nda ne ayti'w mu'mkin?
7.  $AB$  ha'm  $AK$  tuwri'lari' neshe uli'wma noqatqa iye boli'wi' mu'mkin?
8. Tegislikte  $b$  tuwri'si'n si'zi'n' ha'm wonda  $A$  noqati'n belgilen'.  $b$  tuwri'si'nan da parqli'  $AB$  tuwri'si'n ju'rgizin'.  $B$  noqati'  $b$  tuwri'si'nda jata ma?
9. a) Bir; b) yeki; c) u'sh noqattan neshe tuwri' wo'tkeriw mu'mkin? Juwabi'n'i'zdi' tiykarlap berin'.
10. 9-su'wrette neshe tuwri' ko'rsetilgen?
11. Qa'legen u'shewi bir tuwri'da jatpaytug'i'n a) u'sh; b) to'rt noqat arqali' usi' noqatlardi' jup-jubi' menen tutasti'ri'wshi' neshe tuwri' ju'rgiziw mu'mkin?
12. To'rt tuwri'ni'n' ha'r yekewinin kesilisen noqatlari' belgilengen. Noqatlar sani' ko'bi menen neshew boladi'? Tuwri'lar besew bolsa-she?
13. Tegislikte bes noqatti' sonday yetip jaylasti'ri'n', wolardi'n' ha'r yekewi arqali' tuwri' ju'rgizilgende, tuwri'lar besew bolsi'n.



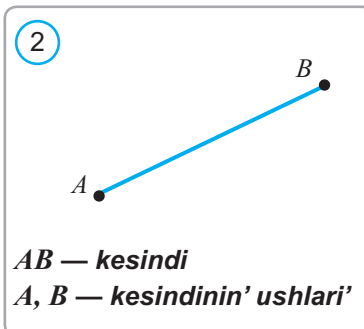
### 3

### Kesindi ha'm nur

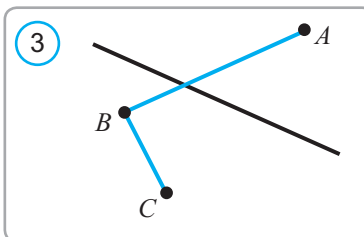
1



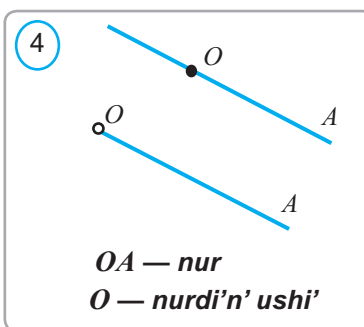
2



3



4



A

Bir tuwri'da belgilengen qa'legen u'sh noqatti'n' tek birewi qalg'an yekewinin arasi'nda jatadi'.

Yeger  $a$  tuwri'si'nda u'sh  $A, B, C$  noqatlari' ali'nsa (1-su'wret), wolardi'n' tek birewi —  $B$  noqati' qalg'an yekewi, yag'ni'y  $A$  ha'm  $C$  noqatlari'ni'n' arasi'nda jatadi'.  $A$  ha'm  $B$  noqatlari'  $C$  noqati'ni'n' bir ta'repinde,  $B$  ha'm  $C$  noqatlari' bolsa  $A$  noqati'ni'n' bir ta'repinde jatadi'.

✓

Kesindi dep, tuwri'ni'n' yeki noqati' ha'm wolardi'n' arasi'nda jatqan noqatlari'n' ibarat bolg'an bo'legine ayti'ladi'.

2-su'wrette kesindi su'wretlengen  $A$  ha'm  $B$  noqatlari' kesindinin' ushlari' yamasa shetki noqatlari' delinedi. Wolardi'n' arasi'ndag'i' noqatlar bolsa kesindinin' ishki noqatlari' dep ataladi'. Kesindi wo'zinin' shetki noqatlari' ja'rdeminde " $AB$  kesindi" tu'rinde belgilenedi. Bul kesindini " $BA$  kesindi" tu'rinde jazi'wg'a da boladi'.

Yeger yeki noqat bir yari'm tegislikke tiyisli bolsa, ushlari' usi' noqatlarda bolg'an kesindi yari'm tegisliktin' shegarasi'n kesip wo'tpeydi, keru jag'dayda kesip wo'tedi (3-su'wret).

✓

Nur dep, tuwri'ni'n' qaysi' bir noqati'n' bir ta'repte jatqan barli'q noqatlari'n' ibarat bolg'an bo'legine ayti'ladi'.

$a$  tuwri'si'nda jatqan  $O$  noqati' bul tuwri'ni' (bir-birin tolti'ri'wshi') yeki nurg'a aji'ratadi'.  $O$  noqati' bul nurdi'n' ushi' yamasa baslang'i'sh noqati' dep ataladi'. Nurdi'n' ushi'  $O$  ha'm qaysi' bir  $A$  noqati' arqali' " $OA$  nur" tu'rinde belgilenedi (4-su'wret). Usi'nday jazi'wda nurdi'n' ushi' birinshi wori'nda jazi'ladi'.

Ayi'ri'm jag'daylarda  $OA$  nuri' " $O$  noqati'n' shi'g'i'wshi' nur" dep te ayti'ladi'.

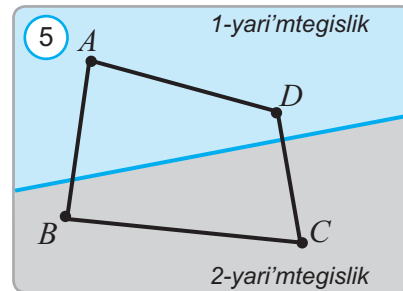
Nurdi' jaqti'li'q nuri'ni'n' geometriyali'q ko'rinisi si'pati'nda qarawg'a da boladi'. "Nur" atamasi' usi'dan kelip shi'qqan.





**Ma'sele.** Qanday da bir tuwri' ha'm wonda jatpaytug'i'n  $A, B, C, D$  noqatlari' berilgen.  $AB$  ha'm  $CD$  kesindileri berilgen tuwri' menen kesilisedi,  $BC$  kesindisi bolsa kesilispaydi.  $AD$  kesindisi tuwri'ni' kesip wo'teme (4-su'wret)?

**Sheshiliwi.** Auwri' tegislikti yeki yari'mtegislikke aji'ratatug'i'nli'g'i' belgili.  $A$  noqati' usi' yari'm tegisliklerinin' birinshisine tiyisli bolsi'n.  $AB$  kesindisi tuwri' menen kesilisedi. Demek,  $B$  noqati' yekinshi yari'm tegislikte jatadi'.  $BC$  kesindisi tuwri' menen kesilispaydi. Demek,  $C$  noqati' yekinshi yari'mtegislikte jatadi'.  $CD$  kesindisi bolsa, tuwri'ni' kesip wo'tedi. Soni'n' ushi'n  $D$  noqati' birinshi yari'm tegislikte, yag'ni'y  $A$  noqati' menen bir yari'm tegislikte jatadi'. Demek  $AD$  kesindisi tuwri'ni' kesip wo'tpeydi.

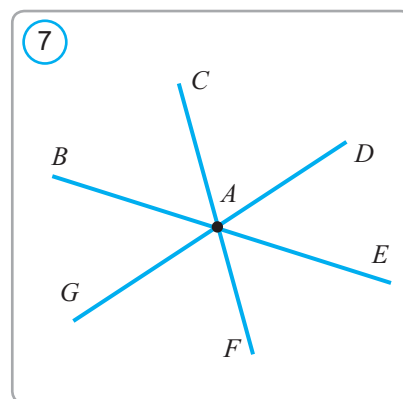
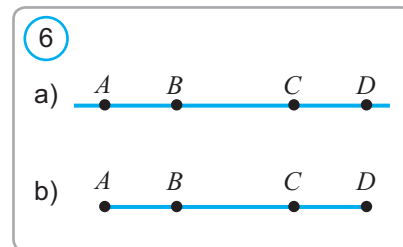


**Juwabi':** Kesip wo'tpeydi.

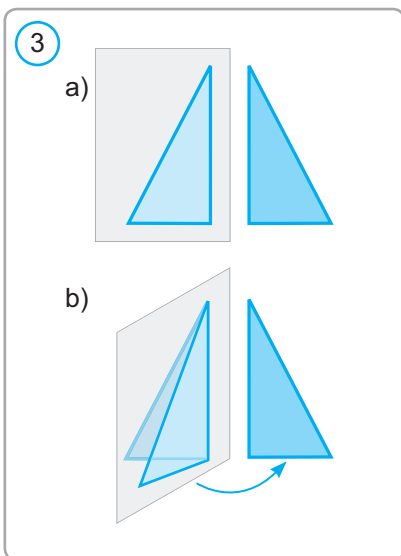
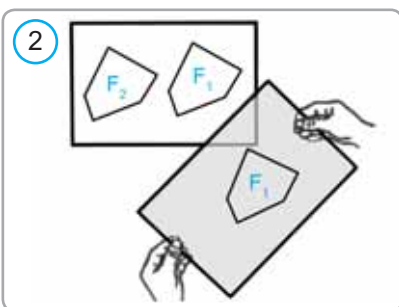
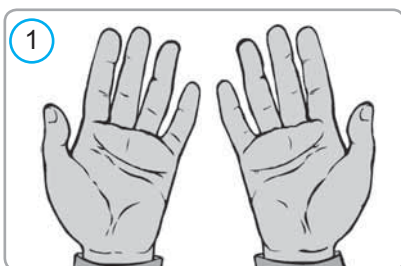


### Soraw, ma'sele ha'm tapsi'rmalar

- 6.a-su'wrette  $B$  noqati' qaysi' noqatlar arasi'nda jatadi'? Qaysi' noqatlar  $C$  noqati'nan bir ta'repte jatadi'?
- Kesindi ha'm nurg'a si'patlama berin'. Wolar qan-day belgilenedi?
- Tuwri'da  $C$  ha'm  $D$  noqatlari' berilgen.  $CD$  ha'm  $DC$  tuwri'lari' u'tpe-u'st tu'se-me?  $CD$  ha'm  $DC$  nurlari'-she?
- Kesindi, nur ha'm tuwri' bir-birinen nesi menen parqlanadi'?
- a) bir; b) yeki; c) u'sh; d) 10; e)  $n$  noqat tuwri'ni' neshe bo'lekke bo'ledi?
- 6.b-su'wrette neshe kesindi bar?
- 7-su'wrette neshe nur bar?
- Bir tuwri'da jatqan 2 noqat usi' tuwri'da jatqan neshe nurdi' ani'qlaydi'? 3 noqat-she?
- Tegislikte jatqan yeki tuwri', usi' tegislikti neshe bo'lekke bo'ledi?
- Tuwri' ha'm wonda jatpaytug'i'n  $A, B, C$  noqatlari' berilgen.  $AB$  kesindisi berilgen tuwri'ni' kesip wo'tedi,  $AC$  kesindisi bolsa kesip wo'tpeydi.  $BC$  kesindisi bul tuwri'ni' kesip wo'te me?





**Aktivlestirivshi shi'ni'g'i'w**

1. Do'gerek a'tirapi'n'i'zdan formasi' da, wo'lshe'mleri de bir qi'yli' bolg'an na'rselerge mi'sallar keltirin'.
2. Yeki da'pterdin' betinin' wo'lshe'mleri bir qi'yli' yekenligin qanday a'meliy usi'l menen ani'qlaw mu'mkin?
3. 1-su'wrette shep qol ha'm won' qoldi'n' ko'rinisi berilgen. Bul figuralardi'n' birin yekinshisine bet-pe-bet u'stpe-u'st tu'setug'i'nday yetip qoyi'w mu'mkin be? Qanday yetip? Buni' wo'z qollari'n'i'z benen wri'nlap ko'rin'.



Ten' figuralar dep, birin ekinshisinin' u'stine betpe-bet u'stpe-u'st tu'setug'i'nday yetip qoyi'w mu'mkin bolg'an figuralarg'a ayti'ladi'.

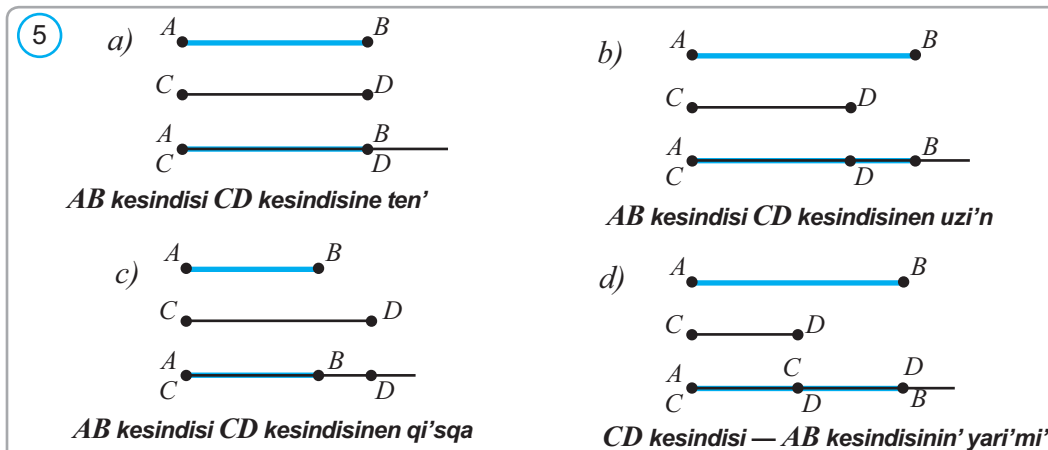
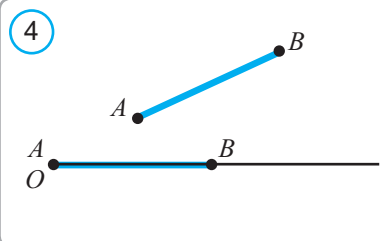
Bir geometriyali'q figurani' ekinshisinin' u'stine qoyi'w tu'sinigi menen aktivlestirivshi shi'ni'g'i'wlarda tani'si'p wo'ttik. Bul tu'sinikti a'melde to'mendegishe ko'z aldi'mi'zg'a keltiriw mu'mkin. Bir figurani' yekinshisinin' u'stine qoyi'w ushi'n, da'slep kalka (ji'lti'r) qag'azi'na birinshi figurani'n' nusqasi'n ko'shirip u'lgi alami'z. Keyin kalka (ji'lti'r) qag'azi'n tegislep boylap ji'lji'ti'p, birinshi figurani'n' u'lginin yekinshi figura menen da'l u'stpe-u'st tu'setug'i'nday yetip qoyi'wg'a ha'reket yetemiz (2-su'wret). Yeger buni'n' mu'mkinshiligi bolsa, bul figuralar ten' boladi'. Geyde bir figurani' yekinshisine da'l u'stpe-u'st qoyi'w ushi'n, da'slep figurani'n' nusqasi' tu'sirilgen kalka qag'azdi' awdari'p ali'wg'a tuwra keledi. 3-su'wrette usi'nday jag'day su'wretlengen.

Ushi'  $O$  noqati'nda bolg'an nur ha'm qa'legen  $AB$  kesindisi berilgen bolsi'n. Bir ushi' usi' nurdi'n' ushi', yekinshi ushi' bolsa nurda jatatug'i'n ha'm  $AB$  kesindige ten' bolg'an kesindini nurdi'n' u'stine qoyi'w mu'mkin (4-su'wret) yekenligi ko'rinip tur. Bunday

kesindi jalg'i'z boli'p, wol berilgen kesindini berilgen nurg'a qoyi'w delinedi. Buni', aldi'mi'zda qi'sqasha "Kesindini nurg'a qoyi'w" dep ju'rgizemiz.

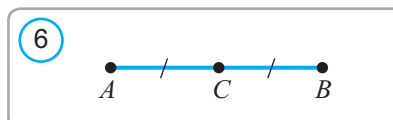
**A** Qa'legen nurdi'n' u'stine woni'n' ushi'nan baslap berilgen kesindige ten' bolg'an jalg'i'z kesindini qoyi'w mu'mkin.

Yeki kesindini wo'z-ara sali'sti'ri'w ushi'n, ha'r yeki kesindi bir nurdi'n' u'stine qoyi'ladi'. Keyin bolsa, to'mendegi jag'daylardan qaysi' biri boli'wi'na qarap, kesindilerdin' wo'z-ara ten'ligi yamasa uzi'n-qi'sqali'g'i' (yag'ni'y u'lken-kishiligi) haqqi'nda juwmaq shi'g'ari'ladi' (5-su'wret):



**✓** Kesindinin' wortasi' dep, woni' ten' yeki kesindige bo'liwshi noqatqa ayti'ladi'.

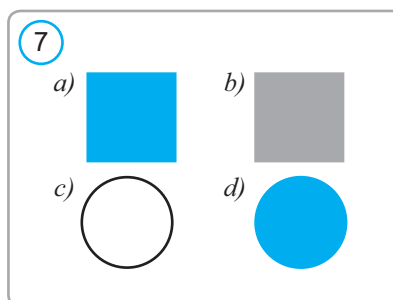
6-su'wrette  $AB$  kesindisinin' wortasi' bolg'an  $C$  noqati' ko'rsetilgen. Figurada ten' kesindiler bir qi'yli' sandag'i' si'zi'qshalar menen belgilenedi.

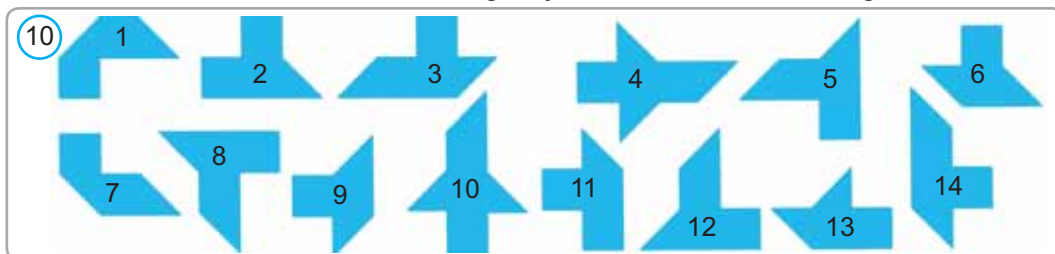
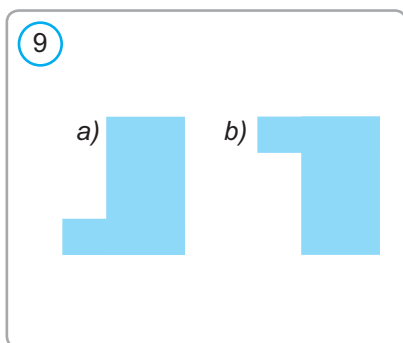
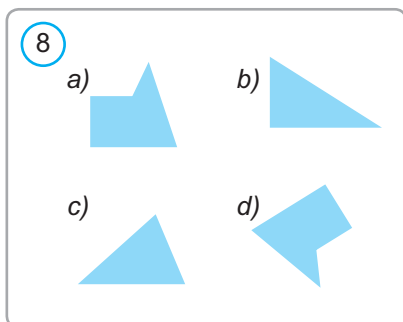


**?** **Soraw, ma'sele ha'm tapsi'rmlar**

1. Qanday figuralardi' wo'z-ara ten' dep ataymi'z?
2. 7-su'wrettegı figuralardi'n' qaysi'lari' wo'z-ara ten'?
3. To'mendegi ha'rip belgilerinin' qaysi'lari' geometriyalı'q figura si'pati'nda wo'z-ara ten'?

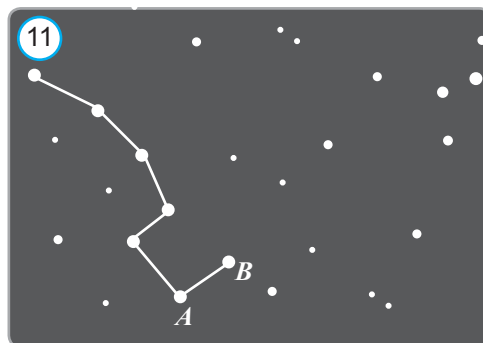
**a, b, g, d, i, y, n, o, p, u, q**





### A'meliy shi'ni'g'i'w.

11-su'wrette "Jeti qaraqshi" juldi'zlar du'rkimi su'wretlengen. Yeger bul juldi'zlardi' kesindiler menen tutastir'saq "Sho'mish" ke uqsas figura payda boladi'. "Sho'mish" tin' aqi'rg'i' yeki juldi'zi' payda yetken  $AB$  kesindini  $B$  noqattan baslap  $AB$  nuri' boyi'nsha 5 ma'rte qoyi'p shi'g'i'lsa temir qazi'q juldi'zi'ni'n' jani'na bari'ladi'. Su'wretten temir qazi'q juldi'zi' qay jerde jaylasqani'n' ani'qlan'.



4. 8-su'wrettegi figuralardan qaysi'lari' wo'z-ara ten'?
5. To'mendegi csifr belgilerinin' qaysi'lari' geometriyali'q figura si'pati'nda wo'z-ara ten'?

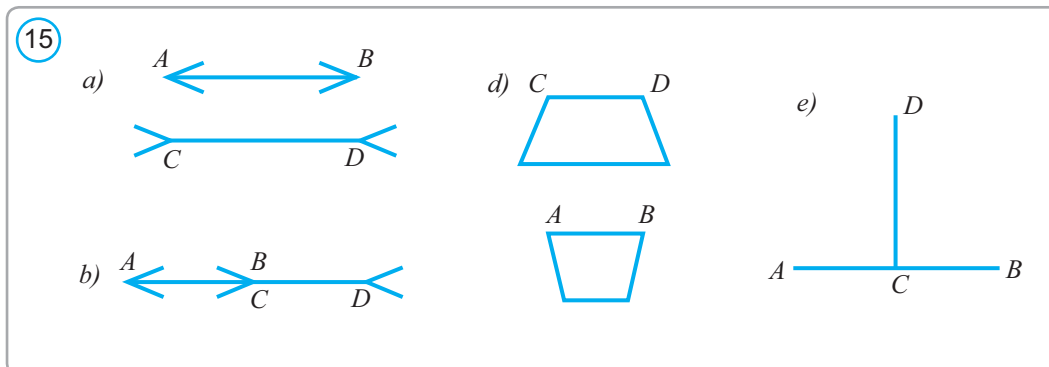
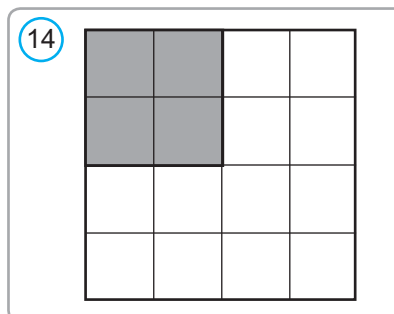
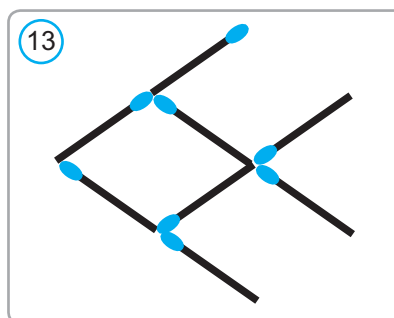
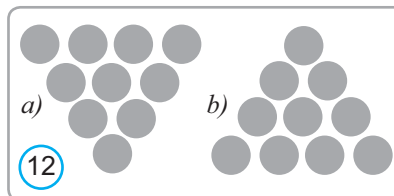
1234567890

6. 9.a-su'wrette berilgen figurani'n' wo'lsheplerin wo'zgerptesten qag'azg'a si'zi'p, qir'qi'p ali'n'. Woni' 9.b-su'wrettegi geometriyali'q figurani'n' u'stine qoyi'w arqali', wolardi'n' ten' yamasa ten' yemesligin ani'qlan'.
7. 10-su'wrettegi figuralardi'n' arasi'nan wo'z-ara ten'lerin tabi'n'.
8. Qanday figuralar wo'z-ara ten' boladi'?
9. Kesindiler qalay sali'sti'ri'ladi'?
10. Kesindinin' wortasi' degen ne?
11. Tuwri'da  $A$ ,  $B$ ,  $C$ ,  $D$  noqatlari' berilgen. Ushlari' usi' noqatlarda bolg'an neshe kesindi bar? Wolardi' jazi'n'?
12. Da'pterinizge qanday da bir kesindini si'zi'n' ha'm woni'n' wortasi'n ko'z benen shamalap tabi'n'. Na'tijjeni si'z-g'i'sh ja'rdeminde tekserin'. Shi'ni'g'i'wdi' ta'kirarlan'.



### Geometriyalı'q basqatı'rmalar

- 10 bir qı'yli' ten'ge 12. *a*-su'wrettegidey yetip jaylastı'ri'lg'an. Tek 3 ten'genin' worni'n wo'zgerıp ten'gelerdi 12. *b*- su'wrettegi ko'riniske keltirin'.
- 12-su'wrettegi 3 shi'rpi' sho'binin' worni'n wo'zgerıp "bali'qti'" arqag'a qaytarı'n'.
- Diyqan atani'n' kvadrat formasi'ndag'i' jer maydanshası' bar yedi. Wol jer maydanshası'ni'n' sherek bo'limin 14-su'wrette ko'rsetilgende yetip wo'zi ushi'n qaldi'rđi'. Qalg'an bo'limin bolsa bir qı'yli' formada bo'leklerge bo'lip, to'rt uli'na bo'listirip berdi. Ata bul isti qalay a'melge asi'rg'an?
- 15-su'wrette su'wretlengen *AB* ha'm *CD* kesindilerin ko'z benen shamalap wo'z-ara sa-li'sti'ri'n'. Keyin bul isti kalka qag'azi' ja'rdeminde wori'nlan'.

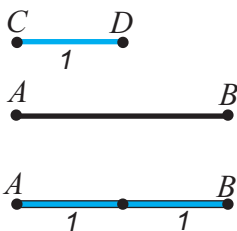


**Juwmaq:** Geometriyada wo'lshew ha'm sali'sti'ri'w jumi'slari' wori'nlanı'wi' kerek: ko'z aldawı' mu'mkin!

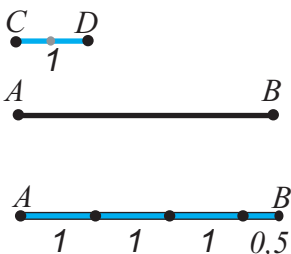
## 5

## Kesindini'n' uzi'nli'g'i' ha'm woni'n' qa'siyetleri. Kesindilerdi wo'lshe

①



②



Kesindilerdi nurdi'n' u'stine qoyi'w arqali' sali'sti'ri'w aytarli'qtay qolayli' yemes. Kesindilerdin' qaysi' biri uzi'n yamasa qi'sqa yekenligin ( yag'ni'y u'lken yamasa kishi yekenligin ), wolardi'n' uzi'nli'qlari'n sali'sti'ri'w arqali' ani'qlawg'a boladi'.

Qanday da bir kesindini birlik kesindi dep ali'p, woni'n' uzi'nli'g'i'n 1 ge ten' dep qabi'l yetemiz. Qalg'an kesindilerdin' uzi'nli'qlari'n usi' birlik kesindinin' uzi'nli'g'i'na sali'sti'ri'p ani'qlaymi'z. Kesindinin' uzi'nli'g'i' won' san boli'p, wol kesindige birlik kesindi ha'm woni'n' bo'leklerin neshe ma'rte qoyi'w mu'mkin yekenligin ko'rsetedi. 1-su'wettegi  $CD$  kesindisin birlik kesindi dep ali'p, woni'n' uzi'nli'g'i'n 1 ge ten' desek, wonda  $AB$  kesindisinin' uzi'nli'g'i' 2 ge ten' bolatug'i'nli'g'i' ko'rinip tur. Sebebi,  $AB$  kesindisine  $CD$  kesindisi yeki ma'rte jaylasi'p tur. 2-su'wettegi  $CD$  kesindisin birlik kesindi dep alsaq, wonda  $AB$  kesindisinin' uzi'nli'g'i' 3,5 ke ten' boladi'. Sebebi,  $AB$  kesindisine  $CD$  kesindisi pu'tinliginshe u'sh ma'rte ha'm woni'n' yari'mi' jaylasi'p tur.

A

Ha'r qanday kesindi belgili bir uzi'nli'qqa iye boli'p, wol won' san menen an'lati'ladi'.



## Aktivlestiriwshi shi'ni'g'i'w.

3-su'wrette su'wretlengen  $AB$ ,  $BC$  ha'm  $AC$  kesindilerinin' uzi'nli'g'i'n si'zg'i'sh ja'rdeminde wo'lshe'n'. Bul kesindilerdin' uzi'nli'qlari'n qanday formula ja'rdeminde wo'z-ara baylani'sti'ri'w mu'mkin yekenligin ani'qlan'.

③



Tuwri'da jati'wshi'  $A$ ,  $B$  ha'm  $C$  noqatlari' berilgen boli'p,  $B$  noqati'  $A$  ha'm  $C$  noqatlari' arasi'nda jaylasqan bolsa,  $AC$  kesindisinin' uzi'nli'g'i'  $AB$  ha'm  $BC$  kesindilerinin' uzi'nli'qlari'ni'n' qosi'ndi'si'nan ibarat boladi', yag'ni'y  $AC = AB + BC$  ten'ligi wori'nli' boladi' (3-su'wret). Kesindilerdin' uzi'nli'qlari' haqqi'ndag'i' bul tasti'yi'qlawdi' da'lillewsiz qabi'l yetemiz:

**A**

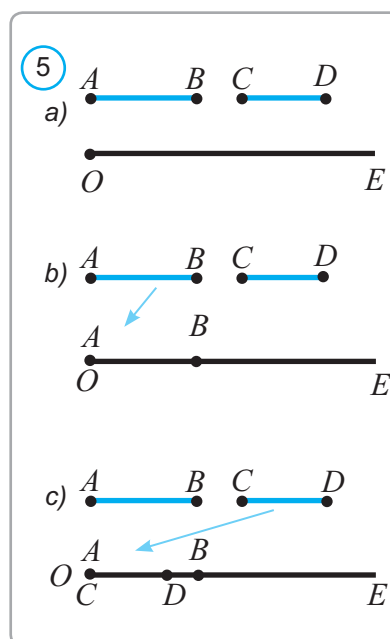
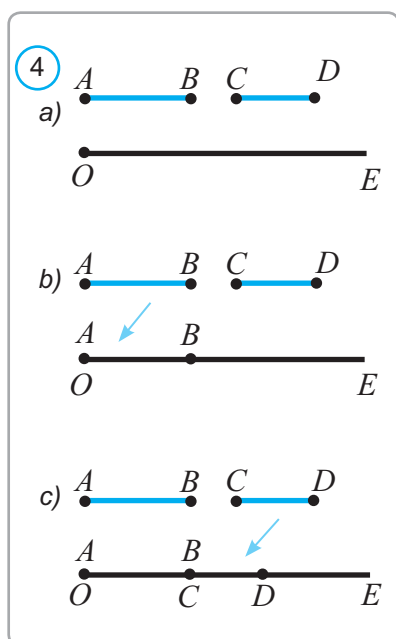
Yeger tuwri'da jati'wshi'  $B$  noqati'  $A$  ha'm  $C$  noqatlari' arasi'nda jaylasqan bolsa,  $AC$  kesindisinin' uzi'nli'g'i'  $AB$  ha'm  $BC$  kesindilerinin' uzi'nli'qlari'ni'n' qosi'ndi'si'na ten' boladi':  
 $AC = AB + BC$ .

Joqari'da keltirilgen da'lil kesindiler u'stinde qosi'w ha'm ali'w a'mellerin ani'qlaw mu'mkinshiligin beredi.  $OE$  nur,  $AB$  ha'm  $CD$  kesindiler berilgen bolsi'n (4.a-su'wret). Aldi'n  $OE$  nurg'a  $AB$  kesindini qoyami'z (4.b-su'wret). So'n  $BE$  nurg'a  $CD$  kesindini qoyami'z (4.c-su'wret).

Na'tijjeda payda bo'lg'an  $AD$  kesindi  $AB$  ha'm  $CD$  kesindilerinin' qosi'ndi'si' dep ataladi' ha'm bul kesindiler ushi'n  $AD = AB + CD$  ten'glik ori'nli' bo'ladi'.

Usi' si'yaqli' kesindilerdi bir-birinen ayi'ri'w a'melin de kirgiziwge boladi'

Aytai'q,  $OE$  nur,  $AB$  ha'm  $CD$  kesindiler berilgen ha'mda  $AB > CD$  bolsi'n (5.a-su'wret).  $OE$  nurg'a uzi'n kesindi  $AB$  ni' qoyami'z (5.b-su'wret). Son' ja'na  $OE$  nurg'a  $CD$  kesindi qoyami'z (5.c-su'wret). Payda bolg'an  $DB$  kesindi  $AB$  ha'm  $CD$  kesindiler ayi'rmasi' deb ataladi' ha'm  $DB = AB - CD$  ten'glik wori'nli' boladi'.



$AB$  kesindinin' uzi'nli'g'i'  $A$  ha'm  $B$  noqtalar arasi'ndag'i' arali'q dep te ju'rgiziledi. Bunnan, bir qi'yl'i' uzi'nli'qa iye bolg'an kesindiler wo'z-ara ten' ekenligi kelip shi'g'adi'.

$AB$  kesindisinin' uzi'nli'g'i'  $A$  ha'm  $B$  noqatlari' arasi'n-dag'i' *arali'q* dep te ataladi'. Bir qi'yl'i' uzi'nli'qqa iye bolg'an kesindiler wo'z-ara ten' boladi'.

A'yyemgi zamannan berli adamlar uzi'nli'qti' wo'lshevide tu'rli uzi'nli'q birliklerinen paydalani'p kelgen. Ma'selen, O'rta Aziyada buwi'n, qari's, qulash, shaqi'ri'm si'yaqli' uzi'nli'q birliklerin qollang'an. Tu'rli wo'lshevi birliklerinen paydalani'w qolaysi'zli'q tuwdi'rg'an. Sonli'qtan, XVIII a'sirden baslap du'nya boyi'nsha xali'qarali'q uzi'nli'q wo'lshevi birligi si'pati'nda metr qabi'l yetilgen.

Siz uzi'nli'q birligi bolg'an metr etaloni' menen 6-klass "Fizika" sabaqli'g'i'nda tani'sqansi'z. Wol jerde metrge qara-g'anda birqansha u'lken yamasa kishi uzi'nli'qlardi' wo'lshevi ushi'n qollani'latug'i'n birliklerde keltirilgen edi. Sonli'qtan:

$$1 \text{ km} = 1000 \text{ m}; \quad 1 \text{ sm} = 0,01 \text{ m}; \quad 1 \text{ mm} = 0,001 \text{ m}.$$

Kesindilerdin' uzi'nli'g'i' tu'rli a'sbaplar ja'rdeminde o'lshevedi. Wolardi'n' yen' a'piwayi'si' shkalali', yag'ni'y bo'liniw noqatlari'na iye bolg'an si'zg'i'sh boladi'. Kesindi uzi'nli'g'i'ni'n' mug'dari' tan'lang'an uzi'nli'q wo'lshevi birligine baylani'sli' boladi'. Yeger uzi'nli'q birligi si'pati'nda uzi'nli'g'i'  $1 \text{ sm}$  ge ten' bolg'an kesindini alatug'i'n bolsaq, 6-su'wrette berilgen kesindinin' uzi'nli'g'i'  $5 \text{ sm}$  ge ten' boladi' ha'm  $AB = 5 \text{ sm}$  dep jazi'ladi'. Yeger uzi'nli'q wo'lshevi birligi retinde uzi'nli'g'i'  $1$  millimetrge ten' kesindini alatug'i'n bolsaq,  $AB = 50 \text{ mm}$  boladi'.

Ayi'ri'm jag'daylarda kesindinin' uzi'nli'g'i'ni'n' wo'lshevi birligi ko'rsetilmesten jazi'ladi'. Ma'selen,  $AB = 5$ . Bunnan  $AB$  kesindisinin' uzi'nli'g'i'  $5$  wo'lshevi birligine ten' dep tu'siniledi.

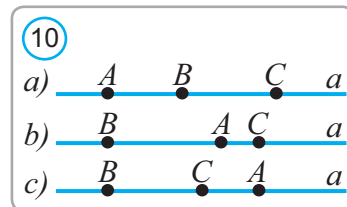
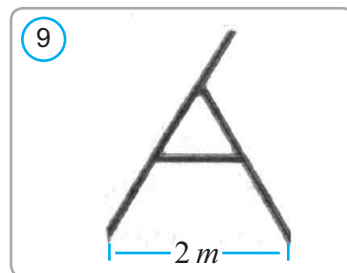
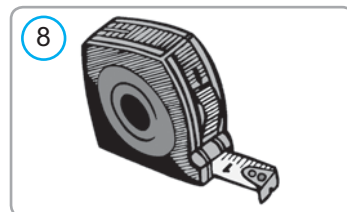
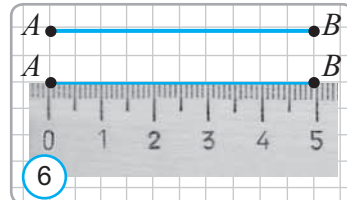
Da'pterin'izde tu'rli kesindi uzi'nli'qlari'n wo'lshevi ushi'n millimetrli bo'linbelerge iye bolg'an woqi'w si'zg'i'shi'nan (7-su'wret) paydalani'p keldin'iz. Taxtag'a kesindilerdi si'zi'w ushi'n santimetr bo'linbelerge iye mektep si'zg'i'shi'nan paydalani'ladi'. Jer betinde tu'rli wo'lshevi jumi'slari'n a'melge asi'ri'w ushi'n lentali' wo'lshevi a'sbabi' – ruletkadan (8-su'wret), dalada bolsa altaqta – dala cirkuli'nan (9-su'wret) paydalani'ladi'.



**Ma'sele.** Bir tuwri'da jati'wshi'  $A$ ,  $B$  ha'm  $C$  no-qatlari' ushi'n  $AB = 8 \text{ sm}$ .  $BC = 11 \text{ sm}$  bolsa,  $AC$  kesindisinin' uzi'nli'g'i' nege ten'?

**Sheshiliwi:** To'mendegi jag'daylardi' qaraymi'z:

1)  $A$ ,  $B$ ,  $C$  noqatlari'  $a$  tuwri'si'nda  $8.a$ -su'wrette





ko'rsetilgan ta'rtipte joylasqan bolsi'n. Kesindilerdin' uzi'nli'qlari'ni'n' qa'siyeti boyi'nsha  $AC = AB + BC = 8 + 11 = 19$  (sm) boladi'.

2) 10.c-su'wrettegidey noqatlar  $a$  tuwri'si'nda 10.b-su'wrette ko'rsetilgan ta'rtipte joylasqan bolsi'n. Bul jag'dayda kesindi uzi'nli'g'i'ni'n' qa'siyeti boyi'nsha  $BA + AC = BC$ , yamasa  $AC = BC - BA = 11 - 8 = 3$  (sm) boladi'.

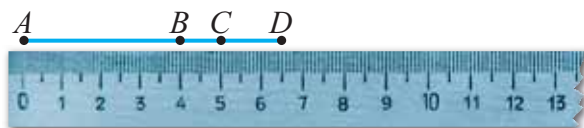
3)  $C$  noqati' 10.c-su'wrettegidey  $B$  ha'm  $A$  noqatlari' arasi'nda joylasa almaydi'. Sebebi,  $AB < BC$ .

Demek,  $AC$  kesindisinin' uzi'nli'g'i', noqatlari'ni'n' wo'z-ara joylasi'wi'na qarap 19 sm yamasa 3 sm ge ten' boladi'.

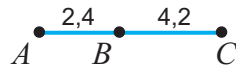
**Juwabi':** 19 sm yamasa 3 sm.

### Soraw, ma'sele ha'm tapsi'rmalar

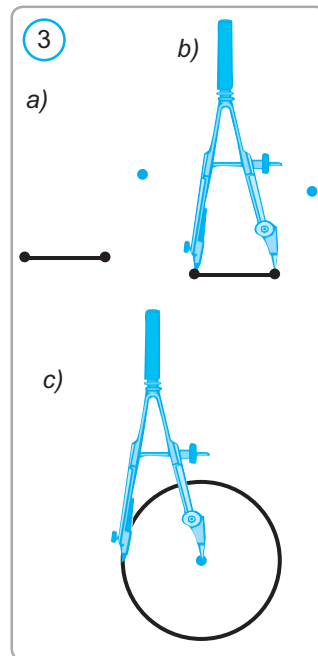
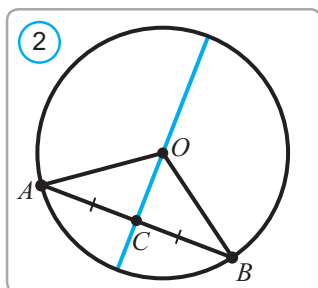
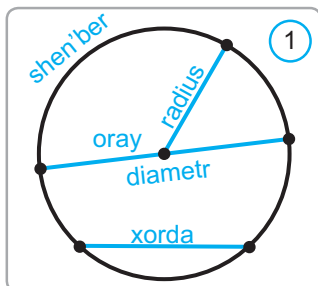
1. Kesindiler qalay o'lishenedi?
2. Kesindi uzi'nli'g'i'ni'n' tiykarg'i' qa'siyetlerin ayti'p berin'.
3. To'mendegi su'wretten  $AB, AC, AD, BC, BD, CD$  kesindilerinin' uzi'nli'g'i'n' ani'qlan'.



4.  $AC = ?$
4.  $AB = 3, AC = 2BC, BC = ?$
5.  $AB = 24, BC = AC + 6, AC = ?$



7. Yeger  $B \in AC, AB = 7,2$  sm,  $AC = 2$  dm bolsa,  $BC$  ni' tabi'n'.
8. Yeger  $C \in AB, D \in AB, AB = 5, AC = 2,2$  ha'm  $BD = 3,6$  bolsa,  $CD$  ni' tabi'n'.
9. Tuwri'dan ko'z benen shamalap, a) 3 sm; b) 7 sm; c) 10 sm bolg'an kesindi bo'lip ali'n'. Keyin isti qansha ani'q wori'nlag'ani'n'i'zdi' si'zg'i'sh penen tekserin'.
10. Tuwri'dag'i'  $A, B, C$  noqatlari' ushi'n  $AB = 600$  m,  $BC = 200$  m bolsa,  $AC$  ni' tabi'n'.
11. Tuwri'dag'i'  $A, B, C$  ha'm  $D$  noqatlari' ushi'n  $AB = 2, AC = CB, 2AD = 3BD$  bolsa,  $CD$  ni' tabi'n'.
12. Nur ha'm uzi'nli'qlari'  $AB = 1,2$  sm,  $CD = 2,8$  sm bolg'an kesindiler berilgen. Bul kesindilerden paydalani'p usi' nurg'a uzi'nli'g'i' a) 4 sm; b) 1,6 sm; c) 0,4 sm; d) 2,6 sm bolg'an kesindilerdi qoyi'n'.
13. Yeger  $AB = 9$  bolsa,  $AB$  kesindisinde jati'wshi' sonday  $C$  noqati'n belgilen', a)  $AC - BC = 1$ ; b)  $AC + BC = 11$ ; c)  $AC + BC = 10$  bolsi'n.
- 14\*.  $AB$  kesindisi berilgen. Uzi'nli'g'i': a)  $2AB$ ; b)  $AB:2$ ; c)  $AB:4$ ; d)  $0,75AB$  bolg'an kesindilerdi jasan'.
15. Tuwri'dag'i'  $A, B, C$  noqatlari' ushi'n  $AB = 5,6$  sm,  $AC = 8,9$  sm va  $BC = 3,3$  sm yekenligi belgili.  $A, B, C$  noqatlari'ni'n' qaysi' biri qalg'an yekewinin wortasi'nda jataadi'?



Berilgen noqattan ten'dey arali'qta jatqan noqatlardan ibarat figura **shen'ber** dep ataladi'. Bul berilgen noqat shen'berdin' **worayi'** delinedi. Shen'berdin' qa'legen noqati'nan woni'n' orayi'na shekemgi arali'q shen'berdin' **radiusi'** dep ataladi' (1-su'wret). Sonday-aq, shen'berdin' orayi'n woni'n' qa'legen noqati' menen tutasti'ri'wshi' kesindini de radius dep ataymi'z. Shen'berdin' qa'legen yeki noqati'n tutasti'ri'wshi' kesindi shen'berdin' **xordasi'** dep ataladi'. Woraydan wo'tiwshi xorda bolsa **diametr** dep ataladi'. Tegislikin' shen'ber menen shegaralang'an bo'legi (shekli bo'limi) **do'n'gelek** dep ataladi'.

Shen'ber tsirkul ja'rdeminde si'zi'ladi'. Worayi' berilgen  $O$  noqati'nda, radiusi'  $a$  kesindiden ibarat bolg'an shen'berdi csirkul ja'rdeminde si'zi'w 3-su'wrette ko'rsetilgen.



**Ma'sele.** Shen'ber xordasi'ni'n' wortasi'nan wo'tiwshi dia-metr xordag'a perpendikulyar bolatug'i'ni'n da'lillen'.

**Da'lillew.** Aytayi'q,  $AB$  — shen'berdin' xordasi' ha'm  $C$  woni'n' wortasi' bolsi'n (3-su'wret).  $AOB$  u'shmu'yeshliginin'  $OA$  ha'm  $OB$  ta'replari shen'berdin' radiuslari' bolg'ani' ushi'n, bul u'shmu'yeshlik ten' qaptalli' boladi'. Sha'rt boyi'nsha,  $OC$  —  $AOB$  ten' qaptalli' u'shmu'yeshliktin' medianasi'. Bul jag'dayda ten' qaptalli' u'shmu'yeshliktin' medianasi'ni'n' qa'siyetleri boyi'nsha,  $OC$  kesindisi biyikligi de boladi'.

Demek, xordani'n' wortasi'na tu'sirilgen diametr xordag'a perpendikulyar boladi'. **Teorema da'lillendi.**

**Shen'berdi shaqmaq da'pterge tsirkulsi'z qol menen si'zi'w jol-jori'g'i'.**

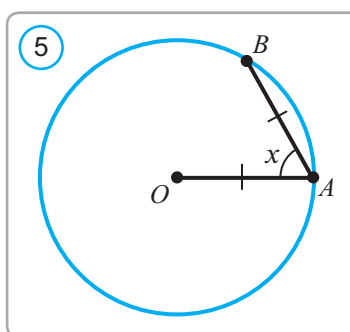
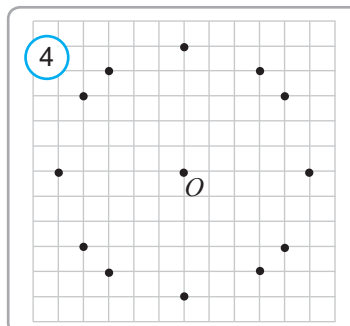
1. Shaqmaq da'pterge 4-su'wrette ko'rsetilgende yetip noqatlardi' belgilen'.
2. Payda bolg'an 12 noqatlardi' izbe-iz dog'a ta'rizli si'zi'q penen tutasti'ri'p si'zi'n'.

Na'tiyjede, worayi'  $O$  noqati'nda bolg'an shen'berlerdin' ko'rinisi shamalap payda boladi'. Bul usi'ldi' (noqatlardi'n' worni'n) yadta saqlap qali'n'.

3.  $O$  noqati'n'nan a'ne usi' 12 noqatqa shekemgi araliqlari'ni'n' wo'z-ara ten'ligin tekserip ko'rin'.

### Soraw, ma'sele ha'm tapsi'rmalar

1. Shen'berge ta'riypleme berin' ha'm si'zi'lmada tu'sindirir'.
2. Shen'berdin' worayi', radiusi', xordasi' ha'm diametri degen ne?
3. Shen'berdin' qaysi' xordasi' yen' uzi'ni' boladi'?
4. Csirkuldan paydalanbastan shen'ber si'zi'wdi'n' qanday usi'llari' bar?
5. Ne ushi'n arba, velosiped, avtomobillerdin' do'n'gelekleri shen'ber tu'rinde?
6. Ne ushi'n qudi'qlardi'n' qaqqag'i' kvadrat formasi'nda yemes, al do'ngelek ta'rizli boladi'?
7. A'tirapi'n'i'zda shen'berge mi'sal bolatug'i'n 10 predmentlerdin' ati'n jazi'n'.
8.  $AB$  ha'm  $CD$  kesindileri  $O$  orayi'na iye shen'berdin' diametrleri: a)  $\angle BCD = \angle ABC$ ; b)  $\angle BAD = \angle BCD$ ; c)  $AD = BC$ ; d)  $AC = BD$  ekenlgini ko'rsetin'.
9. Worayi' berilgen tuwri'da jati'wshi' radiusi'a) 5 sm ge; b) 7 sm ge; c) 4,6 sm ge ten' bolg'an shen'ber si'zi'n'.
10.  $AB$  ha'm  $CD$  kesindileri – worayi'  $O$  noqati'nda bolg'an shen'berdin' diametrleri. Yeger  $CB = 10$  sm,  $AB = 12$  sm bolsa,  $\triangle AOD$  ni'n' perimetrin tabi'n'.
11. 5-su'wrettegı belgisiz mu'yesh  $x$  ti' tabi'n'.
- 12\*. Shen'berdin' xordasi'na perpendikulyar bolg'an diametr usi' xordani' ten' yekige bo'letug'i'ni'n da'lillen'.
13. Shen'berdegi noqattan radiusqa ten' bolg'an yeki xorda ju'rgizildi. Usi' xordalardi'n' arasi'ndag'i' mu'yeshi tabi'n'.

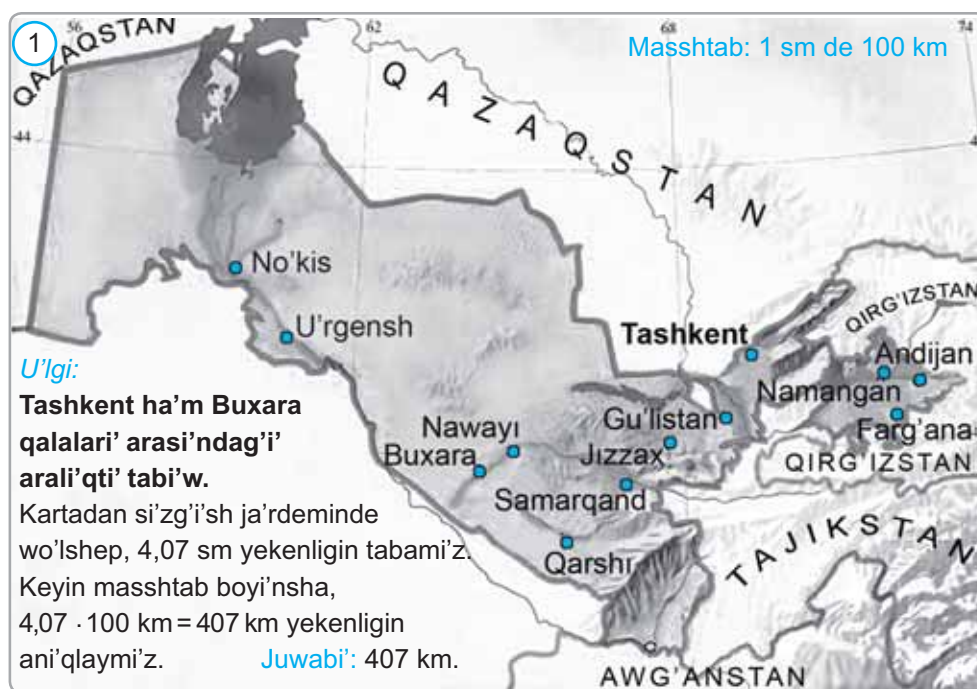


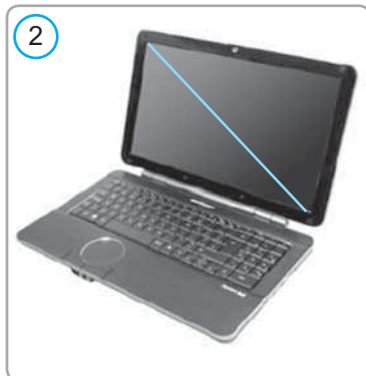


### Aktivlestirish a'meliy shi'ni'g'i'wlar

1. Qoli'n'i'zda'g'i' sabaqli'qti'n' uzi'nli'g'i', eni ha'm qali'n'li'g'i'n si'zg'i'sh ja'rdeminde wo'lshe'n'.
2. Qoli'n'i'zda'g'i' sabaqli'qti'n' bir betinin' qali'n'li'g'i'n qalay wo'lshe'w mu'mkin? Si'zg'i'sh ja'rdeminde gerbishtin' diagonalin' o'lshe'y alasiz ba?
3. Klaslari'n'i'zdi'n' boyin' shamalap wo'lshe'n' ha'm sa-li'sti'ri'n'. Boyi' yen' uzi'n klaslari'n'i'zdi' ani'qlan'.
4. Qari'si'n'i'zdi' si'zg'i'sh ja'rdeminde santimetrlerde wo'lshe'n', keyin bir neshe predmetlerdin' wo'lshe'mlerin (partani'n' yenin, uzi'nli'g'i'n ha'm biyikligin, aynani'n' biyikligin ha'm yenin, taxtani'n' uzi'nli'g'i'n ha'm yenin) qari'slap wo'lshe'n' ha'm santimetrlerde an'lati'n'.
5. Adi'mi'n'i'zdi'n' uzi'nli'g'i'n wo'lshe'n'. Mektep imarati'ni'n' uzi'nli'g'i'n ha'm yenin, sport may-danshasi'ni'n' uzi'nli'g'i'n ha'm yenin adi'mlap wo'lshe'n' ha'm metrlerde an'lati'n'.
6. Wo'zbekstanni'n' kartasi'nan, berilgen masshtab boyi'nsha tu'rli qalalar arasi'ndag'i' arali'qlardi' tabi'n' (1-su'wret).

**Qari'si'n'iz ha'm adi'mi'n'i'zdi'n' uzi'nli'g'i'n wo'lshe'p, eslep qali'n'. Wolardi' biliw sizge ku'n-delikli turmi'sta ko'p jag'daylarda kerek bo-ladi'.**

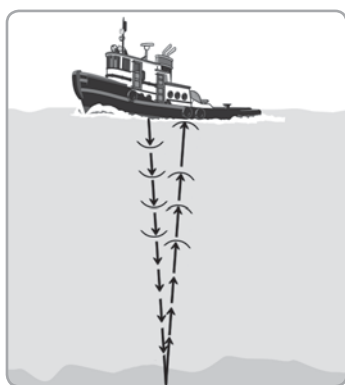
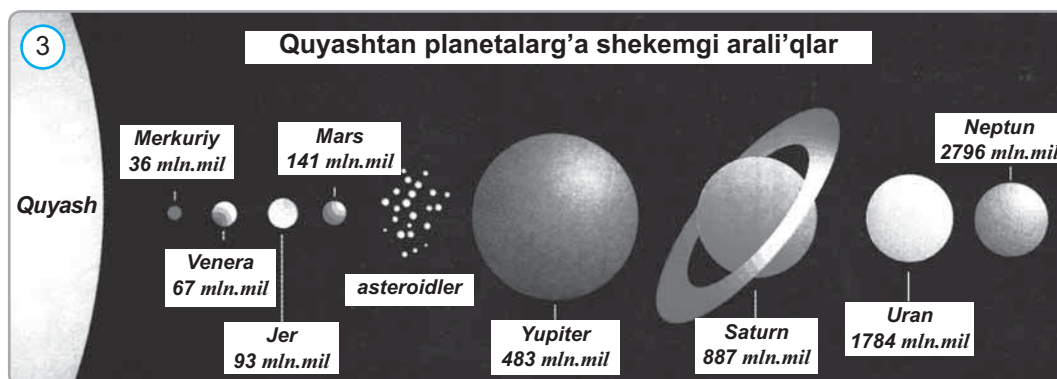




Ko'plegen ma'mleketlerde, xali'q arali'q wo'lshe**m** birliklerinen ti'sqari' to'mendegi uzi'nli'q wo'lshe**m** birlikleri de qollani'ladi'.

$$1 \text{ dyuym} = 2,54 \text{ sm}, \quad 1 \text{ mil} = 1,609 \text{ km}.$$

7. Televizor ha'm kompyuter monitori'ni'n' diagonali' (2-su'wret) dyuymlarda o'lshe**n**edi. Yeger 1 *dyuym* 2,54 *sm* bolsa, 15, 17 ha'm 19 *dyuym*li' monitor diagonali'n santimetrlerde an'lati'n'.
8. 3-su'wrette berilgen mag'li'wmatlardan paydalani'p, Jerden Quyashqa shekem ha'm basqa planetalarg'a shekem bolg'an arali'qti' tabi'n' ha'm woni' kilometrlerde an'lati'n'.
9. Yeger bir shaqi'ri'm 900 *m* yekeni belgili bolsa, Buxara ha'm Samarqand qalalari' arasi'ndag'i' arali'qlardi' shaqi'ri'mlarda an'lati'n'.



**Qi'zi'g'arli' ma'sele.** Qashi'qli'qti' ses penen wo'lshe**w**. Ten'izde ju'zip ju'rgen keme ushi'n ten'iz teren'ligin biliw ju'da' za'ru'rli esaplanadi'. Buni'n' ushi'n ten'izdin' tu'bine ses signali' jiberiledi ha'm sestini' ten'iz tu'bine uri'li'p qansha waqi'tta qayti'p kelgeni wo'lshe**n**edi. Bul waqi'tti'n' yari'mi'n sestini' suwdag'i' tezligi — 1490 m/s qa ko'beytip ten'iz tu'binin' teren'ligi ani'qlanadi'.

Yeger bul waqi't 3 sekundi' qurag'an bolsa, ten'iz tu'bi neshe metr teren'likte?



Mu'yesh dep noqat ha'm wonnan shi'g'i'wshi' yeki nurdan ibarat bolg'an figurag'a ayti'ladi'.

Mu'yeshi payda yetken nurlar mu'yeshin' ta'repleri, wolardi'n' uli'wmali'q to'besi bolsa mu'yeshin' to'besi dep ataladi'. 1-su'wrette mu'yesh su'wretlengen. Wonda  $O$  noqati' mu'yeshin' to'besi,  $OA$  ha'm  $OB$  nurlar bolsa woni'n' ta'repleri. Bul mu'yesh " $\angle AOB$ " yamasa " $\angle BOA$ " tu'rinde belgilenedi ha'm " $AOB$  mu'yeshi" yamasa " $BOA$  mu'yeshi" dep oqi'ladi'. Bunday jazi'wda mu'yeshin' to'besi barqulla ortada jazi'ladi'. Sonday-aq bul mu'yesh qisqasha " $\angle O$ " tu'rinde de belgilenip, " $O$  mu'yeshi" dep oqi'ladi'. Su'wrette mu'yeshi aji'rati'p ko'rsetiw ushi'n, geyde woni'n' yeki ta'repi 1-su'wrette ko'rsetilgenindey yetip dog'a ta'rizli si'zi'q penen tutastiri'p qoyiladi'.



Jayi'q mu'yesh dep ta'repleri bir-birin toli'qti'ri'wshi' nurlardan ibarat bolg'an mu'yeshke ayti'ladi'.

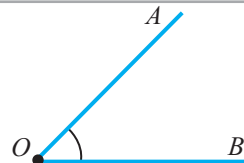
2-su'wrette jayi'q mu'yeshler ko'rsetilgen.

Jayi'q mu'yeshen wo'zgeshe  $O$  mu'yeshi berilgen bolsi'n. To'beleri usi' mu'yeshin' ta'replerinde bolg'an qanday da bir  $AB$  kesindisin qaraymiz (3-su'wret).

Yeger mu'yeshin' to'besinen shi'g'i'wshi'  $OC$  nuri' (3-su'wret)  $AB$  kesindisin kesip wo'tse, bul nardi' mu'yeshin' ta'replerinin' arasi'nan wo'tedi deymiz. Mu'yeshin' ta'replerinin' arasi'nan wo'tiwshi nur yeki mu'yeshke aji'raladi'.

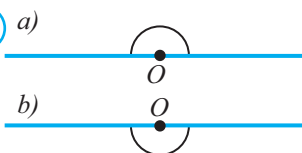
$O$  mu'yeshi jayi'q bolg'anda, woni'n' to'besinen shi'g'i'wshi' ha'm ta'replerinen wo'zgeshe ha'r qanday nardi', woni'n' ta'repleri arasi'nan wo'tedi, deymiz.

1



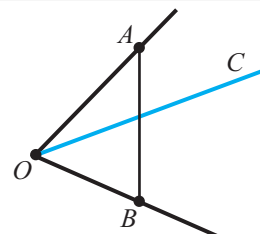
$\angle AOB$  —  $AOB$  mu'yeshi  
 $O$  — mu'yeshin' to'besi  
 $OA, OB$  nurlar — mu'yeshin' ta'repleri

2



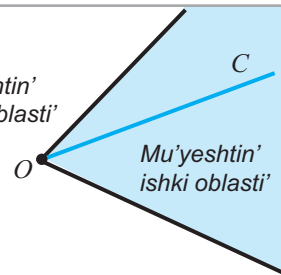
$\angle O$  — jayi'q mu'yesh

3



$OC$  — mu'yesh ta'repleri arasi'nan wo'tiwshi nur.

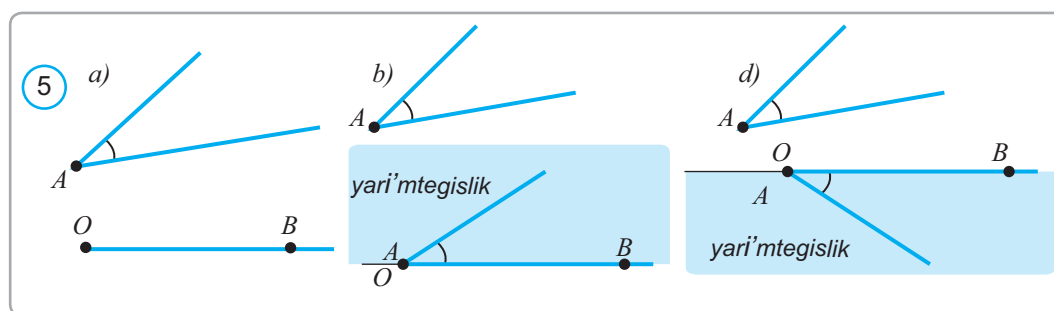
4



4-su'wrette ko'rsetilgen  $O$  mu'yeshi tegislikti yeki bo'lekke aji'ratatug'i'ni' belgili.

Tegisliktin' mu'yesh ta'replerinin' arasi'nan wo'tiwshi qanday da bir nurdi'n' jati'rg'an bo'legi *mu'yeshin' ishki oblasti'* dep ataladi', yekinshisi bolsa *mu'yeshin' si'rtqi' oblasti'* dep ataladi'.

Qa'legen  $OB$  nuri' ha'm jayi'q bolmag'an  $A$  mu'yeshi berilgen bolsi'n (5.a-su'wret).  $OB$  nuri' jatqan tuwri' tegislikti yeki yari'mtegislikke aji'ratatug'i'ni' belgili,  $A$  mu'yeshke ten', bir ta'repi  $OB$  nuri' menen u'stpe-u'st tu'setug'i'n, yekinshi ta'repi berilgen yari'mtegislikke jatatug'i'n mu'yeshi jalgi'z tu'rinde qoyi'w mu'mkinligi ko'rinip tur (5.b,d-su'wretler). Bul "mu'yeshi nuradan yari'mtegislikke qoyi'w" dep te ju'rgiziledi.

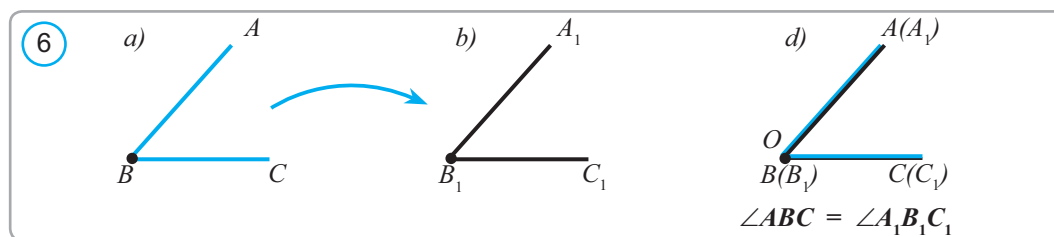


Figurada mu'yeshlardin' ten'ligi ha'r qi'yl'i sandag'i' dog'alar menen belgilenedi.

**A**

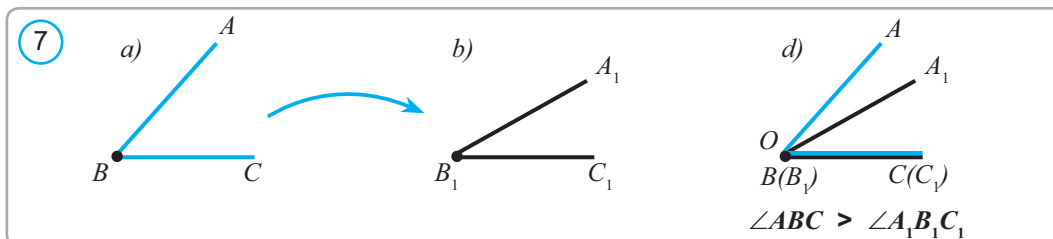
Qa'legen nurdan baslap tayar yari'mtegislikke, berilgen jayi'q yemes mu'yeshke ten' bolg'an jalgi'z mu'yeshi qoyi'w mu'mkin.

Yeki mu'yeshi wo'z-ara sali'sti'ri'w ushi'n, bul mu'yeshler qanday da bir nurdan baslap berilgen yari'mtegislikke qoyi'ladi'. Son' bolsa, to'mendegi jag'daylardi'n' qaysi' biri ju'z beriwine qarap, mu'yeshlardi'n' wo'z-ara ten'ligi yamasa u'lken-kishiligi haqqi'nda juwmaq shi'g'ari'ladi':



$\angle ABC$  ha'm  $\angle A_1B_1C_1$  mu'yeshlardi  $O$  nuri'na qoyg'ani'mi'zda (6.d-su'wret)  $BA$  nuri'  $B_1A_1$  nuri' menen,  $BC$  nuri' bolsa  $B_1C_1$  nuri' menen u'stpe-u'st tu'sedi. Bul jag'dayda,  $ABC$  mu'yeshi  $A_1B_1C_1$  mu'yeshke ten' delinedi ha'm  $\angle ABC = \angle A_1B_1C_1$  tu'rinde an'lati'ladi'.





7.d-su'wrette ko'rsetilgan jag'dayda,  $\angle ABC$  mu'yeshi  $\angle A_1B_1C_1$  mu'yeshinen **u'lken** delinedi ha'm  $\angle ABC > \angle A_1B_1C_1$  jazi'wi' menen an'lati'ladi'. Sonday-aq, bul jag'dayda  $\angle A_1B_1C_1$  mu'yeshi  $\angle ABC$  mu'yeshinen **kishi** delinedi ha'm  $\angle A_1B_1C_1 < \angle ABC$  tu'rde an'lati'ladi'.



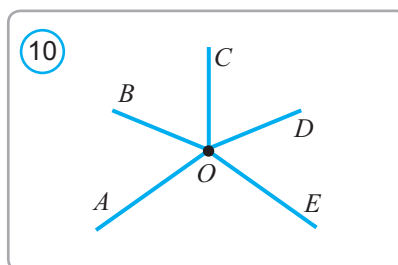
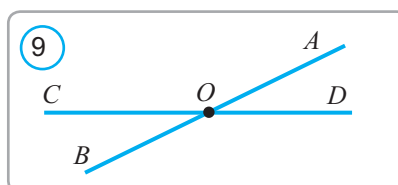
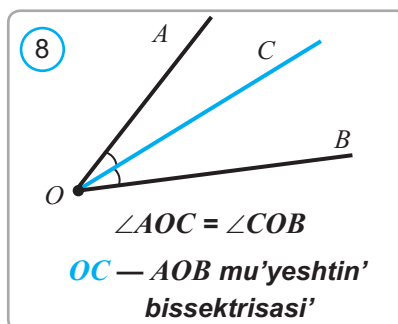
**Mu'yesh tin' bissektisasi'** dep – woni'n to'be-sinen shi'g'i'p, mu'yesh ti ten' yeki mu'yeshke aji'rati'wshi' nurg'a ayti'ladi'.

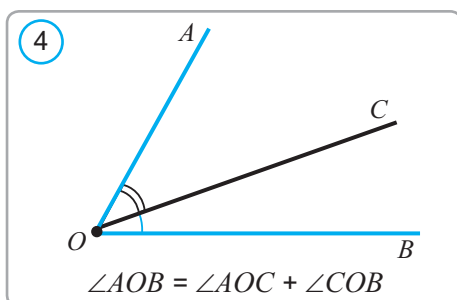
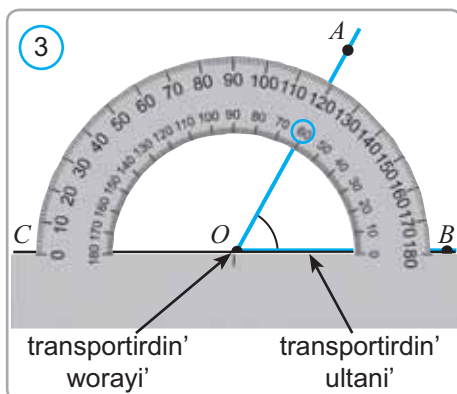
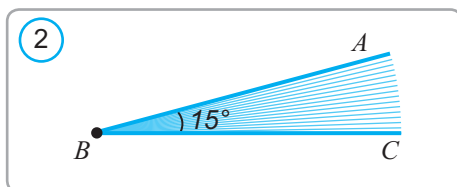
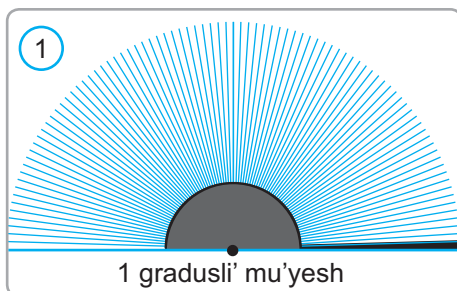
8-su'wrette  $\angle AOB$  mu'yeshinin'  $OC$  bissektisasi' ko'rsetilgan.



### Soraw, ma'sele ha'm tapsi'rmalar

1. Mu'yesh dep nege ayti'ladi' ha'm wol qanday belgilenedi?
2. Jayi'q mu'yesh degen ne?
3. Mu'yesh tegislikti qanday bo'leklerge aji'ratadi'?
4. 9-su'wrette ko'rsetilgan mu'yeshlerdi ani'qlan' ha'm ati'n atan'.
5. 10-su'wrette neshe mu'yesh bar? Wolardi' atap da'pterin'izge jazi'n'.
6. "Mu'yesh ti nurdin' u'stine qoyi'w" degende neni tu'sinesiz?
7. Qashan mu'yeshler wo'z-ara ten' boladi'?
8. Qashan bir mu'yesh yekinshisinen u'lken yamasa kishi boladi'?
9. Mu'yesh bissektisasi'na ani'qlama berin'.
10.  $\angle AOB$  berilgen. To'mendegi ten'likler ma'niske iye me?  $\angle AOB = \angle BOA$ ;  $\angle AOB = \angle ABO$ ;  $\angle AOB = \angle OAB$ .





Jayi'q mu'yesh woni'n' ta'replari arasi'nda jati'wshi' nurlar menen 180 ten' mu'yeshke bo'lingen bolsi'n (1-su'wret). Bul mu'yeshlerdin' birewinin tin' wo'lshew birligi – *birlik mu'yesh* si'pati'nda ali'w qabi'l yetilgen. Woni'n' mu'yesh shamasii' bir *gradus* dep ataladi' ha'm 1° dep belgilenedi. Qa'legen mu'yeshdin' gradus wo'lshevin usi' birlik tiykari'nda ani'qlaw mu'mkin. *Mu'yeshdin' gradus wo'lshevi* mu'yeshdin' ishki oblasti'na neshe birlik mu'yesh ha'm woni'n' bo'lekleri jaylasi'wi'n ko'rsetedi.

2-su'wrette su'wretlengen  $ABC$  mu'yeshi 15° qa' ten'. Sebebi woni'n' ishki oblasti'na 15 birlik mu'yesh jaylasadi'.

**A** *Ha'r qanday mu'yesh tayar gradus wo'lshevine iye boli'p, woni'n' ma'nisi won' san menen an'latiladi'. Jayi'q mu'yeshdin' gradus wo'lshevi 180° qa' ten'.*

Mu'yeshlerdin' gradus wo'lshevi transportir dep atalug'i'n a'sbap ja'deminde wo'lshevedi. Transportir menen to'mengi klaslarda ta-ni'sqansi'z. Woni'n' shkalali' dog'a ta'rizli bo'legi si'zi'qlar menen 180 ten' bo'lekke bo'lingen boli'p, ha'r bir bo'lek bir gradusti' an'latadi'. 3-su'wrette transportir ja'deminde mu'yeshler-di wo'lshew bari'si' su'wretlengen. Su'wrette ko'rip turg'ani'n'i'zday  $AOB$  mu'yeshinin' shamasii' 60 gradusqa ten' ha'm bul  $\angle AOB = 60^\circ$  tu'rinde jazi'ladi'. Birdey gradus o'lshevmge iye mu'yeshler wo'z-ara ten' boladi', ha'm kerisinshe wo'z-ara ten' mu'yeshlerdin' gradus wo'lshevlari de ten' boladi'. U'lken mu'yeshdin' gradus wo'lshevlari de u'lken boladi' ha'm kerisinshe.

Mu'yeshlerdi wo'lishewde gradusti'n' u'leslerinen de paydalani'ladi'.  $1^\circ$  ti'n'  $1/60$  bo'legi "minut",  $1/3600$  "sekund" dep ataladi' ha'm sa'ykes tu'rde «'» ha'm «"» tu'rinde belgile-nedi. Ma'selen, shamasi' 45 gradus 38 minut 59 sekundqa ten' mu'yesh  $45^\circ 38' 59''$  tu'rinde jazi'ladi'.  $1^\circ = 60'$ ,  $1' = 60''$  yekenligi belgili.

Aytayi'q  $AOB$  mu'yeshi berilgen boli'p, woni'n' ta'replari arasi'nda jati'wshi' qa'legen  $OC$  nuri' woni'  $AOC$  ha'm  $COB$  mu'yeshlerge aji'ratsi'n (4-su'wret). Bul jag'dayda  $AOB$  mu'yeshinin' gradus wo'lishemi  $AOC$  ha'm  $COB$  mu'yeshlerinin' gradus wo'lishemleri-nin' qosi'ndi'si'na ten' boladi':

$$\angle AOB = \angle AOC + \angle COB.$$

Bul qa'siyetti to'mendegishe an'lati'w mu'mkin:

**A** Mu'yeshdin' gradus wo'lishemi, mu'yeshdin' ta'replari arasi'nan wo'tiwshi qa'legen nur aji'ratqan mu'yeshlerdin' gradus o'lishemlerinin' qosi'ndi'si'na ten'.

**1-ma'sele.** Yeger 5-su'wret  $\angle ABC = \angle DBE$  bolsa,  $\angle ABD = \angle CBE$  yekenligin korsetin'.

**Sheshiliwi.** Berilgen  $\angle ABC = \angle DBE$  ten'liktin' ha'r yeki ta'repine  $\angle CBD$  ni' qo'sami'z:

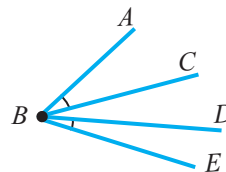
$$\angle ABC + \angle CBD = \angle CBD + \angle DBE$$

$$\text{Lekin, } \angle ABC + \angle CBD = \angle ABD \text{ ha'm}$$

$$\angle CBD + \angle DBE = \angle CBE.$$

$$\text{Demek, } \angle ABD = \angle CBE.$$

5



**Berilgen nurg'a berilgen gradus wo'lishemli mu'yesh jasawdi'n' a'meliy joli'**

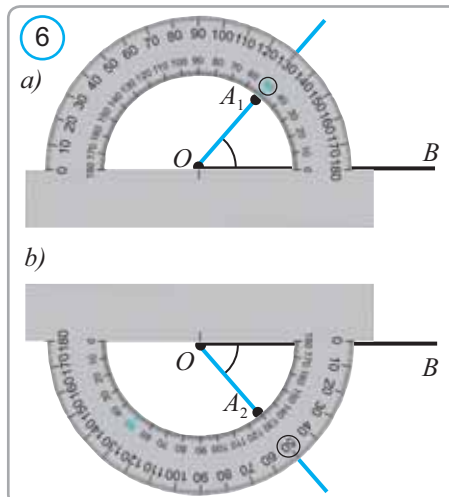
1. Qa'legen  $OB$  nuri' si'zi'p ali'nadi'.
2. Transportirdin' ultani'n berilgen  $OB$  nuri'ni'n' u'stine, worayi'n bolsa  $O$  noqati'na 6-su'wrette ko'rsetilgendey yetip qoyi'ladi'.
3. Transportir shkalasi'nan mu'yeshdin' berilgen gradus wo'lishemin ko'rsetiwshi bolegi tabi'ladi' ha'm woni'n' tuwri'si'na  $A$  noqati' qoyi'ladi'.
4.  $O$  ha'm  $A$  noqatlari' arqali' nur ju'rgiziledi. Na'tiyjede berilgen gradus wo'lishemli  $A_1OB$  ( $A_2OB$ ) mu'yeshi payda boladi'.



**2-ma'sele.** Berilgen  $OB$  nuri'na  $50^\circ$  li' mu'yeshti qoyi'n'.

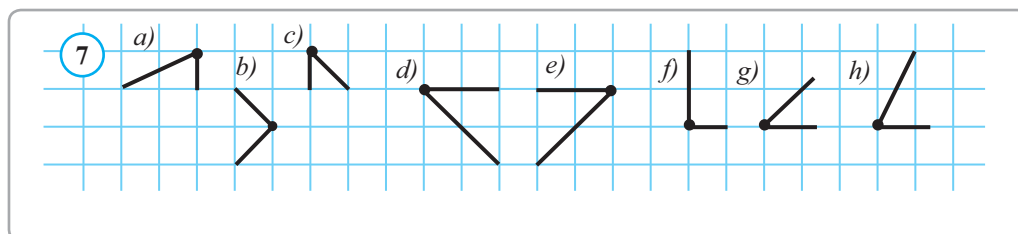
**Sheshiliwi.** Transportirdin' ultani'n  $OB$  nuri'ni'n' u'stine, worayi'n bolsa  $O$  noqati'na qoyi'p, woni'n' shkalasi'nda  $50^\circ$  qa sa'ykes keliwshi bo'legi tabi'ladi' ha'm mu'yesh jasaladi'.  $OB$  tuwri'si'ni'n' bir bo'legi boli'p, bul tuwri' tegislikti yeki yari'mtegislikke aji'ratatug'i'nli'g'i' belgili. Demek, berilgen nurdan ha'r bir yari'mtegislikke birewden  $50^\circ$  li' mu'yesh qoyi'w mu'mkin.

$$\angle A_1OB = \angle A_2OB = 50^\circ \text{ (6-su'wret).}$$

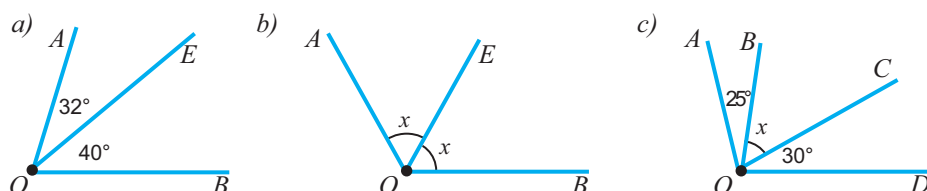


**Soraw, ma'sele ha'm tapsi'rmalar**

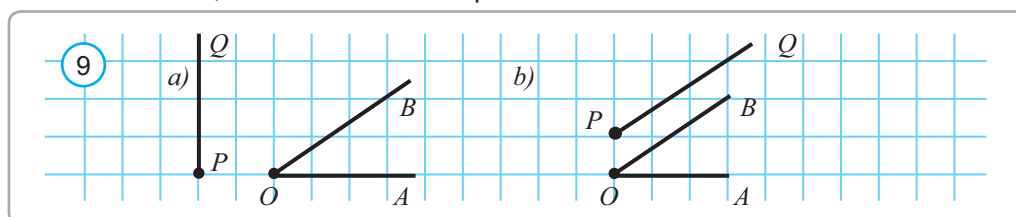
1. Jayi'q mu'yesh neshe gradus?
2.  $1^\circ$  qa ten' mu'yesh degende qanday mu'yeshti tu'sinesiz?
3. Yeki mu'yeshtin' gradus wo'lshe'mleri ten' bolsa, wolar ten' bola ma?
4. Berilgen gradus wo'lshe'mine iye bolg'an mu'yesh qanday jasaladi'?
5. 7-su'wrette ko'rsetilgen mu'yeshler arasi'nan ten' mu'yeshlerdi aniqlang.
6. Transportir ja'rdeminde  $10^\circ$ ,  $30^\circ$ ,  $70^\circ$ ,  $100^\circ$  ha'm  $160^\circ$  li' mu'yeshlerdi jasan'.



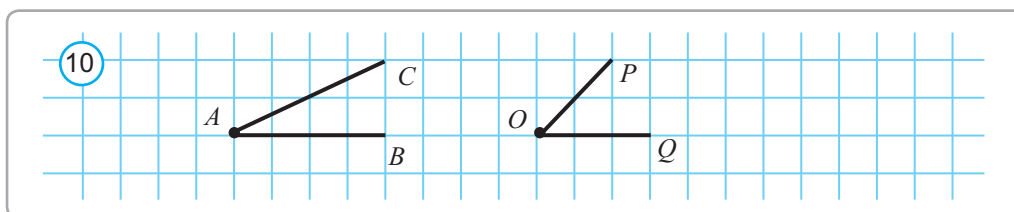
7. a)  $\angle AOB = ?$  (8.a-su'wret) b)  $\angle AOB = 120^\circ$ ,  $x = ?$  (8.a-su'wret)  
c)  $\angle AOD = 105^\circ$ ,  $x = ?$  (8.a-su'wret)
8. Berilgen  $AB$  nuri'na  $150^\circ$  li'  $OAB$  mu'yeshti qoyi'n'.



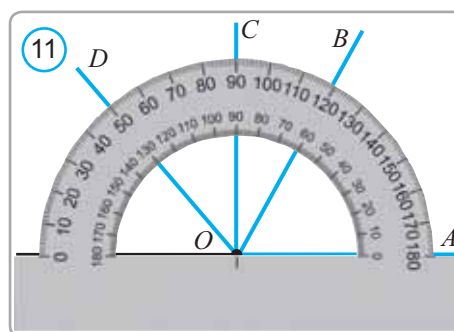
9.  $PQ$  nuri'na  $AOB$  mu'yeshlerdi qoyi'n' (9-su'wret).
10. Uli'wma ta'repke iye bolg'an  $60^\circ$  ha'm  $120^\circ$  li' mu'yeshlerdi jasan'. Qanday mu'yesh payda boladi'?
11. 10-su'wrette ko'rsetilgen mu'yeshlerden qaysi'si' u'lken?
12. Yeger a)  $\angle AOE = 20^\circ$ ,  $\angle EOB = 40^\circ$ ,  $\angle AOB = 60^\circ$ ; b)  $\angle AOE = 80^\circ$ ,  $\angle EOB = 120^\circ$ ; c)  $\angle AOE > \angle AOB$  bolsa,  $OE$  nur  $\angle AOB$  ta'replerinin' wortasi'nan wo'te me?

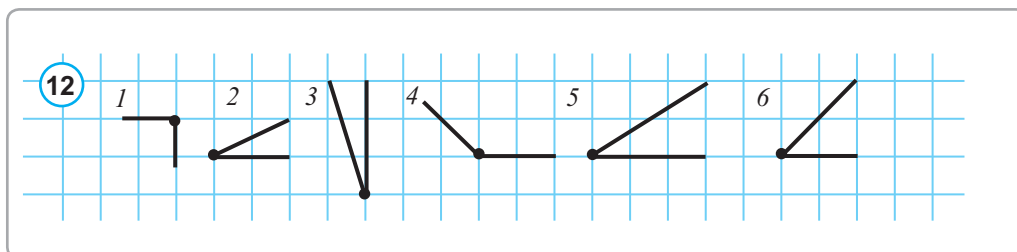


13. Da'pterin'izge nur si'zi'n' ha'm wog'an ko'zin'iz benen shamalap a'piwayi' si'zg'i'sh ja'rde-minde  $15^\circ$ ,  $30^\circ$ ,  $45^\circ$ ,  $60^\circ$ ,  $75^\circ$ ,  $90^\circ$ ,  $120^\circ$  ha'm  $150^\circ$  li' mu'yeshlerdi qoyi'n'. Son'i'nan payda bolg'an mu'yeshlerdi transportir ja'rdeminde wo'lshen' ha'm qanshelli duri's si'zg'ani'n'i'zdi' tekserin'. Shi'ni'g'i'wlardi' ta'kirarlan'.
14. Saat: a) 3.00; b) 6.00 bolg'anda saat ha'm minut tilleri payda yetken mu'yesh neshe gradusqa ten' boladi'?



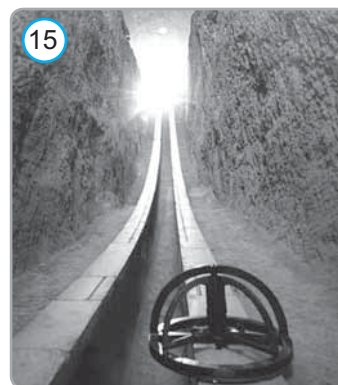
15. 11-su'wrette paydalani'p  $AOB$ ,  $AOC$ ,  $AOD$ ,  $BOC$ ,  $BOD$  ha'm  $COD$  mu'yeshlerinin' gradus wo'lshemin ani'qlan'.
16. 12-su'wretten ko'rsetilgen mu'yeshler sanlari'n wolardi'n' gradus wo'lshewlerin wo'siw ta'rtibinde jazi'n'.



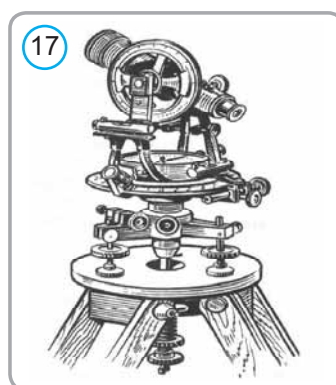
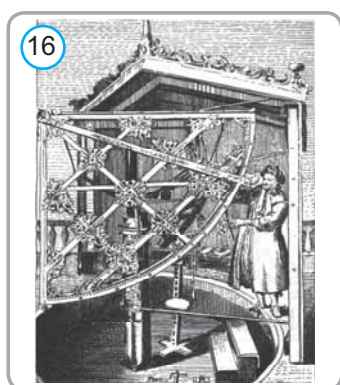


### Tariyxtan u'zindiler

*Astrolabiya (Asturlab) – mu'yesh wo'lsheytag'i'n asbap boli'p, wol a'yyemgi grek astronomi' Gipparx ta'repinen erami'zdan 180–125 ji'l aldi'n woylap tabi'lg'an (13-su'wret). Ko'rinisi ju'da a'piwayi' bolg'an bul asbapta wonlag'an wo'lshew jumi'slari'n wori'nlaw mu'mkin bolg'an. Samarqandtag'i' Ulug'bektin' astronomiyali'q abservatoriyasi'nda da mu'yesh wo'lshew jumi'slari' ali'p bari'lg'an. Bul u'lken cilindr formasi'ndag'i' u'sh qabatli' yetip quri'lg'an abservatoriyada ko'plegen quri'lma ha'm asbaplar bolg'an (14-su'wret). Wolardi'n' yen'tiykarg'i'si' wo'lshevi ha'm geometriyali'q*



sheshimi boyi'nsha ten'siz bolg'an vertikal kvadrant yesaplanadi'. Woni'n' radiusi' 42 m bolg'an! Ulug'bek bul quri'lma ja'rdeminde 1018 juldi'zdi'n' kosmostag'i' worni'n hayran qalarli'q aniqli'qta wo'lshep, wo'zinin' "Ziji jadidi Ko'ragoniy" degen miynetinde keltirgen. 15-su'wrette woni'n'jer asti'nda saqlani'p, usi'ku'nge shekem jetip kelgen bo'legi su'wretlengen. 16-su'wrette Evropali'ali'mlar teleskop woylap tabi'li'wi'nan aldi'n paydalang'an kvadrant su'wretlen-gen. Wol Ulug'bek kvadranti'nan a'dewir kishi a'llette. Ha'zirde jer wo'lshew jumi'slari'nda joqari' aniqli'qqa iye bolg'an teodolit (17-su'wret) degen a'sbap qollani'ladi'.



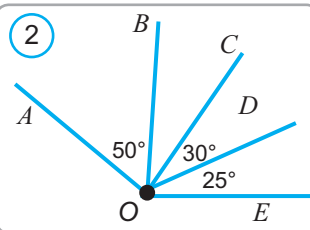
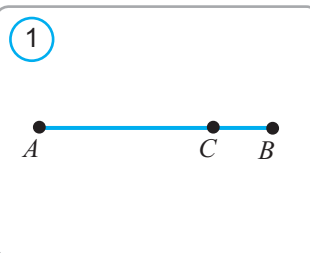
## 10 1-baqlaw jumi'si'

U'lgili baqlaw jumi'si' yeki bo'limnen ibarat boladi':

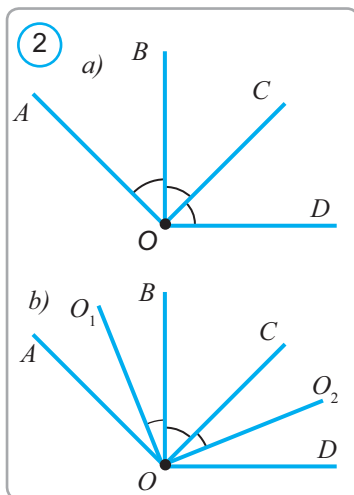
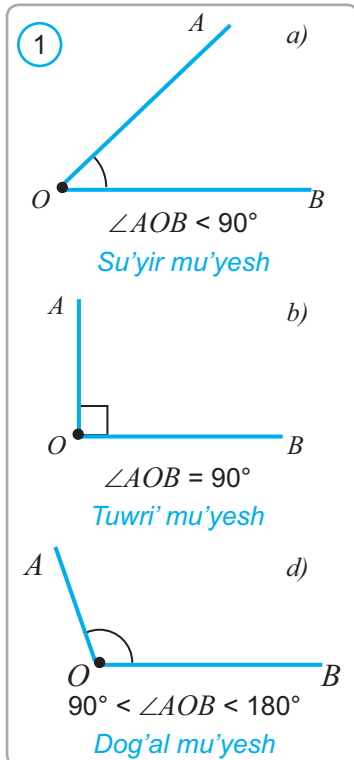
I. Teoriyalig' bo'lim. Usi' waqi'tqa shekem u'yrenilgen geometriyalig' figuralardi' sanan'. Wolarg'a ta'riypleme berin' ha'm wolardi'n' qa'siyetlerin jazi'n'.

II. A'meliy bo'lim. To'mendegi ma'selelerdi sheshin' (4-ma'sele "ayri'qasha" baha almaqshi' bolg'an woqi'wshi'larg'a arnalg'an):

1. Birtuwri'da jati'wshi'  $A, B$  ha'm  $C$  noqatlari' ushi'n  $AB = 9 \text{ sm}$ ,  $AC = 12 \text{ sm}$  bolsa,  $BC$  kesindinin' uzi'nli'g'i' nege ten'?
2.  $AB = 48$ ,  $AC = 3BC$ ,  $BC = ?$  (1-su'wret)
3. Yeger 2-su'wrette  $\angle AOE = 140^\circ$  bolsa,  $\angle BOC$  mu'yeshinin' gradus wo'lshemin tabi'n'.
- 4\*. Saat 5.00 bolg'anda saat ha'm minut tilleri (strelkalari') payda yetken mu'yesh neshe gradus boladi'?







Aldi'n'g'i' sabaqlarda ayti'p wo'tkenimizdey, jayi'q mu'yeshtin' gradus wo'lshe'mi  $180^\circ$  qa ten'. Buni' qi'sqasha: "Jayi'q mu'yesh  $180^\circ$  qa ten" dep te aytami'z. Mu'yeshler shamas'i'na qarap tu'rlerge aji'rati'ladi': Yeger mu'yeshtin' gradus wo'lshe'mi:

$90^\circ$  dan kishi bolsa (1.a-su'wret), su'yir mu'yesh,  $90^\circ$  qa ten' bolsa (1.b-su'wret), tuwri' mu'yesh,  $90^\circ$  penen  $180^\circ$  arasi'nda bolsa (1.d-su'wret), dog'al mu'yesh dep ataladi'.

Si'zi'lmada mu'yeshtin' tuwri' mu'yesh yekenligin ko'r-setiw ushi'n wo'z aldi'na, 1.b-su'rettegidey belgilenedi.



**Ma'sele.** Yeger  $\angle AOD = 135^\circ$ ,  $\angle AOB = \angle BOC = \angle COD$  bolsa (2.a-su'wret),

a) si'zi'lmada neshe su'yir, dog'al ha'm tuwri' mu'yesh bar?  
b)  $AOB$  ha'm  $COD$  mu'yeshlerinin' bissektisalarini' arasi'ndagi' mu'yeshi tabi'n'.

**Sheshiliwi:** a)  $\angle AOB = \angle BOC = \angle COD = \alpha$  bolsi'n. Bul jag'dayda, mu'yeshlerdi wo'lshe'wdin' tiykarg'i' qa'siyeti boyi'nsha,  $\angle AOD = \alpha + \alpha + \alpha = 135^\circ$ . Bunnan  $\alpha = 45^\circ$ . Demek,  $\angle AOC = 2\alpha = 90^\circ$ ,  $\angle BOD = 2\alpha = 90^\circ$ . Solay yetip, si'zi'lmada 3 su'yir, 2 tuwri' ha'm 1 dog'al mu'yesh bar.

b)  $OO_1$  ha'm  $OO_2$  — sa'ykes bissektisalar bolsi'n (2.b-su'wret).  $\angle AOB = \angle COD = 45^\circ$  bolg'ani' ushi'n, mu'yesh bissektisasi'ni'n' ani'qlamasini' boyi'nsha,

$$\angle O_1OB = \angle O_2OC = \frac{\alpha}{2} = 22,5^\circ.$$

Izlenip ati'rg'an mu'yesh bolsa:

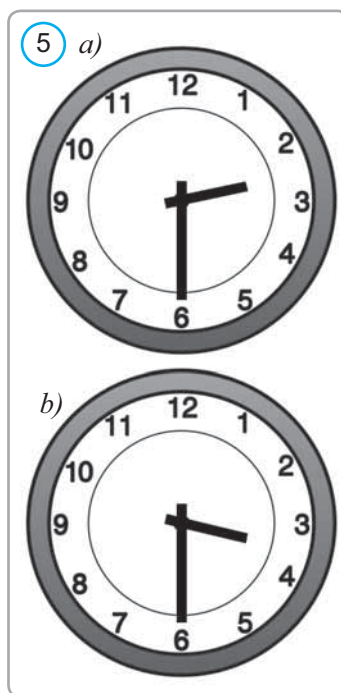
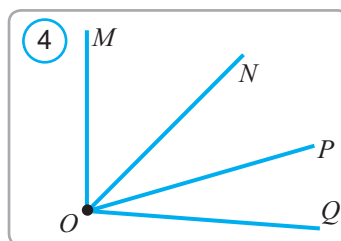
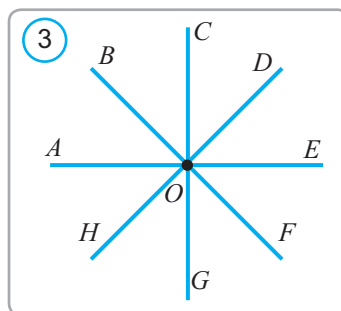
$$\begin{aligned}\angle O_1OO_2 &= \angle O_1OB + \angle BOC + \angle COO_2 = \\ &= \frac{\alpha}{2} + \alpha + \frac{\alpha}{2} = 2\alpha = 90^\circ,\end{aligned}$$

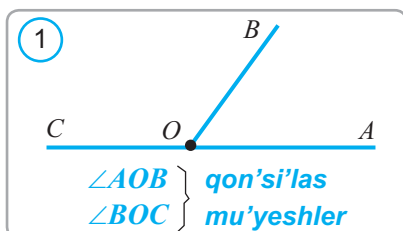
yag'ni'y  $O_1OO_2$  — tuwri' mu'yesh.

**Esletpe.** A'dette mu'yeshlerdin' grek alfavitinin' kishi  $\alpha$  (alfa),  $\beta$  (beta),  $\gamma$  (gamma), ... ha'ripleri menen belgilenedi.

**? Soraw, ma'sele ha'm tapsi'rmalar**

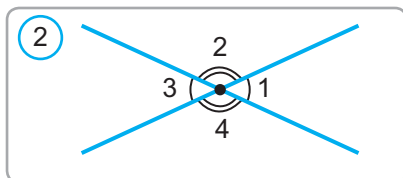
1. Qanday mu'yesh tuwri' mu'yesh delinedi? Do'gerek a'tiraptan tuwri' mu'yeshke mi'sallar keltirin'.
2. Su'yir ha'm dog'al mu'yeshler bir-birinen qanday wo'zgeshelikke iye?
3. U'sh mu'yesh si'zi'n'. Wolardi' sa'ykes tu'rde  $\angle AOB$ ,  $\angle MNL$ ,  $\angle PQR$  menen belgilen'. Transportir menen wolardi' wo'lshen' ha'm tu'rlerin ani'qlan'.
4.  $OA$  nuri'n si'zi'n'. Transportir ja'rdeminde gradus wo'lshemi sa'ykes  $25^\circ$ ,  $72^\circ$  ha'm  $146^\circ$  bolg'an  $AOB$ ,  $AOC$  ha'm  $AOD$  mu'yeshlerin jasan'.
5. Tuwri' mu'yeshstin' bissektisasi' woni'n' ta'repi menen qanday mu'yesh payda yetedi?
6. 3-su'wrette neshe: a) su'yir; b) dog'al; c) tuwri'; d) jayi'q mu'yesh bar?
7. 4-su'wrette neshe su'yir ha'm neshe dog'al mu'yesh bar?
8. Qag'azdi'n' betin bu'klep tuwri' mu'yesh payda yete alasi'z ba?
9. Qashan saatti'n' saat ha'm minut tilleri tuwri' mu'yesh payda yetedi?
10. Saatti'n' saat tili: a) 1 saatta ; b) 6 saatta; c) 2 minutta neshe gradusqa buri'ladi'?
11. Saatti'n' minut tili: a) 1 minutta; b) 5 minutta; c) 0,5 saatta neshe gradusqa buri'ladi'?
- 12\*. Saat: a)  $14^{30}$ ; b)  $15^{30}$  bolg'anda saat ha'm minut tilleri payda yetken mu'yeshsti ani'qlan' (5-su'wret).
13.  $AOB$  mu'yesh  $OC$ ,  $OD$  ha'm  $OE$  nurlari' menen ten'dey to'rt mu'yeshke bo'lingen. Bul nurlar qaysi' mu'yeshlerdin' bissektisalarini' boladi'?





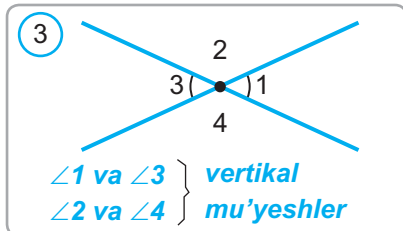
Qon'si'las mu'yeshler dep, bir ta'repi uli'wma, qalg'an ta'repleri tuwri'ni' payda yetiwshi mu'yeshler jubi'na ayti'ladi'.

1-su'wrette  $AOB$  ha'm  $BOC$  qon'si'las mu'yeshleri su'wretlengen. Bunda  $OC$  ha'm  $OA$  nur-lari' bir tuwri'da jatadi'.



### Aktivlestiriwshi shi'ni'g'i'w

- Qon'si'las mu'yeshlerdin' qosi'ndi'si' jayi'q mu'yesh bolatug'i'ni'n ko'rsetin'.
- Yeger qon'si'las mu'yeshler wo'z-ara ten' bolsa, wolar tuwri' mu'yesh bolatug'i'n ko'rsetin'.
- 2-su'wrette ko'rsetilgen, yeki tuwri'ni'n kesilisiwinen payda bolg'an  $\angle 1$ ,  $\angle 2$ ,  $\angle 3$  ha'm  $\angle 4$  mu'yeshlerinen qaysi'lari' wo'z-ara qon'si'las mu'yeshler jupli'g'i'n payda yetedi?



**Qa'siyet.** Qon'si'las mu'yeshlerdin' qosi'ndi'si'  $180^\circ$  qa ten'.



Vertikal mu'yeshler dep, yeki tuwri'ni'n kesilisiwinen payda bolg'an ha'm wo'z-ara qon'si'las bolmag'an mu'yeshlerdin' jupli'g'i'na ayti'ladi'.

3-su'wrette  $\angle 1$  ha'm  $\angle 3$  vertikal mu'yeshler. Sonday-aq,  $\angle 2$  ha'm  $\angle 4$  de vertikal mu'yeshler jupli'g'i'n payda yetedi.

Yendi vertikal mu'yeshlerdin' to'mendegi qa'siyetlerin da'lilleyviz.

**Qa'siyet.** Vertikal mu'yeshler wo'z-ara ten'.

Aytayi'q,  $\angle 1$  ha'm  $\angle 3$  vertikal mu'yeshleri berilgen bolsi'n (3-su'wret).  $\angle 1 = \angle 3$  boli'wi'n da'lilleyviz.

**Da'lillew:**  $\angle 1 + \angle 2 = 180^\circ$ , sebebi  $\angle 1$  ha'm  $\angle 2$  qon'si'las mu'yeshler.

$\angle 2 + \angle 3 = 180^\circ$ , sebebi  $\angle 2$  ha'm  $\angle 3$  ler de qon'si'las mu'yeshler boladi'.

Bul yeki ten'likten  $\angle 1 + \cancel{\angle 2} = \cancel{\angle 2} + \angle 3$ , yag'ni'y  $\angle 1 = \angle 3$  yekenligin payda yetemiz.

**Qa'siyet da'lillendi.**

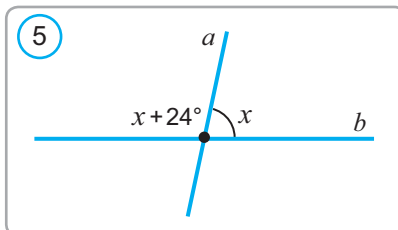
Solay yetip, yeki tuwri' kesiliskende vertikal ha'm qon'si'las mu'yeshler payda boladi'. Qon'si'las mu'yeshlerdin' juplig'i' wo'z-ara jayi'q mu'yeshti payda yetetug'i'ni' belgili. Olardin' biri  $90^\circ$  dan u'lken bolsa, yekinshisi  $90^\circ$  dan kishi boladi'. Qon'si'las mu'yeshlerdin' kishisinin' gradus wo'lishemi tuwri'lardi'n' arasi'ndag'i' mu'yesh dep qabi'l yetilgen. 4-su'wrettegi tuwri'lar arasi'ndag'i' mu'yesh  $30^\circ$  ti' payda yetedi. Buni' basqasha tu'rde "tuwri'lar  $30^\circ$  li' mu'yesh asti'nda kesilisedi" dep te aytami'z.



**Ma'sele.** Yeki tuwri'ni'n' kesilisiwinen payda bolg'an mu'yeshlerdin' biri yekinshisinen  $24^\circ$  u'lken bolsa, bul mu'yeshlerdi tabin'.

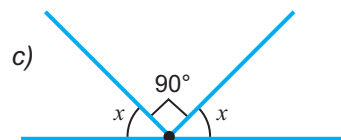
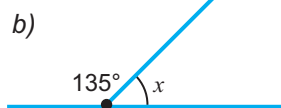
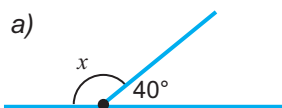
**Sheshiliwi.** Yeki tuwri'ni'n' kesilisiwinen payda bolg'an mu'yeshler qon'si'las ha'm vertikal mu'yeshler bolatug'i'nli'g'i' belgili (5-su'wret). Vertikal mu'yeshler wo'z-ara ten' boladi'.

Demek, ma'sele sha'rtinde berilgen mu'yeshler qon'si'las mu'yeshler yeken. Wolardi'n' birewin (kishisin)  $x$  penen belgilesek, ekinshisi,  $x+24^\circ$  qa ten' boladi'. Qon'si'las mu'yeshler qa'siyeti boyi'nsha,  $x+x+24^\circ=180^\circ$ . Bunnan  $x=78^\circ$  ha'm  $x+24^\circ=102^\circ$  yekenligin ani'qlaymi'z. Demek,  $a$  ha'm  $b$  tuwri'lari' kesiliskende  $78^\circ$ ,  $102^\circ$ ,  $78^\circ$  ha'm  $102^\circ$  li' mu'yeshler payda boladi'. **Juwabi':**  $78^\circ$ ,  $102^\circ$ ,  $78^\circ$  va  $102^\circ$ .



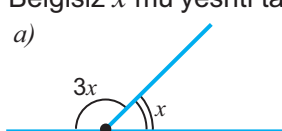
### Soraw ha'm ma'seleler

1. Qanday mu'yeshler qon'si'las mu'yeshler delinedi?
2. Qon'si'las mu'yeshlerdin' qosi'ndi'si' nege ten'? Juwabi'n'i'zdi' tu'sindirin'.
3. Qon'si'las mu'yeshler wo'z-ara ten' boli'wi' mu'mkin be?
4. Vertikal mu'yeshler degen ne? Si'zi'lmada ko'rsetin'.
5. Vertikal mu'yeshlerdin' tiykarg'i' qa'siyetin tu'sindirin'.
6.  $20^\circ$ ,  $30^\circ$ ,  $45^\circ$ ,  $90^\circ$  li' mu'yeshlerge qon'si'las bolg'an mu'yeshlerdi tabi'n'.
7. Yeger qon'si'las mu'yeshlerdin' biri yekinshisinen u'sh ma'rte u'lken bolsa, wonda wolardi' tabi'n'.
8. Qon'si'las mu'yeshlerdin' yekewi de: a) su'yir; b) tuwri'; c) dog'al mu'yeshler bola ala ma?
9. Yeger yeki mu'yesh ten' bolsa, wolarg'a qon'si'las bolg'an mu'yeshler de ten' bola ma?
10. Belgisiz  $x$  mu'yeshti tabi'n'.

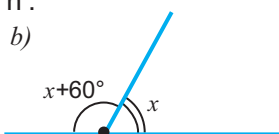


11. Belgisiz  $x$  mu'yeshi tabi'n'.

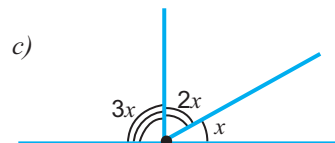
a)



b)



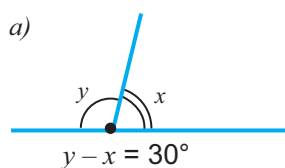
c)



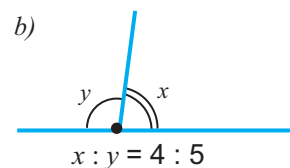
12. Yeger qon'si'las mu'yeshlerdin' gradus wo'lsheplerinin' qatnasi' a) 2:7; b) 11:25; c) 1:9 bolsa, wonda wolardi' tabi'n'.

13. Figurag'a qarap ma'sele du'zin' ha'm woni' sheshin'.

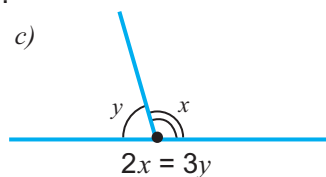
a)



b)



c)



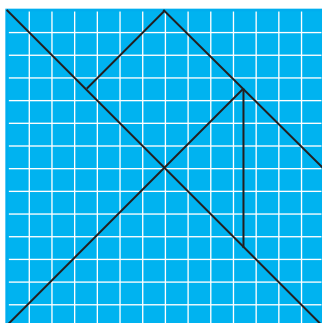
14. Yeger yeki tuwri'ni'n' kesilisiwinen payda bolg'an mu'yeshlerdin' biri  $40^\circ$  bolsa, qalg'an mu'yeshlerdi tabi'n'.

15. "Yeger mu'yeshler ten' bolsa, wolar vertikal mu'yeshler boladi", — degen tasti'yi'qlaw barqulla duri's pa?



### Geometriyalı'q basqatırma

6



Tangram atlı' Qi'tay woyi'nshi'g'i'n jasan'. Buni'n' ushi'n 6-su'wrette ko'rsetilgende y, kvadratti' qali'n' qag'azg'a si'zi'n' ha'm jeti bo'lekke bo'lip, qi'yi'p ali'n'.

Son' "tangram" bo'leklerinin' ha'mesinen paydalani'p, 7-su'wrette ko'rsetilgen figuralardi' jasan'.

a)



b)

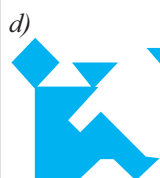


c)



7

d)



e)



f)



g)



h)



k)



l)



Usi' waqi'tqa shekem qatar geometriyalig' figuralar ha'm wolardi'n' qa'siyetleri menen tani'si'p shi'qti'q. Ma'selen, wo'tken sabaqta vertikal mu'yeshler menen tani'sti'q ha'm wolardi'n' wo'z-ara ten' boli'wi'n ko'rsettik. Yeslesen'i'z, bul qa'siyet penen tek tani'si'p qalmastan, woni' da'lilledik. Bul "da'lillew" tu'sinigi menen birinshi ma'rte tani'sqani'mi'z boldi'. Geometriyag'a birinshi boli'p "da'lillew" tu'sinigin ali'p kirgen matematik – erami'zdan aldi'n'g'i' 625 – 527 ji'llarda jasag'an Miletlik grek ali'mi' Fales boli'p esaplanadi'.

Qanday da bir tasti'yi'qlawdi'n' duri'sli'g'i'n logikalig'q pikirler ja'rdeminde keltirip shi'g'ari'w da'lillew dep ataladi'. Duri'sli'g'i'n da'lillew joli' menen da'lillenetug'i'n tasti'yi'qlaw bolsa teorema dep ataladi'. Teorema a'dette sha'rt ha'm juwmaq bo'limlerinen ibarat boladi'. Teoremani'n' birinshi – sha'rt bo'liminde neler berilgeni bayan etiledi. Yekinshi – juwmaq bo'liminde bolsa neni da'lillew kerekligi an'lati'ladi'. Ma'selen, to'mendegi teoremani' ali'p qarayi'q:



**Teorema.** Yeger qon'si'las mu'yeshler wo'z-ara ten' bolsa, wolardi'n' ha'r yekewinde tuwri' mu'yesh boladi'.

Bul teoremani'n' sha'rt bo'limi, "wo'z-ara qon'si'las mu'yeshlerdin' ten'ligi bolsa, juwmaq bo'limi "wolardi'n' tuwri' mu'yeshi boladi'" degeninen ibarat. Teoremani' da'lillew – woni'n' sha'rtinen paydalani'p, usi' waqi'tqa shekem belgili bolg'an mag'li'wmatlarga su'yenip, pikir ju'ritip, juwmaq bo'liminde an'lati'lg'an tasti'yi'qlawdi'n' duri'sli'g'i'n keltirip shi'g'ari'w boli'p yesaplanadi'. Teoremani'n' sha'rt ha'm juwmaq bo'limlerin ani'qlasti'ri'p ali'w teoremani' aydi'nlasti'radi', woni' tu'siniw ha'm da'lillew protsesin jen'illestiredi. Soni'n' ushi'n teoremani' da'lillewden aldi'n woni' sha'rt ha'm juwmaq bo'limlerge aji'rati'p, qayta jazi'p ali'w maqsetke muwapi'q boladi'. Ma'selen, joqari'da keltirilgen teoremani' to'mendegi ko'riniste qayta jazi'p ali'w mu'mkin:

**Berilgen:**  $\angle A$  ha'm  $\angle B$  qon'si'las mu'yeshler,  $\angle A = \angle B$



**Da'lillew kerek:**  
 $\angle A = \angle B = 90^\circ$

Teoremani'n' sha'rti

Teoremani'n' juwmag'i'

Uli'wma alg'anda, teoremani' sha'rt ha'm juwmaq bo'limlerinde aji'rati'p, to'mendegi sxema ko'riniside ko'rsetiw mu'mkin:

Yeger

**A tasti'yi'qlawi' wori'nli'**

bolsa,

**B tasti'yi'qlawi' wori'nli'**

boladi'.

Teoremani'n' sha'rti

Teoremani'n' juwmag'i'

---

**Baslang'i'sh tusinik ha'm aksiomalar.** Noqat, tuwri' ha'm tegislik si'yaqli' tu'sinikler geometriyani'n' baslang'i'sh tu'siniklari boli'p yesaplanadi'. Wolarg'a ani'qlama bermedik. Geometriyani'n' baslang'i'sh tusiniklari ani'qlamasi'z tuwri'dan-tuwri' kiritiletug'i'n tu'sinikler. Geometriyani' bir imarat dep alsaq, bul tu'sinikler woni'n' fundamenti. Baslang'i'sh tu'sinikler tiykari'nda basqa jan'a figura ha'm tu'sinikler haqqi'nda tu'sinik beriledi, yag'ni'y wolar ta'riyplenedi. Sabaqli'qta ta'riypler  belgisi menen ayri'qsha ko'rsetilip aji'rati'ladi', sebebi wolar geometriyani' u'yreniwde a'hmiyetli wori'n tutadi'.

Sonday-aq, usi' waqi'tqa shekem noqat, tuwri' ha'm tegisliktin' wo'z-wo'zinen payda bolg'an qatar qa'siyetlerin de da'lillewsiz, tuwri'dan-tuwri' qabi'l yettik. Bunday qa'siyetler aksiomalar dep ataladi'. Yeger itibar bergin bolsan'i'z, sabaqli'qtag'i' barli'q aksiomalardi' tiykarg'i' tekstten ayri'qsha ko'rsetilip,  belgisi asti'nda berip keldik. Usi' waqi'tqa shekem tani'si'p shi'qqan aksiomalarg'a mi'sallar keltiremiz (qalg'anlari'n sabaqli'q betlerinen tawi'p, jazi'p shi'g'i'n'):

1. *Tegisliktegi tuwri' qanday ali'nbasin, usi' tuwri'g'a tiyisli bolg'an noqatlar da, tiyisli bolmag'an noqatlar da bar.*

2. *Ha'r qanday yeki noqattan tek g'ana bir tuwri' ju'rgiziw mu'mkin.*

3. *Tuwri'da ali'ng'an qa'legen u'sh noqattan tek g'ana birewi qalg'an yekewinin arasi'nda jatadi'.*

Geometriyada tu'sinikler belgili u'zliksizlik ha'm logikali'q izbe-izlikte kiritiledi. Da'slep geometriyani'n' fundamenti – baslang'i'sh tu'sinikler ta'riyplemesiz ha'm aksiomalar da'lillew siz, tuwri'dan-tuwri' qabi'l etiledi. Keyin, bul fundament tiykari'nda jan'a tu'sinikler ta'riyplenedi ha'm wolardi'n' jan'a qa'siyetleri ani'qlanadi'. Bul qa'siyetlerden bir neshewi da'lillewsiz, aksioma si'pati'nda qabi'l etiledi. Qalg'an qa'siyetler bolsa teoremlar ko'rinishinde an'lati'ladi' ha'm aksiomalarg'a tiykarlani'p logikali'q pikirlewler qurli'nda da'lillenedi. Pikir ju'ritiw waqti'nda da'lillibegen qa'siyetlerden, wolardi'n' duri'sli'g'i' ani'q ko'rinip turg'an bolsa da wolardan paydalani'w mu'mkin yemes – bul geometriyani'n' logikali'q quri'li'si'na qarsi' boladi'.



### **Soraw, ma'sele ha'm tapsi'rmalar**

1. Ani'qlama degen ne? Qanday tu'sinikler ta'riypsiz qabi'l etiledi?
2. Teorema degen ne? Wol qanday bo'limlerden ibarat?
3. Teoremlar qanday da'lillenedi? Da'lillew degende neni tu'sinesiz?
4. Aksioma degen ne?
5. Yeger figurani'n' qa'siyeti si'zi'lmada ashi'q-aydi'n ko'rinip turg'an bolsa, bul qa'siyetti da'lillemesten qabi'l etiwge bola ma?
6. To'mende keltirilgen tasti'yi'qlawlardi'n' qaysi'lari' da'lillewsiz qabi'l yetilgen:
  - 1) ha'r qanday yeki noqat arqali' tek bir tuwri' ju'rgiziw mu'mkin;



- 2) jayi'q mu'yesh tuwri' mu'yesh'ten yeki ma'rte u'lken;
- 3) qon'si'las mu'yeshlerdin' qosi'ndi'si'  $180^\circ$  qa ten';
- 4) ha'r bir mu'yesh bissektrisag'a iye;
- 5) ha'r bir kesindinin' tek g'ana bir wortasi' bar;
- 6) ha'r bir won' san ushi'n uzi'nli'g'i' usi' sang'a ten' bolg'an kesindi bar boladi'?
7. Usi' tasti'yi'qlawdi' da'lillewsiz qabi'l etiwge bola ma: "Tuwri'da jati'wshi'  $A, B, C, D$  noqatlari' ushi'n  $AB = CD$  bolsa,  $AD$  ha'm  $BC$  kesindilerinin' wortalari' u'stpe-u'st tu'sedi'".
8. Sabaqli'qta aldi'n'g'i' sabaqlarda wo'tilgen temalarg'a tiyisli da'lillengen qa'siyetlerdi tabi'n'.

14

## Perpendikulyar tuwri'lar

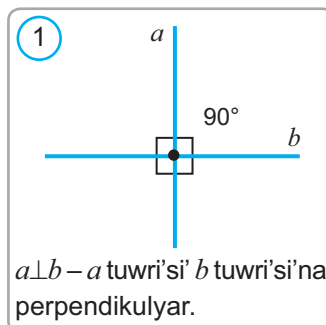


### Aktivlestiriwshi shi'ni'g'i'w

Yeki tuwri' kesiliskende payda bolg'an mu'yeshlerdin' birewi tuwri' mu'yesh bolsa (1-su'wret), qalg'an mu'yeshleri haqqi'nda ne ayti'w mu'mkin?



Tuwri' ( $90^\circ$  li') mu'yesh asti'nda kesilisiwshi tuwri'lar perpendikulyar tuwri'lar dep ataladi'.



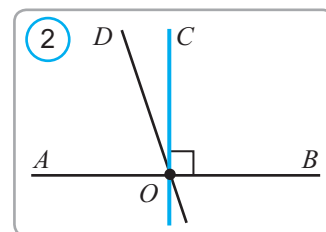
1-su'wrette bir-birine perpendikulyar  $a$  ha'm  $b$  tuwri'lari' su'wretlengen. Bul tuwri'lardi'n' perpendikulyarli'g'i' arnawli' belgi ja'rdeminde  $a \perp b$  tu'rinde jazi'ladi' ha'm " $a$  tuwri'si'  $b$  tuwri'si'na perpendikulyar" dep woqi'ladi'. Perpendikulyar tuwri'lardi'n' kesilisiwinen to'rt tuwri' mu'yesh payda boladi'.

Perpendikulyar tuwri'larda jatqan kesindiler (nurlar) de bir-birine perpendikulyar dep ju'ritiledi.



**Teorema.** Tuwri'ni'n' qa'legen noqati'nan wog'an perpendikulyar bolg'an jalg'i'z tuwri' ju'rgiziw mu'mkin.

**Da'lillew.** Aytayi'q,  $AB$  tuwri' ha'm wondag'i'  $O$  noqati' berilgen bolsi'n (2-su'wret).  $OB$  nurg'a to'besi  $O$  noqatta bolg'an,  $90^\circ$  li'  $COB$  mu'yeshin qoyi'w mu'mkin yekenligi belgili. Wonda  $CO$  tuwri'si'  $AB$  tuwri'si'na perpendikulyar tuwri'lar boladi'.

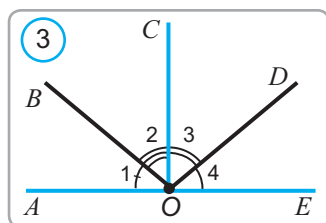


Yendi bul tuwri'ni'n' jalg'i'z yekenligin da'lilleyik. Kerisinshe woylaymi'z, yag'ni'y  $O$  noqati'nan wo'tiwshi, berilgen  $AB$  tuwri'si'na perpendikulyar bolg'an ja'ne bir  $DO$  tuwri'si' bar bolsi'n. Bul jag'dayda,  $DOB$  ha'm  $COB$  mu'yeshlerinin' ha'r biri  $90^\circ$  li' boli'p,  $OB$  nuri'na qoyilg'an mu'yeshler boli'p qaladi'. Biraq,  $OB$  nuri'na ani'q gradus wo'lshemge iye jalg'i'z mu'yesh qoyi'w mu'mkinligi haqqi'ndag'i' aksiomag'a baylani'sli' bunday boli'wi' mu'mkin yemes.

Demek,  $AB$  tuwri'si'na  $O$  noqattan tek g'ana bir perpendikulyar tuwri' ju'rgizi'w mu'mkin yeken. **Teorema da'lillendi.**



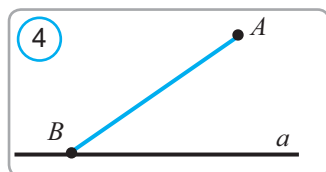
**Ma'sele.** Yeger 3-su'wrette  $\angle 1 = \angle 4$ ,  $\angle 2 = \angle 3$  bolsa,  $CO \perp AE$  boli'wi'n ko'rsetin'.



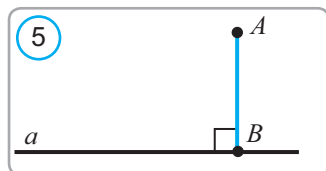
**Sheshiliwi:** Aytayi'q  $\angle 1 = \angle 4 = \alpha$ ,  $\angle 2 = \angle 3 = \beta$  bolsi'n.

Mu'yeshlerdi wo'lshewdin' qa'siyeti boyi'nsha

$\angle AOE = \angle 1 + \angle 2 + \angle 3 + \angle 4 = \alpha + \beta + \alpha + \beta = 2\alpha + 2\beta = 180^\circ$ ,  
 $2(\alpha + \beta) = 180^\circ$ , yag'ni'y  $\alpha + \beta = 90^\circ$  boladi'. Wonda,  
 $\angle AOC = \angle 1 + \angle 2 = \alpha + \beta = 90^\circ$  bolg'ani' ushi'n,  $CO \perp AE$  boladi'.



$a$  tuwri'si' ha'm wonda jatpaytug'i'n  $A$  noqati' berilgen bolsi'n.  $A$  noqatti'  $a$  tuwri'si'ni'n' qa'legen bir  $B$  noqati' menen tutastirami'z (4-su'wret). Yeger  $AB$  kesindisi  $a$  tuwri'si'na perpendikulyar bolmasa,  $AB$  kesindisi  $qi'ya$  dep ataladi'.

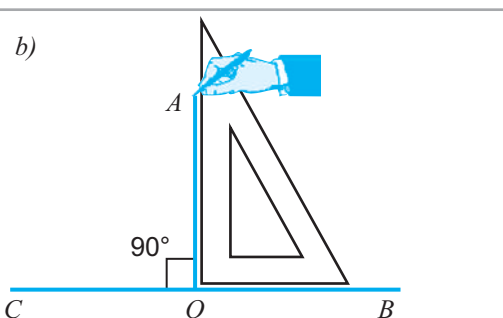
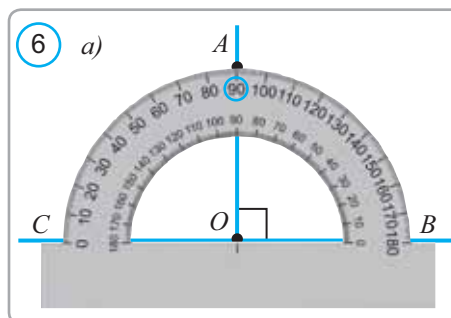


Yeger  $AB$  kesindisi  $a$  tuwri'si'na perpendikulyar bolsa, bul jag'dayda  $AB$  kesindi  $A$  noqati'nan  $a$  tuwri'si'na tu'sirilgen perpendikulyar dep ataladi'. 5-su'wrette  $A$  noqati'nan  $a$  tuwri'si'na tu'sirilgen perpendikulyar su'wretlengen.  $B$  noqati'  $qi'yani'n'$  (perpendikulyardi'n') *ultani'* dep ataladi'.

**Tuwri'g'a perpendikulyar ju'rgiziwdin' a'meliy jollari'**

**1-usi'l.** Tranaportir ja'rdeminde (6.a-su'wret).

**2-usi'l.** Tuwri' mu'yeshli si'zg'i'sh (guniya) ja'rdeminde (6.b-su'wret).





## Geometriyalıq izertlew

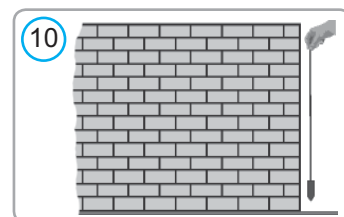
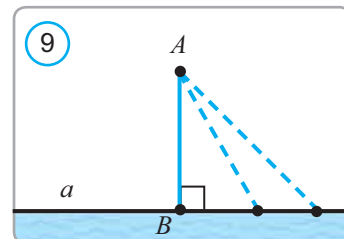
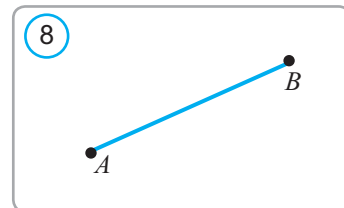
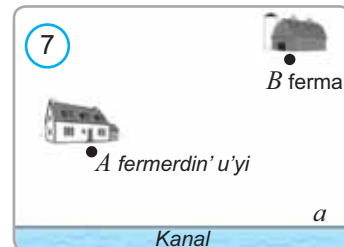
Qanday da bir tuwri' si'zi'n'. Wonda jatpaytug'i'n qanday da bir noqattan tuwri'g'a perpendikulyar ha'm bir neshe qiyalar ju'rgizi'n'. Perpendikulyar ha'm qiyalardi'n uzi'nliqlari'n wo'lshen' ha'm wo'z-ara sali'sti'ri'n'. Qaysi' kesindinin' uzi'nli'g'i' yen' kishi boladi'? Juwabi'n'i'zdi' gipoteza ko'rinisinde an'lati'n'. Bul woylawdi'n' duri'sli'g'i'n da'lillewsiz qabi'l etse bola ma yamasa woni' a'llette da'lillew kerek pe?

**Shi'ni'g'i'w.** Diyqan – fermer xojali'g'i'ni'n' kartasi' 7-su'wrette berilgen.

1. Fermer u'yinen fermag'a ali'p bari'wshi' jol qurmaqshi'. Wog'an joldi' qaysi' si'zi'q boylap quri'wdi' ma'sla'ha't beresiz? Nege? Si'zi'lmada bul joldi' si'zi'p ko'rsetin'.
2. Fermer fermasi'nan kanal'g'a ali'p bari'wshi' jol qurmaqshi'. Wog'an joldi' qaysi' si'zi'q boyi'nsha quri'wdi' ma'sla'ha't beresiz? Nege? Si'zi'lmada bul joldi' si'zi'p ko'rsetin'.

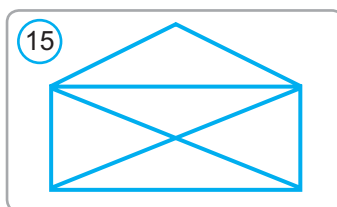
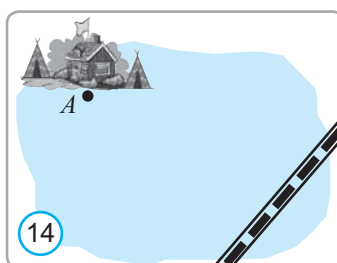
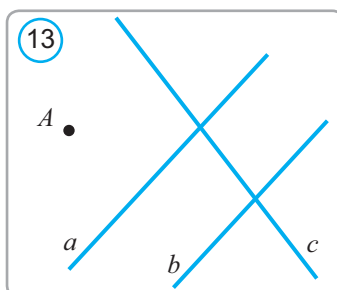
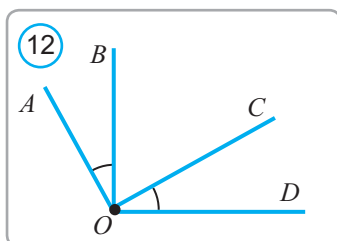
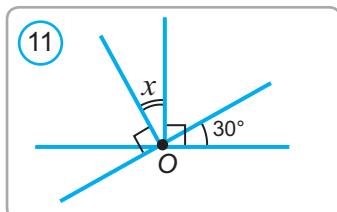
8-su'wrette su'wretlengen  $A$  ha'm  $B$  noqatlari'n tutastiri'wshi' yen' qisqa "jol", bul  $AB$  kesindisi yekenligi belgili. Sonli'qtan to'mengi klaslarda  $AB$  kesindisinin' uzi'nli'g'i'n  $A$  ha'm  $B$  noqatlari' arasi'ndag'i' arali'q dep qabi'l yetken yedik. Usi'g'an uqsas,  $A$  noqati'nan  $a$  tuwri'si'na shekem bolg'an arali'q dep,  $A$  noqati'nan  $a$  tuwri'si'na tu'sirilgen  $AB$  perpendikulyardi'n' uzi'nli'g'i'n qabi'l qilami'z. Bul arali'q  $A$  noqati'nan  $a$  tuwri'si'na tu'sirilgen barli'q qiyalardi'n' uzi'nli'g'i'nan kishi boladi' (9-su'wret). Bul tasti'yi'qlawdi'n' da'lilleniwine keyin toqtalami'z.

Quri'li'sta diywallar ha'm bag'analardi'n' tikligi (polg'a qarata perpendikulyarli'g'i') shoqul degen a'sbap ja'rde-minde tekseriledi (10-su'wret).



## Soraw, ma'sele ha'm tapsi'rmalar

1. Qashan tuwri'lar perpendikulyar boladi'? Juwabi'n'i'zdi' si'zi'lmada ko'rsetip berin'.
2. Berilgen tuwri'da jati'wshi' noqattan wog'an neshe perpendikulyar tuwri' ju'rgiziw mu'mkin? Juwabi'n'i'zdi' tu'sindirin'.



3. Berilgen noqattan tuwri'g'a tu'sirilgen perpendikulyar dep nege ayti'ladi'?
4. Berilgen noqattan tuwri'g'a tu'sirilgen qi'ya degen ne?
5. Berilgen  $A$  noqati'nan tuwri'g'a neshe perpendikulyar tu'siriw mu'mkin?
6. Si'zg'i'sh ha'm guniya ja'rdeminde berilgen tuwri'g'a wonda jati'wshi' noqattan perpendikulyar tu'sirin'.
7.  $a$  tuwri'si'nda  $A, B, C$  noqatlari'n belgilen' ha'm transportir ja'rdeminde bul noqatlardi'n' ha'r biri arqali'  $a$  tuwri'si'na perpendikulyar bolg'an tuwri'lardi' ju'rgizin'.
8. Tuwri' mu'yeshke vertikal bolg'an mu'yesh neshe gradus?
9.  $a$  tuwri'si'  $A$  mu'yeshinin' ta'replerin  $B$  ha'm  $C$  noqatlarda kesip wo'tedi.  $AB$  ha'm  $AC$  tuwri'lari'  $a$  tuwri'si'na perpendikulyar bola ala ma?
10. Yeki tuwri'ni'n' kesilisiwi na'tiyjesinde 4 ten'dey mu'yesh payda boldi'. Bul tuwri'lar perpendikulyar bola ma?
11. 11-su'wrettegı belgisiz mu'yesh  $x$  ti' tabi'n'.
12. 12-su'wrette Yeger  $OB \perp OD$  ha'm  $OA \perp OC$  bolsa,  $\angle AOB = \angle COD$  bolatug'i'ni'n ko'rsetin'.
13. Noqattan tuwri'g'a shekemgi bolg'an arali'q degen ne?
14. Guniya ja'rdeminde  $A$  noqati'nan  $a, b$  ha'm  $c$  tuwri'lari'na shekemgi bolg'an arali'qlardi' tabi'n' (13-su'wret).
15. Transportir ha'm a'piwayi' si'zg'i'sh ja'rdeminde 14-su'wrette su'wretlengen balalar lagerinen temir jolg'a shekemgi bolg'an yen' qi'sqa arali'qti' ani'qlan'. Masshtab: 1 : 10 000.

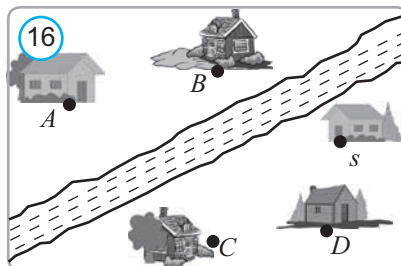


### Geometriyali'q basqati'rmalar

1. a) 10; b) 11 bir qi'yli' sho'pten 3 ten'dey kvadrat jasan'.
2. 12 bir qi'yli' sho'pten, wolardi' si'ndi'rmastan, a) 4; b) 6 ten'dey kvadrat jasay alasi'z ba?
3. 15-su'wrette su'wretlengen figurani' qa'lemdi

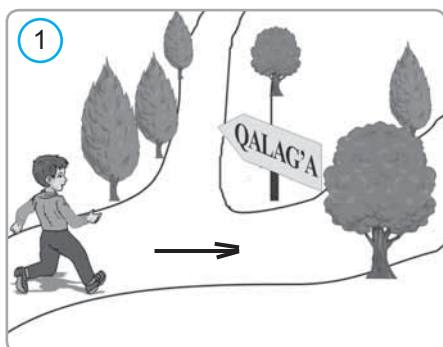
qag'azdan u'zbesten ha'm bir kesindi u'stinen yeki ma'rte ju'rgizbesten si'zi'p ko'rsetin'.

4. Da'rya boyi'nda bes awi'l boli'p, olardan u'shewi da'ryani'n' bir ta'repinde, qalg'an yekewi bolsa da'ryani'n' yekinshi ta'repinde jaylasqan (16-su'wret). Yeger ha'r bir awi'l qalg'an awi'llar menen tuwri' jollar arqali' baylani'sqan bolsa, bul jollardi'n' neshewi da'ryani' kesip wo'tedi?



15

### Kerisinshe woylap da'lillew usi'li'



13-sabaqta keltirilgen teoremadag'i' tuwri'ni'n' jalg'i'z yekenin da'lillewde qollani'lg'an usi'l "Kerisinshe woylap da'lillew usi'li'" dep atalg'an. Bul usi'l tomendegi a'piwayi' logikali'q ma'selege tiykarlang'an. Aytayi'q, jolda ketip barati'ri'p joldi'n' yekige aji'ralg'an bo'limine dus keldin'iz (1-su'wret). Bul jollardi'n' tek birewi ma'nzilin'izge, qalag'a ali'p bari'wi'n' bilesiz. Jol ko'rsetiwshi taxtashada birinshi jol ma'nzilin'izge ali'p bari'wi' ko'rsetilgen. Siz bul jazi'wg'a isenbedin'iz ha'm yekinshi jol boyi'nsha joli'n'i'zdi' dawam yettin'iz. Ju'rip-ju'rip basqa jerge, tani's yemes awi'lg'a bari'p qaldi'n'i'z. Bul jag'dayda birinshi boli'p woyi'n'i'zg'a qanday pikir keledi? A'l'bette, "Taxtashadag'i' jazi'w duri's yeken!", – degen pikir keledi (2-su'wret).

Kerisinshe woylap da'lillew usi'li'nda da usi'g'an uqsas jol qollani'ladi'. Teorema sha'rtin payda yetken tasti'yi'qlaw wori'nli' dep ali'nadi'. Bul jag'dayda bir-birin biykar yetiwshi yeki tu'rli tasti'yi'qlawdan ("jol" dan) tek g'ana birewi wori'nli' boli'wi' mu'mkin:

**1-jag'day.** Teoremani'n' juwmag'i'nda keltirilgen tasti'yi'qlaw wori'nli'.

**2-jag'day.** Teoremani'n' juwmag'i'nda keltirilgen tasti'yi'qlaw wori'nli' yemes. Teoremani'n' juwmag'i'na ker bolg'an tasti'yi'qlaw – yekinshi “jol” tan'lap ali'nadi'. Yeger bul “jol” dag'i' logikali'q pikirlewlerdin' duri'sli'g'i' da'slep ani'qlang'an (yamasa qabi'l yetilgen) qaysi' bir qa'siyetke qarama-qarsi' juwmaqqa ali'p kelse, bul tan'lap ali'ng'an “jol” di'n' naduri's yekenligin bildiredi. Bul bolsa, wo'z gezeginde, birinshi “jol” duri's yekenligin, yag'ni'y teorema sha'rtinde keltirilgen tasti'yi'qlaw wori'nli' bolg'anda woni'n' juwmag'i'nda keltirilgen tasti'yi'qlaw wori'nli' bolatug'i'ni'n bildiredi. Solay yetip, teorema da'lillengen boli'p yesaplanadi'.

Kerinshe woylap da'lillew usi'li'n qollani'p teoremalardi' da'lillewde to'mendegilerge itibar beriwimiz kerek: a) da'lillewdi talap yetken tasti'yi'qlawg'a ker bolg'an ga'pti duri's du'zin'; b) woylang'an tasti'yi'qlaw ha'm basqa belgili bolg'an qa'siyetler tiykari'nda duri's juwmaq shi'g'ari'w; d) pikir ju'ritiw dawami'nda da'slep belgili bolg'an qa'siyetlerge qarama-qarsi' bolg'an na'tiyjeni ani'qlaw.



### Aktivlestiriwshi shi'ni'g'i'w

To'mende berilgen tasti'yi'qlawg'a ker bolg'an tasti'yi'qlawdi' du'zin':

- a)  $CD$  kesindisi  $a$  tuwri'si'n kesip wo'tedi;
- b)  $A$  ha'm  $B$  noqatlari'  $a$  tuwri'si'ni'n' bir ta'repinde jatadi';
- d)  $CD$  kesindisinin' uzi'nli'g'i' 15 ke ten';
- e)  $AOB$  mu'yeshi tuwri' mu'yesh yemes;
- f)  $\angle ABC > \angle MNL$ ;
- g)  $AB$  qi'ya  $AC$  perpendikulyari'nan uzi'n.



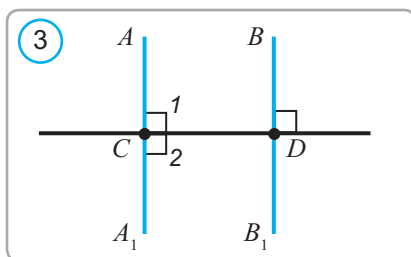
**Teorema.** Bir tuwri'g'a perpendikulyar bolg'an yeki tuwri' wo'z-ara kesilispeydi.



$AA_1, BB_1$  ha'm  $CD$  tuwri'lar,  
 $AA_1 \perp CD$  ha'm  $BB_1 \perp CD$  (3-su'wret)

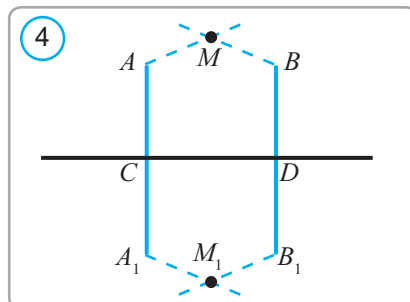


$AA_1$  ha'm  $BB_1$  tuwri'lar wo'z-ara kesilispeydi



**Da'lillew.** Woyi'n'i'zda 3-su'wretti  $CD$  tuwri' boylap bu'klep, joqarg'i' yari'mtegislikti to'mengi yari'mtegislikke u'stpe-u'st qoyami'z. 1- ha'm 2-mu'yeshler ten' bolg'ani' ushi'n  $CA$  nur  $CA_1$  nuri'menen u'stpe-u'st tu'sedi. Usi'g'an uqsas  $DB$  nuri'  $DB_1$  nuri'menen u'stpe-u'st tu'sedi.

Berilgen teoremani' dalillew ushi'n "kerisinshe woylap da'lillew" usi'li'n qollanami'z. Woylaymi'z: teoremani'n' sha'rti wori'nlang'an bolsa da, woni'n' juwmag'i' wori'nli' bolmasi'n, yag'ni'y  $AA_1$  ha'm  $BB_1$  tuwri'lari' qandayda bir  $M$  noqati'nda kesilissin (4-su'wret). Bul jag'dayda, joqarg'i' yari'mtegislikti to'mengi yari'mtegislikke u'stpe-u'st qoyg'ani'mi'zda  $M$  noqati'  $AA_1$  ha'm  $BB_1$  tuwri'lari'nda jati'wshi', to'mengi yari'mtegisliktegi  $M_1$  noqati' penen u'stpe-u'st tu'sedi. Na'tiyjede,  $M$  ha'm  $M_1$  noqatlari'nan yeki  $AA_1$  ha'm  $BB_1$  tuwri'lari' wo'tedi. Bi'raq bul ha'r qanday yeki noqattan tek g'ana bir tuwri' wo'tedi degen aksiomag'a qarama-qarsi'. Demek, bizin' woylag'ani'mi'z naduri's:  $AA_1$  ha'm  $BB_1$  tuwri'lari' wo'z-ara kesilisiwi mu'mkin yemes. **Teorema da'lillendi.**



**Teorema.** Tuwri'da jatpaytug'i'n noqattan usi' tuwri'g'a perpendikulyar yetip birewden arti'q tuwri' ju'rgiziw mu'mkin yemes.

Bul qa'siyetti kerisinshe oylaw usi'li' ja'rdeminde wo'z betinshe da'lillen'.



### Soraw, ma'sele ha'm tapsi'rmalar

1. Kerisinshe woylap da'lillew usi'li' qanday qag'i'ydag'a tiykarlang'an?
2.  $A, B, C$  noqatlari' bir tuwri'da jatsa ha'm: a)  $AB = 3,6$ ;  $BC = 5,4$ ;  $AC = 9$ ; b)  $AB = 2,4$ ;  $BC = 4,2$ ;  $AC = 1,8$  bolsa,  $C$  noqati'ni'n'  $A$  ha'm  $B$  noqatlari' arasi'nda jatpaytug'i'ni'n' da'lillen'. Bul noqatlardan qaysi' biri qalg'an wekewinin arasi'nda jatadi'?
3. Tegislikte u'sh  $A, B, C$  noqat berilgen:  $AB = 2,6$ ,  $AC = 8,3$ ,  $BC = 6,7$ . Bul noqatlardi'n' bir tuwri'da jatpaytug'i'ni'n' da'lillen'.
4. Qon'si'las mu'yeshlerdin' bissektrisalari' arasi'ndag'i' mu'yeshti tabi'n'.
5. Vertikal mu'yeshlerdin' ten'ligin kerisinshe woylaw usi'li' menen da'lillen'.
6. Vertikal mu'yeshlerdin' bissektrisalari' bir tuwri'da jati'wi'n da'lillen'.
7. Yeger  $\angle AOB = 58^\circ$ ,  $\angle BOC = 17^\circ$  ha'm  $\angle AOC = 41^\circ$  bolsa,  $OA$ ,  $OB$  ha'm  $OC$  nurlari'ni'n' qaysi' biri qalg'an yekewinin arasi'nda jatadi'.
8. Yeki mu'yeshtin' kesilisiwinen payda bolg'an mu'yeshlerden yekewinin qosi'ndi'si'  $120^\circ$ . Bul mu'yeshlerdi tabi'n'.
9. Yeki mu'yeshtin' kesilisiwinen payda bolg'an mu'yeshlerden yekewinin ayi'rmasi'  $20^\circ$ . Bul mu'yeshlerdi tabi'n'.
10. Yeki tuwri'ni'n' kesilisiwinen payda bolg'an yeki mu'yeshtin' qosi'ndi'si'  $180^\circ$  qa ten' yemes. Bul mu'yeshlerdin' vertikal mu'yeshler yekenligin da'lillen'.

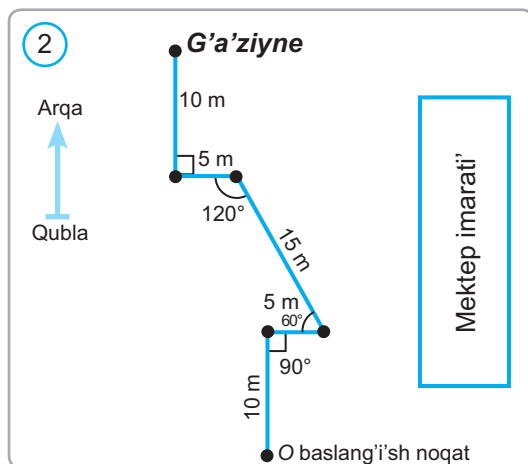
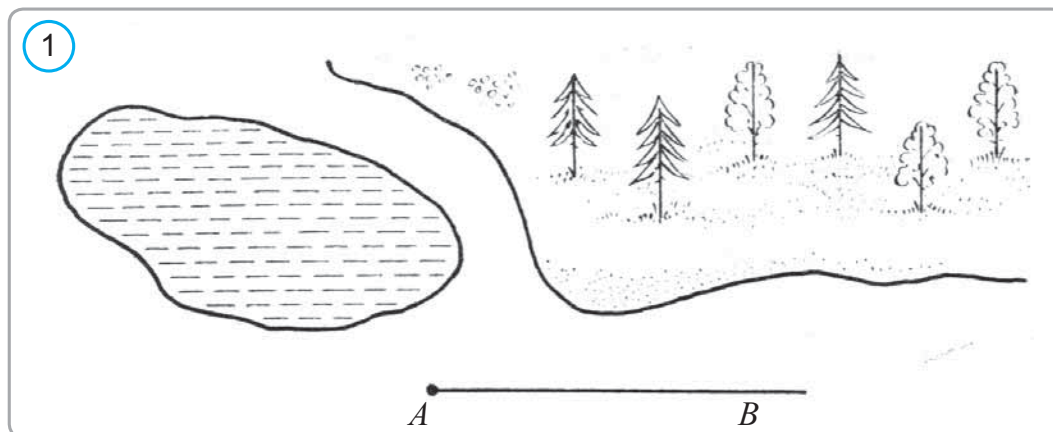




### 1. G'a'ziyneni tabi'n'.

1-su'wrette karta ha'm  $AB$  nuri' su'wretlengen. Bul nurg'a ko'l jaylasqan yari'mtegislkte jati'wshi'  $60^\circ$  li' mu'yesh qoyi'n'. Jalg'an mu'yeshin'  $AB$  dan pariqli' ta'repi boylap  $60\text{ m}$  ju'rin'.  $C$  noqati'na kelesiz.  $CA$  nuri'na ja'ne usi' ko'l jaylasqan yari'mtegislkte jati'wshi'  $120^\circ$  li' mu'yesh qoyi'n'. Bul mu'yeshin'  $CA$  nuri'nan pariqli' ta'repi boylap  $120\text{ m}$  ju'rin'. Usi' jerde, ba'lent qarag'ay teregi asti'na g'a'ziyne ko'milgen.

Karta masshtabi':  $1 : 2000$ . Kartani' da'pterin'izge si'zi'p ali'n'. G'a'ziyne jasi'ri'lg'an noqatti' tabi'n'.



### 2. Ashi'q hawadag'i' geometriyalig'q jari'si'.

Jari'sta yeki yamasa wonnan arti'q toparlar qatnasi'wi' mu'mkin. Ha'r bir toparg'a ruletkha ha'm u'lken transportirden paydalani'wg'a ruxsat beriledi.

Klass toparlarg'a bo'linip, mektep maydanshasi'ni'n' tu'rli mu'yeshlerinde jumi's ali'p baradi'. "G'a'ziyne" (ma'selen, shar, konvertte xat,...) aldi'n-ala maydanni'n' qanday da bir jerine ko'mip qoyiladi'. G'a'ziynege ali'p bari'wshi' kartalar

da woqi'ti'wshi' ta'repinen aldi'n-ala du'ziledi ha'm toparlarg'a tarqati'ladi' (kartani'n' u'lgisi 2-su'wrette ko'rsetilgen). Toparlar wo'z kartalari'nan paydalani'p g'a'ziyneni tabi'wg'a kirisedi. Qaysi' topar birinshi boli'p kartada ko'rsetilgen si'ni'q si'zi'q boylap barli'q noqatlari'n ani'qlap g'a'ziyneni tapsa, sol topar jen'impaz dep tabi'ladi'.



**Tapsi'rma.** U'yin'izden mektepke keletug'i'n joldi'n' 3-su'wretteg'i si'yaqli' kartasi'n du'zin'.

## 17

### Bilimin'i'zdi si'nap ko'rin'

#### 1. Ga'plerdin' ma'nislerine qarap toli'qti'ri'n':

1. Noqat ha'm ushlari' usi' noqatta bolg'an ..... ibarat figurag'a mu'yesh dep ataladi'.
2. Tegisliktegi yeki noqat arqali' ..... tuwri' ju'rgiziwge boladi'.
3. Jayi'q mu'yeshdin' gradus wo'lishemi ..... ten'.
4. Yeki tuwri' tek ..... kesilisedi.
5. Mu'yeshdin' to'besinen shi'g'i'p, woni' ..... mu'yeshdin' bissektrisasi' dep ataladi'.
6. Tuvri'ni'n' qaysi' bir noqati'nan bir ta'repte jaylasqan noqatlardan ibarat bo'legi ..... dep ataladi'.
7. Uli'wma ta'repke iye boli'p, qalg'an yeki ta'repi tuwri'ni' payda yetiwshi mu'yeshler ..... dep ataladi'.
8. Tuvri' tegislikti ..... aji'ratadi'.
9. Vertikal mu'yeshlerdin' bissektrisalari' ..... payda yetedi.
10. Kesindini ten' ..... usi' kesindinin' wo'rtasi' dep ataladi'.
11. Yeger qon'si'las mu'yeshler ....., wolar tuwri' mu'yeshler boladi'.
12. Ten' kesindilerdin' ..... de ten' boladi'.

#### 2. To'mendegi ga'plerde qa'te bolsa, woni' tabi'n' ha'm du'zetin':

1. Qosi'ndi'si'  $180^\circ$  qa ten' bolg'an mu'yeshler qon'si'las mu'yeshler boladi'.
2. Tegisliktegi qa'legen yeki tuwri' tek bir uli'wma noqatqa iye boladi'.
3. Mu'yeshdin' to'besinen wo'tip, woni' ten' yekige bo'liwshi tuwri' mu'yeshdin' bissektrisasi' dep ataladi'.
4. Qa'legen noqat arqali' tek yeki tuwri' ju'rgiziwge boladi'.
5. Yeki ta'repi de nurlarda jati'wshi' mu'yesh jayi'q mu'yesh dep ataladi'.
6. Tegisliktegi yeki tuwri' woni' yeki yari'mtegislikke aji'ratadi'.
7. Yeki tuwri'ni'n' kesilisiwinen payda bolg'an mu'yeshlerge vertikal mu'yeshler dep ataladi'.
8. Kesindini yekige bo'liwshi noqat kesindini'n' wortasi' dep ataladi'.
9. Berilgen nurdi'n' basi'na tek bir tuwri' mu'yesh qoyi'wg'a boladi'.

10. Tegisliktegi qa'legen  $A, B, C$  noqatlari' ushi'n  $AB + BC = AC$  ten'ligi wori'nli'.
11. Vertikal mu'yeshlerdin' qosi'ndi'si'  $180^\circ$ qa ten'.

**3. To'mende berilgen qa'siyetke iye bolg'an geometriyali'q figurani' won' bag'anadag'i' sa'ykes qatarg'a jazi'n':**

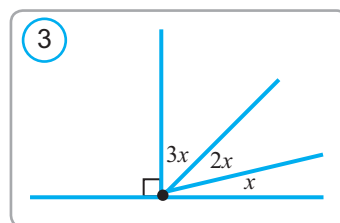
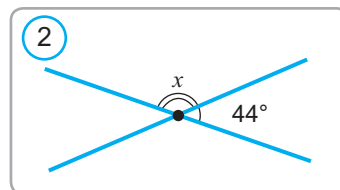
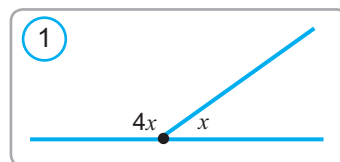
|     |                                              |  |
|-----|----------------------------------------------|--|
| 1.  | Qosi'ndi'si' $180^\circ$ qa ten'             |  |
| 2.  | Ta'repleri nurlardan ibarat                  |  |
| 3.  | Shamasi' $180^\circ$ qa ten'                 |  |
| 4.  | Belgili uzi'nli'qqa iye                      |  |
| 5.  | Kesindini ten' yekige bo'ledi                |  |
| 6.  | Da'lillewsiz duri's dep qabi'l yetilgen ga'p |  |
| 7.  | Mu'yeshi ten' yekige bo'ledi                 |  |
| 8.  | Tuwri'lar kesiliskende payda boladi'         |  |
| 9.  | Duri'sli'g'i'n da'lillew kerek               |  |
| 10. | Wo'lshemge iye yemes                         |  |

**4. Birinshi bag'anada berilgen geometriyali'q tu'siniklarga yekinshi bag'anadan tiyisli qa'siyet yaki talqi'lawlardi' sa'ykes qoyi'n':**

| <i>Geometriyali'q tu'sinik</i>          | <i>Talqi'law, qa'siyet</i>                                            |
|-----------------------------------------|-----------------------------------------------------------------------|
| 1. Noqat                                | A. "Geometriya" so'zinin' ma'nisi                                     |
| 2. Tuwri'                               | B. Qosi'ndi'si' $180^\circ$ qa ten'                                   |
| 3. Jer wo'lshew                         | C. Wo'z-ara ten' mu'yeshler                                           |
| 4. Kesindi                              | D. Tuwri'da jati'wshi' noqat ha'm wonnan bir ta'repte jatqan noqatlar |
| 5. Nur                                  | E. $180^\circ$                                                        |
| 6. Kesindinin' uzi'nli'g'i'             | F. Uli'wma to'bege iye bolg'an yeki nur                               |
| 7. Birdey (ten'dey) figuralar           | G. Uzi'nli'g'i'n wo'lshew bolmaydi'                                   |
| 8. Yari'mtegislik                       | H. Tuwri' mu'yeshlin' $1/90$ bo'legi                                  |
| 9. Planimetriya                         | I. Da'lilleniwsiz qabi'l yetiletug'i'n tasti'yi'qlaw                  |
| 10. Mu'yesh                             | J. Da'lilleniwi kerek bolg'an tasti'yi'qlaw                           |
| 11. 1 gradus                            | K. Tuwri'ni'n' yeki noqati' ha'm wolar arasi'ndag'i' noqatlar         |
| 12. Jayi'q mu'yeshlin' gradus wo'lshemi | L. Tegisliktegi geometriyali'q figuralardi'n' qa'siyetlerin u'yrenedi |
| 13. Vertikal mu'yeshler                 | M. Mu'yeshi ten' yekige bo'ledi                                       |
| 14. Qon'si'las mu'yeshler               | N. Tegisliktin' tuwri' aji'ratqan bo'leklerinen biri                  |
| 15. Teorema                             | O. Bo'limlarga iye yemes                                              |
| 16. Aksioma                             | P. Won' san                                                           |
| 17. Bissektrisa                         | Q. Da'l u'stpe-u'st tu'setug'i'n yetip qoyi'w mu'mkin                 |

### 5. Testler (berilgan juwaplardi'n' ishinen yen' duri's bolg'an birewin ani'qlan'):

1. Ta'riplemesiz qabi'l yetilgen tiykarg'i' geometriyalig' tu'siniklerdi ko'rsetin': a) tegislik; b) noqat; c) kesindi; d) nur; e) tuwri'; f) yari'mtegislik.  
A) a; b; c      B) b; c; e      D) a; b; c; e      E) a; b; e.
2. Yeki qon'si'las mu'yeshdin' ayi'rmasi'  $24^\circ$  qa ten' bolsa, wolardi'n' kishisin tabi'n':  
A)  $72^\circ$ ;      B)  $76^\circ$ ;      D)  $78^\circ$ ;      E)  $82^\circ$ .
3. Geometriya pa'n si'pati'nda qaysi' ma'mlekette qa'liplesken?  
A) A'yyemgi Mi'sr;      B) Bobil;      D) Gretsiyada;      E) Qi'tay.
4. Yeki tuwri'ni'n' kesilisiwinen payda bolg'an mu'yeshlerdin' u'shewinin' qosi'ndi'si'  $200^\circ$  qa ten'. Mu'yeshlerdin' kishisin tabi'n':  
A)  $20^\circ$ ;      B)  $40^\circ$ ;      D)  $60^\circ$ ;      E)  $80^\circ$ .
5. Hesh qanday u'shewi bir tuwri'da jatpaytug'i'n to'rt noqat berilgen. Usi' noqatlardi'n' ha'r bir jubi' arqali' tuwri'lar ju'rgiziledi. Wolardi'n' sani'n tabi'n'.  
A) 1;      B) 4;      D) 5;      E) 6.
6. Mu'yesh bissektrisasi' woni'n' ta'repi menen  $60^\circ$  li' mu'yesh payda yetedi. Berilgen mu'yeshke qon'si'las bolg'an mu'yeshi tabi'n':  
A)  $30^\circ$ ;      B)  $60^\circ$ ;      D)  $90^\circ$ ;      E)  $120^\circ$ .
7.  $AB$  kesindini yeki tuwri' kesip wo'tse, ko'bi menen neshe  $AB$  kesindisinde jatqan kesindi payda boladi'?  
A) 3;      B) 4;      D) 5;      E) 6.
8. Saat 4 bolg'anda, saat ha'm minut tilleri arasi'ndag'i' mu'yesh neshe gradus boladi'?  
A)  $60^\circ$ ;      B)  $75^\circ$ ;      D)  $105^\circ$ ;      E)  $120^\circ$ .
9.  $AB = 6$ ,  $C \in AB$ ,  $AC = 3BC$ ,  $BC = ?$   
A) 1;      B) 1,5;      D) 2;      E) 3.
10. Saatti'n' saat tili 30 minutta neshe gradusqa buriladi'?  
A)  $180^\circ$ ;      B)  $15^\circ$ ;      D)  $60^\circ$ ;      E)  $30^\circ$ .
11.  $AB = 18$ ,  $C \in AB$ ,  $AC - BC = 4$ ,  $BC = ?$   
A) 7;      B) 8;      D) 10;      E) 11.
12. Vertikal mu'yeshlerdin' qosi'ndi'si'  $180^\circ$  qa ten'. Bul mu'yeshlerdi tabi'n':  
A)  $60^\circ$  ha'm  $120^\circ$ ;      B)  $45^\circ$  ha'm  $135^\circ$ ;  
D)  $90^\circ$  ha'm  $90^\circ$ ;      E)  $45^\circ$  ha'm  $45^\circ$ .
13. U'sh tuwri' tegislikti yen' ko'bi menen neshe bo'lekke aji'rati'wi' mu'mkin?  
A) 4;      B) 5;      D) 6;      E) 7.
14. 1-su'wrette  $x = ?$   
A)  $30^\circ$ ;      B)  $36^\circ$ ;      D)  $45^\circ$ ;      E)  $60^\circ$ .
15. 2-su'wrette  $x = ?$   
A)  $136^\circ$ ;      B)  $72^\circ$ ;      D)  $56^\circ$ ;      E)  $96^\circ$ .
16. 3-su'wrette  $x = ?$   
A)  $15^\circ$ ;      B)  $30^\circ$ ;      D)  $45^\circ$ ;      E)  $60^\circ$ .

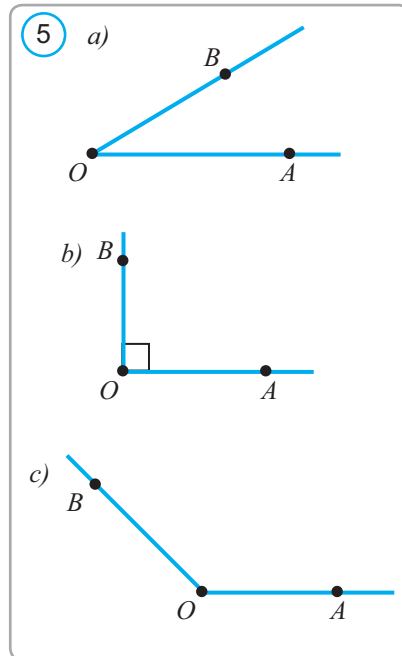
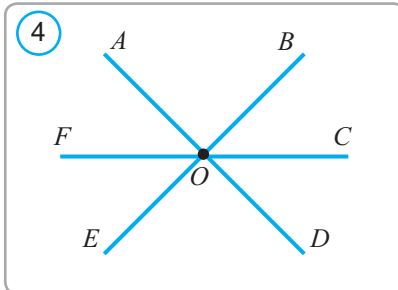


17. To'mendegi talqi'lawlardi'n' duri'si'n tabi'n':
  - A) Tegislikte berilgen noqattan tek g'ana bir tuwri' ju'rgiziw mu'mkin.
  - B) Tuwri'ni'n' qanday da bir noqati'nan bir ta'repine jatqan noqatlari'dan ibarat bo'legine nur dep ataladi'.
  - D) Tuwri'ni'n', yeki noqati' arasi'nda jatqan noqatlari'nan ibarat bolg'an bo'legi kesindi dep ataladi'.
  - E) Ha'r qanday nurg'a tek g'ana bir mu'yesh qoyi'w mu'mkin.
18. To'mendegi talqi'lawlardi'n' duri'si'n tabi'n'.
  - A) Qon'si'las mu'yeshler jayi'q mu'yeshler boladi'.
  - B) Yeger  $AB = 5$  sm,  $BC = 6$  sm bolsa,  $AC = 11$  sm boladi'.
  - D) Yeger mu'yeshler ten' bolsa, wolar vertikal mu'yesh boladi'.
  - E) Yeger yeki mu'yesh ten' bolsa, wolar g'a qon'si'las bolg'an mu'yeshler de ten' boladi'.

## 6. Ma'seleler

1. Transportir ja'rdeminde bir ta'repi uli'wma bolg'an  $10^\circ$ ,  $20^\circ$ ,  $40^\circ$ ,  $60^\circ$ ,  $90^\circ$ ,  $130^\circ$ ,  $170^\circ$  li' mu'yeshlerdi jasan'.
2. Jayi'q mu'yeshtin' bissektrisasi' woni'n' ta'repleri menen qanday mu'yeshti payda yetedi?
3. Mu'yeshtin' bissektrisasi' woni'n' ta'repi menen  $30^\circ$  li' mu'yesh payda yetken bolsa, mu'yeshtin' wo'zi neshe gradus?
4. Mu'yeshtin' bissektrisasi' woni'n' ta'repleri menen dog'al mu'yesh payda yetiwi mu'mkin be?
5.  $\angle AOB = 50^\circ$ ,  $\angle BOC = 80^\circ$  bolsa,  $AOB$  ha'm  $BOC$  mu'yeshlerinin' bissektrisalari' arasi'ndagi' mu'yeshti tabi'n'. Ma'sele neshe sheshimge iye?
6.  $15^\circ$  li' mu'yeshke 10 ma'rte u'lkeytiwshi lupa (ayna) arqali' qaralg'anda, neshe gradusli' mu'yesh ko'rinedi?
7. a)  $90^\circ$ ; b)  $60^\circ$ ; c)  $50^\circ$ ; d)  $20^\circ$  li' mu'yeshtin' bissektrisasi'n transportir ja'rdeminde jasan'.
8.  $\angle AOB = 120^\circ$  bolg'an mu'yeshtin'  $OK$  bissektrisasi'n transportir ja'rdeminde jasan'. Son'i'nan payda bolg'an  $AOK$  ha'm  $KOB$  mu'yeshlerinin' bissektrisalari'n jasan' ha'm bul bissektrisalardi'n' arasi'ndagi' mu'yeshti tabi'n'.
9. Yeger  $AB = 1,8$  m,  $AC = 1,3$  m ha'm  $BC = 3$  m bolsa,  $A$ ,  $B$  ha'm  $C$  noqatlari' bir tuwri'da jata ma?
10.  $A$ ,  $B$  ha'm  $C$  ha'm  $C$  bir tuwri'da jatadi'. Yeger  $AB = 2,7$  m,  $AC = 3,2$  m bolsa,  $BC$  kesindisinin' uzi'nli'g'i'n tabi'n'. Ma'sele neshe sheshimge iye?
11. Uzi'nli'g'i' 15 m bolgan  $AB$  kesindisinde  $C$  noqati' belgilengen. Yeger:
  - a)  $AC$  kesindisi  $BC$  kesindisinen 3 m uzi'n,
  - b)  $C$  noqat  $AB$  kesindilerinin' uzi'nli'qlari',

- c)  $AC$  ha'm  $BC$  kesindilerinin' uzi'nli'qlari' 2:3 qatnasta bolsa,  $AC$  ha'm  $BC$  kesindileri uzi'nli'qlari'n' tabi'n'.
12.  $A, B, C, D$  noqatlari' bir tuwri'da jatadi'. Yeger  $B$  noqati'  $AC$  kesindisinin',  $C$  noqati' bolsa  $BD$  kesindisinin' wortasi' bolsa,  $AB = BC = CD$  yekenligin ko'rsetin'.
13. Hesh birewi bir tuwri'da jatpaytug'i'n u'sh: a) 6; b) 7; c) 10 noqatti'n' ha'r yekewi arqali' tuwri' ju'rgizilgen. Ja'mi neshe tuwri' ju'rgizilgen?
14.  $OA$  ha'm  $OB$  nurlari' qashan u'stpe-u'st tu'sedi?
15.  $AB$  nuri'nda  $C$  noqati',  $BA$  nuri'nda  $D$  noqat sonday yetip ali'ng'an,  $AC = 0,7$  ha'm  $BD = 2,1$ . Yeger  $AB = 1,5$  bolsa,  $CD$  ni' tabi'n'.
16. 4-su'wrette neshe vertikal mu'yeshlar jupli'g'i' ko'rsetilgen?
- 17\*. Yeger saatti'n' saat ha'm minut tilleri arasi'ndag'i' mu'yesh  $45^\circ$  boli'p, minut tili 6 da turg'an bolsa, saat qaysi' waqi'tti' ko'rsetip turg'an boladi'?
18. Tuwri'g'a wonda jatpaytug'i'n  $O$  noqati'nan  $OA$  qi'ya ha'm  $OB$  perpendikulyar ju'rgizilgen. Wolardi'n' uzi'nli'qlari'ni'n' qosi'ndi'si' 13, ayi'rmasi' bolsa 1 ge ten' bolsa,  $O$  noqati'nan tuwri'g'a shekemgi bolg'an arali'qti' tabi'n'.
19.  $AOB$  ha'm  $BOC$  qon'si'las mu'yeshlar yekenligi belgili. Yeger:
- $AOB$  mu'yeshi  $BOC$  mu'yeshinen  $40^\circ$  u'lken;
  - $AOB$  mu'yeshi  $BOC$  mu'yeshinen 4 ma'rte kishi;
  - $\angle AOB = \angle BOC + 44^\circ$ ;
  - $\angle AOB = 5 \cdot \angle BOC$  bolsa, bul mu'yeshlerdi tabi'n'.
20. Yeki tuwri'ni'n' kesilisiwinen to'rt mu'yesh payda boladi'. Wolardi'n' yekewinin gradus wo'lshe'mlerinin' qosi'ndi'si'  $100^\circ$  qa ten' bolsa, bul to'rt mu'yeshin' gradus wo'lshe'mlerin tabi'n'.
21.  $A, B$  ha'm  $C$  noqatlari' tegislikte sonday yetip jaylasqan, a)  $AC + CB = AB$ ; b)  $AB + AC = BC$ . Qaysi' noqat qalg'an yekewinin arasi'nda jatadi'?
22. 5-su'wrettegi mu'yeshlerdin' ta'replerine  $A$  ha'm  $B$  noqatlari' arqali' perpendikulyar tuwri'lar ju'rgizin'. Bul tuwri'lardi'n' kesilisiw noqati'nda qanday mu'yeshlar payda boladi'?



U'lgili baqlaw jumi'si' yeki bo'limnen ibarat boli'p, birinshi bo'limge 49–50-betlerde keltirilgan testlerden besewi kiritiledi. Yekinshi bo'limde bolsa, to'mende keltirilgan ma'selelerge uqsas beriledi (4-ma'sele "ayri'qsha " baha almaqshi' bolg'an woqi'wshi'lar-g'a usi'ni's yetiledi):

1.  $MN$  ha'm  $KL$  tuwri'lari'ni'n' kesilisiwinen payda bolg'an  $MOL$  ha'm  $KON$  vertikal mu'yeshlerinin' qosi'ndi'si'  $148^\circ$  qa ten'.  $MOK$  mu'yeshin tabi'n'.
2. Qon'si'las mu'yeshlerdin' ayi'rmasi'  $60^\circ$  qa ten'. Bul mu'yeshlerdin' kishisin tabi'n'.
3. Mu'yesh bissektrisasi' usi' mu'yeshtin' ta'repi menen  $66^\circ$  li' mu'yesh payda yetedi. Bul mu'yeshke qo'n'si'las bolg'an mu'yeshti tabi'n'.
- 4\*. Qon'si'las mu'yeshlerdin' bissektrisalari' tuwri' mu'yesh asti'nda kesilisiwin da'lillen'.



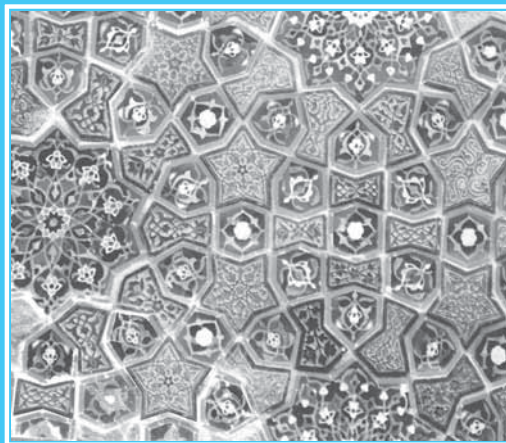
#### **Qa'biliyetli woqi'wshi'lar ushi'n qosi'msha tapsi'rma.**

1. «Geometriya–7» elektron sabaqli'g'i'ni'n' tiyisli babi' betleri menen tani'si'p shi'g'i'n'. Usi' bapqa kiritilgen temalarg'a tiyisli interaktiv animatsiya an'lati'wlari'nda berilgen tapsi'rmalardi' wori'nlap ha'm test tapsi'rmalari'n sheship wo'z bilimin'izdi si'nap ko'rin'.

2. Sonday-aq, 10-bette keltirilgan internet resurslari'nan usi' bapqa tiyisli materiallardi' tabi'n' ha'm u'yrenip shi'g'i'n'.



## II BAP



### U'ShMU'YESHLIKLER

**Bul bapti' u'yrenip shi'qqannan keyin to'mendegi bilim ha'm a'meliy ko'nlikpelerga iye bolasi'z:**

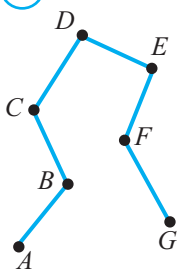
#### **Bilimler:**

- Si'ni'q si'zi'q ha'm woni'n' tu'rlerin biliw;
- ko'pmu'yeshliktin' ani'qlamasi'n biliw;
- u'shmu'yeshlik ha'm woni'n' tiykarg'i' elementleri, bul elementler boyi'nsha u'shmu'yeshlikti tu'rlerge aji'rati'w;
- u'shmu'yeshliktin' medianasi', bissektrisasi' ha'm biyikliginin' ani'qlamalari'n biliw;
- u'shmu'yeshliklerdin' ten'liginin' TMT belgisin biliw;
- ten' qaptalli' u'shmu'yeshliktin' qa'siyetin biliw;
- u'shmu'yeshliklerdin' ten'liginin' MTM belgisin biliw;
- u'shmu'yeshliklerdin' ten'liginin' TTT belgisin biliw;
- ten' ta'repli u'shmu'yeshliklerdin' qa'siyetin biliw;
- kesindinin' worta perpendikulyari'ni'n' qa'siyetin biliw.

#### **Ko'nlikpeler:**

- U'shmu'yeshliklerdin' ten'liginin' belgileri boyi'nsha ten' u'shmu'yeshliklerdi ani'qlay ali'w;
- wo'zlestirilgen bilimlerdi ma'selelerdi sheshiwde ha'm a'meliy jumi'slardi' wori'nlawda qollani'p biliw;
- geometriyani'n' go'zalli'g'i' ha'm na'zikligin seziw;

1



$A B C D E F G$  —  
**si'ni'q si'zi'q;**  
 $A, B, C, D, E,$   
 $F, G$  — **si'ni'q**  
**si'zi'qti'n'**  
**to'beleri;**  
 $AB, BC, CD,$   
 $DE, EF, FG$  —  
**si'ni'q si'zi'qti'n'**  
**buwi'n l a r i'** ( **ta'replari** ).



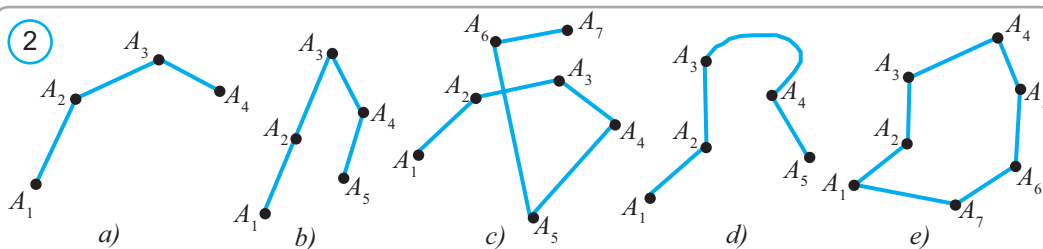
izbe-iz kelgen yekewi bir tuwri'da  
 jatpaytug'i'n  $A_1A_2, A_2A_3, \dots, A_{n-1}A_n$   
 kesindilerinen du'zilgen figurag'a  
 si'ni'q si'zi'q delinedi.

$A_1, A_2, \dots, A_n$  noqatlari' si'ni'q si'zi'qti'n'  
 to'beleri,  $A_1A_2, A_2A_3, \dots, A_{n-1}A_n$  kesindilari  
 bolsa si'ni'q si'zi'qti'n' **buwi'n l a r i'** yamasa  
**ta'replari** dep ataladi'. 1-su'wrette  $ABCDEF G$   
 — si'ni'q si'zi'q su'wretlengen..

Baslang'i'sh ha'm aqirg'i' to'beleri u'stpe-u'st tu'setug'i'n si'ni'q si'zi'qti' — **tuyi'q**  
 si'ni'q si'zi'q dep ataymi'z.

**Shi'ni'g'i'w.** 2-su'wrette su'wretlengen si'zi'qlardi'n' si'ni'q si'zi'q boli'wi'n yamasa  
 bolmaytug'i'ni'n ani'qlan' ha'm tu'sindirin'.

2



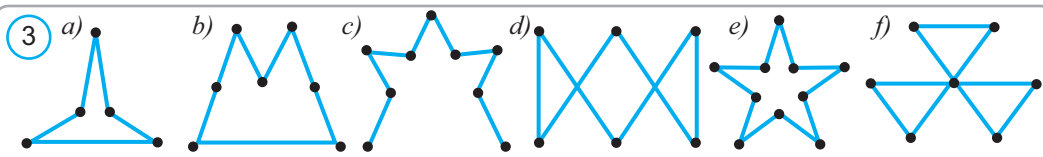
Wo'zin-wo'zi kesip wo'tpeytug'i'n si'ni'q si'zi'q ko'pmu'yeshlik dep ataladi'.



### Aktivlestirish shi'ni'g'i'w.

Ko'pmu'yeshlikti'n' ani'qlamasi'nan kelip shi'g'atug'i'n wo'zgesheliklerin sanan'  
 ha'm 3-su'wrettegi figuralardi'n' ko'pmu'yeshlik boli'wi'n yamasa bolmaytug'i'ni'n  
 ani'qlan' ha'm tu'sindirin'.

3



Ta'replerinin' sani'na qarap, ko'pmu'yeshlikler u'shmu'yeshlik, tortmu'yeshlik, besmu'yeshlik, alti'mu'yeshlik, uli'wma jag'dayda  $n$ - mu'yesh dep ataladi'. Sizler bazi'-bir ko'pmu'yeshlikler menen to'mengi klaslarda tani'sqansi'zlar.

Ha'r qanday ko'pmu'yeshlik tegislikti yeki oblastqa aji'ratadi'. Ko'pmu'yeshlik penen shegaralang'an shekli oblast — ko'pmu'yeshliktin' *ishki oblasti'* dep, yekinshisi — sheksiz oblasti' bolsa ko'pmu'yeshliktin' *si'rtqi' oblasti'* dep ataladi'. 4-su'wrette  $ABCDEF$  alti'mu'yeshliktin' ishki ( $a$ -su'wret) ha'm si'rtqi' ( $b$ -su'wret) oblastlari' boyap ko'rsetilgen.

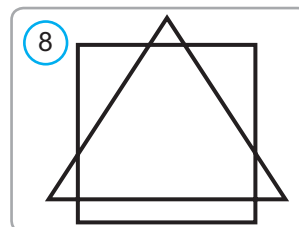
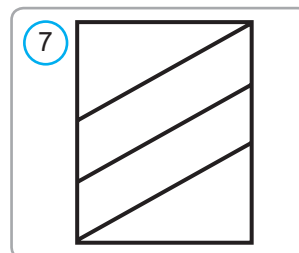
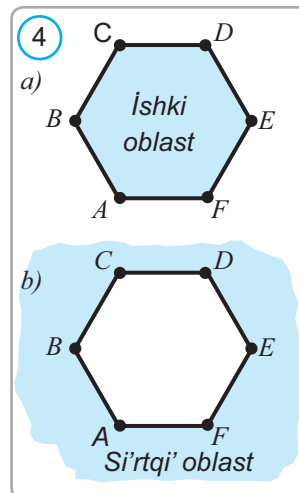
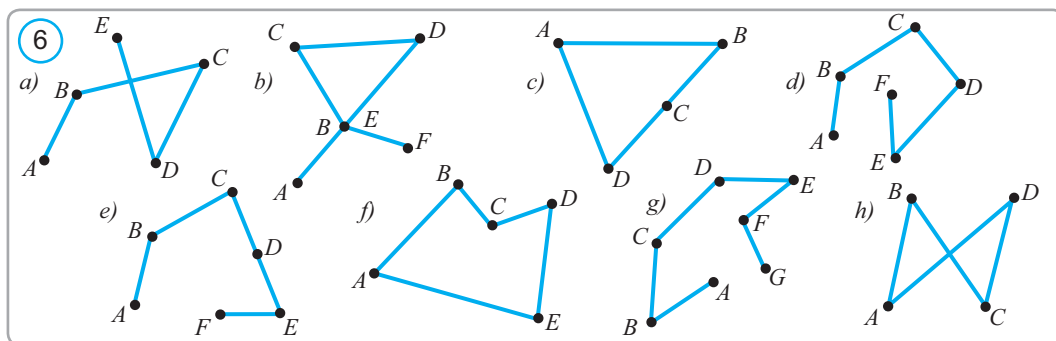


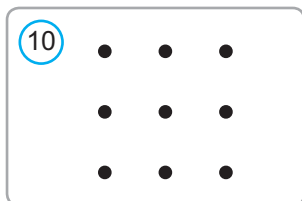
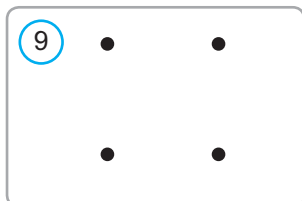
### Soraw, ma'sele ha'm tapsi'rmalar

1. Si'ni'q si'zi'q degen ne?
2. Si'ni'q si'zi'q si'zi'n', woni' belgilen' ha'm woni'n' to'beleri ha'm buwi'nlari'n si'zi'lmada ko'rsetin'.
3. Tuyi'q si'ni'q si'zi'qlarg'a mi'sallar keltirin'.
4. Klass bo'lmesinde, mektepte, u'yde si'ni'q si'zi'qti' yesletiwshi na'rselerge mi'sallar tabi'n'.
5. Ko'pmu'yeshlik degen ne? Mi'sallar keltirin'.
6. 5-su'wrette su'wretlengen cifrlar qanday si'ni'q si'zi'qlardi' an'latadi'?



7. 6-su'wrette su'wretlengen figuralardi'n' qaysi'lari': a) si'ni'q si'zi'q; b) tuyi'q si'ni'q si'zi'q; c) ko'pmu'yeshlik bolatug'i'ni'n ani'qlan'.





8. Ha'r yeki qon'si'las buwi'ni' perpendikulyar bolg'an bes si'ni'q si'zi'q si'zi'n'. Bunday si'ni'q si'zi'q neshe tu'rli boli'wi' mu'mkin?



### Geometriyalı'q basqatı'rmalar

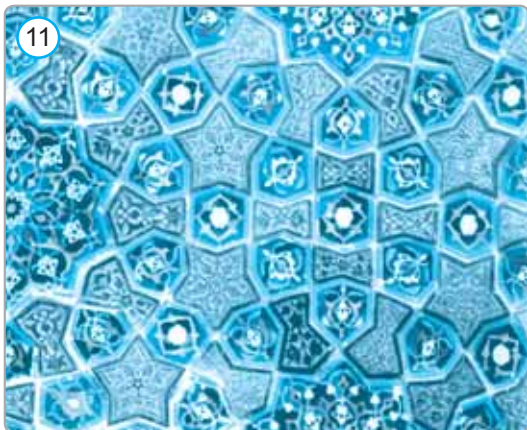
1. 7-su'wrette neshe to'rtmu'yeshlik bar?
2. 8-su'wrette ko'rsetilgen figurani' qa'lemdi qag'azdan u'zbesten ha'm bir si'zi'q u'stinen qayta ju'rgizbesten si'zi'n'.
3. Ta'repleri 9-su'wrette berilgen to'rt noqattan wo'tiwshi u'shmu'yeshlik si'zi'n'.
4. 10-su'wrette su'wretlengen 9 noqatti'n' ha'mmesinen wo'tiwshi, buwi'nları'ni'n' sani' 4 bolg'an si'ni'q si'zi'q si'za alasi'z ba?



### Tariyxtan u'zindiler

**Geometriya iliminde wo'z da'wirinen bes a'sir wozi'p ketken arxitektor ustazlari'mi'z.**

2007-ji'l fevral ayi'nda Amerikada basi'lg'an worta a'sir arxitekturasi' haqqi'ndag'i' maqala da'bdebege sebep boldi'. Ga'p sonda, 2005-ji'li' Samarqandtag'i' Abdullaxan medresesi gu'mbezindegi kafeldegi nag'i'slardi'ko'zden keshirgen Garvard universitetinin' aspiranti' Piter Lu tan'lani'p jag'asi'n uslap qaldi'. Woni'n'ko'z aldi'nda, 1970-ji'llarda woylap tabi'lg'an dep esaplang'an, Penrouz nag'i'slari' dep atalg'an quramali' geometriyalı'q figuralar turar edi. Bunnan, bizin' arxitektor ata-babalari'mi'z aqi'lli'-ziyreklikte wo'z da'wirinen bes a'sir aldi'g'a ketip, pa'nde jaqi'nda g'ana kiritilgen quramali'geometriyalı'q figuralardi'bilip g'ana qalmastan, wolardan wo'z islerinde unamli' paydalang'an yeken! Haqi'yqati'nda da solay boli'p shi'qti'. 11-su'wrette arxitekturalı'q yesteligindegi nag'i's ko'rsetilgen. 12-su'wrette orta a'sir qoljazbalari'nan ali'ng'an boli'p, bunda tani'qli' nag'i's tiykari'n qurawshi' ko'pmu'yeshlikler ko'rsetilgen.



Bir tuwri'da jatpaytug'i'n u'sh noqatti' belgileymiz. Wolardi' wo'z-ara kesindiler menen wo'z-ara tutasti'ri'p shi'qsaq, *u'shmu'yeshlik* payda boladi' (1-su'wret). Belgilengen u'sh noqat u'shmu'yeshliktin' to'beleri, kesindiler bolsa u'shmu'yeshliktin' ta'replerinen ibarat boladi'. A'dette, "u'shmu'yeshlik" so'zi worni'na  $\Delta$  belgisi qollani'ladi'. " $\Delta ABC$ " jazi'wi "u'shmu'yeshlik  $ABC$ " yamasa " $ABC$  u'shmu'yeshligi" dep woqi'ladi'.  $\angle BAC$ ,  $\angle ABC$ ,  $\angle ACB$  — u'shmu'yeshliktin' *mu'yeshleri* dep ju'ritiledi. Wolardi' geyde aniqliq ushi'n *ishki mu'yeshler* dep te ataydi' (1-su'wret).

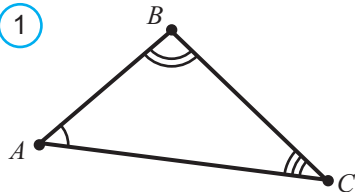
U'shmu'yeshliktin' mu'yeshlerin  $\angle A$ ,  $\angle B$ ,  $\angle C$  tu'rinde de belgilew mu'mkin. U'shmu'yeshliktin' ta'repleri ha'm mu'yeshleri woni'n tiykarg'i elementleri dep ataladi'. U'shmu'yeshliktin' u'sh ta'repinin' uzi'nliqlari'ni'n qosi'ndi'si'na, woni'n *perimetri* delinedi. Wol  $P$  ha'ribi menen belgilenedi,

*BAC mu'yesh u'shmu'yeshliktin' AB ha'm AC ta'repleri arasi'nda jati'wshi' mu'yeshi;*

*AB ha'm AC ta'repleri BAC mu'yeshine irgeles jatadi',*

*BC ta'repi BAC mu'yeshinin' qarama-qarsi'si'nda jati'r si'yaqli' so'z dizbekleri qollani'ladi.*

1



$\Delta ABC$  —  $ABC$  u'shmu'yeshligi

$A, B, C$  noqatlari' — u'shmu'yeshliktin' ushlari'

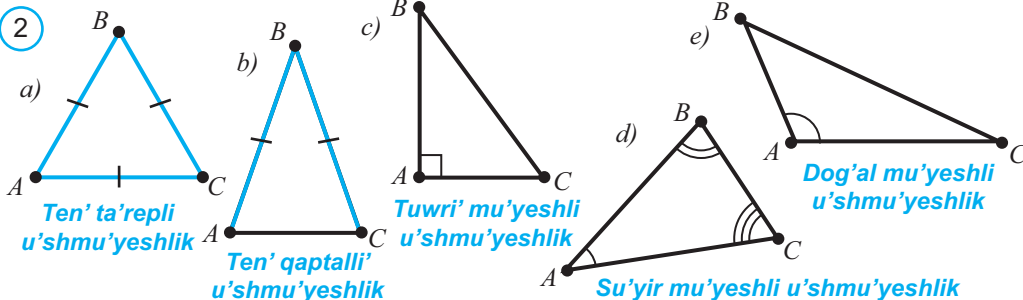
$AB, BC, AC$  kesindileri — u'shmu'yeshliktin' ta'repleri

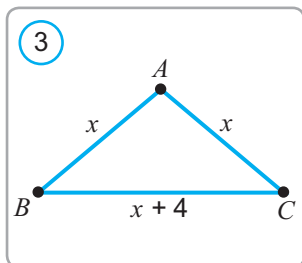
$\angle A, \angle B, \angle C$  — u'shmu'yeshliktin' mu'yeshleri

$P = AB + BC + AC$  — u'shmu'yeshliktin' perimetri

Ta'repleri ha'm mu'yeshlerine qaray u'shmu'yeshlikler to'mendegi tu'rlerge bo'linedi: u'sh ta'repi wo'z-ara ten' bolsa, *ten' ta'repli u'shmu'yeshlik* (2.a-su'wret), ta'replerinen yekewi wo'z-ara ten' bolsa, *ten' qaptalli' u'shmu'yeshlik* (2.b-su'wret), bir mu'yeshi tuwri' bolsa, *tuwri' mu'yeshli u'shmu'yeshlik* (2.c-su'wret), barliq mu'yeshleri su'yir bolsa, *su'yir mu'yeshli u'shmu'yeshlik* (2.d-su'wret), bir mu'yeshi dog'al bo'lsa, *dog'al mu'yeshli u'shmu'yeshlik* (2.e-su'wret).

2





**Ma'sele.** Perimetri 28 sm ge ten' bolg'an ten' qaptalli' u'shmu'yeshliktin' ultani' qaptal ta'repinen 4 sm uzi'n. Usi' u'shmu'yeshliktin' ta'replerin tabi'n'.

**Sheshiliwi:**  $ABC$  u'shmu'yeshliginin' qaptal ta'repin  $x$  dep belgilesek, ultani'  $x+4$  boladi' (3-su'wret). Wonda, ma'sele sha'rti boyi'nsha,  $P = x + x + x + 4 = 3x + 4 = 28$ ,  $x = 8$ . Demek,  $AB = AC = 8$  sm;  $BC = 12$  sm. **Juwabi':** 8 sm; 8 sm; 12 sm.

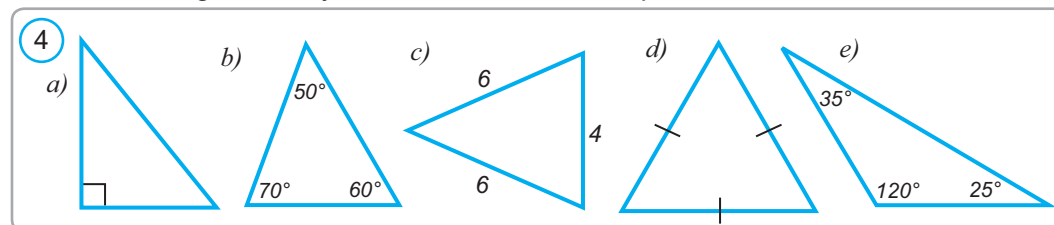


### Soraw, ma'sele ha'm tapsi'rmalar

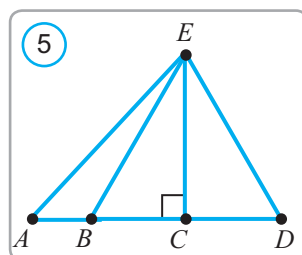
1. Qanday figura u'shmu'yeshlik dep ataladi'?
2.  $PQR$  u'shmu'yeshliginde:
  - a)  $\angle P$  qarama-qarsi'si'nda qaysi' ta'rep jatadi'?
  - b)  $PQ$  ta'repine qaysi' mu'yeshler irgeles jatadi'?
  - c)  $PQ$  ha'm  $QR$  ta'replerinin' arasi'nda qaysi' mu'yesh jaylasqan?
  - d)  $PR$  ta'repi qaysi' mu'yesh qarama-qarsi'si'nda jati'r?

Bul sorawlarg'a figurag'a qaramay juwap beriwge ha'reket yetin'.

3. U'shmu'yeshliktin' qanday tu'rleri bar? Ha'r bir u'shmu'yeshlik tu'rinen bir u'shmu'yeshlik si'zi'n'. Wolardi' belgilen'. U'shmu'yeshlik tu'rlerinin' ani'qlamasi'nan kelip shi'g'i'p, wolardi'n' wo'zgesheliklerin an'lati'n'.
4. 4-su'wrettegi u'shmu'yeshliklerdin' tu'rlerin ani'qlan'.



5. Ko'z benen shamalap, u'sh ta'repi ten' bolg'an u'shmu'yeshlik jasan'. Son'i'nan ta'replerin wo'lshep tekserip ko'rin'.



6. Ten' ta'repli u'shmu'yeshlik si'zi'p, mu'yeshlerin wo'lshen' ha'm juwmaq shi'g'ari'n'.
7. 5-su'wrette bir to'besi: a)  $A$  noqati'nda; b)  $B$  noqati'nda; c)  $C$  noqati'nda bolg'an neshe u'shmu'yeshlik bar?
8. 5-su'wrette u'shmu'yeshliktin' qanday tu'rlerin ko'rip tursi'z? Wolardi' tu'rleri boyi'nsha da'pterinizge jazi'n'.
9. Qanday da bir u'shmu'yeshlikti si'zi'n' ha'm woni' belgilen'. Si'zg'i'sh ja'rdeminde ta'replerin wo'lshen' ha'm u'shmu'yeshliktin' perimetrin tabi'n'.

$ABC$  u'shmu'yeshliginin'  $B$  to'besin woni'n' qarama-qarsi'si'nda jati'wshi'  $AC$  ta'reptin' wortasi'  $M$  noqati' menen tutasti'rami'z (1-su'wret). Payda bolg'an  $BM$  kesindisi  $ABC$  u'shmu'yeshliginin' *medianasi'* dep ataladi'. Bul mediana  $B$  to'besinen shi'qqan yamasa  $AC$  ta'repke tu'sken delinedi.



U'shmu'yeshliktin' to'besin, usi' to'be qarama-qarsi'si'ndag'i' ta'reptin' wortasi' menen tutasti'ri'wshi' kesindi, u'shmu'yeshliktin' **medianasi'** dep ataladi'.

$ABC$  u'shmu'yeshliginin'  $B$  mu'yeshinin' bissektisasi'n ju'rgizemiz (2-su'wret). Woni'n'  $AC$  ta'repi menen kesilisken noqati'n  $L$  menen belgileymiz. Payda bolg'an  $BL$  kesindisi  $ABC$  u'shmu'yeshliginin' *bissektisasi'* dep ataladi'.

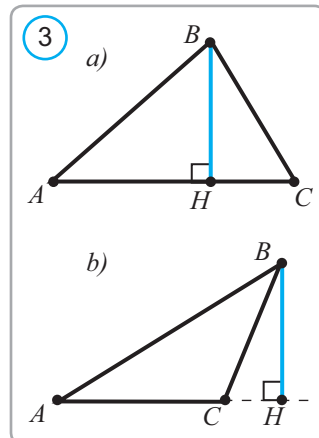
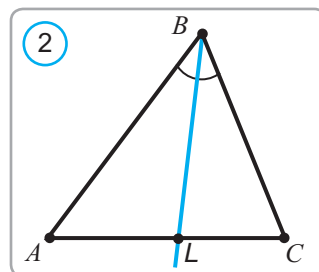
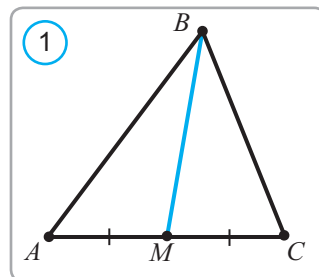


U'shmu'yeshlik mu'yeshinin' bissektisasi'ni'n' u'shmu'yeshlik ishinde jatqan bo'legi (kesindisi) u'shmu'yeshlik bissektisasi' delinedi.

$ABC$  u'shmu'yeshliginin'  $B$  to'besinen,  $AC$  ta'repi jati'rg'an tuwri'g'a perpendikulyar tu'siremiz (3-rasm). Perpendikulyar ultani'n  $H$  penen belgileymiz. Payda bolg'an  $BH$  kesindisi  $ABC$  u'shmu'yeshliginin' biyikligi dep ataladi'.



U'shmu'yeshliktin' to'besinen usi' to'be qarama-qarsi'si'ndag'i' ta'repide jati'rg'an tuwri'g'a tu'sirilgen perpendikulyar, u'shmu'yeshliktin' biyikligi dep ataladi'.



U'shmu'yeshliktin' u'sh to'besi bolg'ani' sebepli, ha'r bir u'shmu'yeshlik u'shewden mediana, biyiklik ha'm bissektisag'a iye.

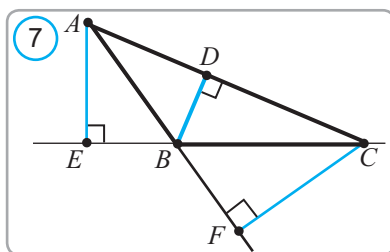
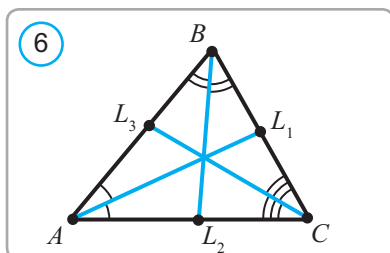
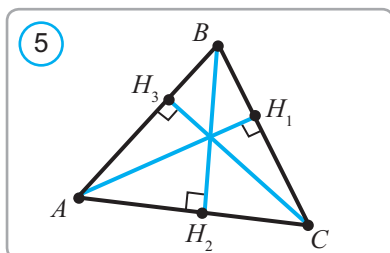
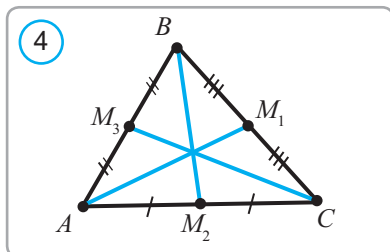
4-su'wretteg'i  $AM_1$ ,  $BM_2$  ha'm  $CM_3$  kesindileri —  $ABC$  u'shmu'yeshliginin' medianalari'.

5-su'wretteg'i  $AL_1$ ,  $BL_2$  ha'm  $CL_3$  kesindileri —  $ABC$  u'shmu'yeshliginin' bissektisalari'.

6-su'wretteg'i  $AH_1$ ,  $BH_2$  ha'm  $CH_3$  kesindileri —  $ABC$  u'shmu'yeshliginin' biyikliklari'.

Bul a'hmiyetli tu'siniklerdin' qa'siyetleri menen keyingi sabaqlarda tani'sami'z.





### Geometriyalıq izertlewler

1. Qa'legen u'shmu'yeshlik si'zi'n'. Woni'n' barlıq me-dianalari'n ju'rgizin' (4-su'wret). Neni ko'rip tursi'z? Ta'jiriybeni ja'ne yeki u'shmu'yeshlik ushi'n wri'nlap ko'rin' ha'm ani'qlang'an qa'siyetti qi'yali'y ko'riniste an'lati'n'.
2. Qa'legen u'shmu'yeshlik si'zi'n'. Woni'n' barlıq biyikliklerin ju'rgizin' (5-su'wret). Neni ko'rip tursi'z? Ta'jiriybeni ja'ne yeki u'shmu'yeshlik ushi'n wri'nlap ko'rin' ha'm ani'qlang'an qa'siyetti qi'yali'y ko'riniste an'qlan'.
3. Qa'legen u'shmu'yeshlik si'zi'n'. Woni'n' barlıq bissektisalarini'n ju'rgizin' (6-su'wret). Neni ko'rip tursi'z? Ta'jiriybeni ja'ne yeki u'shmu'yeshlik ushi'n wri'nlap ko'rin' ha'm ani'qlang'an qa'siyetti qi'yali'y ko'riniste an'lati'n'.

O'tkerilgen ta'jiriybeler tiykari'nda ani'qlang'an qa'siyetlerdi teorema dep esaplasaq bola ma? Nege?

**Shi'ni'g'i'w.** Dog'al mu'yeshli u'shmu'yeshliktin' biyikliklerin ju'rgizin'.

**Wori'nlanı'wı'.** U'shmu'yeshliktin', tiykari'nan, dog'al mu'yeshli u'shmu'yeshliktin' de u'sh biyikligi bar. Dog'al mu'yeshli  $ABC$  u'shmu'yeshlikti qaraymız (7-su'wret). Dog'al mu'yeshi to'besinen tu'sirilgen  $BD$  biyiklik u'shmu'yeshliktin' ishinde jatadi'. Su'yir mu'yeshi  $A$  to'besinen biyiklik tu'siriw ushi'n, usi' mu'yesh qarama-qarsi'si'ndag'i'  $BC$  ta'repin dawam ettiremiz ha'm  $BC$  ta'repinin' dawami'na  $A$  noqati'nan  $AE$  perpendikulyar

tu'siremiz. Payda bolg'an  $AE$  kesindisi  $ABC$  u'shmu'yeshliginin'  $A$  to'besinen tu'sirilgen biyikligi boladi'. Tap sonday,  $AB$  ta'repinin' dawami'na  $CF$  biyikligin tu'siriw mu'mkin.

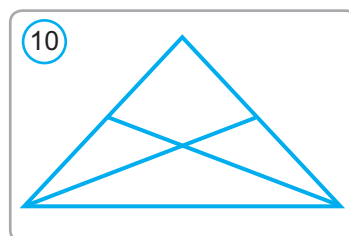
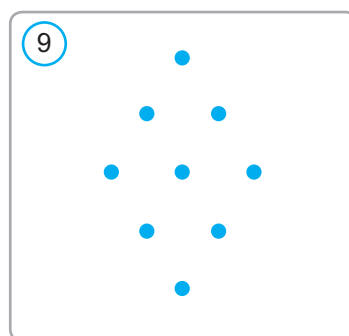
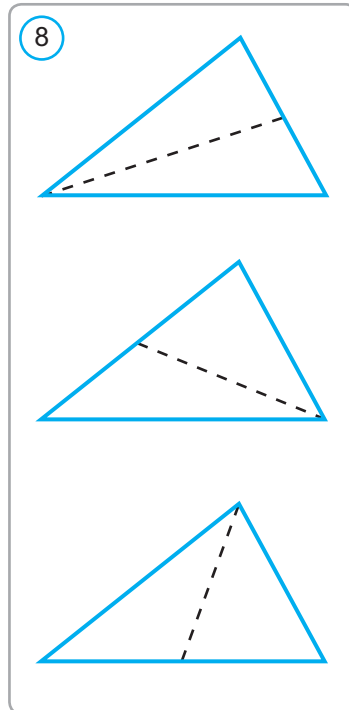


### Soraw, ma'sele ha'm tapsi'rmalar

1. U'shmu'yeshliktin' medianasi' degen ne? U'shmu'yeshliktin' neshe medianasi' bar.
2. U'shmu'yeshliktin' biyikligi degen ne? U'shmu'yeshliktin' neshe biyikligi bar? Si'zi'lmada si'zi'p ko'rsetin'.

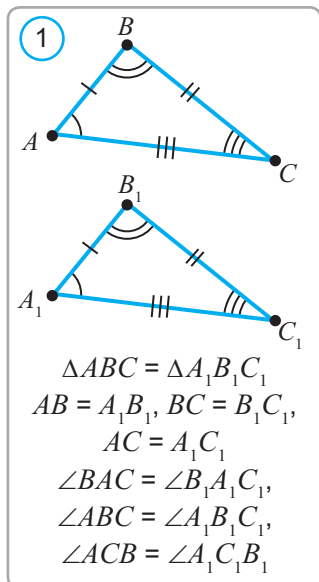


3. U'shmu'yeshliktin' bissektrisasi' degen ne? U'shmu'yeshliktin' neshe bissektrisasi' bar? Si'zi'lmada si'zi'p ko'rsetin'.
4. Mu'yeshtin' bissektrisasi' menen u'shmu'yeshliktin' bissektrisasi' arasi'ndag'i' uqsasli'q ha'm wo'z-geshelikti ayti'n'?
5. (*A'meliy shi'ni'g'i'w*). U'sh birdey u'shmu'yeshlikti tu'rli medianalari' boylap qi'rqi'n' (*8-su'wret*). Payda bolg'an 6 u'shmu'yeshlikten bir u'shmu'yeshlik jasan'.
6. U'shmu'yeshlikti'n' qaysi' elementleri barqulla u'shmu'yeshliktin' ishinde jatadi'?
- 7\*. Qaysi' u'shmu'yeshlikte u'sh biyikligi de u'shmu'yeshliktin' bir to'besinde kesilisedi'?
- 8\*. U'shmu'yeshlikti'n' biyikligi woni'n' u'sh ta'repinen de kishi boli'wi' mu'mkin be?
9. Perimetri 36 g'a ten' bolg'an u'shmu'yeshlitin' biyikligi woni' perimetrleri 18 ha'm 24 ke ten' bolg'an u'shmu'yeshliklerge aji'ratadi'. Berilgen u'shmu'yeshliktin' biyikligin tabi'n'.
10. Perimetri 36 g'a ten' bolg'an u'shmu'yeshliktin' bissektrisasi' woni' perimetrleri 24 ha'm 30 g'a ten' bolg'an u'shmu'yeshliklerge aji'ratadi'. Berilgen u'shmu'yeshliktin' bissektrisasi'n tabi'n'.
11.  $ABC$  u'shmu'yeshlikte  $AB = BC$  ha'm  $BD$  medianasi' 4 sm. Yeger  $ABD$  u'shmu'yeshliginin' perimetri 12 sm bolsa,  $ABC$  u'shmu'yeshliginin' perimetrin tabi'n'.



### Geometriyalı'q basqatı'rmalar

1. Bes birdey sho'pten 2 u'shmu'yeshlik jasan'.
2. Tog'i'z birdey sho'pten 5 u'shmu'yeshlik jasan'.
3. To'beleri 9-su'wrette ko'rsetilgen noqatlarda jatatug'i'n neshe ten' ta'repli u'shmu'yeshlik si'zi'w mu'mkin?
4. 10-su'wrette neshe u'shmu'yeshlik bar?



Geometriyalı'q figuralardi'n' ten'liginin' ani'qlaması boyı'nsha, Yeger yeki u'shmu'yeshlikten birin yekinishisine da'l u'stpe-u'st yetip qoyı'w mu'mkin bolsa, wolar ten' boladı'. 1-su'wrette  $ABC$  ha'm  $A_1B_1C_1$  — ten'dey u'shmu'yeshlikler su'wretlengen. Wolardan qa'legen birewin yekinishisine u'stpe-u'st qoyı'w mu'mkin. Bunda, bir u'shmu'yeshliktin' u'sh to'besi ha'm u'sh ta'repi sa'ykes tu'rde yekinishi u'shmu'yeshliktin' u'sh to'besi ha'm u'sh ta'repi menen u'stpe-u'st tu'sedi. Bunda u'shmu'yeshliklardin' mu'yeshleri de sa'ykes tu'rde u'stpe-u'st tu'sedi.

$ABC$  ha'm  $A_1B_1C_1$  u'shmu'yeshliklerinin' ten'ligi

$$\triangle ABC = \triangle A_1B_1C_1$$

tu'rinde an'latı'ladi'. Si'zi'lmada ten'dey mu'yeshler birdey sandag'i' dog'alar menen, ten'dey ta'repler bolsa birdey sandag'i' si'zi'qlar menen 1-su'wrette su'wretlengenindey aji'rati'p ko'rsetiledi.



### Aktivlestiriwshi soraw.

U'shmu'yeshlik formasi'ndag'i' yeki jer maydani'ni'n' wo'z-ara ten'ligin a'melde qalay tekseriw mu'mkin? Sebebi, olardan birin yekinishinin' u'stine qoyı'wg'a bolmaydi' - g'o?

Yeki u'shmu'yeshliktin' wo'z-ara ten' yamasa ten' yemesliligin ani'qlaw ushi'n barqulla wolardi' u'sti-u'stine qoyı'w sha'rt pe? Bug'an za'ru'rlik joq yeken. Bul ma'seleni u'shmu'yeshlikler-din' bazi' bir elementlerin sali'sti'ri'p sheshiw mu'mkin yeken. "u'shmu'yeshliklardin' ten'lik belgileri" dep atalg'an teoremlar — usi' haqqi'nda.

Bul teoremlardi'n' "belgisi" dep ayti'li'wi'na sebep, wolardi'n' ja'rdeminde u'shmu'yeshliklardin' ten' yamasa ten' yemesligi haqqi'nda qarar shi'g'ari'w mu'mkin.

Uli'wma alg'anda, geometriyada "belgisi" — figurani'n' qaysi' bir qa'siyetin ani'qlawg'a ja'rdem beriwshi sha'rtler haqqi'ndag'i' teoremadan ibarat boladi'.

$ABC$  u'shmu'yeshligi berilgen bolsi'n. Wog'an ten' bolg'an basqa u'shmu'yeshlikti to'mendegi usi'l menen jasaymi'z.  $A$  mu'yeshin wo'lsheymiz ha'm tegisliktin' basqa bir jerine wog'an ten' bolg'an  $A_1$  mu'yeshin jasaymi'z.  $A_1$  mu'yeshinin' ta'replerine, sa'ykes tu'rde  $A_1B_1 = AB$  ha'm  $A_1C_1 = AC$  kesindilerin qoyami'z.  $B_1$  ha'm  $C_1$  noqatlari'n tutasti'rami'z. Na'tiyjede,  $ABC$  u'shmu'yeshligi menen yeki ta'repi ha'm wolardi'n'

arasi'ndag'i bir mu'yeshi ten' bolg'an  $A_1B_1C_1$  u'shmu'yeshligin payda yetemiz. Sonli'qtan  $A_1B_1C_1$  u'shmu'yeshligi  $ABC$  u'shmu'yeshligine ten' boladi'.

To'mendegi teorema usi'ni' tasti'yi'qlaydi'. Wol "U'shmu'yeshliklerdin' yeki ta'repi ha'm wolardi'n' arasi'ndag'i mu'yeshi boyi'nsha ten'ligi haqqi'ndag'i teorema" dep ataladi'. Biz woni' qi'sqasha u'shmu'yeshliklerdin' ten'liginin' "TMT belgisi" dep aytami'z. (TMT jazi'wi, "ta'rep", "mu'yesh", "ta'rep" so'zlerinin' bas ha'riplerinen du'zilgen).



**Teorema.** (U'shmu'yeshliklerdin' ten'liginin' TMT belgisi). Yeger bir u'shmu'yeshliktin' yeki ta'repi ha'm wolardi'n' arasi'ndag'i mu'yeshi yekinshi u'shmu'yeshliktin' yeki ta'repi ha'm wolardi'n' arasi'ndag'i mu'yeshine sa'ykes tu'rde ten' bolsa, wonda bunday u'shmu'yeshlikler wo'z-ara ten' boladi'. (2-su'wret)

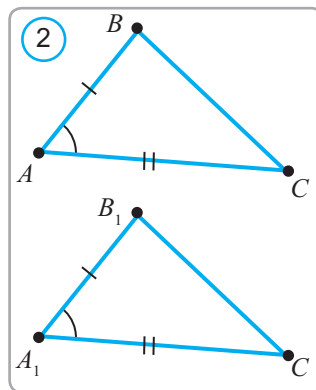


Berilgen:  $\triangle ABC$  ha'm  $\triangle A_1B_1C_1$   
 $AB = A_1B_1$ ,  $AC = A_1C_1$ ,  $\angle A = \angle A_1$



$\triangle ABC = \triangle A_1B_1C_1$

**Da'lillew.**  $\angle ABC = \angle A_1B_1C_1$  bolg'ani' ushi'n,  $ABC$  u'shmu'yeshligin  $A_1B_1C_1$  u'shmu'yeshligine sonday yetip qoyi'w mu'mkin, bunda  $A$  to'besi  $A_1$  to'besine,  $AB$  ha'm  $AC$  ta'replari bolsa sa'ykes tu'rde,  $A_1B_1$  ha'm  $A_1C_1$  nurlari'ni'n u'stine tu'sedi.  $AB = A_1B_1$  ha'm  $AC = A_1C_1$  bolg'ani' ushi'n,  $AB$  ta'repi  $A_1B_1$  ta'repi menen,  $AC$  ta'repi bolsa  $A_1C_1$  menen u'stpe-u'st tu'sedi. Sonli'qtan,  $B$  noqati'  $B_1$  noqati' menen,  $C$  noqati' bolsa  $C_1$  noqati' menen u'stpe-u'st tu'sedi. Bunda,  $B_1C_1$  ha'm  $BC$  ta'replari de u'stpe-u'st tu'sedi. Na'tiyjede,  $ABC$  u'shmu'yeshliginin' u'sh to'besi,  $A_1B_1C_1$  u'shmu'yeshliginin' u'sh to'besi menen, sa'ykes tu'rde u'stpe-u'st tu'sedi. Demek,  $ABC$  ha'm  $A_1B_1C_1$  u'shmu'yeshlikleri wo'z-ara ten'.

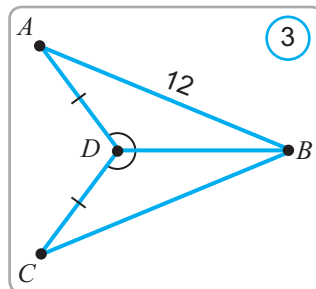


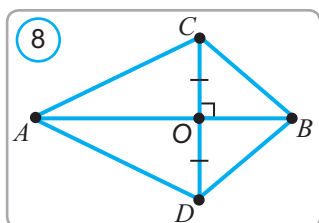
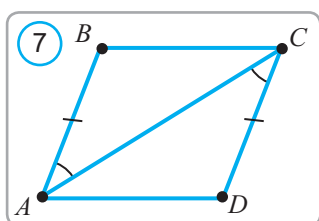
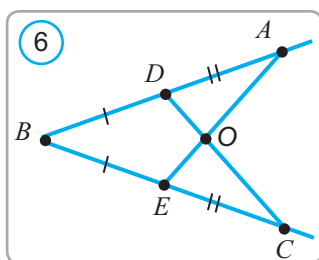
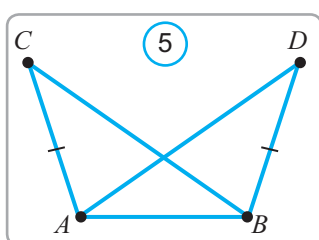
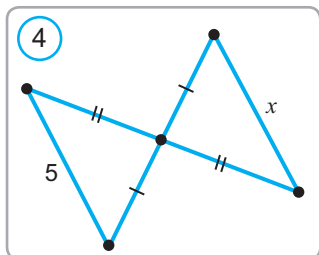
**Teorema da'lillendi.**

**Ma'sele.** 3-su'wrette berilgen mag'li'wmatlar boyi'nsha  $BC$  kesindisin tabi'n'.

**Sheshiliwi:**  $ADB$  ha'm  $CDB$  u'shmu'yeshliklerin qaraymi'z.  $AD=DC$ ,  $\angle ADB=\angle CDB$ ,  $BD$  — bul u'shmu'yeshlikler ushi'n uli'wma ta'rep. Demek, u'shmu'yeshliklerdin' ten'liginin' TMT belgisi boyi'nsha,  $\triangle ADB=\triangle CDB$ , sonli'qtan,  $CB=AB=12$  yekenligi belgili boladi'.

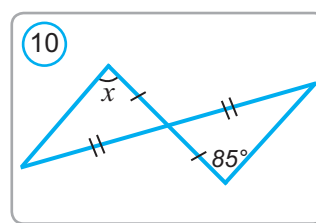
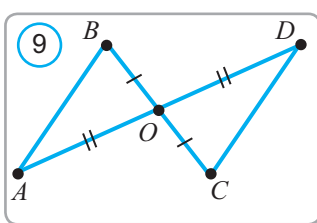
**Juwabi':** 12.





## ? Soraw, ma'sele ha'm tapsi'rmalar

1. Qanday u'shmu'yeshliklar ten' dep ataladi'?
2.  $\triangle ABC = \triangle A_1B_1C_1$  ten'ligi u'shmu'yeshliklardan' qaysi' yelemntlarini' ten'ligin bildiradi?
3. 4-su'wrettegı belgisiz kesindi  $x$  ti' tabi'n'.
4. TMT belgisi boyi'nsha u'shmu'yeshliklardan' ten'ligi qanday elementlar boyi'nsha tabi'ladi'?
5. U'shmu'yeshliklardan' ten'ligini' TMT belgisini' tu'sindirini'.
6. Yeger 5-su'wrette  $\angle CAB = \angle ABD$  bolsa,  $AD = BC$  yekenligin ko'rsetini'.
7. 6-su'wrette  $\angle BAO = \angle BCO$  yekenligin ko'rsetini'.
8. 7-su'wrette  $\triangle ABC = \triangle CDA$  yekenligin da'llilen'.
9. 8-su'wrette  $\triangle ABC = \triangle ABD$  yekenligin da'llilen'.
10.  $AD$  ha'm  $BC$  kesindilari  $O$  noqati'nda kesilisedi ha'm bul noqatta yekige bo'linedi (9-su'wret).
  - a)  $\triangle AOB = \triangle DOC$  yekenligi;
  - b)  $BD = AC$  yekenligi;
  - d)  $\triangle ABD = \triangle DCA$  yekenligin da'llilen'.
  - e) Yeger  $AOB$  u'shmu'yeshliginde  $\angle A = 35^\circ$  ha'm  $\angle B = 62^\circ$  bolsa,  $DOC$  u'shmu'yeshligini'  $D$  ha'm  $C$  mu'yeshlarini' tabi'n'.
11. 10-su'wrettegı belgisiz mu'yesh  $x$  ti' tabi'n'.
12. Bir u'shmu'yeshlikni' perimetri yekinshi u'shmu'yeshlikni' perimetrinen u'lken. Bul u'shmu'yeshliklar ten' boli'wi mu'mkin be?
13.  $ABC$  u'shmu'yeshligini'  $AB$  ta'repinde  $D$  noqati',  $A_1B_1C_1$  u'shmu'yeshligini'  $A_1B_1$  ta'repinde  $D_1$  noqati' ali'ng'an.  $\triangle ADC = \triangle A_1D_1C_1$  ha'm  $BD = B_1D_1$  ten'liklari belgili.  $ABC$  ha'm  $A_1B_1C_1$  u'shmu'yeshliklarini' ten' yekenligin da'llilen'.



Yeki ta'repi ten' bolg'an u'shmu'yeshlikti **ten' qaptalli' u'shmu'yeshlik** deb atag'an yedik. Ten' qaptalli' u'shmu'yeshliklerdin' ten' ta'repleri woni'n' **qaptal ta'repleri**, u'shinshi ta'repi bolsa, woni'n' **ultani'** dep ataladi'.



### Aktivlestiriwshi shi'ni'g'i'w

2-su'wrettegi u'shmu'yeshliklerdin' qaysi' biri ten' qaptalli'? Wolardi'n' ultani'n' ha'm qaptal ta'replerin ayti'n'.



### Geometriyalı'q izertlew

Qa'legen ten' qaptalli' u'shmu'yeshlik jasan'. Woni'n' ultani'na irgeles jatqan mu'yeshlerdi wo'lshen' ha'm wolardi' sali'sti'ri'n'. Ta'jiriybeni ja'ne 2 – 3 basqa ten' qaptalli' u'shmu'yeshlikler ushi'n qaytalan' ha'm wo'z shamalawi'n'i'zdi' tasti'yi'qlaw ko'rinisinde an'lati'n'. Ta'jiriybe na'tiyjesinde tabi'lg'an bul qa'-siyetti barli'q ten' qaptalli' u'shmu'yeshlikler ushi'n wori'nli' dep ayti'w mu'mkin be?



**Teorema.** Ten' qaptalli' u'shmu'yeshliktin' ultani'ndag'i' mu'yeshleri ten'.



Berilgeni:  
 $\triangle ABC, AB = AC$



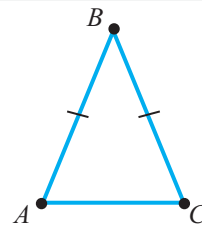
$\angle B = \angle C$

**Da'lillew.** Aytayi'q,  $AL - ABC$  u'shmu'yeshliginin' bissektrisasi' bolsi'n (3-su'wret).  $ABL$  ha'm  $ACL$  u'shmu'yeshliklerin qaraymi'z. Birinshiden,  $AL$  ta'repi uli'wma, yekinshiden, teorema sha'rti boyi'nsha  $AB = AC$  ( $\triangle ABC$  — ten' qaptalli'). U'shinshiden,  $\angle 1 = \angle 2$ , sebebi  $AL$  — bissektrisa.

Demek, u'shmu'yeshliklerdin' ten'liginin' TMT belgisi boyi'nsha,  $\triangle ABL = \triangle ACL$  boladi.

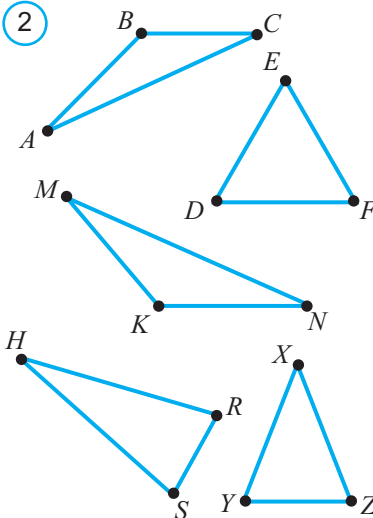
Bul jag'dayda,  $\angle B = \angle C$ . **Teorema da'lillendi.**

1

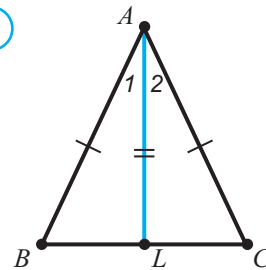


$ABC$  — **ten' qaptalli' u'shmu'yeshlik**  
 $AB, BC$  — **qaptal ta'repleri**  
 $AC$  — **ultani'**

2



3





## Geometriyali'q izertlew

Ten' qaptalli' u'shmu'yeshlik si'zi'n'. Woni'n' to'besinen bissektisasi'n ju'rgizin'. Bis-sektrisa tu'sken noqat ultandi' bo'lgen bo'lekler uzi'nli'g'i'n wo'lshep sali'sti'ri'n'. Bunnan qanday juwmaq shi'g'adi'? Son' bissektisa ultan menen payda yetken mu'yeshlerdi transpartirde wo'lshen' ha'm sali'sti'ri'n'. Bunnan qanday juwmaq shi'g'adi'? Bul juwmaqlardi' tasti'yi'qlaw tu'rinde an'lati'n'. Ta'jriybe na'tijesinde tabi'lg'an bul qa'siyetlerdi barli'q ten' qaptalli' u'shmu'yeshlikler ushi'n wori'nli' dep ayti'w mu'mkin be?



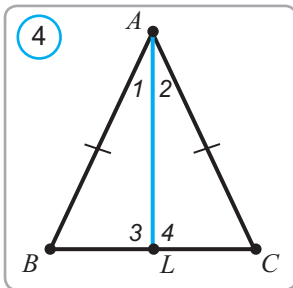
**Teorema.** Ten' qaptalli' u'shmu'yeshliktin' ultani'na tu'sirilgen bissektisa, woni'n' ha'm medianasi', ha'm biyikligi boladi' (4-su'wret).

$\triangle ABC$ ,  $AB = AC$ ,  $AL$  – bissektisa.



$AL$  – mediana ha'm biyiklik

**Da'lillew.**  $AL$  kesindini  $ABC$  u'shmu'yeshliktin' bissektisasi' bolsa, joqari'da da'lillengen



teorema boyi'nsha  $\triangle ABL = \triangle ACL$  boladi'. U'shmu'yeshlikler ten'liginen  $BL = LC$  ha'm  $\angle 3 = \angle 4$  yekenligin tabami'z.

Demek,  $L$  noqati'  $BC$  ta'reptin' wortasi',  $AL$  bolsa  $ABC$  u'shmu'yeshliginin' medianasi' yeken.

$\angle 3$  ha'm  $\angle 4$  wo'z-ara ten' ha'm qon'si'las mu'yeshler bolg'ani' ushi'n, wolar tuwri' mu'yeshler boladi'.

Demek,  $AL$  kesindi  $ABC$  u'shmu'yeshliginin' biyikligi de boladi' yeken.

**Teorema da'lillendi.**

**Juwmaq.** Solay yetip ten' qaptalli' u'shmu'yeshliktin' to'besinen shi'g'ari'lg'an bissektisasi', medianasi' ha'm biyikligi u'stpe-u'st tu'sedi yeken.

## Shi'ni'g'i'w.

1. Ten' ta'repli u'shmu'yeshliktin' bissektisalari', medianalari' ha'm biyiklikleri haqqi'nda ne ayti'w mu'mkin?



**Ma'sele.** Ten' qaptalli'  $ABC$  u'shmu'yeshliklerine  $AD$  ha'm  $CF$  medianalari' tu'sirilgen.  $\triangle ADC = \triangle CFA$  ha'm  $\triangle ADB = \triangle CFB$  yekenligin da'lillen' (5-su'wret).



$\triangle ABC$ ,  $AB = BC$ ,  $AD$  va  $CF$  — medianalari'



$\triangle ADC = \triangle CFA$ ;  $\triangle ADB = \triangle CFB$

**Da'lillew.**  $AB = BC$  bolg'ani' ushi'n, bul ta'replerden  $AD$  ha'm  $CF$  medianalar aji'ratqan kesindiler wo'z-ara ten' boladi':

$$AF = FB = BD = CD. \quad (1)$$

a)  $\triangle ADC$  ha'm  $\triangle CFA$  u'shmu'yeshliklerde

1.  $\angle ACD = \angle FAC$ , sebebi  $\triangle ABC$  — ten' qaptalli';
2.  $AC$  ta'repi uli'wma;
3.  $AF = CD$  — (1) ten'ligi boyi'nsha.

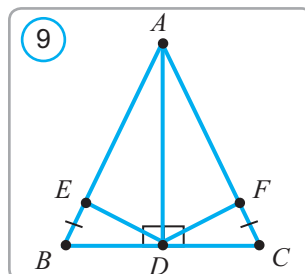
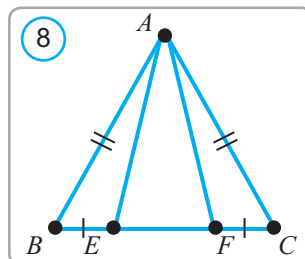
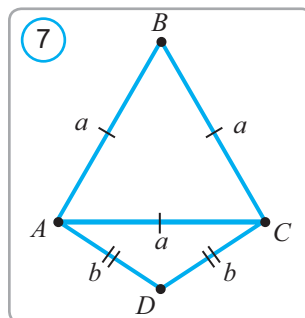
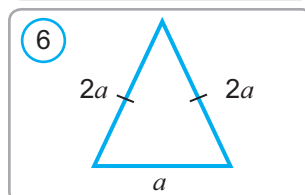
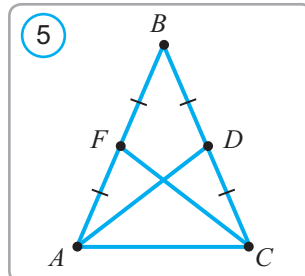
Demek, u'shmu'yeshliklerdin' ten'liginin' TMT belgisi boyi'nsha  $\triangle ADC = \triangle CFA$ .

b)  $\triangle ADB = \triangle CFB$  yekenligin wo'z betinshe da'lillen'.



### Soraw, ma'sele ha'm tapsi'rmalar

1. Qanday u'shmu'yeshlikler ten' qaptalli' dep ataladi'?
2. Ten' qaptalli' u'shmu'yeshlikdin' qaysi' mu'yeshi ten' boladi'?
3. 6-su'wrett  $P = 50 \text{ sm}$  bolsa,  $a = ?$
4. 7-su'wrette  $P_{ABC} = 36$  ha'm  $P_{ADC} = 28$  bolsa,  $a = ?$ ,  $b = ?$
5. Ten' qaptalli' u'shmu'yeshlikdin' qaptal ta'replerine tu'sirilgen medianalari' ten' bolatug'i'ni'n da'lillen'.
6. 8-su'wrette  $AB = AC$ ,  $BE = FC$ . a)  $\triangle ABE = \triangle ACF$ ; b)  $AE = AF$ ; c)  $\triangle ABF = \triangle ACE$  yekenligin da'lillen'.
7. 9-su'wrette  $AB = AC$ ,  $BE = CF$ . a)  $\triangle AED = \triangle AFD$ ; b)  $\triangle BED = \triangle CFD$  ten'liklerin da'lillen'.
8. Ten' ta'repli u'shmu'yeshlikdin' barli'q mu'yeshleri ten' yekenligin da'lillen'.
9. Yeki ten' qaptalli' u'shmu'yeshlikdin' ultanlari' ha'm usi' ultang'a tu'sirilgen biyikliklari ten' bolsa, bul mu'yeshler ten' bolatug'i'ni'n da'lillen'.
10. Ten' ta'repli u'shmu'yeshlikdin' ultani' qaptal ta'repinen  $3 \text{ sm}$  u'lken, biraq qaptal ta'replerinin' qosi'ndi'si'nan  $5 \text{ sm}$  kishi. U'shmu'yeshlikdin' ta'replerin tabi'n'.
11. Ten' qaptalli' u'shmu'yeshlikdin' ta'replerinin' wortalari' tutasti'ri'lsa, ten' qaptalli' u'shmu'yeshlik payda boli'wi'n da'lillen'.





Yendi u'shmu'yeshliklardin' bir ta'repi ha'm wog'an irgeles jatqan mu'yeshleri boyi'nsha ten'lik belgisin ko'remiz. Aldi'mi'zda woni' "MTM belgisi" dep juritemiz.



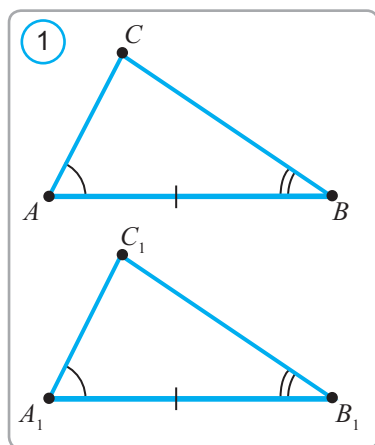
**Teorema.** (U'shmu'yeshliklardin' ten'liginin' MTM belgisi). Yeger bir u'shmu'yeshliktin' bir ta'repi ha'm wog'an irgeles jatqan yeki mu'yeshi yekinshi u'shmu'yeshliktin' bir ta'repi ha'm wog'an irgeles jatqan yeki mu'yeshine sa'y-kes tu'rde ten' bolsa, bunday u'shmu'yeshlikler wo'z-ara ten' boladi'.



Berilgeni:  $\triangle ABC$  ha'm  $\triangle A_1B_1C_1$ ,  
 $AB = A_1B_1$ ,  $\angle A = \angle A_1$ ,  $\angle B = \angle B_1$



$\triangle ABC = \triangle A_1B_1C_1$

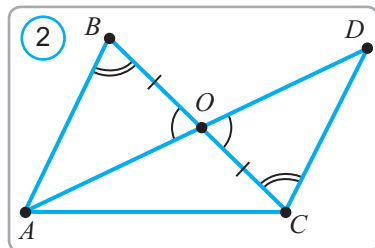


**Da'lillew.**  $ABC$  u'shmu'yeshligin  $A_1B_1C_1$  u'shmu'yeshliginin' u'stine sonday yetip qoyayi'q,  $A$  to'besi  $A_1$  to'besi menen  $AB$  ta'repi  $A_1B_1$  ta'repi menen u'stpe-u'st tu'ssin ha'm  $C$  ha'm  $C_1$  to'beleri  $A_1B_1$  tuwri'ni'n' bir ta'repide jatsi'n.

Bul jag'dayda,  $\angle A = \angle A_1$  bolg'ani' ushi'n,  $AC$  ta'repi  $A_1C_1$  nuri'nda jatadi',  $\angle B = \angle B_1$  bolg'ani' ushi'n,  $BC$  ta'repi  $B_1C_1$  nuri'nda jatadi'. Soni'n' ushi'n  $C$  noqati'  $AC$  ha'm  $BC$  nurlari'ni'n' uli'wmali'q noqati' si'pati'nda  $A_1C_1$  ha'm  $B_1C_1$  nurlari'ni'n' ha'r yekewinde de jatadi'. Bul jag'dayda,  $C$  noqati'  $A_1C_1$  ha'm  $B_1C_1$  nurlari'ni'n' uli'wmali'q noqati' —  $C_1$  menen u'stpe-u'st tu'sedi. Na'tiyjede,  $AC$  ha'm  $A_1C_1$ ,  $BC$  ha'm  $B_1C_1$  ta'repleri de wo'z-ara u'stpe-u'st tu'sedi. Demek,  $ABC$  ha'm  $A_1B_1C_1$  u'shmu'yeshlikleri da'l u'stpe-u'st tu'sedi. Bul bolsa, wolar wo'z-ara ten' degeni.



**Ma'sele.** 2-su'wrette berilgenlerinen paydalani'p,  $\triangle AOB = \triangle DOC$  yekenligin da'lillen'.



**Sheshiliwi:**  $\angle AOB$  ha'm  $\angle DOC$  — vertikal mu'yesh bolg'ani' ushi'n wo'z-ara ten' boladi'.

Demek,

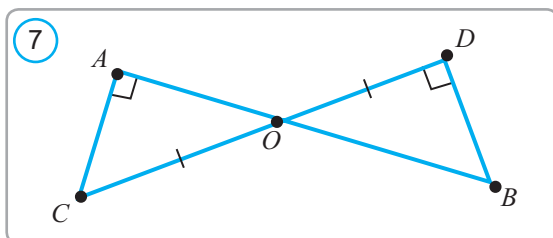
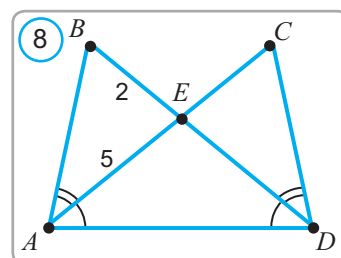
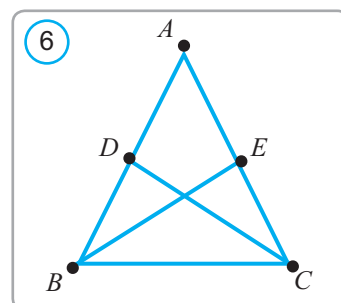
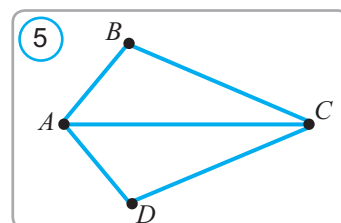
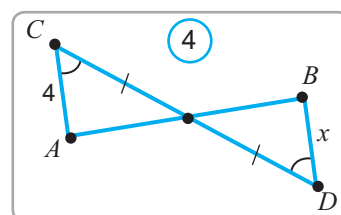
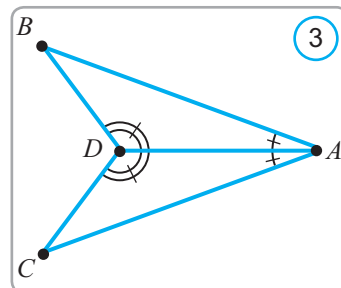
$$BO = OC, \angle ABO = \angle DCO, \angle AOB = \angle DOC$$

ha'm u'shmu'yeshliklardin' ten'liginin' MTM belgisi boyi'nsha,  $\triangle AOB = \triangle DOC$ .



### Soraw, ma'sele ha'm tapsi'rmalar

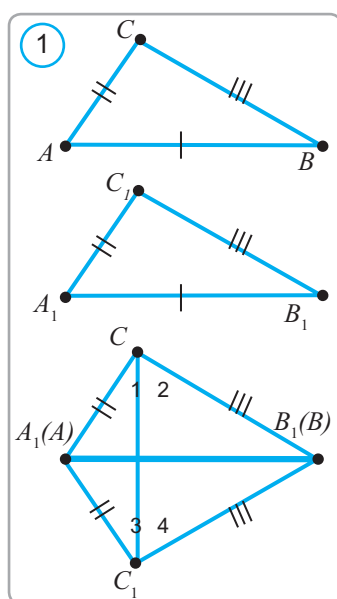
1. U'shmu'yeshliklerdin' ten'ligi MTM belgisi boyi'nsha qaysi' elementlerdi sali'sti'ri'w arqali' ani'qlanadi'?
2. U'shmu'yeshliklerdin' ten'liginin' MTM belgisin tu'sindirir'.
3. 3-su'wrette  $\triangle ABD = \triangle ACD$  yekenligin da'lillen'
4. 4-su'wrettegi belgisiz  $x$  ti' tabi'n'.
5. 5-su'wrette  $AC$  kesindisi  $BAC$  ha'm  $BCD$  mu'yeshlerinin' bissektisasi' bolsa,  $\triangle ABC = \triangle ADC$  yekenligin da'lillen'.
6.  $ABC$  ha'm  $A_1B_1C_1$  u'shmu'yeshliklerinde  $AB = A_1B_1$ ,  $BC = B_1C_1$  ha'm  $\angle B = \angle B_1$  yekenligi belgili.  $AB$  ha'm  $A_1B_1$  ta'replerinde sa'ykes tu'rde  $D$  ha'm  $D_1$  noqatlari'  $\angle ACD = \angle A_1C_1D_1$  bolatug'i'nday yetip ali'ng'an. Wonda  $\triangle BCD = \triangle B_1C_1D_1$  yekenligin da'lillen'.
7.  $AB$  ha'm  $CD$  kesindileri  $O$  noqati'nda kesilisedi. Yeger  $BO = CO$  ha'm  $\angle ACO = \angle DBO$  bolsa,  $ACO$  ha'm  $DBO$  u'shmu'yeshlikleri ten' yekenliklerin da'lillen'.
8. Yeger  $ABC$  u'shmuyeshlikte  $AB = AC$ ,  $BE$  ha'm  $CD$  — bissektisasi' bolsa,  $BE = CD$  yekenligin da'lillen' (6-su'wret).
9.  $\triangle OAC = \triangle ODB$  bolatug'i'ni'n da'lillen' (7-su'wret).
10.  $ABC$  ha'm  $ADC$  u'shmu'yeshlikleri ten'.  $B$  ha'm  $D$  noqatlari'  $AC$  tuwri'si'ni'n' tu'rli ta'repinde jatadi'.  $ABD$  ha'm  $BCD$  u'shmu'yeshliklerinin' ten' qaptalli' yeken-ligin da'lillen'.
11. 8-su'wrettegi mag'li'wmatlar tiykari'nda  $AC$  ha'm  $BD$  kesindilerin tabi'n'.



Yendi u'shmu'yeshliklardin' u'sh ta'repi boyi'nsha ten'lik belgisi menen tani'sami'z. Aldi'mi'zda woni' "TTT belgisi" dep ju'riterimiz.



**Teorema.** (U'shmu'yeshlikler ten'liginin' TTT belgisi). Yeger bir u'shmu'yeshliktin' u'sh ta'repi yekinishi u'shmu'yeshliktin' u'sh ta'repine sa'ykes tu'rde ten' bolsa, bunday u'shmu'yeshlikler wo'z-ara ten' boladi'.



Berilgeni:  $\triangle ABC$  ha'm  
 $\triangle A_1B_1C_1$ ;  $AB = A_1B_1$ ,  
 $AC = A_1C_1$ ,  $BC = B_1C_1$ .



$\triangle ABC =$   
 $= \triangle A_1B_1C_1$

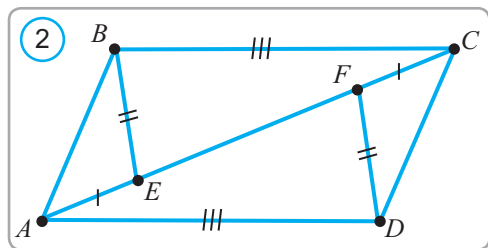
**Da'lillew.** Aytayi'q,  $ABC$  u'shmu'yeshliginin' yen' u'lken ta'repi  $AB$  bolsi'n.  $ABC$  u'shmu'yeshligin sonday yetip qoyami'z,  $AB$  ta'repi  $A_1B_1$  ta'repi menen u'ste-u'st tu'ssin ha'mde  $C$  ha'm  $C_1$  to'beleri  $A_1B_1$  tuwri'si'ni'n' tu'rli ta'replerinde jatsi'n. Bul jag'dayda,  $AC = A_1C_1$  ha'm  $BC = B_1C_1$  bolg'ani' ushi'n  $A_1C_1C$  ha'm  $B_1C_1C$  u'shmu'yeshlikleri ten' qaptalli' boladi'. Ten' qaptalli' u'shmu'yeshliktin' qa'siyeti boyi'nsha,  $\angle 1 = \angle 3$  va  $\angle 2 = \angle 4$  boladi'. Soni'n' ushi'n,  $\angle ACB = \angle A_1CB_1 = \angle A_1C_1B_1$  boladi'.

Demek,  $ABC$  ha'm  $A_1B_1C_1$  u'shmu'yeshliklerinde:  $AC = A_1C_1$ ,  $BC = B_1C_1$  ha'm  $\angle ACB = \angle A_1C_1B_1$ . U'shmu'yeshliklardin' ten'liginin' TTT belgisi boyi'nsha,  $\triangle ABC = \triangle A_1B_1C_1$ .

**Juwmaq.** Yeger yeki u'shmu'yeshliktin' u'sh ta'repleri saykes tu'rde ten' bolsa, wolardin' sa'ykes mu'yeshleri de wo'z-ara ten' boladi.

**Teorema da'lillendi.**

**Shi'ni'g'i'w.** Joqari'dag'i' teoremani' da'lillewde ne sebepten  $AB$  ha'm  $A_1B_1$  ta'repleri yen' u'lken ta'repler bolsi'n dep ali'ndi'?



**Ma'sele.** 2-su'wrette berilgenlerden paydalani'p, a)  $\triangle AFD = \triangle CEB$ ;  
b)  $\triangle AEB = \triangle CFD$  yekenligin da'lill'en'.

**Da'lillew:** 2-su'wrette berilgenler boyi'nsha  $AE = FC$ ,  $BE = FD$  ha'm  $AD = BC$ .

a)  $AF = AE + EF$  bolg'ani' ushi'n  $EC = EF + FC = EF + AE = AF$ .

Demek,  $\triangle AFD$  ha'm  $\triangle CEB$  ni'n' sa'ykes ta'replari wo'z-ara ten' ha'm u'shmu'yeshlik-lerdin' ten'liginin' TTT belgisi boyi'nsha  $\triangle AFD = \triangle CEB$ .

b)  $\triangle AFD = \triangle CEB$  bolg'ani' ushi'n  $\angle BEF = \angle EFD$ . Bul jag'dayda,  $BEF$  ha'm  $AEB$ ,  $EFD$  ha'm  $CFD$  bul jag'dayda, qon'si'las mu'yeshler bolg'ani' ushi'n  $\angle AEB = \angle CFD$  boladi'.

$AEB$  ha'm  $CFD$  u'shmu'yeshliklerinde:

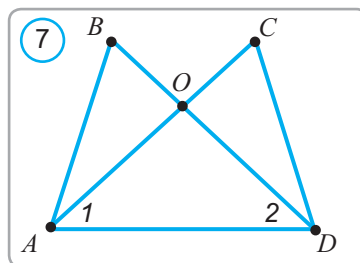
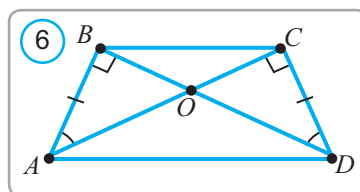
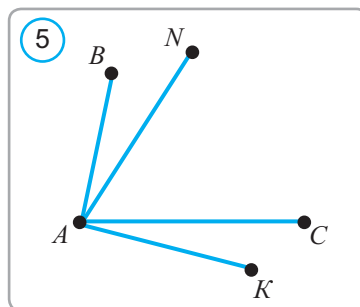
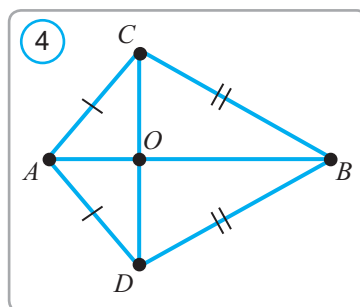
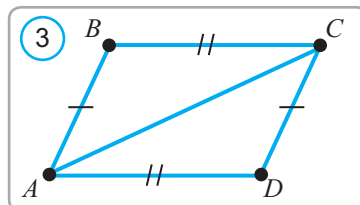
1.  $AE = FC$ ;
2.  $BE = FD$ ;
3.  $\angle AEB = \angle CFD$ .

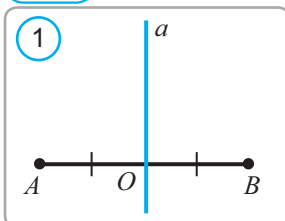
Demek, u'shmu'yeshliklerdin' ten'liginin' TMT belgisi boyi'nsha,  $\triangle AEB = \triangle CFD$  boladi'.



### Soraw, ma'sele ha'm tapsi'rmalar

1. TTT belgisinde u'shmu'yeshlikler ten'ligi qanday elementler boyi'nsha sali'sti'ri'p ani'qlanadi'?
2. U'shmu'yeshliklerdin' ten'liginin' TTT belgisin tu'sindirini'.
3. 3-su'wrette berilgenler boyi'nsha  $\triangle ABC = \triangle CDA$  yekenligin da'lillen'.
4. 4-su'wrette: a)  $\triangle ABC = \triangle ABD$ ; b)  $\triangle BOC = \triangle BOD$ ; c)  $\triangle AOC = \triangle AOD$ ; d)  $AB \perp CD$  yekenligin da'lillen'.
5.  $ABC$  ha'm  $ABD$  — ultanlari'  $AB$  bolg'an ten' qaptalli' u'shmu'yeshlikler bolsa,  $\triangle ACD = \triangle BCD$  yekenligin da'lillen'.
6. Yeger 5-su'wrette  $BA = AK$ ,  $AC = AN$ ,  $\angle BAC = \angle NAK$  bolsa, to'beleri  $A$ ,  $B$ ,  $C$ ,  $K$  ha'm  $N$  noqatlari'nda bolg'an barli'q ten' u'shmu'yeshlikler jupli'g'i'n ani'qlan'.
7.  $ABC$  ha'm  $A_1B_1C_1$  u'shmu'yeshliklerinde  $AB = A_1B_1$  ha'm  $BC = B_1C_1$  boli'p, woldi'n' perimetrleri ten' bolsa,  $\triangle ABC = \triangle A_1B_1C_1$  yekenligin da'lillen'.
- 8.\*  $AB$  ha'm  $CD$  kesindileri kesilisiw noqati'nda ten' yekige bo'linedi.  $\triangle ACD = \triangle BDC$  yekenligin da'lillen'.
9. 6-su'wrette neshe ten' u'shmu'yeshlikler jubi' bar yekenligin ani'qlan'.
- 10\*. Yeger 7-su'wrette: a)  $\angle 1 = \angle 2$ ,  $AC = BD$ ; b)  $\angle 1 = \angle 2$ ,  $BO = OC$ ,  $AB = CD$  bolsa,  $\triangle ABD = \triangle ACD$  yekenligin ko'rsetin'.





Yendi u'shmu'yeshliklerdin' ten'lik belgilerinin' teoremlari'n da'lillewde qollani'li'wi'n u'yrenemiz.

$AB$  kesindisi berilgen bolsi'n. Woni'n' wortasi' bolg'an  $O$  noqati'nan  $AB$  kesindige perpendikulyar  $a$  tuwri'ni' ju'rgizemiz (1-su'wret). Bul tuwri'  $AB$  kesindinin' **worta perpendikulyari'** dep ataladi'.



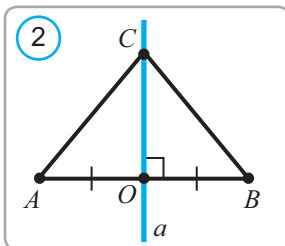
**Teorema.** Kesindinin' worta perpendikulyarlari'ni'n' qa'legen noqati' kesindi ushlari'nan ten'dey uzaqli'qta jaylasqan boladi'.



$AB$  kesindi,  $C$  —  $AB$  kesindisinin' worta perpendikulyari'ni'n' qa'legen noqati' (2-su'wret).



$$AC = BC$$



**Da'lillew.**  $ACO$  ha'm  $BCO$  u'shmu'yeshliklerinde

1.  $OC$  — uli'wmali'q ta'rep;

2.  $AO = BO$  — sha'rt boyi'nsha;

3.  $\angle AOC = \angle BOC = 90^\circ$  — sha'rt boyi'nsha.

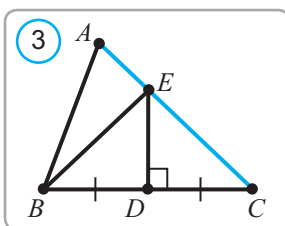
Demek, u'shmu'yeshliktin' ten'luginin' TMT belgisi boyi'nsha

$$\triangle AOC = \triangle BOC. \text{ Tiykari'nan, } AC = BC.$$

**Teorema da'lillendi.**



**Ma'sele.**  $ABC$  u'shmu'yeshliktin'  $BC$  ta'repine tu'sirilgen worta perpendikulyar  $AC$  ta'repin  $E$  noqati'nda kesip wo'tedi. Yeger  $BE = 6 \text{ sm}$ ,  $AC = 8,4 \text{ sm}$  bolsa,  $AE$  ha'm  $CE$  kesindisin tabi'n'.



**Sheshiliwi:**  $ABC$  u'shmu'yeshliginde  $BC$  ta'repinin' worta perpendikulyari'  $DE$  bolsi'n (3-su'wret). Kesindinin' worta perpendikulyari'ni'n' qa'siyeti boyi'nsha,  $CE = BE = 6 \text{ sm}$ .

$$AE + EC = AC \text{ bolg'ani' ushi'n,}$$

$$AE = AC - EC = 8,4 - 6 = 2,4 \text{ (sm).}$$

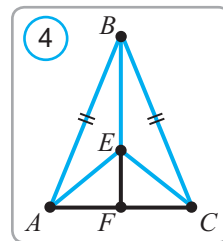
**Juwabi':**  $AE = 2,4 \text{ sm}$ ,  $CE = 6 \text{ sm}$ .



**Soraw, ma'sele ha'm tapsi'rmalar**

1. Kesindinin' worta perpendikulyarlari' degen ne?
2. Kesindinin' worta perpendikulyarlari'ni'n' qa'siyetin tu'sindirir'.

3. Qanday da bir u'shmu'yeshlik si'zi'n' ha'm woni'n' ha'r ta'repine worta perpendikulyarlar ju'rgizin'. Neni payda yettin'iz? Si'zi'lman'i'zdi' klaslasi'n'i'zdi'n' si'zi'lmasi' menen sali'sti'ri'n' ha'm ani'qlag'an qa'siyetti qi'yali'y tu'de an'lati'n'.
4. Qanday u'shmu'yeshlikte u'shmu'yeshliktin' ta'repine tu'sirilgen worta perpendikulyar usi' ta'repke tu'sirilgen biyiklik penen u'stpe-u'st tu'sedi
5.  $ABC$  u'shmu'yeshliginin'  $BC$  ta'repine ju'rgizilgen worta perpendikulyar  $AC$  ta'repin  $D$  noqati'nda kesip wo'tedi. Agar  $BD = 7,2 \text{ sm}$ ,  $AD = 3,2 \text{ sm}$  bolsa,  $AC$  nege ten'?
6.  $ABC$  ha'm  $ABD$  ten' qaptalli' u'shu'myeshlikleri uli'wmali'q  $AB$  ultang'a iye.  $CD$  tuwri'si'  $AB$  kesindisinin' worta perpendikulyari' bolatug'i'ni'n da'lillen'.
- 7\*.  $ABC$  ten' qaptalli' u'shmu'yeshliktin'  $AB$  qaptal ta'repine ju'rgizilgen worta perpendikulyar  $BC$  ta'repin  $D$  noqati'nda kesip wo'tedi. Yeger  $ADC$  u'shmu'yeshliginin' perimetri  $24 \text{ sm}$  ge ten' ha'm  $AB = 16 \text{ sm}$  bolsa,  $AC$  ultani'n tabi'n'.
- 8\*. U'shmu'yeshliktin' ta'replerine tu'sirlgen worta perpendikulyarlar bir noqatta kesilisetug'i'ni'n da'lillen'.
9. Ten' qaptalli'  $ABC$  u'shmu'yeshliginin' ultani'na tu'sirilgen  $BF$  bissektrisasi'nda  $E$  noqati' ali'ng'an (4-su'wret).  $\triangle ABE = \triangle CBE$  ten'likti TTT belgisinen: a) paydalani'p; b) paydalanbastan da'lillen'.



27

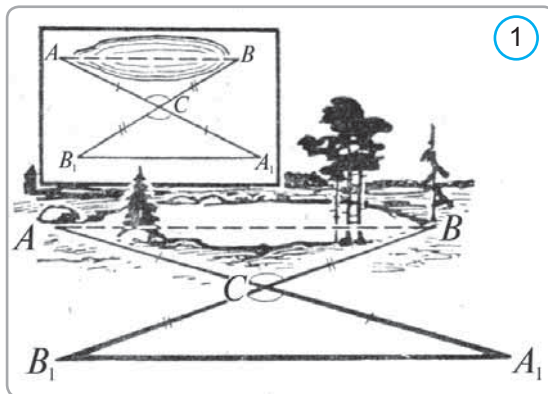
### A'meliy shi'ni'g'i'w

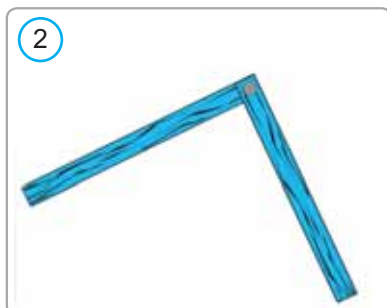
#### Ko'ldin' ken'ligin wo'lshew.

Aytayiq,  $A$  ha'm  $B$  noqatlari' ko'ldin' shetki noqatlari' bolsi'n (1-su'wret). Bul jag'dayda,  $AB$  kesindisin tikkeley wo'lshep bolmaytug'i'nli'g'i' belgili. Qurg'aqli'qta qanday jasaw islerin wri'nlap, bul arali'qti' wo'lshew mu'mkin?

**Sheshiliwi:**  $CA$  ha'm  $CB$  kesindileri arqali'  $A$  ha'm  $B$  noqatlari'na bari'wg'a bolatug'i'n  $C$  noqati'n tan'laymi'z ha'm qa'legen  $ABC$  u'shmu'yeshligin jasaymi'z.  $AC$  ha'm  $BC$  ta'replerin dawam yettirip,  $A_1C = AC$  ha'm  $B_1C = BC$  kesindilerin qoyami'z.  $A_1$  ha'm  $B_1$  noqatlari'n tutasti'rami'z. Na'tiyjede u'shmu'yeshliklerdin' ten'ligin TMT belgisi boyi'nsha  $\triangle ABC = \triangle A_1B_1C$  boladi'. Tiykari'nan,  $AB = A_1B_1$  yekenligi kelip shi'g'adi'.

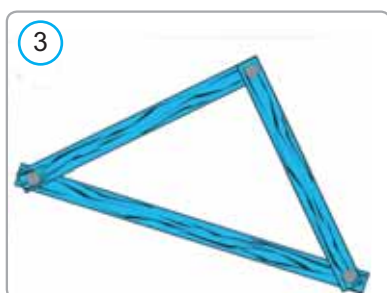
Demek, jasalg'an  $A_1B_1$  kesindinin' uzi'nli'g'i'n wo'lshep,  $AB$  kesindinin' de uzi'nli'g'i'n tapqan bolami'z.





**U'shmu'yeshliklerdin' ten'liginin' TTT – belgisine tiykarlani'p u'shmu'yeshliktin' "qatti' (bekkem)" figura yekenligin tiykarlaw.**

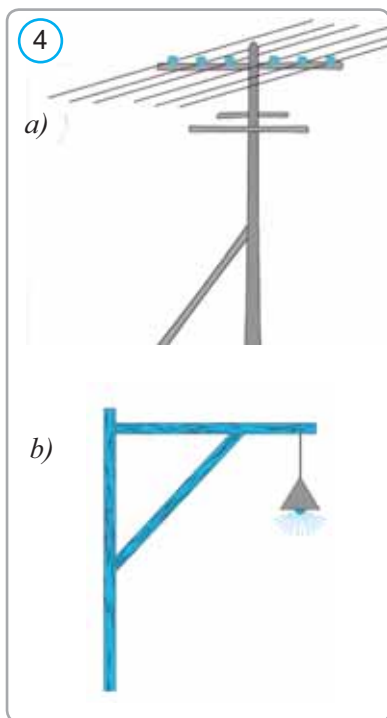
Yeki ag'ash taxta (reyka)lardi'n' ushlari'n bir-birine 2-su'wrette ko'rsetilgenindey yetip shege menen birlestiremiz. Payda bolg'an figura bekkem bolmaydi', sebebi woni'n' yerkin ushlari' tu'rli ta'replerge buri'li'p, ta'repleri arasi'ndag'i' mu'yeshsti qa'legenshe wo'zgertiwi mu'mkin.



Yendi bul reykalardi'n' yerkin ushlari'na u'shinshi reykani' 5-su'wrette ko'rsetilgende yetip shege menen qag'i'p, birlestiremiz. Payda bolg'an u'shmu'yeshlik bekkem figura boladi'. Sebebi, qanshelli uri'nban' woni'n' ta'replerin buri'p, mu'yeshlerin wo'zgerte almay-si'z.

1. Bul tasti'yi'qlawdi'n' duri'sli'g'i' qaysi' teoremadan kelip shi'g'adi'.

2. U'shmu'yeshliktin' bekkem figura yekenliginen turmi'sta qay jerlerde paydalani'latug'i'ni'n 4-su'wret arqali' tu'sindirin'.



### **Soraw, ma'sele ha'm tapsi'rmalar**

1. U'shmu'yeshlik – "bekkem figura" degende neni tu'sinesiz?
2. U'shmu'yeshliktin' bekkemligi qaysi' teorema ja'r-deminde tu'sindirildi?
3. U'shmu'yeshliktin' bekkemligi qay jerde qollani'ladi'? (4-su'wret)
4.  $AB = A_1B_1$ ,  $BC = B_1C_1$ ,  $CA = C_1A_1$  yekenligi belgili.  $ABC$  ha'm  $A_1C_1B_1$  u'shmu'yeshliklerinde  $\angle A = 30^\circ$ ,  $\angle B = 60^\circ$  ha'm  $\angle C_1 = 90^\circ$ .  $ABC$  ha'm  $A_1B_1C_1$  u'shmu'yeshliklerinin' qalg'an mu'yeshlerin tabi'n'.
5.  $ABC$  ha'm  $DEF$  ten' qaptalli' u'shmu'yeshlikleri ten'.  $ABC$  u'shmu'yeshliginde  $AC=BC$  ha'm  $AB = 2\text{ sm}$ . Yeger  $DE = 4\text{ sm}$  bolsa, ha'r bir u'shmu'yeshliktin' perimetrin tabi'n'.

### 1. Bos qaldi'ri'lg'an wori'nlardi' logikali'q jaqtan duri's bolg'an so'zler menen toli'qti'ri'n'.

1. Yeger u'shmu'yeshliktin' yeki ta'repi de ten' bolsa, wol ..... boladi'.
2. Ten' qaptalli' u'shmu'yeshlikti'n' ..... woni'n' medianasi' da, biyikligi de boladi'.
3. Wo'zin-wo'zi kesip wo'tpeytug'i'n tuyi'q si'ni'q si'zi'qtan ibarat figura ..... delinedi.
4. Barli'q ta'replari wo'z-ara ten' bolg'an u'shmu'yeshliktin' ..... ten' boladi'.
5. .... u'shmu'yeshliktin' medianalari', bissektrisalari' ha'm biyikliklari wo'z-ara ten'.
6. .... ultani'na irgeles jatqan mu'yeshleri ten'.
7. Ten' ta'repli u'shmu'yeshlik ..... u'shmu'yeshlik te boladi'.

### 2. To'mende keltirilgen ga'plerdegil qa'teni tabi'n' ha'm du'zetin'.

1. Ten' qaptalli' u'shmu'yeshliklardin' mu'yeshleri ten'.
2. Yeger yeki u'shmu'yeshliktin' mu'yeshleri sa'ykes tu'rde ten' bolsa, bul u'shmu'yeshlikler ten' boladi'.
3. Ten' qaptalli' u'shmu'yeshliktin' medianasi', woni'n' bissektrisasi' da, biyikligi de boladi'.
4. U'shmu'yeshliktin' mu'yeshinen shi'g'i'p, usi' mu'yeshi ten' yekige bo'liwshi nurg'a u'shmu'yeshliktin' bissektrisasi' delinedi.
5. Mediana – u'shmu'yeshliktin' ta'repin ten' yekige bo'liwshi si'zi'q.
- 6.\* Yeger yeki u'shmu'yeshliktin' bir ta'repi ha'm yeki mu'yeshi sa'ykes tu'rde ten' bolsa, bul u'shmu'yeshlikler ten' boladi'.
7. Bir u'shmu'yeshliktin' yeki ta'repi ha'm bir mu'yeshi, yekinshi mu'yeshin' yeki ta'repi ha'm bir mu'yeshine sa'ykes tu'rde ten' bolsa, bul u'shmu'yeshlikler ten' boladi'.

### 3. Kestede keltirilgen qa'siyetler, talqi'lawlarga sa'ykes keliwshi geometriyalig' tu'siniklerdi tabi'n'.

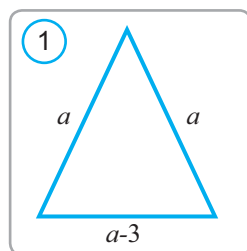
|    |                                                                                                                         |  |
|----|-------------------------------------------------------------------------------------------------------------------------|--|
| 1. | Barli'q medianalari' ten'.                                                                                              |  |
| 2. | U'shmu'yeshliktin' bir to'besi ha'm usi' to'besinin' qarama-qarsi'si'ndag'i' ta'rep wortasi'n tutasti'ri'wshi' kesindi. |  |
| 3. | U'shmu'yeshliktin' bir to'besi usi' to'besinin' qarama-qarsi'si'ndag'i' ta'repke tu'sirilgen perpendikulyar.            |  |
| 4. | U'shmu'yeshliktin' ta'replerinin' qosi'ndi'si'.                                                                         |  |
| 5. | Wo'zin-wo'zi kesip wo'tpeytug'i'n tuyi'q si'ni'q si'zi'q.                                                               |  |



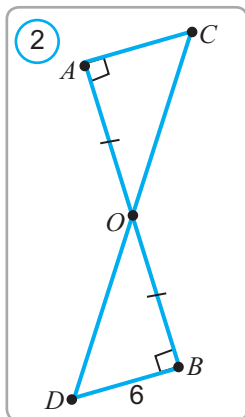
**4. Birinshi bag'anada berilgen geometriyalıq tu'sinikke yekinshi bag'anadan tiyisli qa'siyet yamasa talqilawdi' tawoi'p sa'ykes rawishte qoyi'n'**

|     | Geometriyalı'q tu'sinik            | Talqilaw yaku qa'siyeti                                                                                                  |
|-----|------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| 1.  | Siniq siziq                        | A. Bir mu'yeshi tuwri' mu'yesh                                                                                           |
| 2.  | Ko'pmu'yeshlik                     | B. U'shmu'yeshliktin' ushi'n usi' u'sh qarama-qarsi' ta'repi wortasi' menen tutasti'radi'                                |
| 3.  | U'shmu'yeshlik perimetri           | C. Yeki ta'repi ten'                                                                                                     |
| 4.  | Sa'yir mu'yeshli u'shmu'yeshlik    | D. Wo'zin-wozi kespeytug'i'n jabi'q si'ni'q si'zi'q                                                                      |
| 5.  | Ten' ta'repli u'shmu'yeshlik       | E. Izbe-iz bolg'an yekewi bir tuwri'da jaylasqan $A_1A_2, A_2A_3, \dots, A_{n-1}A_n$ kesispelerinen quralg'an            |
| 6.  | Tuwri' mu'yeshli u'shu'yeshlik     | F. U'sh ta'repi qosi'ndi'si'                                                                                             |
| 7.  | U'shmu'yeshliktin' medianasi       | G. Barli'q mu'yeshleri su'yir                                                                                            |
| 8.  | U'shmu'yeshliktin' bissektisasi    | H. U'shmu'yeshlik mu'yeshi bissektisasi'nin' u'shmu'yeshliktin' ishki ta'repinde jaylasqan bo'legi                       |
| 9.  | U'shmu'yeshliktin' biyioligi       | I. U'shmu'yeshlik ushi'nan usi' ushti'n' qarama-qarsi' ta'repinde jati'rg'an tuwri' si'zi'qqa tu'sirilgen perpendikulyar |
| 10. | Kesindinin' worta perpendikulyari' | J. Kesispenin' wortasi'na tu'sirilgen perpendikulyar.                                                                    |

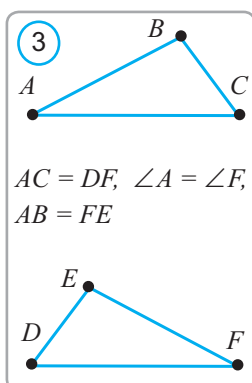
**4. Testler.**



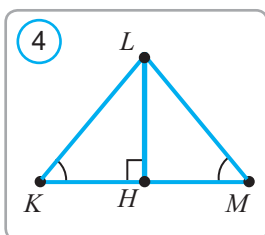
- Ten' qaptalli' u'shmu'yeshliktin' yeki ta'repi 8 ha'm 3 ke ten'. Woni'n' u'shinshi ta'repin tabi'n'.  
A) 5; B) 8; D) 11; E) 9.
- $P = 36, a = ?$  (1-su'wret)  
A) 11; B) 12; D) 13; E) 18.
- Ten' qaptalli' u'shmu'yeshliktin' perimetri 48, qaptal ta'repi 18 ge ten'. Woni'n' ultani'n tabi'n'.  
A) 18; B) 12; D) 16; E) 18.



4. Ten' qaptalli' u'shmu'yeshliktin' perimetri 48 ge ten'. Woni'n' ta'replerinen biri 12 ge ten' bolsa, qalg'an ta'replerin tabi'n'.  
A) 12; 12    B) 16; 16    D) 18; 24    E) 18; 18.
5. Ten' qaptalli' u'shmu'yeshliktin' perimetri 36 g'a, ta'replerinin' biri bolsa 16 g'a ten'. U'shmu'yeshliktin' qalg'an yeki ta'repinin' uzi'nli'g'i'n tabi'n'.  
A) 16 ha'm 4;                      B) 10 ha'm 10;  
D) 10 ha'm 10 yamasa 16 ha'm 4;  
E) Bunday u'shmu'yeshlik joq.
6.  $AC=?$  (2-su'wret)  
A) 6;                      B) 8;                      D) 12;                      E) 10,5.



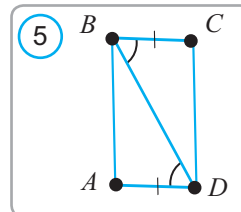
7. U'shmu'yeshliktin' neshe medianasi' bor?  
A) Bir;                      B) Eki;    D) U'sh; E) Altı'.
8. U'shmu'yeshliktin' bissektrisasi' qanday ko'rinish?  
A) Kesindi;    B) Nur;    D) Tuvri' si'zi'q;    E) Noqta.
9. U'shmu'yeshliktin' qaysi' elementi woni'n' si'rtqi' ta'repinde jati'wi' mu'mkin?  
A) Medianasi';                      B) Biyioligi';  
D) Bissektrisasi';                      E) Diagonali'.
10. "Eger u'shmu'yeshliktin' yeki muyeshi ten' bolsa, bul u'shmu'yeshlik ten' qaptalli' u'shmu'yeshliktin' boladi", degen tasti'yqlawdi' qanday ataw mu'mkin?  
A) Ta'riyp;                      B) Qa'siyet;  
D) Belgi;                      E) Aksioma.



11. 3-su'wrette keltirilgen  $ABC$  ha'm  $DEF$  u'shmu'yeshliktin' ten' bo'lama?  
A) Awa;                      B) Yaq.
12. 4-su'wrette qaysi' u'shmu'yeshlikler wo'z-aro ten'?  
A)  $\triangle KLM = \triangle LMH$ ;                      B)  $\triangle K LH = \triangle MLH$ ;  
D)  $\triangle KLM = \triangle KLH$ ;                      E) Hesh qaysi'.

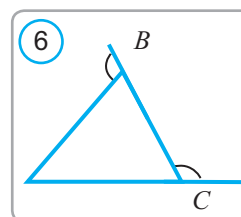
13. 5-su'wrette  $ABD$  ha'  $CDB$  u'shmu'yeshlikler qaysi belgige ten' boladi'?

- A) U'shmu'yeshlikler ten'liginin TBT belgisine ko're;  
 B) U'shmu'yeshlikler ten'liginin BTB belgisine ko're;  
 D) U'shmu'yeshlikler ten'liginin TTT belgisine ko're;  
 E) Bul u'shmu'yeshlikler ten' yemas.



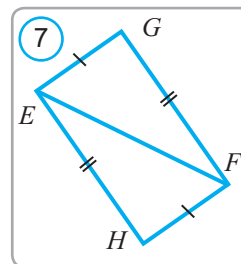
14. 6-su'wrette qarab u'shmu'yeshlik tu'rin aniqlan'.

- A) Ten' ta'repli; B) Ten' qaptalli;  
 D) Dod'al mu'eshli; E) Hech na'rse aytip bolmaydi'.



15. 7-su'wrette mag'li'matlarg'a qarap to'mendegi ten'liklerden naduri'si'n tabi'n.

- A)  $\angle GEF = \angle HFE$ ; B)  $\angle EGF = \angle FHE$ ;  
 D)  $\angle EHF = \angle FEG$ ; E)  $\angle EFH = \angle GEF$ .

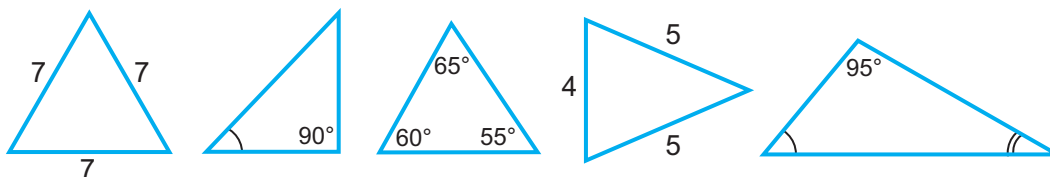


16. Perimetri 12 sm bolg'an u'shmu'yeshliktin' biyioligi wuni' perimetrleri 7 sm ha'm 9 sm bolg'an u'shmu'yeshliklarga ajratadi. Biyikliginin' uzi'nlig'i'n tobi'n'.

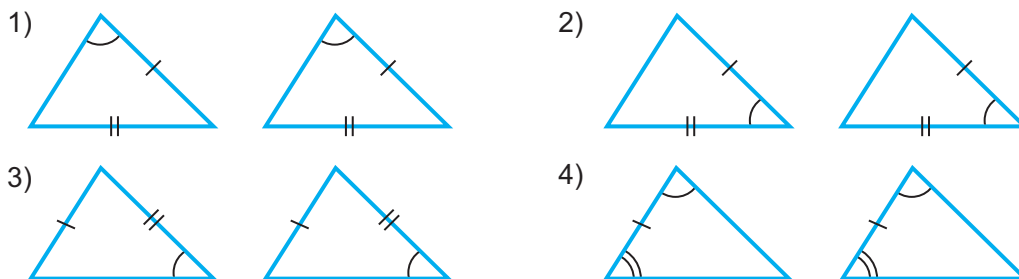
- A) 2 sm; B) 3 sm; D) 1 sm; E) 4 sm.

## 6. Ma'seleler.

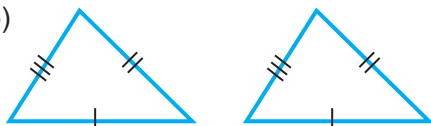
1. Su'wrette berilgen mag'li'wmatlar tiykari'nda u'shmu'yeshliklerdi'n' tu'rlerin aniqlan'.



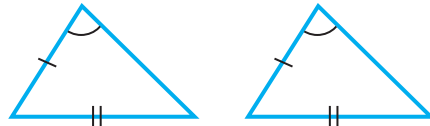
2. To'mende keltirilgen u'shmu'yeshlikler jupli'qlari'nan qaysi'lari' wo'z-ara ten' boladi'? Qaysi' belgisi boyi'nsha?



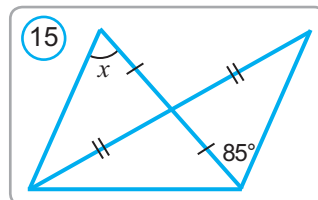
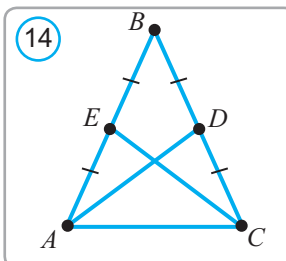
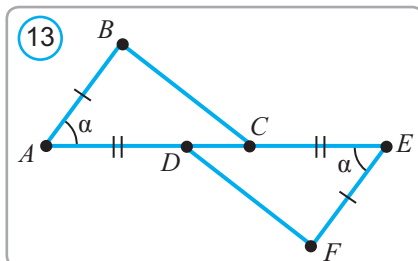
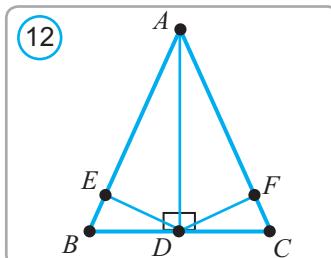
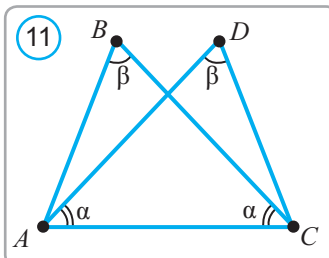
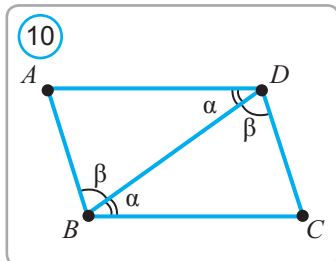
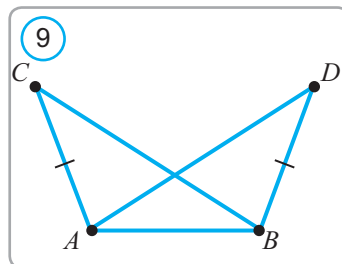
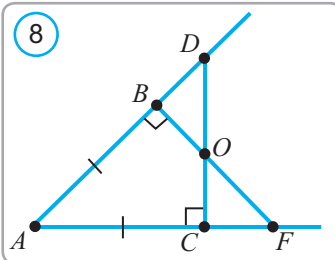
5)

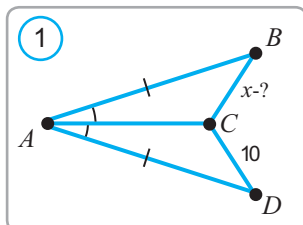


6)



3. 8-su'wrette  $\triangle ACD = \triangle ABF$  yekenligin da'lillen'.
4. Yeger 9-su'wrette  $\angle CAB = \angle ABD$  bolsa,  $AD = BC$  yekenligin ko'rsetin'.
5. 10-su'wrette  $\triangle ABD = \triangle BCD$  bolatug'i'ni'n da'lillen'.
6. 11-su'wrette  $\triangle ABC = \triangle ADC$  bolatug'i'ni'n da'lillen'.
7. Yeger  $\triangle ABC$  ha'm  $\triangle PQR$  da  $AB = PQ$ ,  $AC = PR$  ha'm  $BC = QR$  bolsa,  $\triangle ABC$  ha'm  $\triangle PQR$  ten' bola ma?
8. Yeger 12-su'wrette  $AB = AC$ ,  $BE = CF$  bolsa, a)  $\triangle AED = \triangle AFD$ ; b)  $\triangle BED = \triangle CFD$  yekenligin da'lillen'.
9. 13-su'wrette  $\triangle ABC = \triangle EFD$  bolatug'i'ni'n da'lillen'.
10. 14-su'wrette  $AD = CE$  yekenligin da'lillen'.
11. 15-su'wrettegi mag'li'wmatlar boyi'nsha  $x$  ti' tabi'n'.
12.  $AE$  ha'm  $BD$  kesindileri  $C$  noqatta kesilisedi. Yeger  $DC = DE$ ,  $AB = BC$  ha'm  $\angle BAC = 48^\circ$  bolsa,  $\angle CED$  i'n tabi'n'.
13.  $ABC$  u'shmu'yeshliginin' ishinde  $D$  noqati' ali'ng'an. Yeger  $AC = AB$ ,  $CD = BD$  ha'm  $\angle BDA = 120^\circ$  bolsa,  $\angle ADC$  ni' tabi'n'.





Baqlaw jumi'si' yeki bo'limnen ibarat boladi':

I. 81-83-bettegi test sorawleri'na uqsas 5 test;

II. To'mendegi ma'selelerge uqsas 3 ma'sele (4-ma'sele "ayri'qsha" baha almaqshi' bolg'an woqi'wshi'lar ushi'n qosi'msha).

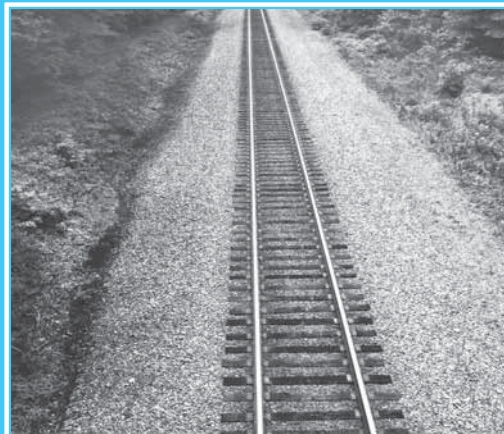
1. 1-su'wrette berilgen mag'li'wmatlar boyi'nsha belgisiz kesindini tabi'n'.
2.  $AB$  ha'm  $CD$  kesindileri  $O$  noqati'nda kesilisedi. Yeger  $\angle CAB = \angle ABD$  ha'm  $AO = BO$  bolsa,  $\angle ACO = \angle BDO$  yekenligin da'llillen'.
3. Ten' qaptalli' u'shmu'yeshliktin' perimetri  $18,4 m$  ge ten', ultani' bolsa qaptal ta'repinen  $3,6 m$  ge qi'sqa. Bul u'shmu'yeshliktin' ta'replerin tabi'n'.
- 4\*. U'shmu'yeshliklerdin' ten'ligin yeki ta'repi ha'm usi' ta'replerdin' birine tu'sirilgen medianasi' boyi'nsha da'llillen'.



#### Qa'biliyetli woqi'wshi'lar ushi'n qosi'msha tapsi'rma.

1. «Geometriya–7» yelektron sabaqli'g'i'ni'n' tiyisli babi' betleri menen tani'si'p shi'g'i'n'. Usi' bapqa kiritilgen temalarg'a tiyisli interaktiv animatsiya qosi'mshalari'nda berilgen tapsi'rmalardi' wori'nlap ha'm test tapsi'rmalari'n sheship wo'z bilimin'izdi si'nap ko'rin'.
2. Sonday-aq, 10-bette keltirilgen internet resurslari'nan usi' bapqa tiyisli materiallardi' tabi'n' ha'm u'yrenip shi'g'i'n'.

### III BAP



## PARALLEL TUWRILAR

**Bul bapti' u'yrenip shi'qqannan keyin to'mendegi bilim ha'm ko'nlikpelerga iye bolasi'z:**

**Bilimler:**

- Parallel tuwri'lardi'n' ani'qlamasi' ha'm qa'siyetlerin biliw;
- yeki tuwri'ni' kesiwshi menen keskende payda bolatug'i'n mu'yeshlerdin' tu'rlerin biliw ha'm wolardi' si'zi'lmada pari'qlay ali'w;
- yeki tuwri'ni'n' paralellik belgilerin biliw;
- berilgen teoremag'a kerri bolg'an teoremani' an'lata ali'w.

**Ko'nlikpeler:**

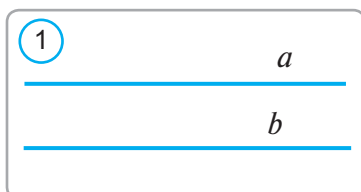
- U'shmu'yeshli ha'm a'piwayi' si'zg'i'sh ja'rdeminde parallel tuwri'lardi' jasay ali'w;
- yeki tuwri'ni' kesiwshi menen keskende payda bolatug'i'n mu'yeshlerdi si'zi'lmada ko'rsetip bile ali'w.

**Aktivlestirish shi'ni'g'i'w.**

Yeger yeki tuwri' bir tuwri'g'a perpendikulyar bolsa, wonda wolar wo'z-ara kesilisiwi mu'mkin be? Juwabi'n'i'zdi' tiykarlan'.



Bir tegislikte jatqan, wo'z-ara kesilispeytug'i'n tuwri'lar **parallel tuwri'lar** dep ataladi'.



1-su'wrette parallel tuwri'lar su'wretlengen.  $a$  ha'm  $b$  tuwri'lari'ni'n' parallelligi  $a \parallel b$  tu'rinde jazi'ladi' yamasa qi'sqasha " $a$  tuwri'si'  $b$  tuwri'si'na parallel" dep ataladi'.

Parallel tuwri'larda jatqan kesindiler (nurlar) parallel kesindiler (nurlar) dep ju'ritiledi. Parallel kesindilerdi turmi'sta ko'p ushi'ratqansi'z. Mi'sal ushi'n, temir jol

relsleri, tuwri'mu'yeshlik formasi'ndag'i' stoldi'n' qarama-qarsi' qi'rlari', shaqmaq da'pter betindegi gorizontalar yamasa vertikal si'zi'qlar ha'm tag'i'i' basqa.

Solay yetip, ani'qlama boyi'nsha tuwri'lar parallel boli'wi' ushi'n

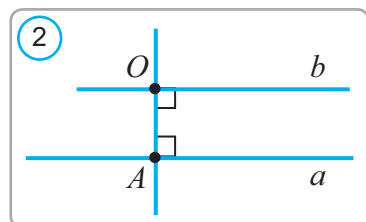
— wolar bir tegislikte jati'wi';

— uli'wmali'q noqatqa iye bolmawi', yag'ni'y kesilispewi kerek.

15-temada da'lillengen teoremani' yendi to'mendegishe an'lati'w mu'mkin:



**Teorema.** Bir tuwri'g'a perpendikulyar bolg'an yeki tuwri' wo'z-ara parallel boladi'.



**Shi'ni'g'i'w.**  $a$  tuwri'si'na tiyisli bolmag'an  $O$  noqati'nan wog'an parallel tuwri' ju'rgiziwi mu'mkin yekenligin ko'rsetin'.

**Sheshiliwi:**  $O$  noqattan  $a$  tuwri'g'a perpendikulyar yetip  $OA$  tuwri'si'n ju'rgizemiz (2-su'wret). Son'  $O$  noqati'nan  $OA$  tuwri'g'a perpendikulyar yetip  $b$  tuwri'ni'

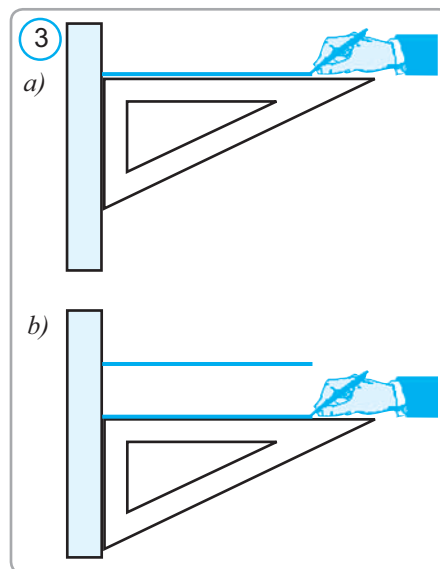
ju'rgizemiz. Na'tiyjede  $a \perp OA$  ha'm  $OA \perp b$ , yag'ni'y  $OA$  tuwri'si'na perpendikulyar bolg'an yeki  $a$  ha'm  $b$  ha'm  $b$  tuwri'lari'na iye bolami'z. Wonda joqari'dag'i' teorema boyi'nsha,  $a$  ha'm  $b$  tuwri'lari' wo'z-ara parallel boladi', yag'ni'y,  $b$  izlengen tuwri' boladi'.

Parallel tuwri'lardi' a'meliyatta a'piwayi' ha'm u'shmu'yeshli si'zg'i'shlar ja'rdeminde 3-su'wrette su'wretlengen ta'rtipte si'zi'w mu'mkin. Bul usi'ldi'n' duri'sli'g'i'n da'lillen'.

Tuwri'g'a wonda jatpaytug'i'n noqattan neshe parallel tuwri' ju'rgizi'w mu'mkin? *Parallellik aksiomasi'* dep atalg'an to'mendegi tasti'yi'qlaw bul sorawg'a juwap beredi.

**A** Tegisliktegi tuwri'g'a, wonda jatpaytug'i'n noqattan tek g'ana bir parallel tuwri' ju'rgizi'w mu'mkin.

Bul tasti'yi'qlaw aksioma si'pati'nda da'lillewsiz qabi'l etiledi.



**Teorema.** Bir tuwri'g'a parallel bolg'an yeki tuwri' wo'z-ara parallel boladi'.

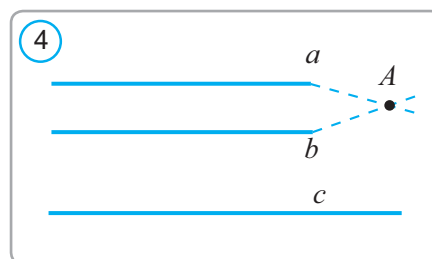


$a, b$  ha'm  $c$  tuwri'lari,  $a \parallel c, b \parallel c$ .



$a \parallel b$

**Da'lillew.**  $a \parallel c$  ha'm  $b \parallel c$  bolsa-da,  $a$  ha'm  $b$  tuwri'lari' parallel bolmaydi' dep woylayi'q. Wonda, wolar qaysi' bir  $A$  noqati'nda kesiledi (4-su'wret) ha'm  $A$  noqati'nan  $c$  tuwri'si'na yeki  $a$  ha'm  $b$  parallel tuwri' ju'rgizilgen boli'p qaladi'. Bul bolsa parallellik aksiomasi'na qarsi' keledi. Demek, woylang'ani'n'iz naduri's —  $a$  ha'm  $b$  tuwri'lari' wo'z-ara parallel yeken. **Teorema da'lillendi.**



**Geometriyali'q izertlew**

45° qa ten' bolg'an  $ABC$  mu'yeshin si'zi'n'. Mu'yeshtin' to'besinen baslap woni'n'  $BA$  tuwri'si'nda to'rt bir-birine ten' kesindilerdi izbe-iz qoyi'n' ha'm bul kesindilerdin' ushlari' arqali' mu'yeshtin'  $BC$  ta'repinen kesip wo'tiwshi parallel tuwri'lar ju'rgizin'. Keyin  $BC$  ta'repide payda bolg'an kesindilerdin' uzi'nli'qlari'n wo'z-ara sali'sti'ri'n'. Bul kesindiler haqqi'nda qanday juwmaqqa keldin'iz? Na'tiyjeni basqa shamadag'i' mu'yeshler ushi'n tekserip ko'rin'.



## Soraw, ma'sele ha'm tapsi'rmalar

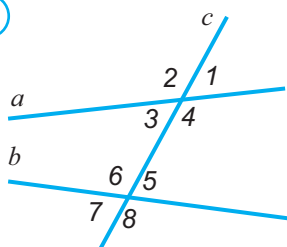
1. Qanday jag'dayda tuwri'lar parallel dep ataladi'?
2. Berilgen tuwri'da jatpaytug'i'n noqat arqali' usi' tuwri'g'a parallel bolg'an neshe tuwri' ju'rgiziw mu'mkin?
3. Yeki kesindi qashan parallel boladi'?
4. Klass bo'lmesine na'zer taslan' ha'm parallel kesindilerdi ani'qlan'.
5. U'shinshi tuwri'g'a parallel bolg'an yeki tuwri'ni'n' wo'z-ara parallel bolatug'i'ni'n ko'rsetin'.
6. Tuwri'ni' si'zi'p wonda  $A, B$  ha'm  $C$  noqatlari'n belgilen'. Si'zg'i'sh ha'm u'shmu'yeshli si'zg'i'sh ja'rdeminde  $A$  noqati'nan,  $B$  noqati'nan ha'm  $C$  noqati'nan wo'tiwshi ha'm bir-birine parallel bolg'an tuwri'lardi' ju'rgizin'.
7. Wo'z-ara kesilispeytug'i'n yeki tuwri'ni' parallel kesindiler dese bola ma? Kesilispeytug'i'n yeki nurdi'-she?
8. Qashan kesindi menen nur parallel boladi'?
9. Tuwri'mu'yeshliktin' qarama-qarsi' ta'repleri wo'z-ara parallel yekenligin ko'rsetin'.
10. Yeger tuwri' parallel tuwri'lardi'n' birewin kesip wo'tse, yekinshisin de kesip wo'te-me? Juwabi'n'i'zdi' da'lillen'.
11. Qag'az betine yeki tuwri' si'zi'ldi'. Yeger qag'az beti usi' si'zi'qlar boylap qi'rqi'lsa, neshe bo'lek payda boladi'.

38

## Yeki tuwri' ha'm kesiwshi payda yetken mu'yeshler

Tegislikte berilgen yeki  $a$  ha'm  $b$  tuwri'si' u'shinshi  $c$  tuwri'si' menen kesilgende, 8 mu'yesh payda boladi'. Wolardi' 1-su'wrette ko'rsetilgende cifrlar menen belgileyik. Bul mu'yeshllerdin' to'mendegi jupli'qlari'n wo'z aldi'na atamalar menen ataymi'z:

1



|                            |                               |
|----------------------------|-------------------------------|
| $\angle 3$ ha'm $\angle 5$ | ] ayqi'sh mu'yeshler          |
| $\angle 4$ ha'm $\angle 6$ |                               |
| $\angle 4$ ha'm $\angle 5$ | ] bir ta'replemeli mu'yeshler |
| $\angle 3$ ha'm $\angle 6$ |                               |
| $\angle 1$ ha'm $\angle 5$ | ] sa'ykes mu'yeshler          |
| $\angle 2$ ha'm $\angle 6$ |                               |
| $\angle 3$ ha'm $\angle 7$ |                               |
| $\angle 4$ ha'm $\angle 8$ |                               |

Bul mu'yeshlardin' to'mendegi qa'siyetlerin atap wo'temiz:



**1-qa'siyet.** Yeger yeki tuwri' ha'm kesiwshi payda yetken bir jup ayqi'sh mu'yeshler wo'z-ara ten' bolsa, yekinshi jup ayqi'sh mu'yeshler de wo'z-ara ten' boladi'.



$a, b$  tuwri'lari' ha'm  $c$  kesiwshi:  $\angle 1 = \angle 2$  (2-su'wret)



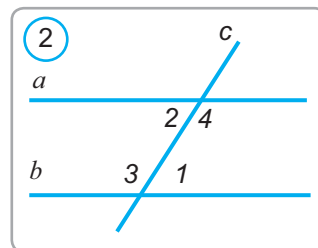
$\angle 3 = \angle 4$

**Da'lillew.**  $\angle 2$  ha'm  $\angle 4$  qon'si'las mu'yesh bolg'ani' ushi'n:  $\angle 2 + \angle 4 = 180$ . Bunnan  $\angle 4 = 180 - \angle 2$ .

$\angle 1$  ha'm  $\angle 3$  te qon'si'las mu'yesh bolg'ani' ushi'n:  $\angle 1 + \angle 3 = 180$ . Bunnan  $\angle 3 = 180 - \angle 1$ .

Sha'rt boyi'nsha  $\angle 1 = \angle 2$  yekenligin yesapqa alsaq:  $\angle 3 = 180 - \angle 1 = 180 - \angle 2 = \angle 4$ .

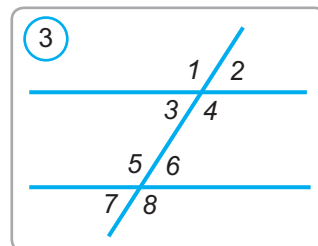
Demek,  $\angle 3 = \angle 4$ . **Qa'siyet da'lillendi.**



**2-qa'siyet.** Yeger sa'ykes mu'yeshleri ten' bolsa, bir ta'replemeli mu'yeshlardin' qosi'ndi'si'  $180^\circ$  qa ten' boladi'.

**Da'lillew.** Sa'ykes mu'yeshlardin' qaysi' bir jubi'n, ma'selen  $\angle 2 = \angle 6$  bolsi'n (3-su'wret).  $\angle 6 + \angle 4 = 180^\circ$  yekenligin da'lilleymiz.  $\angle 2$  ha'm  $\angle 4$  qon'si'las mu'yeshler bolg'ani' ushi'n  $\angle 2 + \angle 4 = 180^\circ$  boladi'. Wonda,  $\angle 2 = \angle 6$  bolg'ani' ushi'n  $\angle 6 + \angle 4 = 180^\circ$  yekenligi kelip shi'g'adi'.

Basqa bir ta'replemeli mu'yeshlardin' qosi'ndi'si'  $180^\circ$  qa ten'ligi usi' si'yaqli' da'lillenedi. **Qa'siyet da'lillendi.**



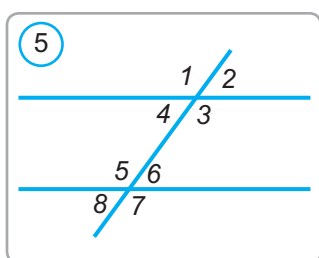
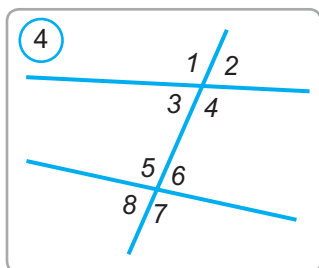
**3-qa'siyet.** Yeger ayqi'sh mu'yeshler wo'z-ara ten' bolsa, wonda sa'ykes mu'yeshlerde wo'z-ara ten' boladi'.

**Da'lillew.** Ten' ayqi'sh mu'yeshler  $\angle 3$  ha'm  $\angle 6$  bolsi'n (3-su'wret). Wonda,  $\angle 3$  ha'm  $\angle 2$  vertikal mu'yesh bolg'ani' ushi'n  $\angle 3 = \angle 2$  boladi'. Demek, sa'ykes mu'yeshleri  $\angle 6$  ha'm  $\angle 2$  ten' yeken. Basqa sa'ykes mu'yeshlardin' jupli'g'i' da usi'g'an uqsas da'lillenedi.



**Soraw, ma'sele ha'm tapsi'rmalar**

1. Qa'legen yeki tuwri' si'zi'n'. Wolardi' u'shinshi tuwri' – kesiwshi menen kesin'. Bir ta'replemeli, ayqi'sh ha'm sa'ykes mu'yeshlerdi si'zi'lmadan ko'rsetin'.
2. 4-su'wrettegi mu'yeshlardin' qaysi'lari' vertikal ha'm qaysi'lari' qon'si'las mu'yeshler boladi'?
3. Yeger 5-su'wrette  $\angle 2 = \angle 6 = 63^\circ$  bolsa, qalg'an mu'yeshlerdi tabi'n'.



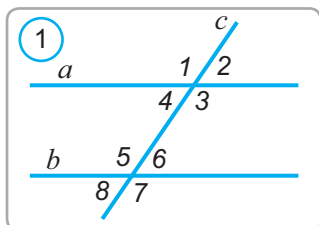
4. Yeger yeki tuwri'ni' u'shinshi tuwri' menen kesip wo'tkende payda bolg'an mu'yeshlerdin' biri  $82^\circ$  ha'm ja'ne birewi  $110^\circ$  bolsa qalg'an mu'yeshlerdi tabi'n'.
5. 5-su'wrette  $\angle 3 = \angle 5$  bolsa,  $\angle 4 = \angle 6$  bola ma? Yeger  $\angle 1 = \angle 7$  bolsa,  $\angle 2 = \angle 8$ ,  $\angle 3 = \angle 5$ ,  $\angle 4 = \angle 6$  ten'ligi wori'nana ma? Juwabi'n'i'zdi' tiykarlan'.
6. Bir ta'replemeli mu'yeshler wo'z-ara ten' boli'wi' mu'mkin be?
- 7.\* Ayqi'sh mu'yeshler ten' bolsa, bir ta'replemeli mu'yeshlerdin' qosi'ndi'si'  $180^\circ$  qa ten' yekenligin ko'rsetin'. Keri tasti'yi'qlaw da duri's pa?
- 8.\* Yeger yeki tuwri' ha'm kesiwshi payda yetken bir jup sa'ykes mu'yeshler wo'z-ara ten' bolsa, yekinshi jup sa'ykes mu'yeshler de ten' bolatug'i'ni'n da'lillen'.

32

## Yeki tuwri'ni'n' parallellik belgileri



### Aktivlestiriwshi shi'ni'g'i'w.



1-su'wrette  $a$  ha'm  $b$  parallel tuwri'lari' ha'm  $c$  kesiwshi ko'rsetilgen. To'mendegi tapsi'rmalardi' wori'nlan' ha'm sorawlarg'a juwap berin'.

1. Barli'q ayqi'sh mu'yeshler jupli'g'i'n jasan' ha'm wolardi' transportir menen wo'lshen'. Ha'r bir jup ayqi'sh mu'yeshlerdin' gradus wo'lshemleri haqqi'nda ne ayta alasi'z?
2. Barli'q bir ta'replemeli mu'yeshlerdin' jupli'qlari'n jasan' ha'm wolardi' transportir menen wo'lshen'. Ha'r bir jup bir ta'replemeli mu'yeshlerdin' gradus wo'lshemlerinin' qosi'ndi'si' haqqi'nda ne ayta alasi'z?
3. Barli'q sa'ykes mu'yeshlerdin' jupli'qlari'n jazi'n' ha'm wolardi' transportir menen wo'lshen'. Ha'r bir jup sa'ykes mu'yeshlerinin' gradus wo'lshemleri haqqi'nda ne ayta alasi'z?
4. Joqari'da ani'qlang'an qa'siyetler barli'q waqi'tta da wori'nli' bola bere me?

Yeki tuwri'ni'n' parallelligin qanday usi'llar menen ani'qlawg'a boladi'? To'mendegi yeki tuwri'ni'n' parallellik belgileri dep atalg'an teoremlar usi' sorawg'a juwap beredi.



**Teorema.** Yeger yeki tuwri' ha'm kesiwshi payda yetken ayqi'sh mu'yeshler ten' bolsa, wonda bul yeki tuwri' parallel boladi'

• **Da'lillew.** 1) Da'slep  $\angle 1$  ha'm  $\angle 2$  tuwri' mu'yesh bolg'an jag'daydi' qaraymi'z (2-su'wret): Bul jag'dayda  $AB$  tuwri'si'  $a$  ha'm  $b$  tuwri'lari'na perpendikulyar boladi'. Wonda  $a$  ha'm  $b$  tuwri'lari' bir tuwri'g'a perpendikulyar bolg'an yeki tuwri' haqqi'ndag'i' teoremag'a tiykarlani'p wo'z-ara parallel boladi' (87-betke qaran').

2) Yendi  $\angle 1$  ha'm  $\angle 2$  tuwri' mu'yesh bolmag'an jag'daydi' qaraymi'z:  $AB$  kesindisinin' wortasi' ( $AO=BO$ )  $O$  noqati'nan  $a$  tuwri'si'na  $OC$  perpendikulyar ju'rgizemiz (3-su'wret).  $b$  tuwri'si'na  $B$  noqati'nan uzi'nli'g'i'  $AC$  g'a ten' bolg'an  $BD$  kesindisin qoyami'z.  $AOC$  ha'm  $BOD$  u'shmu'yeshliklerin qaraymi'z:

Olarda

1. figuralardi' jasaw boyi'nsha:  $AC=BD$ ;
2. figuralardi' jasaw boyi'nsha:  $AO=BO$ ;
3. sha'rt boyi'nsha:  $\angle 1 = \angle 2$ .

Wonda u'shmu'yeshliklerdin' ten'liginin' TMT belgisi boyi'nsha  $\triangle AOC = \triangle BOD$  boladi'. Sonli'qtan,  $\angle 3 = \angle 4$  ha'm  $\angle 5 = \angle 6$  boladi'.

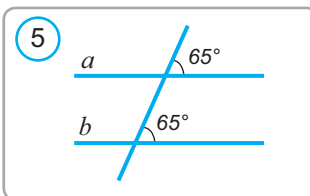
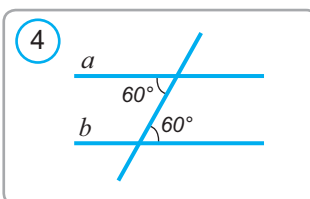
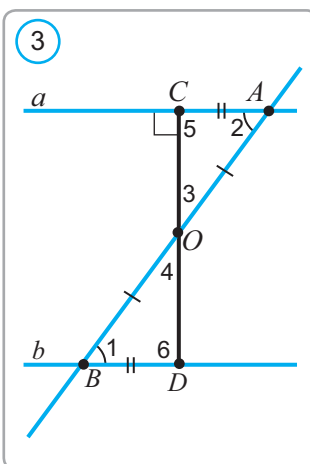
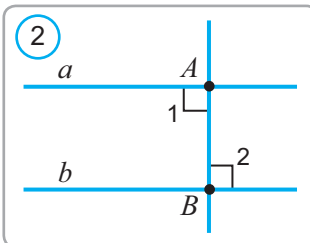
$\angle 3 = \angle 4$  bolg'anli'qtan  $D$  noqati'  $CO$  nuri'ni'n dawami'nda jati'wi', yag'ni'y  $C$ ,  $O$  ha'm  $D$  noqatlari' bir tuwri'da jatatug'i'nli'g'i' kelip shi'g'adi'.

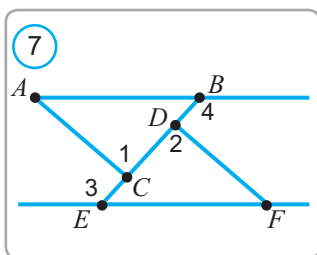
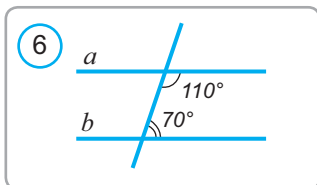
$\angle 5 = \angle 6$  bolg'anli'qtan,  $\angle 6$  ha'm  $\angle 5$  si'yaqli' tuwri' mu'yesh yekenligi kelip shi'g'adi'. Solay yetip,  $a$  ha'm  $b$  tuwri'lari' bir  $CD$  tuwri'si'na perpendikulyar yeken. Demek, wolar wo'z-ara parallel boladi'. **Teorema da'lillendi.**



**Ma'sele.** Yeger 1-su'wrette  $\angle 2 = 55^\circ$  ha'm  $\angle 5 = 125^\circ$  bolsa,  $a$  ha'm  $b$  tuwri'lari' wo'z-ara parallel bola ma?

**Sheshiliwi:**  $\angle 2$  ha'm  $\angle 4$  vertikal mu'yeshler bolg'ani ushi'n  $\angle 4 = \angle 2 = 55^\circ$ .  $\angle 5$  ha'm  $\angle 6$  qon'si'las bolg'ani ushi'n  $\angle 6 = 180^\circ - \angle 5 = 180^\circ - 125^\circ = 55^\circ$ . Na'tiyjede, ayqi'sh mu'yeshlerdin' wo'z-ara ten' yekenligin ani'qlaymi'z:  $\angle 4 = \angle 6$ . Demek, joqari'da da'lillengen yeki tuwri'ni'n' parallellik belgisi boyi'nsha  $a$  ha'm  $b$  tuwri'lari' parallel boladi'. **Juwabi':** Awa.



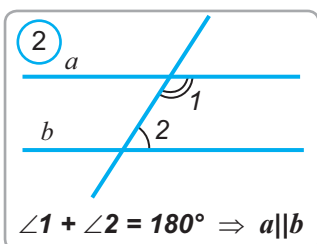
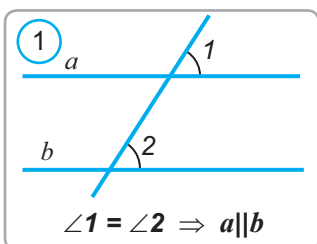


### Soraw, ma'sele ha'm tapsi'rmalar

1. Yeki tuwri'ni'n' parallellik belgisin tu'sindirin'.
2. 4-su'wrette  $a \parallel b$  bolatug'i'ni'n ko'rsetin'.
3. 5-su'wrette  $a \parallel b$  bolatug'i'ni'n ko'setin'.
4. 6-su'wrette  $a \parallel b$  bolatug'i'ni'n ko'setin'.
5. Yeger 1-su'wrette: a)  $\angle 1 = 132^\circ$ ,  $\angle 8 = 48^\circ$  b)  $\angle 2 = 36^\circ$ ,  $\angle 5 = 144^\circ$  c)  $\angle 3 = 113^\circ$ ,  $\angle 6 = 77^\circ$  d)  $\angle 1 + \angle 7 = 180^\circ$  bolsa,  $a \parallel b$  bola ma?
6. Yeger: 7-su'wrette: a)  $\angle 3 = \angle 4$ ,  $BD = CE$ ,  $AB = EF$ ; b)  $\angle 1 = \angle 2$ ,  $\angle 3 = \angle 4$ ,  $BD = CE$ ; c)  $AB = EF$ ,  $BD = EC$ ,  $AC = FD$  bolsa,  $\triangle ABC = \triangle EFD$  yekenligin ko'rsetin'.
7.  $a$  tuwri'si' ha'm wonda jatpaytug'i'n  $K$  noqati' berilgen. Bul tuwri'lardan neshewi  $a$  tuwri'si' menen kesiledi.

33

### Yeki tuwri'ni'n' parallellik belgileri (dawami')



Teoremadan tuwri'dan-tuwri' kelip shi'g'atug'i'n qa'siyet-ke **na'tiyje** deb ayti'ladi'. Aldi'n'g'i' temada da'lillengen teoremlardan ha'm 38- temada da'lillengen 2-3- qa'siyetlerden to'mendegi na'tiyjeler kelip shi'g'adi'.

**1-na'tiyje.** Yeger yeki tuwri' ha'm kesiwshi payda yetken sa'ykes mu'yeshler ten' bolsa, wonda bul yeki tuwri' parallel boladi' (1-su'wret).

**2-na'tiyje.** Yeger yeki tuwri' ha'm kesiwshi payda yetken bir ta'replemeli mu'yeshlerdin' qosi'ndi'si'  $180^\circ$  qa ten' bolsa, wonda bul yeki tuwri' parallel boladi' (2-su'wret).



**Ma'sele.** 3-su'wrettegi tuwri'lardi'n' qaysi'lari' parallel?

**Sheshiliwi:** Vertikal mu'yeshlerdin' ten'liginen,  $\angle 1 = 105^\circ$ ,  $\angle 2 = 125^\circ$ ,  $\angle 3 = 115^\circ$ .  $a$  ha'm  $b$  tuwri'lari' parallel yemes, sebebi  $\angle 1 + 65^\circ = 105^\circ + 65^\circ \neq 180^\circ$ .  $a \parallel b$  boladi', sebebi,  $\angle 1 + 75^\circ = 105^\circ + 75^\circ = 180^\circ$  (2-na'tiyjege qaran').

Tap usi'nday  $b \parallel e$  boladi', sebebi  $65^\circ + \angle 3 = 65^\circ + 105^\circ = 180^\circ$ .

$a, c$  ha'm  $e$  tuwri'lari' wo'z-ara parallel yemes, sebebi wolardi'n' sa'ykes mu'yeshleri ten' yemes (1-na'tiyjege qaran').

Tap usi'nday  $b$  ha'm  $d$  tuwri'lari' da parallel yemes, sebebi sa'ykes mu'yeshleri ten' yemes:  $65^\circ \neq 75^\circ$ .

**Juwabi':**  $a \parallel d, b \parallel e$ .



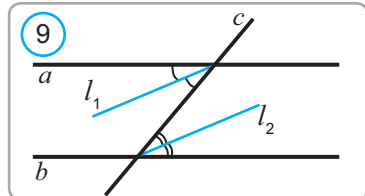
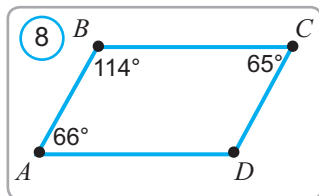
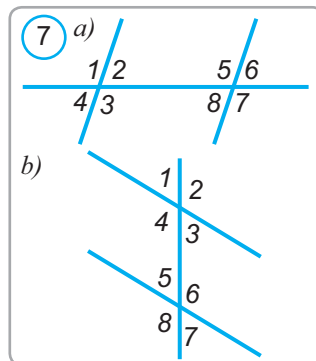
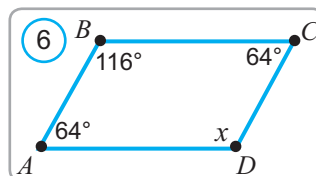
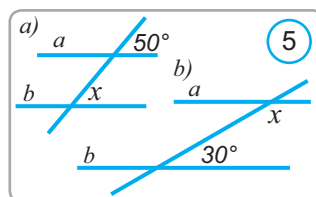
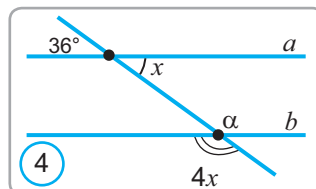
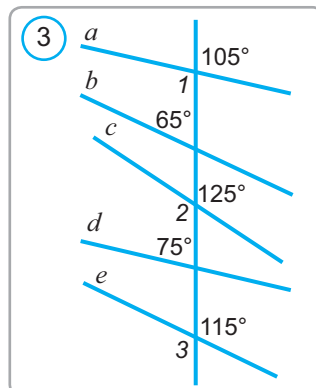
**Ma'sele.** 4-su'wrette  $a \parallel b$  bola ma?

**Sheshiliwi:** Vertikal mu'yeshlerdin' qa'siyeti boyi'nsha  $x = 36^\circ$ . Wonda  $\alpha = 4x = 4 \cdot 36^\circ = 144^\circ$  boladi'. Bir ta'replemeli mu'yeshlerdin' qosi'ndi'si'  $x + \alpha = 36^\circ + 144^\circ = 180^\circ$ . Demek, 2-na'tiyje boyi'nsha  $a \parallel b$  boladi'.



**Soraw, ma'sele ha'm tapsi'rmalar**

1. Yeki tuwri'ni'n' parallellik belgilerin ayti'p berin'.
2. 5-su'wrette  $a$  ha'm  $b$  tuwri'lari' parallel boli'wi' ushi'n belgisiz mu'yesh neshe gradus boli'wi' kerek?
3. 6-su'wrettegi belgisiz mu'yeshlerdi tabi'n'.
4. Yeger 7-su'wrette a)  $\angle 1 = \angle 5 = 105^\circ$ ; b)  $\angle 3 = 60^\circ$ ,  $\angle 8 = 120^\circ$  bolsa, qalg'an mu'yeshlerdi tabi'n'.
5. 8-su'wrettegi to'rtmu'yeshliktin' qaysi' ta'replari parallel boladi'?
6. Yeki tuwri'ni'n' kesiwshi menen kesilisiwinen payda bolg'an mu'yeshlerdin' birewi  $32^\circ$ , wog'an sa'ykes bolg'an mu'yesh bolsa  $33^\circ$  qa ten' bolsa, bul tuwri'lar parallel bola ma?
7.  $a$  ha'm  $b$  parallel tuwri'lari'n'  $c$  tuwri'si' menen kesiwden payda bolg'an ayqi'sh mu'yeshlerdin' bissektisalari parallel yekenligin ko'rsetin' (9-su'wret).



Yeger teoremani'n' sha'rti ha'm juwmaqlari'ni'n' worni' almasti'ri'lsa, jan'a ayti'm (yag'ni'y tasti'yi'qlaw) payda boladi'. Yeger bul ayti'm da duri's bolsa (yag'ni'y da'lillense), wol berilgen teoremag'a **keri teorema** dep ataladi'.

**Duri's teorema:** Yeger

**A**  
tasti'yi'qlawi'  
wori'nli'

bolsa,

**B**  
tasti'yi'qlawi'  
wori'nli'

boladi.

Qi'sqasha:  $A \Rightarrow B$

**Keri teorema:** Yeger

**B**  
tasti'yi'qlawi'  
wori'nli'

bolsa,

**A**  
tasti'yi'qlawi'  
wori'nli'

boladi.

Qi'sqasha:  $B \Rightarrow A$

Mi'sal. "Yeger u'shmu'yeshlik ten' qaptalli' bolsa, wonda woni'n' ultani'ndag'i' mu'yeshleri ten' boladi'" — degen teoremag'a keri teorema to'mendegiden ibarat "**Yeger u'shmu'yeshliktin' yeki mu'yeshi ten' bolsa, wonda wol ten' qaptalli' u'shmu'yeshlik dep ataladi'**".

**1-shi'ni'g'i'w.** Joqari'da atap o'tilgen keri teorema "U'shmu'yeshliktin' ten' qaptalli' boli'w belgisi", dep ayti'ladi'. Woni'n' duri'sli'g'i'n' wo'z betinshe da'lillen'.

Soni' ayti'p wo'tiw kerek, ha'r qashanda berilgen duri's teoremag'a keri bolg'an tasi'yi'qlaw wori'nli' bola bermeydi.

Ma'selen, "Yeger mu'yeshler vertikal bolsa, wonda wolar ten' boladi'", degen teoremag'a keri "Yeger mu'yeshler ten' bolsa, wonda wolar vertikal boladi'" degen tasi'yi'qlaw duri's yemes.

**2-shi'ni'g'i'w.**

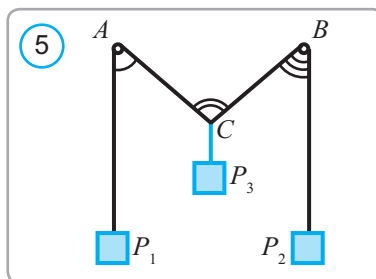
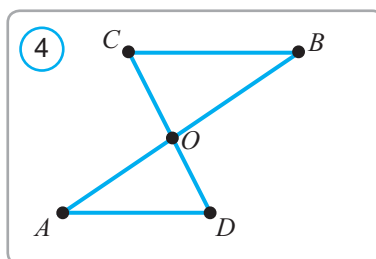
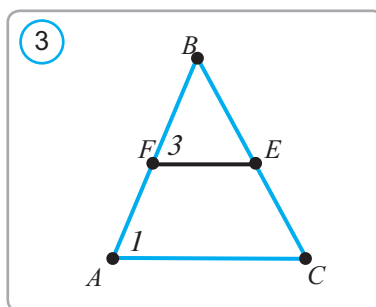
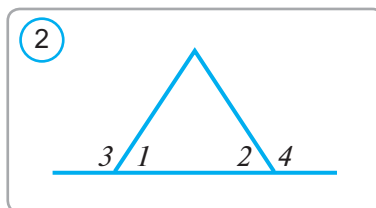
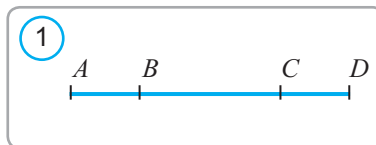
1. "Yeger jawi'n jawsa, aspanda bult boladi'", degen tasi'yi'qlawg'a keri bolg'an tasi'yi'qlawdi' du'zin'. Payda bolg'an keri tasi'yi'qlawdi'n' ha'r qashan da duri's boli'w-bolmasli'g'i'n' tu'sindirir'.
2. To'mendegi duri's teoremalarg'a keri teoremalardi' jazi'p shi'g'i'n'. Ha'r bir keri teoremada an'latil'g'an tasi'yi'qlawdi'n' duri's yamasa naduri's yekenligin tu'sindirir'.
  - 1) Bir tuwri'g'a perpendikulyar bolg'an yeki tuwri' wo'z-ara kesilispeydi.
  - 2) Yeger yeki u'shmu'yeshlik ten' bolsa, woldi'n' sa'ykes ta'repleri ten' boladi'.
  - 3) Yeger qon'si'las mu'yeshler wo'z-ara ten' bolsa, wonda wolar tuwri' mu'yesh boladi'.
  - 4) Bir tuwri'g'a parallel bolg'an yeki tuwri' parallel boladi'.



**Soraw, ma'sele ha'm tapsi'rmalar**

1. Keri teorema menen duri's teoremani'n' qanday parqi' bar?

2. Duri's teoremag'a keri bolg'an teorema barqulla da wori'nli' bola ma?
3. Duri's teoremani' da'lillep, wog'an keri teoremani' da'lilsiz qabi'l etse bola ma?
4. Keri teoremag'a keri bolg'an teorema qanday ataladi'.
5. To'mendegi temalardi'n' sha'rti ha'm juwmag'i'n' jazi'n'. Bul teoremalarg'a keri teoremalardi' an'lati'n' ha'm wolardi'n' duri'sli'g'i'n' tekserin':
  - 1) Yeger 1-su'wrette  $AC = BD$  bolsa,  $AB = CD$  boladi'.
  - 2) Yeger 2-su'wrette  $\angle 1 = \angle 2$  bolsa,  $\angle 3 = \angle 4$  boladi'.
  - 3) Yeger 3-su'wrette  $EF \parallel AC$  bolsa,  $\angle 1 = \angle 3$ .
  - 4) Yeger 4-su'wrette  $AO = OB$  ha'm  $CO = OD$  bolsa,  $\triangle AOD = \triangle BOC$  boladi'.
6.  $A$  ha'm  $B$  noqatlarda bekkemlengen bloklar arqali' wo'tken jipke  $P_1$  ha'm  $P_2$  denelerdi ildirip qoyilg'an (5-su'wret).  $P_3$  dene bolsa usi' jiptin'  $C$  noqati'nda ildirilgen boli'p,  $P_1$  ha'm  $P_2$  denelerdi ten' salmaqli'qta saqlap turi'pti'.  $AP_1 \parallel BP_2 \parallel CP_3$  yekenligi belgili bolsa, wonda,  $\angle ACB = \angle A + \angle B$  bolatug'i'ni'n da'lillen'.
7. To'mendegi temalarg'a keri temalardi' an'lati'n' ha'm wolardi'n' duri'sli'g'i'n' tekserin':
  - 1) Yeki tuwri'ni' kesiwshi menen kesilisiwinen payda bolg'an sa'ykes mu'yeshleri ten' bolsa, bul jag'dayda bul tuwri'lar parallel boladi'.
  - 2) U'shinshi tuwri'g'a parallel bolg'an yeki tuwri' parallel boladi'.
  - 3) Ten' ta'repli u'shmu'yeshliktin' barli'q mu'yeshleri wo'z-ara ten' boladi'.
8. U'shmu'yeshliklerdin' ten'lik belgilerine keri teoremalardi' ayti'n'. Bul keri teoremlar duri's pa?

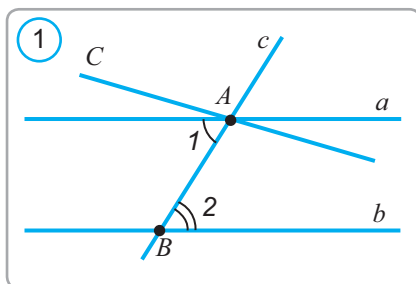




To'mende yeki tuwri'ni'n' parallellik belgilerine keri bolg'an teoremlar u'stinde toqtalami'z.



**1-teorema.** Yeki parallel tuwri' ha'm kesiwshi payda yetken ayqi'sh mu'yeshler wo'z-ara ten' boladi'.



$a \parallel b, c$  – kesiwshi (1su'wret)



$\angle 1 = \angle 2$

**Da'lillew.** Kerisin woyleymi'z:  $\angle 1 \neq \angle 2$  bolsi'n.  $AB$  nuri'na  $\angle 2$  ge ten' bolg'an  $CAB$  mu'yeshin qoyami'z ( $\angle CAB = \angle 2$ ). Bul jag'dayda,  $CA$  ha'm  $b$  tuwri'lari'n  $AB$  kesiwshi menen keskende, bir-birine ten' (jasawg'a qaray) ayqi'sh  $\angle CAB$  ha'm  $\angle 2$  mu'yeshlerge iye bolami'z.

Demek,  $CA$  ha'm  $b$  tuwri'lari' wo'z-ara ten' boladi'. Solay yetip,  $A$  noqati'nan  $b$  tuwri'g'a parallel bolg'an yeki ( $CA$  ha'm  $a$ ) tuwri'g'a iyemiz.

Bul bolsa parallellik aksiomasi'na qarama-qarsi' boladi'. Demek, woylag'ani'mi'z naduri's,  $\angle 1 = \angle 2$  yeken.

**Teorema da'lillendi.**

**Na'tiyje.** Yeger tuwri' parallel tuwri'lardan birine perpendikulyar bolsa, wonda yekinshisine de perpendikulyar boladi'.

Na'tiyje si'pati'nda keltirilgen tasti'yi'qlawdi'n' duri'sli'g'i'n wo'z betinshe tekserip ko'rin'.



**2-teorema.** Yeki parallel tuwri' ha'm kesiwshi payda yetken sa'ykes mu'yeshler wo'z-ara ten' boladi'.

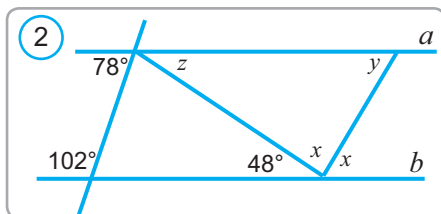


**3-teorema.** Yeki parallel tuwri' ha'm kesiwshi payda yetken bir ta'replemeli mu'yeshlerdin' qosi'ndi'si'  $180^\circ$  qa ten' boladi'.

Teoremlardi' wo'z betinshe da'lillewge uri'ni'p ko'rin'.



**Ma'sele.** 2-su'wrettegi belgisiz mu'yeshlerdi tabi'n'.



**Sheshiliwi:** Bir ta'replemeli mu'yeshlerdin' qosi'ndi'si'  $78^\circ + 102^\circ = 180^\circ$  bolg'ani' ushi'n  $a \parallel b$  boladi'. Demek, 1-teorema boyi'nsha  $z = 48^\circ$  ha'm  $x = y$  boladi'.  $x + x + 48^\circ = 180^\circ$  bolg'ani' ushi'n (jayiq mu'yeshlerdin' shamasii'),  $x = 66^\circ$ . Demek,  $y = 66^\circ$ .

**Juwabi':**  $x = 66^\circ$ ;  $y = 66^\circ$ ;  $z = 48^\circ$ .



**Ma'sele.** 3-su'wrette  $a \parallel b$ ,  $c \parallel d$ . To'mendegi ten'liklerdin' qaysi' biri duri's?

- 1)  $\angle 1 = \angle 15$ ; 2)  $\angle 3 = \angle 13$ ; 3)  $\angle 4 = \angle 16$ ; 4)  $\angle 4 = \angle 8$ ;  
 5)  $\angle 1 = \angle 12$ ; 6)  $\angle 7 = \angle 10$ ; 7)  $\angle 8 = \angle 16$ ; 8)  $\angle 8 = \angle 11$ ;  
 9)  $\angle 4 + \angle 13 = 180^\circ$ ; 10)  $\angle 6 + \angle 14 = 180^\circ$ ; 11)  $\angle 7 + \angle 12 = 180^\circ$ ; 12)  $\angle 8 + \angle 9 = 180^\circ$ .

**Sheshiliwi:** 3)  $\angle 4 = \angle 2$  (vertikal mu'yeshlerdin' qa'siyeti boyi'nsha),  $\angle 2$  va  $\angle 16$  – sa'ykes mu'yeshler bolg'ani' ushi'n  $\angle 2 = \angle 16$ . Demek,  $\angle 4 = \angle 16$  ten'ligi duri's.

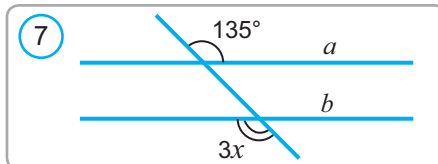
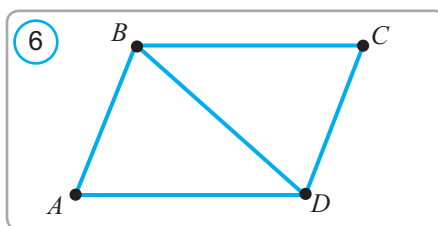
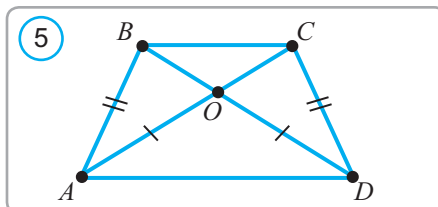
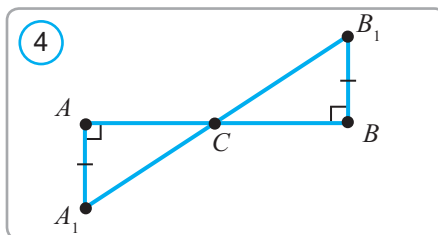
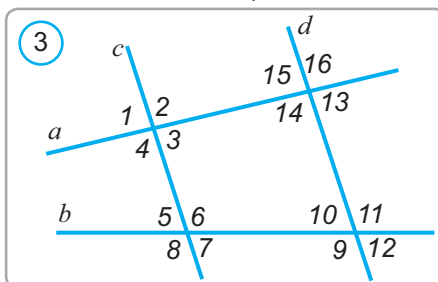
5)  $\angle 12 = \angle 7$  (sa'ykes mu'yeshlerdin' qa'siyeti boyi'nsha) ha'm  $\angle 7 = \angle 5$  (vertikal mu'yeshler).  $\angle 5$  ha'm  $\angle 1$  sa'ykes mu'yeshler.  $a \parallel b$ , soni'n' ushi'n  $\angle 1 = \angle 5 = \angle 7 = \angle 12$ , yag'ni'y  $\angle 1 = \angle 12$  ten'ligi naduri's.

9)  $\angle 4 = \angle 2$ ,  $\angle 13 = \angle 15$  (vertikal mu'yeshler),  $c \parallel d$ ,  $\angle 2$  ha'm  $\angle 15$  – bir ta'replemeli mu'yeshler bolg'ani' ushi'n,  $\angle 2 + \angle 15 = 180^\circ$ . Demek,  $\angle 4 + \angle 13 = 180^\circ$  ten'ligi duri's.

11)  $c \parallel d$  bolg'ani' ushi'n  $\angle 7 = \angle 10$  (ayqi'sh mu'yeshlerdin' qa'siyeti boyi'nsha) ha'm  $\angle 10 = \angle 12$  (vertikal mu'yeshler). Demek,  $\angle 7 = \angle 12$ .

Soni'n' ushi'n  $\angle 7 + \angle 12 = 180^\circ$  ten'ligi tek  $\angle 7 = \angle 12 = 90^\circ$  bolg'anda wori'nli' boladi'.

Qalg'an ten'liklerdin' usi' si'yaqli' wo'zin'iz wo'z betinshe tekserip shi'g'i'n'.



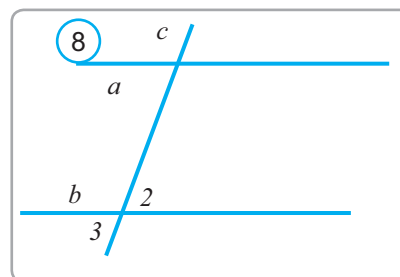
**Soraw, ma'sele ha'm tapsi'rmalar**

- 4-su'wrette  $AC = CB$  yekenligin ko'rsetin'.
- Berilgen kesindinin' wortasi'n tabi'wda 1-ma'seleden qalay paydalani'w mu'mkin?
- 5-su'wrette  $BC \parallel AD$ ,  $AO = OD$  yekenligi belgili.  
 a)  $BO = OC$ ; b)  $AC = BD$ ; c)  $\triangle AOB = \triangle COD$ ;  
 d)  $\triangle ABD = \triangle ACD$  ten'liklerin da'lillen'.
- 6-su'wrette  $BC \parallel AD$  ha'm  $AB \parallel CD$  bolsa,  $\triangle ABD = \triangle CBD$  yekenligin da'lillen'.
- 7-su'wrette  $a \parallel b$  bolsa,  $x = ?$

6.  $ABC$  ha'm  $A_1B_1C_1$  su'yir mu'yeshler berilgen. Yeger  $AB \parallel A_1B_1$  ha'm  $BC \parallel B_1C_1$  bolsa,  $\angle ABC = \angle A_1B_1C_1$  boli'wi'n da'lillen'.
- 7\*. Sa'ykes ta'replari parallel tuwri' si'zi'qlarda jatgan mu'yeshlerdin' qosi'ndisi  $180^\circ$  ga ten' yekenligin esaplan'.

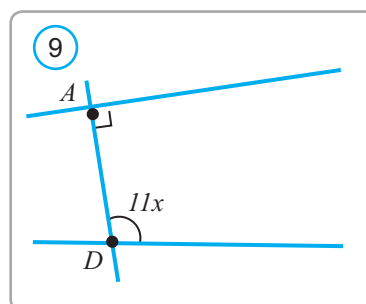
**Yesletpe.** 6-7-ma'selelerde kettirilgen teoremlar – sa'ykes ta'replari parallel bolg'an ko'rinishin' qa'siyetleri dep ju'rgiziledi.

8. Yeger 8-su'wrette  $a \parallel b$ ,  $c \parallel d$  ha'm  $\angle 1 = 55^\circ$  bolsa,  $\angle 2$  ham  $\angle 3$  ti tabin'.
9. Sa'ykes ta'replari parallel tuwri'larda jatqan mu'yeshlerdin'  $40^\circ$  ga ten'. Usi mu'yeshlerdi tabin'.
- 10\*.  $ABC$  ha'm  $A_1B_1C_1$  su'yir mu'yeshler berilgen. Yeger  $AB \perp A_1B_1$  ha'm  $BC \perp B_1C_1$  bolsa,  $ABC = A_1B_1C_1$  boli'wi'n da'lillen'?
- 11\*. Sa'ykes ta'replari perpendikular tuwri'larda jatqan mu'yeshlerdin' birewi su'yir, ekinshisi dog'al. Bul mu'yeshlerdin'  $180^\circ$  ga ten' yekenligin da'lillen'.



**Yesletpe.** 10-11-ma'selelerde keltirilgen teoremlar – sa'ykes ta'replari wo'z-ara perpendikulyar bolg'an mu'yeshlerdin' qa'siyetleri dep jurgiziledi.

12. 9-sizilmada'gi  $ABC$  ha'm  $ADC$  mu'yeshlerdin' sa'ykes ta'replari perpendikulyar. Belgisiz mu'yeshlerdi tabi'n?



**1. Bos qaldi'ri'lg'an wori'nlar di' logikali'q jaqtan duri's so'zler menen toli'qti'ri'n'.**

1. Tuvri'da jati'wshi' noqat arqali' wog'an perpendikulyar bolg'an ..... ju'rgiziw mu'mkin.
2. Yeger yeki tuwri'ni' kesiwshi menen keskende payda bolg'an ..... ten' bolsa, bul tuwri'lar parallel boladi'.
3. Tegisliktegi yeki tuwri' ..... , wolar parallel tuwri'lar delinedi.
4. Yeki parallel tuwri'dan birewin kesip wo'tken tuwri' ..... .
5. Tuvri'da jatpaytug'i'n noqat arqali' wog'an parallel ..... tuwri' wo'tedi.
6. Tuvri'ni'n' qa'legen noqati' arqali' ..... tek bir tuwri' ju'rgiziw mu'mkin.
7. Tuvri' mu'yesh asti'nda kesilisen tuwri'lar ..... dep ataladi'.
8. Bir tuwri'g'a ..... yeki tuwri' wo'z-ara parallel boladi'.
9. Yeger yeki tuwri'ni' kesiwshi menen keskende payda bolg'an bir ta'replemeli mu'yeshler ..... tuwri'lar parallel boladi'.
10. Parallel tuwri'lardi' kesiwshi menen keskende payda bolg'an sa'ykes ..... .

**2. To'mende keltirilgen ga'plerde qa'te bolsa, qa'teni tabi'n' ha'm woni' du'zetin'.**

1. Tuvri'ni'n' tek g'ana bir noqati'nan wog'an perpendikulyar tuwri' ju'rgiziw mu'mkin.
2. Berilgen tuwri'da jatpaytug'i'n tek g'ana bir noqattan usi' tuwri'g'a perpendikulyar tu'siriw mu'mkin.
3.  $AB$  ha'm  $AK$  parallel tuwri'lari'ni'n' birine perpendikulyar bolg'an yekinishisine de perpendikulyar boladi'.
4. Yeki tuwri'ni'n' kesiwshi menen kesilisiwinen payda bolg'an ayqi'sh mu'yeshleri ten' boladi'.
5. Yeger yeki kesindi kesilispese wolar parallel kesindiler dep ataladi'.
6. Sa'ykes ta'repleri parallel bolg'an mu'yeshler ten' boladi'.
7. Yeger  $a \perp b$ ,  $b \perp c$  bolsa,  $a \perp c$  boladi'.
8. Sa'ykes ta'repleri perpendikulyar bolg'an mu'yeshlerdin' qosi'ndi'si'  $180^\circ$  qa ten'.
9. Yeger yeki tuwri'ni' kesiwshi menen kesilisiwinen payda bolg'an bir ta'replemeli mu'yeshler ten' bolsa, tuwri'lar parallel boladi'.
10. Perpendikulyar tuwri'larg'a parallel bolg'an tuwri'lar da wo'z-ara parallel boladi'.
11. Yeger  $a \parallel b$ ,  $b \parallel c$  bolsa,  $a \parallel c$  boladi'.

**3. Kestede keltirilgan qa'siyetlar ha'm talqi'lawlarga sa'ykes keliwshi geometriyalı'q mu'yeshlerdi tabi'n'.**

|    |                                                                     |  |
|----|---------------------------------------------------------------------|--|
| 1. | Uli'wmali'q noqatqa iye bolmag'an tuwri'lar                         |  |
| 2. | Tuwri' mu'yesh asti'nda kesilisedi                                  |  |
| 3. | Noqattan tuwri'g'a tek g'ana birewin tu'siriw mu'mkin               |  |
| 4. | Noqattan tuwri'g'a qa'legenshe tu'siriw mu'mkin                     |  |
| 5. | Sha'rt ha'm juwmaq bo'limi almasqan                                 |  |
| 6. | Yeki tuwri'ni' kesiwshi menen keskende payda bolatug'i'n mu'yeshler |  |

**4. Birinshi bag'anada berilgen geometriyalı'q tu'sinikke yekinshi bag'anadan tiyisli qa'siyet yamasa talqi'lawdi' duri's qoyi'n'.**

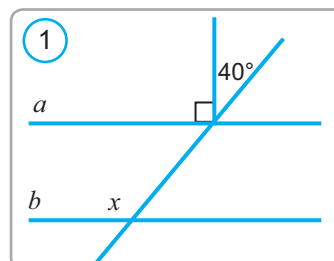
| <i>Geometriyalı'q tu'sinik</i>       | <i>Qa'siyetler, tali'qlawlar</i>                              |
|--------------------------------------|---------------------------------------------------------------|
| 1. Parallel tuwri'lar                | A. Barli'q waqi'tta tuwri' yemes.                             |
| 2. Perpendikulyar tuwri'lar          | B. Kesilispaydi.                                              |
| 3. Kesiwshi yeki tuwri'ni' kes-kende | C. Kesiliskende tuwri' mu'yeshler payda yetedi.               |
| 4. Ayqi'sh mu'yeshler                | D. Ayqi'sh, sa'ykes bir ta'replemeli mu'yeshler payda yetedi. |
| 5. Keri teorma                       | E. Bir yari'mtegislkte jatadi'.                               |
| 6. Bir ta'replemeli mu'yeshler       | F. Ten' bolsa, tuwri'lar parallel boladi'.                    |

**5. Testler.**

- Berilgen tuwri'da jatpaytug'i'n noqat arqali' wog'an parallel bolg'an neshe tuwri' ju'rgiziw mu'mkin?  
A) 1;    B) 2;    D) 4;    E) qa'legenshe.
- Yeger  $a||b$ ,  $b\perp c$ ,  $c\perp d$  bolsa, to'mendegi juwaplardi'n' qaysi'lari' duri's?  
A)  $a\perp d$ ,  $b\perp d$     B)  $a\perp c$ ,  $b||d$   
D)  $a||c$ ,  $a\perp d$     E)  $a\perp c$ ,  $a\perp d$ ,  $b\perp d$ .
- Tegislkte berilgen tuwri'da jatpaytug'i'n noqat arqali' usi' tuwri'g'a neshe perpendikulyar tuwri' ju'rgiziw mu'mkin?  
A) 1;    B) 2;    D) 4;    E) qa'legenshe.

4. Sa'ykes ta'replari perpendikulyar bolg'an mu'yeshlardin' biri yekinishinen  $90^\circ$  qa u'lken. Usi mu'yeshlerdi tabi'n'.

A)  $90^\circ, 90^\circ$ ;                      B)  $60^\circ, 150^\circ$ ;  
D)  $30^\circ, 120^\circ$ ;                      E)  $45^\circ, 135^\circ$ .

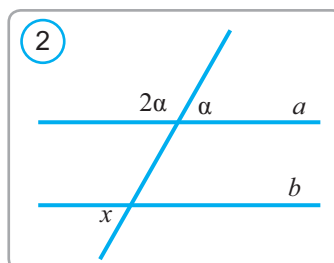


5. 1-su'wrette  $a \parallel b$  bolsa,  $x = ?$

A)  $100^\circ$ ;    B)  $110^\circ$ ;    D)  $130^\circ$ ;    E)  $140^\circ$ .

6. 2-su'wrette  $a \parallel b$  bolsa,  $x = ?$

A)  $30^\circ$ ;    B)  $45^\circ$ ;    D)  $60^\circ$ ;    E)  $36^\circ$ .

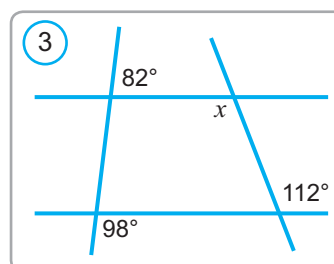


7.  $x = ?$  (3-su'wret)

A)  $96^\circ$ ;    B)  $108^\circ$ ;    D)  $112^\circ$ ;    E)  $78^\circ$ .

8.  $x = ?$  (4-su'wret)

A)  $96^\circ$ ;    B)  $86^\circ$ ;    D)  $94^\circ$ ;    E)  $74^\circ$ .



9. 5-su'wrette  $a \parallel b$  ha'm  $\alpha - \beta = 70^\circ$  bolsa,  $\alpha = ?$

A)  $30^\circ$ ;    B)  $125^\circ$ ;    D)  $75^\circ$ ;    E)  $36^\circ$ .

10. Yeki tuwri' si'zi'q u'shinshi tuwri' siziq penen kesiliskende neshe ten' su'yir mu'yesh payda boladi'?

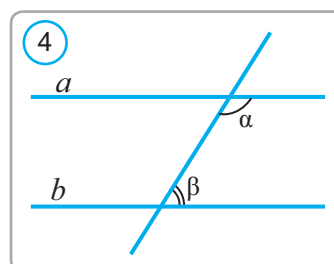
A) 3;                      B) 4;                      D) 6;                      E) 5.

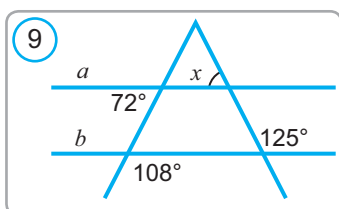
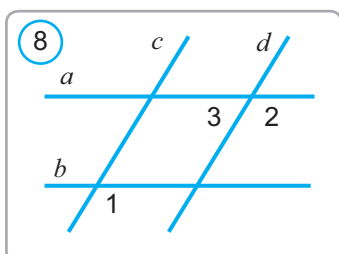
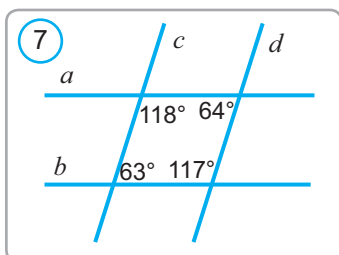
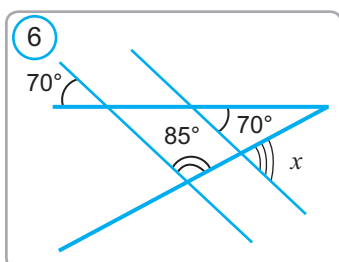
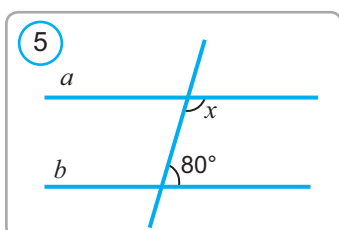
11. Yeki tuwri' si'zi'q u'shinshi tuwri' si'zi'q penen kesiliskende neshe tuwri' mu'yesh payda boladi'?

A) 2;                      B) 6;                      D) 8;                      E) 5.

12. Yeki tuwri' si'zi'q u'shinshi tuwri' si'zi'q penen kesiliskende payda bolg'an u'sh ishki mu'yesh qosindisi  $290^\circ$  qa ten'. To'rtinshi mu'yeshti: tabin'.

A)  $145^\circ$ ;    B)  $110^\circ$ ;    D)  $36^\circ$ ;    E)  $70^\circ$ .





13. 5-su'wrette  $a \parallel b$  bolsa,  $x$  ti tabi'n'.

- A)  $100^\circ$ ; B)  $80^\circ$ ; D)  $110^\circ$ ; E)  $90^\circ$ .

14. 6-su'wrette  $x$  ti mu'yeshti tabi'n'.

- A)  $105^\circ$ ; B)  $95^\circ$ ; D)  $85^\circ$ ; E)  $75^\circ$ .

15. 7-su'wrette qaysi' tuwri' si'zi'qlar wo'z-ara parallel boladi'?

- A)  $a \parallel b$ ; B)  $a \parallel c$ ; D)  $c \parallel b$ ; E)  $c \parallel d$ .

16. 8-su'wrette  $a \parallel b$ ,  $c \parallel d$  ha'm  $\angle 1 = 122^\circ$  bolsa,  $\angle 2$  ha'm  $\angle 3$  ti tabi'n'.

- A)  $\angle 2 = 122^\circ$ ;  $\angle 3 = 58^\circ$

- B)  $\angle 2 = 130^\circ$ ;  $\angle 3 = 58^\circ$

- D)  $\angle 2 = 122^\circ$ ;  $\angle 3 = 68^\circ$

- E)  $\angle 2 = 130^\circ$ ;  $\angle 3 = 50^\circ$

## 6. Ma'seleler.

1. 1-su'wrette sa'ykes ta'repleri perpendikulyar bolg'an mu'yeshlerdi ani'qlan' ha'm wo'z-ara ten' bolg'ani'n ko'rsetin'.

2. Yeger 2-su'wrette  $OA \perp OC$ ,  $OD \perp OB$  bolsa,  $x = ?$ .

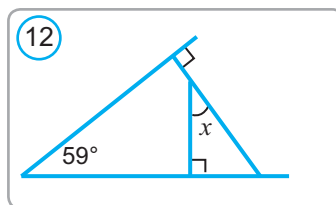
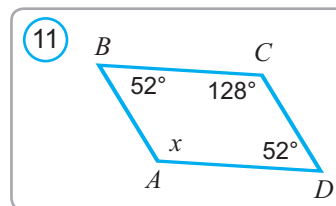
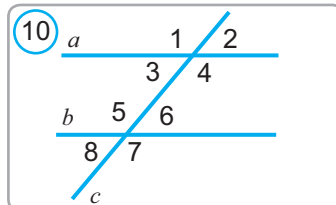
3.\* 3-su'wrette neshe sa'ykes ta'repleri perpendikulyar bolg'an mu'yeshler bar?

4.  $\alpha + \beta = ?$  (4-su'wret)

5.  $x = ?$  (5-su'wret)

6.\*  $ABC$  u'shmu'yeshliktin'  $AD$  bisseiktrisasi' wortasi'nan  $AD$  g'a perpendikulyar yetip ju'rgizilgen tuwri'  $AC$  ta'repti  $M$  noqatta kesedi.  $MD \parallel AD$  yekenligin da'lillen'.

7. Yeki tuwri' si'zi'qti' u'shinshi tuwri' si'zi'q penen keskende payda bolg'an mu'yeshlerdin' birewi  $47^\circ$ ga ten'. Jnde sa'ykes mu'yesh neshe gradus bolg'anda bul yeki tuwri' si'zi'q parallel boladi'?
8. Yeki parallel tuwri' si'zi'qta kesiwshi menen keskende payda bolg'an almasi'ni'wshi' mu'yeshler qosi'ndi'si'  $84^\circ$ . Qalg'an mu'yeshlerdi tabi'n'.
9. Yeki parallel tuwri' si'zi'qti' kesiwshi menen keskende payda bolg'an mu'yeshlerden birewi yekinishinen 8 ma'rte u'iken. Payda bolg'an barliq mu'yeshlerdi tabi'n'.
10. Yeki tuwri' parallel tuwri' si'zi'qti' kesiwshi menen keskende payda bolg'an bir ta'repli mu'yeshler ayirmasi'  $30^\circ$ . Bul mu'yeshlerdi tabi'n'.
11. 12-su'wretegi; belgisiz mu'yesh; tabi'n'.
12. Sa'ykes ta'repleri parallel tuwri' si'zi'qlarda jatgan mu'yeshler ayi'rmasi'  $30^\circ$ ga ten'. Usi' mu'yeshlerdi tabi'n'.



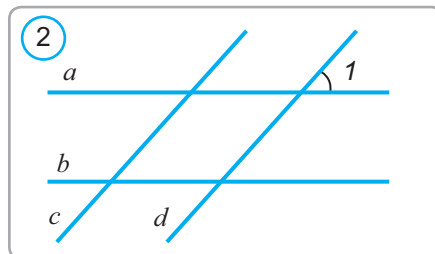
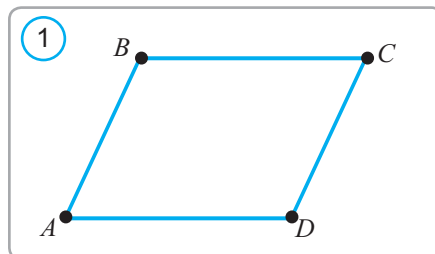
37

#### 4-baqlaw jumi'si'

U'lgili baqlaw jumi'si' yeki bo'limnen ibarat:

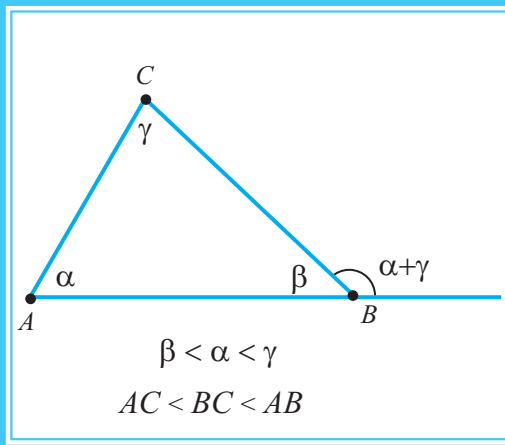
- I. 101–103-bettegi testlerge uqsas 5 test;
- II. To'mendegi ma'selelerge uqsas 3 ma'sele (4-ma'sele jaqsi' wo'zlestirip ati'rg'an woqi'wshi'lar ushi'n).

1. Yeki parallel tuwri'ni'n' kesiwshi menen kesilgende payda bolg'an mu'yeshlerdin' biri  $34^\circ$  ke ten'. Qalg'an mu'yeshlerdi tabi'n'.
2. Yeger 1-su'wrette  $BC \parallel AD$  ha'm  $AB \parallel CD$  bolsa,  $AB = CD$  yekenligin da'lillen'.
3. Yeger 2-su'wrette  $a \parallel b$ ,  $c \parallel d$  ha'm  $\angle 1 = 48^\circ$  bolsa, qalg'an mu'yeshlerdi tabi'n'.
4.  $ABC$  u'shmu'yeshliginin'  $A$  to'besinen ju'rgizilgen bissektisa  $BC$  ta'repin  $D$  noqati'nda kesip wo'tedi.  $D$  noqati'nan ju'rgizilgen tuwri'  $AC$  ta'repin  $E$  noqati'nda kesip wo'tedi.  $AE = DE$  bolsa,  $DE \parallel AB$  yekenligin da'lillen'.





## IV BAP



### U'ShMU'YEShLIKTiN' TA'REPLERI HA'M MU'YEShLERI ARASINDAG'I QATNASLAR

Bul bapti' u'yrenip shi'qqannan keyin to'mendegi bilim ha'm ko'nlikpelerge iye bolasi'z:

#### Bilimler:

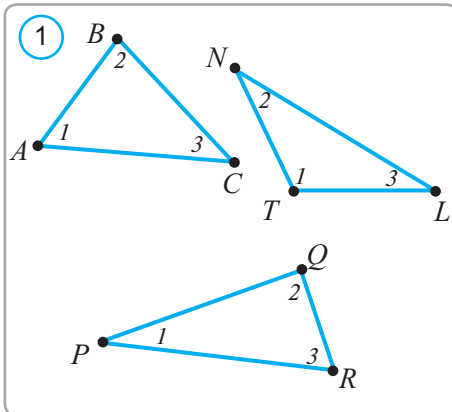
- Sa'ykes ta'replari wo'z-ara parallel bolg'an mu'yeshlerdi ha'm wolardi'n' qa'siyetlerin biliw;
- sa'ykes ta'replari wo'z-ara perpendikulyar bolg'an mu'yeshlerdi ha'm wolardi'n' qa'siyetlerin biliw;
- u'shmu'yeshliktin' ishki mu'yeshlerinin' qosi'ndi'si' haqqi'ndag'i' teoremani' biliw ha'm da'lillewdi biliw;
- u'shmu'yeshliktin' si'rtqi' mu'yeshin ha'm woni'n' qa'siyetin biliw;
- u'shmu'yeshliktin' mu'yeshleri ha'm ta'replari arasi'ndag'i' qatnasti' an'lati'wshi' teoremalardi' biliw.

#### Ko'nlikpeler:

- Sa'ykes ta'replari wo'z-ara parallel yamasa wo'z-ara perpendikulyar bolg'an mu'yesh-lerdi si'zi'lmada ko'rsetip bere ali'w;
- u'shmu'yeshliktin' ishki mu'yeshlerinin' qosi'ndi'si'n a'meliy usi'l menen taba ali'w.
- wo'zlestirilgen teoriyali'q bilimlerde, qa'siyetlerdi ma'seleler sheshiwde ha'm a'meliy islerde wori'nlawda qollana biliw.

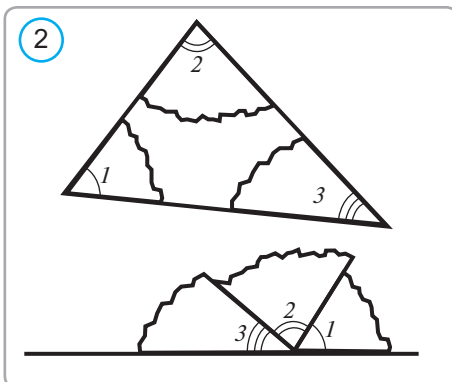


## Aktivlestirivshi shi'ni'g'i'w.



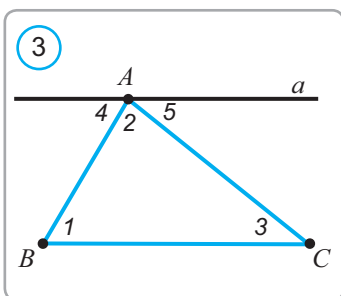
1. To'mendegi su'wrette su'wretlengen  $ABC$  u'shmu'yeshliginin' u'sh mu'yeshlerin transportir ja'rdeminde wo'lshen' ha'm wolardi'n' qosi'ndi'si'n esaplan'. Tap usi' isti  $MNL$  ha'm  $PQR$  u'shmu'yeshlikleri ushi'n da wori'nlan'. Na'tiyjeler tiykari'nda kesteni toltiri'n'. Qanday qa'siyetti ani'qladi'n'i'z? Woni' bir ga'p penen an'lati'n'.

| U'shmu'yeshlikler | $\angle 1$ | $\angle 2$ | $\angle 3$ | $\angle 1 + \angle 2 + \angle 3$ |
|-------------------|------------|------------|------------|----------------------------------|
| $\triangle ABC$   |            |            |            |                                  |
| $\triangle MNK$   |            |            |            |                                  |
| $\triangle PQR$   |            |            |            |                                  |



2. Bir bet qag'azg'a qa'legen  $ABC$  u'shmu'yesh-likti si'zi'n' ha'm mu'yeshlerin 1, 2 ha'm 3 tsifrlari' menen belgilen'. Woni'n' mu'yeshlerin 2-su'wrette ko'rsetilgende yetip ji'rti'p ali'n' ha'm izbe-iz qoyi'n'. Bunnan qanday juwmaq shi'g'ari'w mu'mkin.

Yendi geometriyani'n' yen' a'hmiyetli teoremlari'ni'n' biri – u'shmu'yeshliktin' mu'yeshlerinin' qosi'ndi'si' haqqi'ndag'i' teoremani' da'lilleymiz.



**Teorema.** U'shmu'yeshliktin' mu'yeshlerinin' qosi'ndi'si'  $180^\circ$  qa ten'.



$\triangle ABC$



$$\angle A + \angle B + \angle C = 180^\circ$$

**Da'lillew.**  $A$  to'besinen  $BC$  ta'repine parallel  $a$  tuwri'si'n ju'rgizemiz (3-su'wret).

$\angle 1 = \angle 4$ , sebebi bul mu'yeshler,  $a$  ha'm  $BC$  parallel tuwri'lardi'  $AB$  kesiwshi menen keskende payda bolg'an ayqi'sh mu'yesh boladi'.

$\angle 3 = \angle 5$ , sebebi bul mu'yeshler,  $a$  ha'm  $BC$  parallel tuwri'lardi'  $AC$  kesiwshi menen keskende payda bolg'an ayqi'sh mu'yesh boladi'.

$\angle 4 + \angle 2 + \angle 5 = 180^\circ$ , sebebi bul mu'yeshler uli'wma to'bege iye ha'm jayi'q mu'yeshi payda yetip ati'r. Payda bolg'an bul u'sh ten'likten,

$\angle 1 + \angle 2 + \angle 3 = 180^\circ$ , yag'ni'y  $\angle A + \angle B + \angle C = 180^\circ$  yekenligin payda yetemiz. **Teorema da'lillendi.**

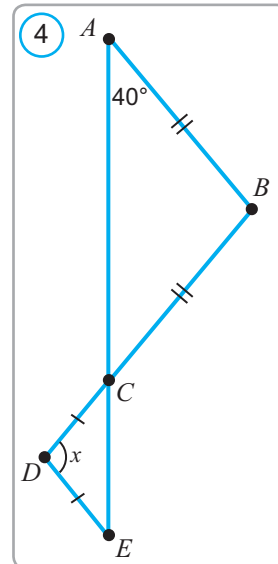


**1-ma'sele.** 4-su'wrette berilgen mag'li'wmatlardan paydalani'p belgisiz mu'yesh  $x$  ti' tabi'n'.

**Sheshiliwi:**  $\triangle ABC$ —ten' qaptalli' u'shmu'yeshlik bolg'ani' ushi'n,  $\angle ACB = \angle A = 40^\circ$ . Vertikal mu'yeshlerdin' qa'siyeti boyi'nsha,  $\angle DCE = \angle ACB = 40^\circ$ . Sha'rt boyi'nsha  $\triangle CED$  de ten' qaptalli'. Sonli'qtan,  $\angle DCE = \angle DEC = 40^\circ$ .

Demek, u'shmu'yeshliktin' mu'yeshlerinin' qosi'ndi'si' haqqi'ndag'i' teoremag'a baylani'sli',  $\triangle CDE$  de:  $40^\circ + 40^\circ + x = 180^\circ$ , yamasa  $x = 100^\circ$ .

**Juwabi':**  $100^\circ$ .



**2-ma'sele.** U'shmu'yeshliktin' mu'yeshleri 2:3:7 qatnasta bolsa, wolardi'n gradus wo'lshevin tabi'n'

**Sheshiliwi:** Sha'rt boyi'nsha u'shmu'yeshliktin' mu'yeshlerin  $2x$ ,  $3x$  ha'm  $7x$  dep belgileymiz. Bul jag'dayda u'shmu'yeshliktin, mu'yeshlerinin' qosi'ndi'si' haqqi'ndag'i' teorema boyi'nsha.  $2x + 3x + 7x = 180^\circ$  ten'likke iyemiz. Wonnan  $x = 15^\circ$  yekenligin tabami'z.

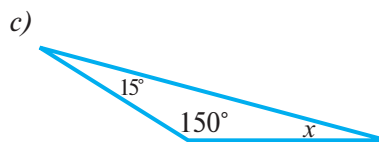
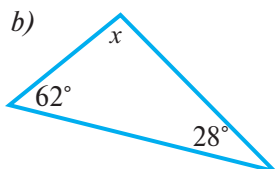
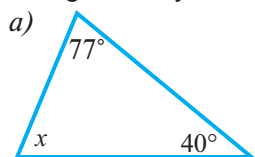
Demek, u'shmu'yeshliktin' mu'yeshlerinin' gradus wo'lshevi  $30^\circ$ ,  $45^\circ$  ha'm  $105^\circ$  qa ten' yeken. **Juwabi':**  $30^\circ$ ,  $45^\circ$ ,  $105^\circ$ .



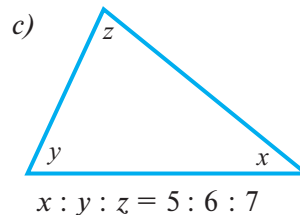
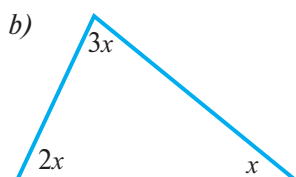
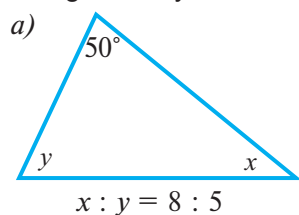
**Soraw, ma'sele ha'm tapsi'rmalar**

1. U'shmu'yeshliktin' mu'yeshleri haqqi'ndag'i' teoremani' keltirin' ha'm su'wrette tu'sindirin'.
2. U'shmu'yeshliktin' neshe mu'yeshi tuwri' boli'wi' mu'mkin?
3. U'shmu'yeshliktin' neshe mu'yeshi dog'al boli'wi' mu'mkin?
4. Mu'yeshleri: a)  $5^\circ$ ,  $55^\circ$ ,  $120^\circ$ ; b)  $46^\circ$ ,  $150^\circ$ ,  $4^\circ$ ; c)  $100^\circ$ ,  $20^\circ$ ,  $50^\circ$  bolg'an u'shmu'yeshlikler bar ma?
5. Yeger u'shmu'yeshliktin' yeki mu'yeshi: a)  $60^\circ$  ha'm  $40^\circ$ ; b)  $70^\circ$  ha'm  $85^\circ$ ; c)  $90^\circ$  ha'm  $45^\circ$ ; d)  $105^\circ$  ha'm  $30^\circ$  bolsa, woni'n' u'shinshi mu'yeshin tabi'n'.

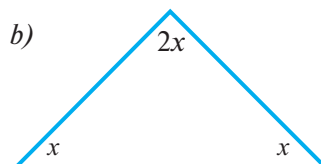
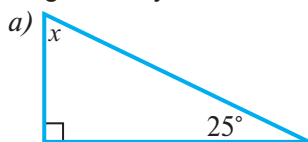
6. Belgisiz mu'yeshli tabi'n'.



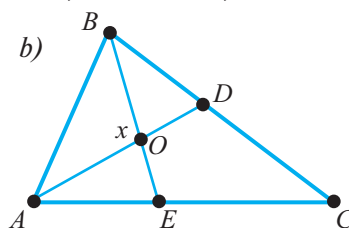
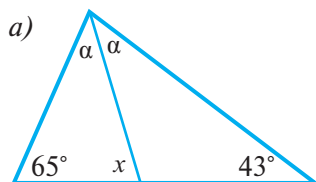
7. Belgisiz mu'yeshlerdi tabi'n'.



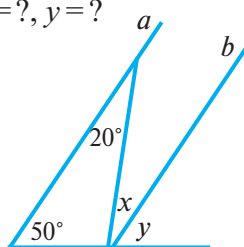
8. Belgisiz mu'yeshlerdi tabi'n'.



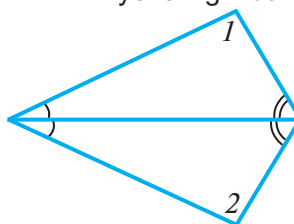
9. a)  $x=?$ ; b)  $AD$  va  $BE$  – bissektisalar,  $\angle BAC=64^\circ$ ,  $\angle ABC=96^\circ$ ,  $x=?$



10.  $a \parallel b$ ,  $x=?$ ,  $y=?$



11.  $\angle 1 = \angle 2$  yekenligin da'lillen'.



12\*. U'shmu'yeshliktin' mu'yeshleri  $\alpha$ ,  $\beta$ ,  $\gamma$  ushi'n  $\alpha = (\beta + \gamma)/2$  bolsa,  $\alpha$  ni' tabi'n'.

13. Ten' ta'repli u'shmu'yeshliktin' mu'yeshlerin tabi'n'.

14. Ten' qaptalli' tuwri' mu'yeshli u'shmu'yeshliktin' mu'yeshlerin tabi'n'.

15. Yeger ten' qaptalli' u'shmu'yeshliklerdin' biri a)  $50^\circ$ ; b)  $60^\circ$ ; c)  $105^\circ$  bolsa, wonda woni'n' mu'yeshlerin tabi'n'.



U'shmu'yeshliktin' ishki mu'yeshine qon'si'las bolg'an mu'yesh u'shmu'yeshliktin' **si'rtqi' mu'yeshi** dep ataladi'.

1-su'wrette  $ABC$  u'shmu'yeshliginin'  $B$  mu'yeshine si'rtlay bolg'an  $CBD$  ha'm  $ABE$  mu'yeshleri su'wretlengen. Bul mu'yeshler vertikal bolg'ani' ushi'n wo'z-ara ten' bolatug'i'nlig'i' belgili. Qalg'an  $A$  ha'm  $C$  mu'yeshlerinin' si'rtqi' mu'yeshlerin si'zi'p ko'rsetin'.

U'shmu'yeshliktin' mu'yeshlerin, woni'n' si'rtqi' mu'yeshlerinen pariqlaw ushi'n ishki mu'yeshler dep te ataymiz.



### Geometriyalı'q izertlew.

2-su'wrettegi  $ABC$  u'shmu'yeshliginin' barlı'q ishki ha'm si'rtqi' mu'yeshlerin transportir ja'rdeminde wo'lshe'n' ha'm to'mendegi mu'yeshler (ha'r bir si'rtqi' mu'yesh ha'm wog'an qon'si'las bolmag'an ishki mu'yeshlerdin' qosi'ndi'si'ni'n') din' shamalari'n wo'z-ara sali'sti'ri'n':

- $\angle 4$  ha'm  $\angle 2 + \angle 3$
- $\angle 5$  ha'm  $\angle 1 + \angle 3$
- $\angle 6$  ha'm  $\angle 1 + \angle 2$

Sali'sti'ri'w na'tiyjesinde qanday juwmaqqa keldin'iz. Woni' shamalap tasti'yi'qlaw tu'rinde an'lati'n'.



**Teorema.** U'shmu'yeshliktin' si'rtqi' mu'yeshi u'shmu'yeshliktin' wog'an qon'si'las bolmag'an yeki ishki mu'yeshlerinin' qosi'ndi'si'na ten'.



$\triangle ABC$ ,  $\angle 4$  – si'rtqi' mu'yesh  
(1-su'wret)



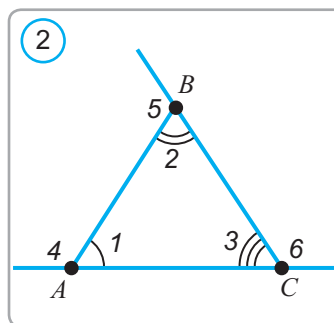
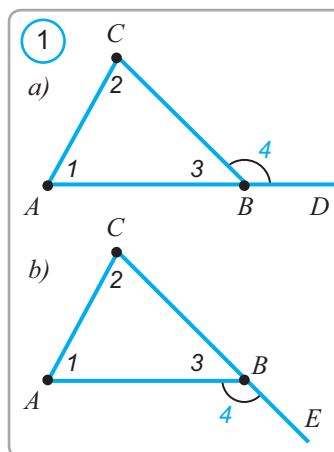
**Da'lillew kerek:**  
 $\angle 1 + \angle 2 = \angle 4$

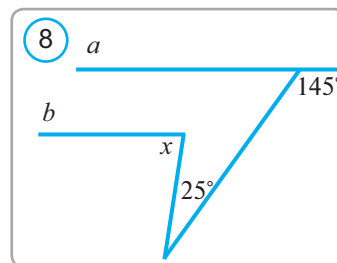
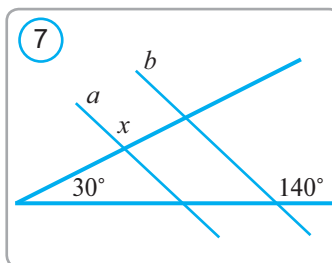
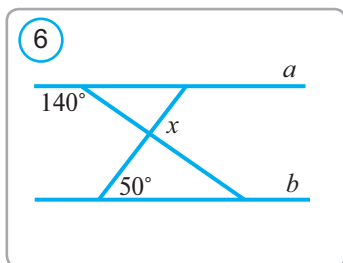
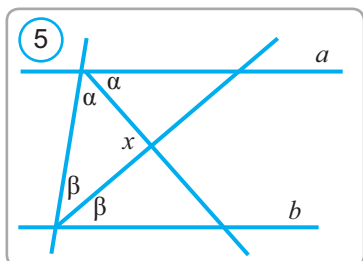
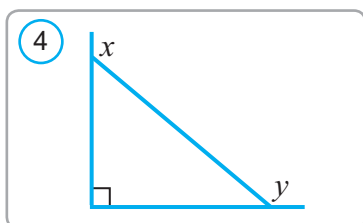
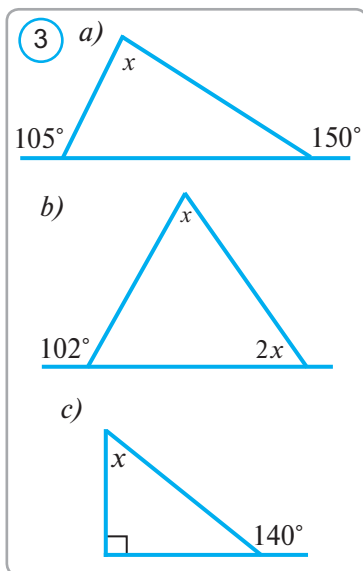
**Da'lillew.** 1-su'wretke qaraymiz. Wonda, qon'si'las mu'yeshlerdin' qa'siyeti boyi'nsha  $\angle 3 + \angle 4 = 180^\circ$ .

U'shmu'yeshliktin' mu'yeshlerinin' qosi'ndi'si' haqqi'ndag'i' teorema boyi'nsha  $\angle 1 + \angle 2 + \angle 3 = 180^\circ$ .

Bul yeki ten'likten,  
 $\angle 1 + \angle 2 + \cancel{\angle 3} = \cancel{\angle 3} + \angle 4$ , yag'ni'y  $\angle 1 + \angle 2 = \angle 4$  ten'ligin payda yetemiz.

**Teorema da'lillendi.**





Bul teoremadan to'mendegi na'tiyje kelip shi'g'adi'.

**Na'tiyje.** *U'shmu'yeshliktin' si'rtqi' mu'yeshi, wog'an qon'si'las bolmag'an, ishki mu'yeshlerinin' ha'r birinen u'lken.*

Woni'n' duri'sli'g'i'n wo'z betinshe tekserin'.

### ? Soraw, ma'sele ha'm tapsi'rmalar

1. U'shmu'yeshliktin' si'rtqi' mu'yeshi degen ne?
2. U'shmu'yeshliktin' si'rtqi' mu'yeshi haqqi'ndag'i teoremani' tu'sindirin'.
3. U'shmu'yeshliktin' yeki si'rtqi' mu'yeshi  $120^\circ$  ha'm  $135^\circ$  bolsa, ishki mu'yeshlerin tabi'n'.
4. U'shmu'yeshliktin' ishki mu'yeshlerinin' biri  $30^\circ$  qa, si'rtqi' mu'yeshlerinin' biri  $60^\circ$  qa ten'. U'shmu'yeshliktin' qalg'an ishki mu'yeshlerin tabi'n'.
5. 3-su'wrettegi belgisiz mu'yeshi tabi'n'.
6. 4-su'wrette  $x + ti$  tabi'n'.
7. Yeger 5-su'wrette  $a \parallel b$  bolsa,  $x$  ti tabi'n'.
8. Yeger 6-su'wrette  $a \parallel b$  bolsa,  $x$  ti tabi'n'.
9. Yeger 7-su'wrette  $a \parallel b$  bolsa,  $x$  ti tabi'n'.
10. Yeger 8-su'wrette  $a \parallel b$  bolsa,  $x$  ti tabi'n'.
11. U'shmu'yeshliktin' si'rtqi' mu'yeshi su'yir boli'wi mu'mkin be? Yeger mu'mkin bolsa, neshew?
- 12\* U'shmu'yeshliktin' si'rtqi' mu'yeshlerinin' qosi'ndi'si'n esaplan'.



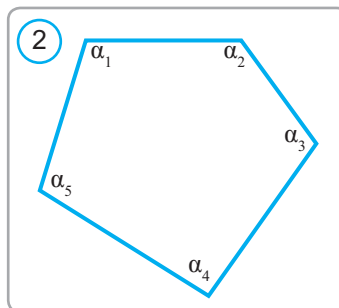
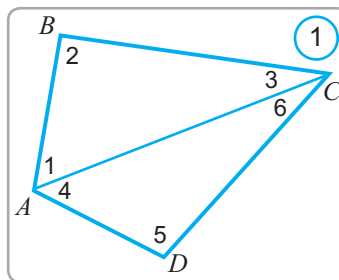
**Ma'sele.** To'rtmu'yeshliktin' mu'yeshlerinin' qosi'ndi'si'  $360^\circ$  qa ten' yekenligin da'llilen'.

**Sheshiliwi:** Qa'legen  $ABCD$  to'rtmu'yeshligin si'za-mi'z.  $A$  ha'm  $C$  noqatlari'n tutasti'ri'p, woni' yeki u'shmu'yeshlikke aji'ratami'z.  $ABC$  ha'm  $ADC$  u'shmu'yeshliklerinin' ishki mu'yeshlerinin' qosi'ndi'si'  $180^\circ$  qa ten' (1-su'wret):

$$\angle 1 + \angle 2 + \angle 3 = 180^\circ, \quad \angle 4 + \angle 5 + \angle 6 = 180^\circ.$$

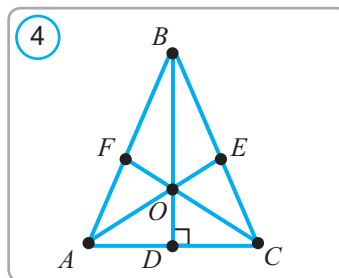
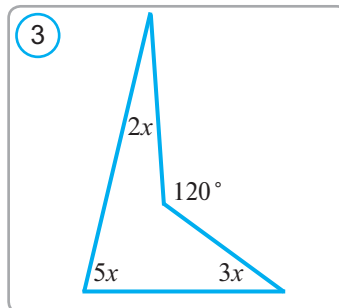
$$\angle A = \angle 1 + \angle 4 \quad \text{va} \quad \angle C = \angle 3 + \angle 6 \quad \text{bolg'ani' ushi'n}$$

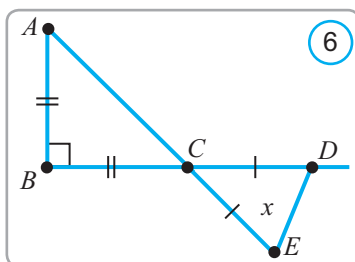
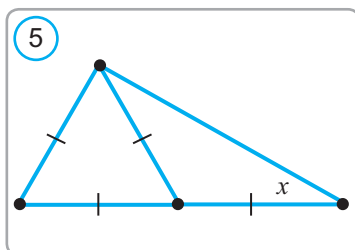
$$\begin{aligned} \angle A + \angle B + \angle C + \angle D &= (\angle 1 + \angle 4) + \angle 2 + (\angle 3 + \angle 6) + \angle 5 = \\ &= (\angle 1 + \angle 2 + \angle 3) + (\angle 4 + \angle 5 + \angle 6) = 180^\circ + 180^\circ = 360^\circ. \end{aligned}$$



**Soraw, ma'sele ha'm tapsi'rmalar**

1. U'shmu'yeshliktin' yeki mu'yeshinin' wo'lshemleri 5 : 9 tu'rinde, u'shinshi mu'yeshi usi' mu'yeshlerdin' kishisinen  $10^\circ$  qa kishi. U'shmu'yeshliktin' mu'yeshlerin tabi'n'.
2. U'shmu'yeshliktin'  $108^\circ$  li' si'rtqi' mu'yeshine qon'si'las bolmag'an ishki mu'yeshlerinin' qatnasi' 5 : 4 tu'rinde bolsi'n. Usi' ishki mu'yeshlerdi tabi'n'.
3. U'shmu'yeshliktin' yeki ta'repi u'shinshi ta'repine perpendikulyar boli'wi' mu'mkin be?
4. U'shmu'yeshliktin' dog'al si'rtqi' mu'yeshleri: a) 1; b) 2; c) 3 boli'wi' mu'mkin be?
5. U'shmu'yeshliktin' bir to'besindegi ishki ha'm si'rtqi' mu'yeshleri ten' boli'wi' mu'mkin be?
6. 2-su'wrette su'wretlengen besmu'yeshliktin' mu'yeshlerinin' qosi'ndi'si'n tabi'n'.
7. Belgisiz mu'yeshlerdi tabi'n' (3-su'wret).
8. Yeki mu'yeshi ten' bolg'an u'shmu'yeshliktin' ten' qaptalli' yekenligin ko'rsetin'.
9. Ten' qaptalli' u'shmu'yeshliktin' bir mu'yeshi: a)  $120^\circ$ ; b)  $70^\circ$  qa ten' bolsa, woni'n' qalg'an mu'yeshlerin tabi'n'.





10. Ten' qaptalli' u'shmu'yeshliktin' ultani'ndag'i' mu'yeshlerinen biri a)  $15^\circ$ ; b)  $75^\circ$  bolsa, qalg'an mu'yeshleri nege ten'?
11. Yeki u'shmu'yeshliktin' sa'ykes ta'replari parallel bolsa, wolarg'a sa'ykes bolg'an mu'yeshleri de ten' bolatug'i'ni'n da'lillen'.
12. Yeger 4-su'wrette  $AB=BC$ ,  $\angle ABC=50^\circ$ ,  $AE$  ha'm  $FC$  – bissektisalari' bolsa,  $AOB$  ha'm  $EOC$  mu'yeshlerin tabi'n'.
13. 5-su'wrettegi belgisiz  $x$  mu'yeshin tabi'n'.
14. 6-su'wrettegi belgisiz  $x$  mu'yeshin tabi'n'.
15. Yeki u'shmu'yeshliktin' sa'ykes ta'replari perpendikulyar bolsa, wolardi'n' sa'ykes mu'yeshleri ten' bola ma? Juwabi'n'i'zdi' tiykarlan'.
16. Qaysi' bir u'shmu'yeshlikti tek bir tuwri' boylap qi'rqi'p yeki su'yir mu'yeshli u'shmu'yeshlik payda yetiw mu'mkin be? Juwabi'n'i'zdi' tiykarlan'.

## 41

### Tuwri' mu'yeshli u'shmu'yeshliktin' qa'siyetleri

Yesletip wo'temiz, tuwri' mu'yeshli u'shmu'yeshliktin' bir mu'yeshi tuwri' ( $90^\circ$ ) boli'p, qalg'an yeki mu'yeshi bolsa su'yir mu'yeshlerden ibarat . Tuwri' mu'yeshli u'shmu'yeshliktin' tuwri' mu'yeshinin' qarsi'si'ndag'i' ta'repi **gipotenuza**, qalg'an yeki ta'repi bolsa **katet** dep ataladi'. Yendi tuwri' mu'yeshli u'shmu'yeshliktin' bazi' bir qa'siyetlerin ko'rip shi'g'ayiq.



**1-q'asiyet.** Tuwri' mu'yeshli u'shmu'yeshliktin' yeki su'yir mu'yeshlerinin' qosi'ndi'si'  $90^\circ$  qa ten'.

Haqi'yqattan da, u'shmu'yeshliktin' ishki mu'yeshlerinin' qosi'ndi'si'  $180^\circ$  qa ten' . Tuwri' mu'yeshli u'shmu'yeshliktin' bir mu'yeshi bolsa  $90^\circ$  qa ten'. Soni'n' ushi'n, woni'n' qalg'an yeki mu'yeshlerinin' qosi'ndi'si'  $90^\circ$  qa ten' boladi'.



**1-ma'sele.** Tuwri' mu'yeshli u'shmu'yeshliktin'  $30^\circ$  li' mu'yeshinin' qarsi'si'ndag'i' kateti gipotenuzani'n' yari'mi'na ten'.

Aytayi'q, 1-su'wrette ko'rsetilgen  $ABC$  tuwri' mu'yeshli u'shmu'yeshligi berilgen boli'p, wonda  $\angle ACB = 90^\circ$  ha'm  $\angle ABC = 30^\circ$  qa ten' bolsi'n. Wonda  $\angle BAC = 60^\circ$  boladi'

$AC = \frac{AB}{2}$  yekenligin ko'rsetemiz.

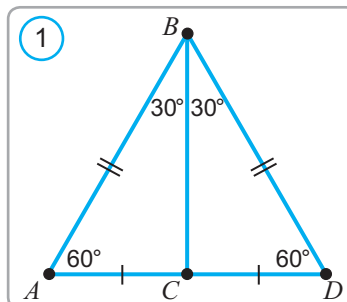


Berilgen u'shmu'yeshlikke ten' bolg'an  $BCD$  u'shmu'yeshligin 1-su'wrette ko'rsetilgendey yetip jasaymi'z. Na'tiyjede, barli'q mu'yeshleri  $60^\circ$  qa ten' bolg'an  $ABD$  u'shmu'yeshligine iye bolami'z. Demek,  $ABD$  u'shmu'yeshligi ten' ta'repli yeken. Sonli'qtan,  $AB = AD$  boladi'. Biraq,

$$AD = AC + CD = 2AC.$$

Solay yetip,  $AB = 2AC$ , yag'ni'y  $AC = \frac{AB}{2}$ .

**Qa'siyet da'lillendi.**



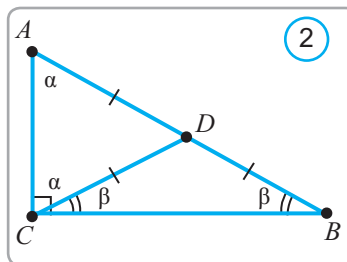
**2-qa'siyet.** Tuwri' mu'yeshli u'shmu'yeshliktin' katetlerinen biri gipotenuzani'n' yari'mi'na ten' bolsa, wonda wol katet  $30^\circ$  li' mu'yeshlin' qarama-qarsi'si'nda jatadi'.

**2-ma'sele.**  $ABC$  tuwri' mu'yeshli u'shmu'yeshlikte  $C$  tuwri' mu'yeshi ha'm  $AB = 12$  ha'm  $CD = DB$  bolsa,  $CD$  ni' tabi'n' (2-su'wret).

**Sheshiliwi:**  $CDB$  — ten' qaptalli' u'shmu'yeshlik, sebebi  $CD = DB$  (2-su'wret). Demek,  $\angle B = \beta$  desek,  $\angle A + \angle B = 90^\circ$  bolg'ani' ushi'n  $\angle A + \beta = 90^\circ$ . Biraq,  $\alpha + \beta = 90^\circ$  bolg'ani' ushi'n,  $\angle A = \alpha$ . Demek,  $ADC$  — ten' qaptalli' u'shmu'yeshlik. Soni'n' ushi'n  $AD = CD = DB$ , yag'ni'y  $D$  noqati'  $AB$  kesindisinin' wortasi'.

Demek,  $CD = \frac{AB}{2} = 6$ . **Juwabi':**  $CD = 6$

Bul ma'seleni sheshiw bari'si'nda  $AD = DB$  ha'm  $AD = CD$  ten'liklerin payda yettik. Wolar tuwri' mu'yeshli u'shmu'yeshliktin' to'mendegi qa'siyetin an'latadi'.



**3-qa'siyet.** Tuwri' mu'yeshli u'shmu'yeshlitin' gipotenuzasi'na tu'sirilgen medianasi' gipotenuzani'n' yari'mi'na ten'.

Bul a'hmiyetli qa'siyetke 8-klasta ja'ne qaytami'z.

**? Soraw, ma'sele ha'm tapsi'rmalar**

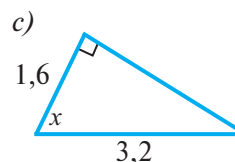
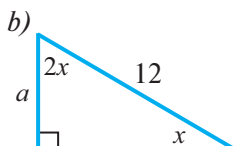
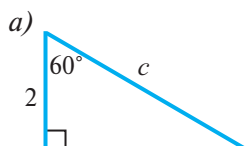
1. Tuwri' mu'yeshli u'shmu'yeshliktin' ta'replerinin' atamasi' qanday?
2. Tuwri' mu'yeshli u'shmu'yeshliktin' su'yir mu'yeshlerinin' qosi'ndi'si' nege ten'?
3. Tuwri' mu'yeshli u'shmu'yeshliktin' mu'yeshlerinin' birewi su'yir boli'wi' mu'mkin be?
4. Tuwri' mu'yeshli u'shmu'yeshliktin' neshe biyikligi bar?
5.  $30^\circ$  li' mu'yeshlin' qarama-qarsi'si'ndag'i' katet penen gipotenuza arasi'nda qanday baylani's bar?

6. Ten' qaptalli' tuwri' mu'yeshli u'shmu'yeshliktin' gipotenuzasi'na tu'sirilgen biyiklik gipotenuzani'n' yari'mi'na ten' yekenligin ko'rsetin'.

7. a)  $c = ?$

b)  $a = ?$

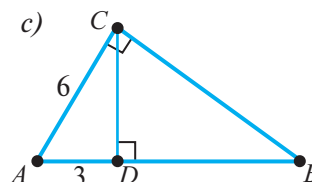
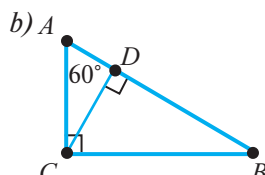
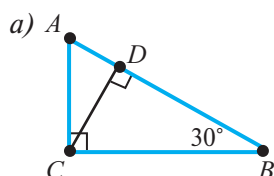
c)  $x = ?$



8. a)  $AB = 20, AD = ?$

b)  $AB = 18, BD = ?$

c)  $BD = ?$



9. Tuwri' mu'yeshli u'shmu'yeshliktin' gipotenuzasi'na tu'sirilgen medianasi' 8 sm. Yeger u'shmu'yeshliktin' bir mu'yeshi  $60^\circ$  qa ten' bolsa, bul mu'yeshke irgeles jatqan ta'replerin tabi'n'.

### Geometriyadag'i' aniqliq ha'm qisqaliq

Ani'q matematikali'q ayti'm jeterlishe toli'q ha'm soni'n' menen birge qisqa, arti'qsha so'zlersiz boli'wi' kerek.

1. To'mendegi ga'plerdegı arti'qsha so'zlerdi ani'qlap ko'rin'she?

a) Tuwri' mu'yeshli u'shmu'yeshliktin' yeki su'yir mu'yeshlerinin' qosi'ndi'si'  $190^\circ$  qa ten'.

b) Yeger tuwri' mu'yeshli u'shmu'yeshliktin' kateti gipotenuzani'n' yari'mi'na ten' bolsa, woni'n' qarama-qarsi'si'nda jati'wshi' su'yir mu'yesh  $30^\circ$  qa ten' boladi'.

2. Tiyisli atamalari'nan paydalani'p, to'mendegi ga'plerdi i'qshamlan'.

a) Yen' az ta'repli ko'pmu'yeshlik;

b) Shen'ber worayi'nan wo'tiwshi xorda;

c) Ultani' qaptal ta'repine ten' bolg'an ten' qaptalli' u'shmu'yeshlik.

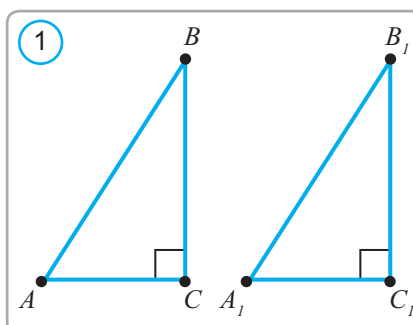
**Shi'ni'g'i'w.**  $ABC$  ha'm  $A_1B_1C_1$  tuwri' mu'yeshli u'shmu'yeshlikleri berilgen bolsi'n. Bul u'shmu'yeshliklardin' bir mu'yeshi tuwri' mu'yesh bolg'ani' ushi'n, bul mu'yeshler barqulla wo'z-ara ten' boladi'. Sonli'qtan, tuwri' mu'yeshli u'shmu'yeshlikler ushi'n u'shmu'yeshliklardin' ten'lik belgileri bir qansha a'piwayi'lasadi'.

Tuwri' mu'yeshli u'shmu'yeshlikler ushi'n yeki katet boyi'nsha (KK belgisi), katet ha'm su'yir mu'yesh boyi'nsha (KM belgisi), gipotenuza ha'm su'yir mu'yesh boyi'nsha (GM belgisi) ha'm gipotenuza ha'm katet boyi'nsha (GK belgisi) si'yaqli' ten'lik belgilerin ketiremiz:



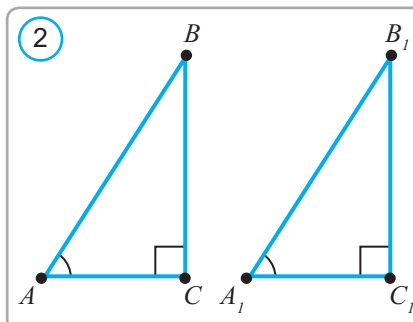
**Teorema. KK belgisi.** Bir tuwri' mu'yeshli u'shmu'yeshliktin' katetleri yekinshi tuwri' mu'yeshli u'shmu'yeshliktin' katetlerine sa'ykes tu'rde ten' bolsa, bul u'shmu'yeshlikler wo'z-ara ten' boladi' (1-su'wret).

Bul belgi u'shmu'yeshliklardin' ten'liginin' TMT – belgisinen tikkeley kelip shi'g'adi'.



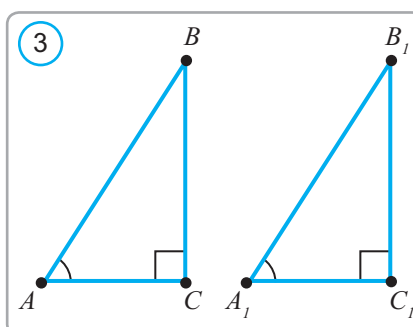
**Teorema. KM belgisi.** Bir tuwri' mu'yeshli u'shmu'yeshliktin' kateti ha'm wog'an irgeles jatqan su'yir mu'yeshi, yekinshi tuwri' mu'yeshli u'shmu'yeshliktin' kateti ha'm wog'an irgeles jatqan su'yir mu'yeshine ten' bolsa, bul u'shmu'yeshlikler wo'z-ara ten boladi' (2-su'wret).

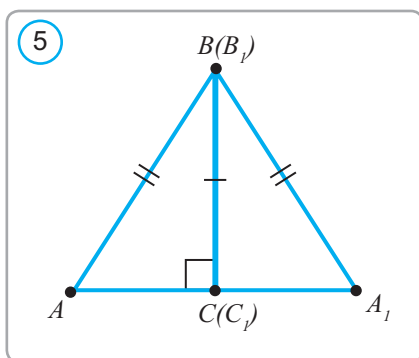
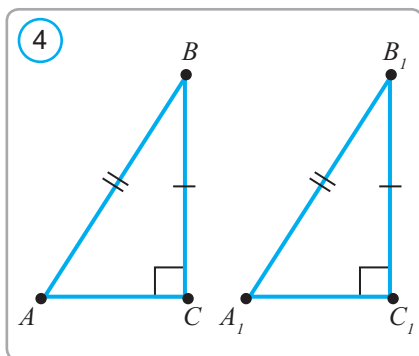
Bul belgi u'shmu'yeshliklardin' ten'liginin' MTM – belgisinen tikkeley kelip shi'g'adi'.



**Teorema. GB belgisi.** Bir tuwri' mu'yeshli u'shmu'yeshliktin' gipotenuzasi' ha'm bir su'yir mu'yeshi, yekinshi tuwri' mu'yeshli u'shmu'yeshliktin' gipotenuzasi' ha'm bir su'yir mu'yeshine ten' bolsa, bul u'shmu'yeshlikler wo'z-ara ten' boladi' (3-su'wret).

Bul belgi u'shmu'yeshliklardin' ten'liginin' MTM – belgisinen tikkeley kelip shi'g'adi'.





**Teorema. GK belgisi.** Bir tuwri' mu'yeshli u'shmu'yeshliktin' gipotenuzasi' ha'm bir kateti yekinshi tuwri' mu'yeshli u'shmu'yeshliktin' gipotenuzasi' ha'm bir katetine ten' bolsa, bul u'shmu'yeshlikler wo'z-ara ten' boladi' (4-su'wret).

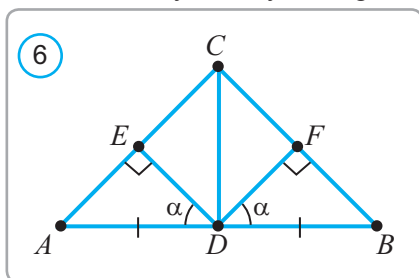
Bul belgi da'llileniwi kerek.  $ABC$  ha'm  $A_1B_1C_1$  mu'yeshleri berilgen (4-su'wret) ha'm olarda  $\angle C = 90^\circ$ ,  $\angle C_1 = 90^\circ$ ,  $AB = A_1B_1$ ,  $BC = B_1C_1$  bolsi'n. Wonda  $\triangle ABC = \triangle A_1B_1C_1$  yekenligin ko'rsetemiz.

**Da'llilew.**  $ABC$  ha'm  $A_1B_1C_1$  u'shmu'yeshliklerinin' yeki-yekiden ta'repleri wo'z-ara ten':  $AB = A_1B_1$ ,  $BC = B_1C_1$ . Yeger  $ABC$  ha'm  $A_1B_1C_1$  mu'yeshlerinin' ten'ligin ko'rsetsek, TMT belgisi boyi'nsha u'shmu'yeshlikler wo'z-ara ten' boladi'.

Buni'n ushi'n,  $A_1B_1C_1$  u'shmu'yeshligin  $ABC$  u'shmu'yeshligi menen,  $BC$  ha'm  $B_1C_1$  katetleri u'ste-u'st tu'setug'i'nday yetip qaptallasti'ri'p qoyami'z (5-su'wret). Bul jag'dayda,  $\angle C$  ha'm  $\angle C_1$  tuwri' mu'yesh bolg'anli'gi' ushi'n  $CA$  ha'm  $C_1A_1$  nurlari' jayi'q mu'yeshiti quraydi', yag'ni'y  $A$ ,  $C$ ,  $C_1$  ha'm  $A_1$  noqatları bir tuwri'da jatadi'. Na'tiyjede,  $ABA_1$  ten' qaptalli' u'shmu'yeshlik boladi'. Biraq, ten' qaptalli' u'shmu'yeshlikte ultang'a tu'sirilgen biyiklik bissektrisa da boladi' (71-bettegi teoremani'n juwmag'i' boyi'nsha). Demek,  $\angle ABC = \angle A_1B_1C_1$ . **GK belgisi da'llilendi.**



**Ma'sele.** 6-su'wrette berilgen mag'li'wmatlarga tiykarlani'p  $ABC$  — ten'qaptalli' u'shmu'yeshlik yekenligin da'llilen'.

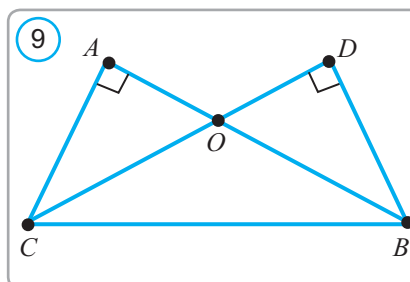
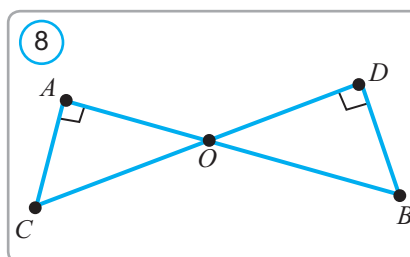
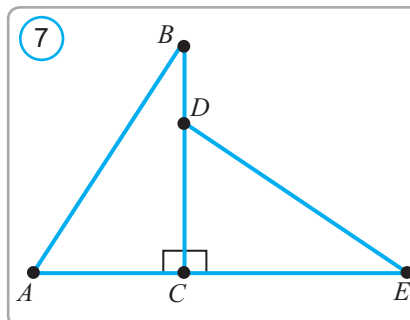


**Sheshiliwi:**  $\triangle AED = \triangle BFD$ , sebebi wolardi'n' gipotenuzalari' ha'm bir su'yir mu'yeshleri ten'.  $CED$  ha'm  $CFD$  — tuwri' mu'yeshli u'shmu'yeshlikler,  $ED = FD$  ha'mde  $CD$  gipotenuzasi' uli'wma bolg'ani' ushi'n, tuwri' mu'yeshli u'shmu'yeshliklerdin' ten'liginin' GK belgisi boyi'nsha  $\triangle CED = \triangle CFD$ .

Demek,  $\triangle ADC = \triangle BDC$ , yag'ni'y  $AC = BC$  ha'm  $ABC$  — ten' qaptalli' u'shmu'yeshlik.

## **?** Soraw, ma'sele ha'm tapsi'rmalar

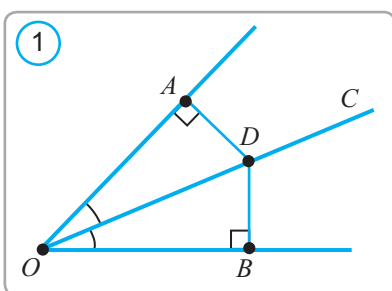
1. Tuwri' mu'yeshli u'shmu'yeshliklerdin' ten'ligi-nin' belgilerin ayti'p berin' ha'm tu'sindirin'.
2. Tuwri' mu'yeshli u'shmu'yeshliklerdin' bir kateti ha'm bir mu'yeshi sa'ykes tu'rde ten' bolsa, wonda bul u'shmu'yeshlikler ten' bola ma?
3. Yeger 7-su'wtrette:
  - a)  $\angle A = \angle D$ ,  $\angle B = \angle E$ ;
  - b)  $BC = DE$ ,  $AB = CE$ ;
  - d)  $AC = CD$ ,  $BC = CE$ ;
  - e)  $AB = DE$
 bolsa,  $\triangle ACB$  ha'm  $\triangle DCE$  u'shmu'yeshlikleri ten' bola ma?
4. Yeger 8-su'wtrette: a)  $OC = OB$ ; b)  $AC = BD$ ; d)  $AO = OD$ ; e)  $AC = OD$ ; f)  $\angle OCA = \angle OBD$  bolsa,  $\triangle OAC$  ha'm  $\triangle ODB$  u'shmu'yeshlikleri ten' bola ma?
5. Tuwri' mu'yeshli  $\triangle ABC$  ha'm  $\triangle A_1B_1C_1$  u'shmu'yeshliklerinde  $A$  ha'm  $A_1$  tuwri' mu'yeshleri,  $BD$  ha'm  $BD_1$  ler bissektrisalari' ha'm  $\angle B = \angle B_1$ ,  $BD = B_1D_1$  bolsa,  $\triangle ABC = \triangle A_1B_1C_1$  yekenligin da'lillen'.
6. Yeger 9-su'wtrette:
  - a)  $AC = BD$ ;
  - b)  $OA = OD$ ;
  - d)  $\angle OCB = \angle OBC$ ;
  - e)  $BC = OD$ ;
  - f)  $\angle ACB = \angle DBC$  bolsa, $\triangle BAC$  ha'm  $\triangle CDB$  u'shmu'yeshlikleri ten' bola ma?
7.  $\triangle ABC$  u'shmu'yeshliginde  $BD$  biyikligi ju'rgizilgen. Yeger  $AD = DC$  bolsa,  $\triangle ABC$  u'shmu'yeshliginin' ten' qaptalli' yekenligin da'lillen'.
8. Su'yir mu'yeshli  $\triangle ABC$  u'shmu'yeshliginde  $AA_1$  ha'm  $CC_1$  biyiklikleri ten'.  $\angle BAC = \angle BCA$  ten'-ligin da'lillen'.



Yadi'n'i'zda bolsa, noqattan tuwri'g'a shekemgi bolg'an arali'q dep, noqattan tuwri'g'a tu'sirilgen perpendikulyar uzi'nli'g'i'na ayti'lg'an edi.



**Teorema.** Mu'yesh bissektisasi'ni'n' qa'legen noqati'nan mu'yeshlin' ta'replerine shekem bolg'an arali'qlar wo'z-ara ten'.



**Da'lillew.** Aytayi'q,  $O$  mu'yeshi ha'm woni'n  $OC$  bissektisasi' berilgen bolsi'n (1-su'wret).  $OC$  bissektisada qa'legen  $D$  noqati'n alomi'z ha'm berilgen mu'yeshlin' ta'replerine  $DA$  ha'm  $DB$  perpendikulyarlari'n tu'siremiz.

$OAD$  ha'm  $OBD$  tuwri' mu'yeshli u'shmu'yeshlerinde:

1.  $\angle AOD = \angle BOD$  — sha'rt boyi'nsha;
2.  $OD$  — uli'wma gipotenuza.

Tuwri' mu'yeshli u'shmu'yeshliklerdin' ten'liginin' GB belgisi boyi'nsha,  $\triangle OAD = \triangle OBD$ . Sonli'qtan,  $DA = DB$ .

**Teorema da'lillendi.**

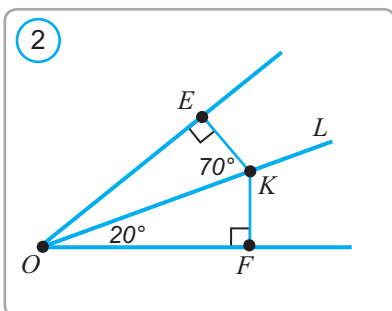


**Ma'sele.**  $EOF$  mu'yeshinin'  $WO$  bissektisasi'nda  $K$  noqati' belgilengen (2-su'wret). Yeger  $EK \perp OE$ ,  $KF \perp OF$ ,  $\angle OKE = 70^\circ$  ha'm  $\angle KOF = 20^\circ$  bolsa, a)  $EOK$  ha'm  $OKF$  mu'yeshlerin; b)  $EOF$  ha'm  $EKF$  mu'yeshlerin tabi'n'.

**Sheshiliwi:** a) Joqari'da qarap wo'tilgendey  $\triangle EOK = \triangle FOK$ . Soni'n' ushi'n  $\angle EOK = \angle FOK = 20^\circ$  ha'm  $\angle OKF = \angle OKE = 70^\circ$ .

- b)  $\angle EOF = 2 \cdot \angle KOF = 40^\circ$ ,  
 $\angle FKE = \angle FKO + \angle OKE = 70^\circ + 70^\circ = 140^\circ$ .

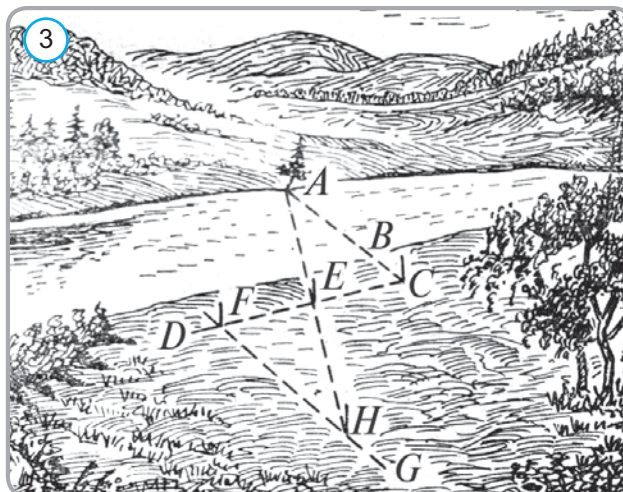
**Juwabi':** a)  $20^\circ$  ha'm  $70^\circ$ ; b)  $40^\circ$  ha'm  $140^\circ$ .





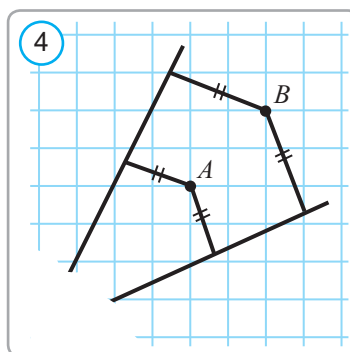
### A'meliy tapsi'rma

Tuwri' mu'yeshli u'shmu'yeshliklerdin' ten'liginin' belgisi-nen paydalani'p, 3-su'wrette ko'rsetilgen da'ryani'n' ken'ligin ani'qlaw ushi'n wori'nlang'an si'zi'w jumi'slari'n tu'sindirin' ha'm da'rya-ni'n' ken'ligin tabi'w usi'li'n ayti'p berin'



### Soraw, ma'sele ha'm tapsi'rmalar

1. Mu'yesh bissektrisasi'ni'n' qa'legen noqati' woni'n' ta'replerinen ten'dey qashi'qli'qta yekenligin da'lillen'.
2. Mu'yesh  $AOB$  mu'yeshinin' bissektrisasi'nda ali'ng'an noqattan  $OA$  nuri'na shekem bolg'an arali'q  $7\text{ sm}$  bolsa, usi' noqattan  $OB$  nuri'na shekem bolg'an arali'qti' tabi'n'.
3.  $O$  mu'yeshi ha'm woni'n' bissektrisasi'nda  $C$  noqati' berilgen. Yeger  $\angle O = 60^\circ$  ha'm  $OC = 14\text{ sm}$  bolsa,  $C$  noqati'nan mu'yeshtin' ta'replerine shekem bolg'an arali'qti' tabi'n'.
4.  $AOB$  mu'yeshi ishinde  $N$  noqati' ali'ng'an. Yeger  $AN = BN$ ,  $OA \perp AN$  ha'm  $OB \perp BN$  bolsa,  $N$  noqati'  $AOB$  mu'yeshinin' bissektrisasi'nda jatatug'i'ni'n da'lillen'.
- 5\*. 4-su'wrette shaqmaq qag'azda si'zi'lg'an mu'yeshtin' bir bo'limi su'wretlengen. Qag'azdi'n' mu'yeshtin' to'besi jaylasqan bo'legi ji'rti'li'p qalg'an.  $A$  ha'm  $B$  noqatlari' mu'yeshtin' ta'replerinen ten'dey qashi'qli'qta yekenligi belgili. Mu'yeshtin' bissektrisasi'n qalay jasaw mu'mkin?
- 6\*. U'shmu'yeshliktin' yeki bissektrisasi'ni'n' kesilisen noqati' u'shmu'yeshliktin' u'sh ta'repinen ten'dey qashi'qli'qta yekenligin da'lillen'.
7. Ten' qaptalli'  $ABC$  va  $A_1B_1C_1$  u'shmu'yeshliklerinin'  $AC$  ha'm  $A_1C_1$  ultanlari' ha'm ultanlari'na tu'sirilgen  $BD$  ha'm  $B_1D_1$  biyiklikleri ten'.  $ABC = A_1B_1C_1$  ten'ligin da'lillen'.



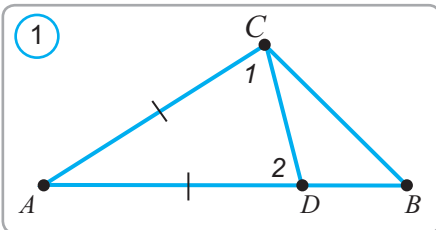


**Teorema.** U'shmu'yeshliktin' u'lken ta'repinin' qarama-qarsi'si'nda u'lken mu'yesh jatadi'.

$\triangle ABC, AB > AC$  (1-su'wret)



$\angle C > \angle B$



**Da'lillew.**  $AB$  nuri'na  $AC$  ta'repine ten' bolg'an  $AD$  kesindisin qoyami'z.  $AB > AD$  bolg'ani' ushi'n,  $D$  noqati'  $AB$  kesindisine tiyisli boladi'. Demek,  $CD$  nuri'  $C$  mu'yeshinin' ishki oblasti'nda jatadi' ha'm  $C$  mu'yeshin yeki mu'yeshke aji'ratadi'. Solay yetip,  $\angle C > \angle 1$ .

$ACD$  u'shmu'yeshlikti ten' qaptalli' yetip jasag'ani' mi'z ushi'n,  $\angle 1 = \angle 2$ .  $\angle 2$  —  $CBD$  u'shmu'yeshliginin' si'rtqi' mu'yeshi bolg'ani' ushi'n,  $\angle 2 > \angle B$ .

Bul aji'rati'p ko'rsetilgen u'sh qatnastan,

$\angle C > \angle 1 = \angle 2 > \angle B$ , yag'ni'y  $\angle C > \angle B$  yekenligin payda yetemiz.

**Teorema da'lillendi.**

Sonday-aq, bul teoremag'a kerii teorema da wori'nli'.

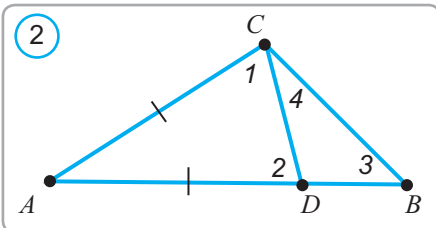


**Keri teorema.** U'shmu'yeshliktin' u'lken mu'yeshi qarama-qarsi'si'nda u'lken ta'rep jatadi'.

Bul teoremani'n' da'lilleniwin wo'z betinshe ori'nlan'.

**Na'tiyje.** Ten' qaptalli' u'shmu'yeshlikte ten' ta'replari qarama-qarsi'si'nda ten' mu'yeshler jatadi'.

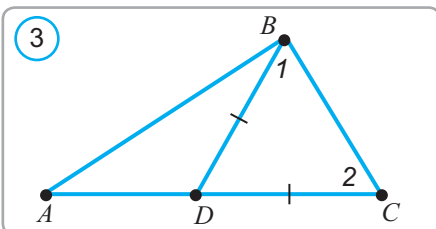
Woni'n' duri'sli'g'i'n aldi'n da'lillegan yedik.



**1-ma'sele.** 2-su'wrette berilgen mag'li'w-mattan paydalani'p,  $\angle 1 > \angle 3$  yekenligin da'lillen'.

**Sheshiliwi:**  $\angle 2 > \angle 3$  yekenligi belgili, sebebi  $\angle 2$  —  $BDC$  u'shmu'yeshliginin' si'rtqi' mu'yeshi bo'li'p, si'rtqi' mu'yeshin' qa'siyeti boyi'nsha,  $\angle 2 = \angle 3 + \angle 4$  ha'm  $\angle 4 > 0$ .  $ACD$  — ten' ta'repli u'shmu'yeshlik bolg'ani' ushi'n  $\angle 1 = \angle 2$ . Demek,  $\angle 1 > \angle 3$  boladi'.

**2-ma'sele.** 3-su'wrette berilgenlerden paydalani'p,  $AB < AC$  yekenligin ko'rsetin'.



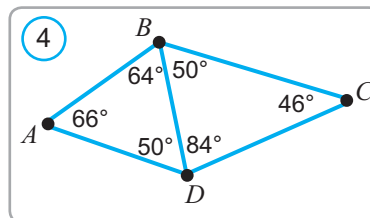


**Sheshiliwi:**  $BDC$  — ten' qaptalli' u'shmu'yeshlik (sebebi  $BD=DC$ ), demek,  $\angle 1=\angle 2$  boladi'.  $\angle 1<\angle ABC$  bolg'ani' ushi'n  $\angle 2<\angle ABC$ . U'lken mu'yeshlin' qarama-qarsi'nda u'lken ta'rep jatqani' ushi'n  $AB<AC$  boladi'.



### Soraw, ma'sele ha'm tapsi'rmalar

1. U'shmu'yeshliktin' u'lken ta'repi qarama-qarsi'si'nda u'lken mu'yesh ha'm kerisinshe, u'lken mu'yesh qarama-qarsi'si'nda u'lken ta'rep jati'wi'n da'lillen'.
2.  $ABC$  u'shmu'yeshlikte  $AB = 12\text{ sm}$ ,  $BC = 10\text{ sm}$ ,  $CA = 7\text{ sm}$  bolsa, u'shmu'yeshliktin' u'lken ha'm yen' kishi mu'yeshleri qaysi'.
3.  $ABC$  u'shmu'yeshlikte a)  $AB < BC < AC$ ; b)  $AB = AC < BC$  bolsa, u'shmu'yeshliktin' mu'yeshlerin sali'sti'ri'n'.  $A$  mu'yeshi dog'al mu'yesh boli'wi' mu'mkin be?
4. Ten' qaptalli' u'shmu'yeshliktin' to'besindegi mu'yeshi  $62^\circ$  bolsa, woni'n' qaysi' ta'repi u'lken boladi'?  $58^\circ$  bolsa-she?
5. U'shmu'yeshliktin' dog'al mu'yeshi qarama-qarsi'si'nda kishi ta'rep jati'wi' mu'mkin be?
6.  $ABC$  u'shmu'yeshlikte a)  $\angle A > \angle B > \angle C$ ; b)  $\angle A = \angle B < \angle C$  bolsa, u'shmu'yeshliktin' ta'replerin sali'sti'ri'n'.
7. U'shmu'yeshliktin' u'lken mu'yeshi  $60^\circ$  dan kishi boli'wi' mu'mkin be?
8. Ten' ta'repli u'shmu'yeshliktin' yeki bissektrisasi' kesiliskende payda bolatug'i'n mu'yeshlerdi tabi'n'.
- 9\*.  $ABC$  u'shmu'yeshlikte  $AB > BC$  ha'm  $\angle A = 60^\circ$  bolsa,  $B$  mu'yeshi qanday ma'nislardi qabi'l yetedi.
- 10\*. U'shmu'yeshliktin'  $\alpha$ ,  $\beta$  ha'm  $\gamma$  mu'yeshleri ushi'n  $\alpha < \beta + \gamma$ ,  $\beta < \alpha + \gamma$ ,  $\gamma < \alpha + \beta$  qatnaslari' wori'nli' bolsa, bul qanday u'shmu'yeshlik boladi'?
- 11\*. 4-su'wretten yen' u'lken ha'm yen' kishi kesindilerdi ko'rsetin'. Juwabi'n'i'zdi' tu'sindirin'.
12. Tuvri' mu'yeshli u'shmu'yeshliktin' gipotenuzasi' u'lken be yamasa kateti me?





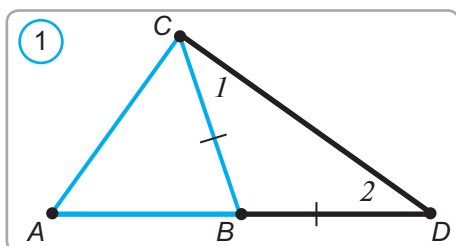
U'shmu'yeshliktin' qa'legen bir ta'repi qalg'an yeki ta'repinin' qosi'ndi'si'nan kishi.



$\triangle ABC$  (1-su'wret)



$AC < AB + BC$



**Da'lillew.**  $AB$  tuwri'si'nda  $BC$  kesindige ten'  $BD$  kesindisin qoyami'z ha'm  $C$  ha'm  $D$  noqatlari'n tutasti'rami'z (1-su'wret). Na'tiyjede,  $BCD$  ten' qaptalli' u'shmu'yeshlik payda boladi'. Wonda,  $\angle 1 = \angle 2$ , sebebi  $BC = BD$ . Si'zi'lmanan ko'rinip turg'ani'nday,  $\angle ACD > \angle 1$ .

Bul jag'dayda,  $\angle ACD > \angle 2$  sebebi  $\angle 1 = \angle 2$ ,

Bul mu'yeshler  $ACD$  u'shmu'yeshligine tiyisli. Yendi u'lken mu'yesh qarama-qarsi'si'nda u'lken ta'rep jati'wi'n esapqa alsaq,  $AC < AD$  ten'sizlikke iye bolami'z.

Bul jag'dayda,  $AC < AB + BD$  sebebi  $AD = AB + BD$ . Wonnan  $BD = BC$  yekenligin yesapqa alsaq,  $AC < AB + BC$  ni' payda yetemiz.

**Teorema da'lillendi.**

Bul teoremadan to'mendegi na'tiyje kelip shi'g'adi'.

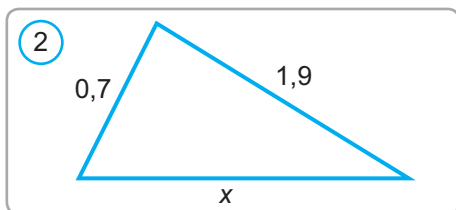
**Na'tiyje.** Bir tuwri'da jatpaytug'i'n qa'legen u'sh  $A, B$  ha'm  $C$  noqati' ushi'n  $AC < AB + BC$ ,  $AB < AC + BC$  ha'm  $BC < AB + AC$  ten'sizlikleri wori'nli'.

Bul ten'sizliklerdin' ha'r biri u'shmu'yeshliktin' ten'sizligi dep ataladi'.



**Ma'sele.** U'shmu'yeshliktin' yeki ta'repi 0,7 ha'm 1,9. Yeger u'shinshi ta'repi pu'tin san yekenligi belgili bolsa, woni' tabi'n' (2-su'wret).

**Shesiliwi:** Berilgen u'shmu'yeshliktin' yeki ta'repi belgili: 0,7 ha'm 1,9. U'shinshi ta'repin u'shmu'yeshliktin' ten'sizliginen paydalani'p tabami'z:



$$x + 0,7 > 1,9, \text{ yamasa } x > 1,2$$

$$1,9 + 0,7 > x, \text{ yamasa } x < 2,6.$$

Bul yeki ten'sizlikten  $1,2 < x < 2,6$  ni' payda yetemiz.

$x$  – pu'tin san, tek g'ana  $x=2$  ma'nisi bul qos ten'sizlikni qanaatlandi'radi'. Demek, u'shmu'yeshliktin' belgisiz ta'repi 2 ge ten'.

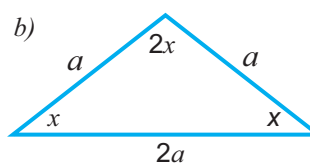
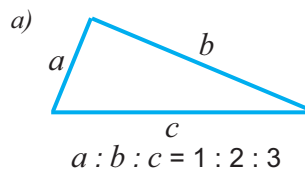
**Juwabi':** 2



### Soraw, ma'sele ha'm tapsi'rmalar

1. U'shmu'yeshliktin' ten'sizliginin' mazmuni' neden ibarat?
2. U'shmu'yeshliktin' ten'sizligi qanday ma'selelerdi sheshiwde qollani'ladi'?
3. Uzi'nli'qlari' 1 m, 2 m ha'm 3 m bolg'an kesindilerden u'shmu'yeshlik jasaw mu'mkin be?
4. Ta'repleri a) 2; 3; 4; b) 2; 2; 4; c) 3,6; 1,8; 5; d) 56; 38; 19; bolg'an u'shmu'yeshlik bar ma?
5. Ten' qaptalli' u'shm'yeshliktin' ta'repleri: a) 7 ha'm 3; b) 10 ha'm 5; c) 8 ha'm 5 bolsa, u'shinshi ta'repin tabi'n'.
6. Ma'selenin' beriliwi duri's pa (3-su'wret)?
7. U'shmu'yeshliktin' qa'legen ta'repi woni'n' qalg'an yeki ta'repinin' ayi'rmasi'nan u'lken bolatug'i'ni'n da'lillen'.
8. Ten' qaptalli' u'shmu'yeshliktin' perimetri 25 sm, bir ta'repi yekinshi ta'repinen 4 sm arti'q ha'm si'rtqi' mu'yeshlerinin' biri su'yir bolsa, u'shmu'yeshliklerdin' ta'replerin tabi'n'.
- 9.\* Uzi'nli'qlari' 2; 3; 4; 5 ha'm 6 g'a ten' kesindilerden neshe tu'rli u'shmu'yeshlik jasaw mu'mkin?
10. Tegisliktegi u'sh A, B, C noqatlari' ushi'n  $AB+BC \geq AC$  ten'sizligi wori'nlansa, AB, BC ha'm AC kesindileri qanday geometriyalı'q figurani' an'latadi'?
- 11.\* U'shmu'yeshliktin' medianasi' u'shmu'yeshliktin' yari'm perimetrinen (perimetrdin' yari'mi'nan) kishi yekenligin da'lillen'.
12. Shen'berdin' yen' u'lken xordasi' woni'n' diametri bolatug'i'ni'n da'lillen'.

3



46

### Bilimin'izdi si'nap ko'rin'

#### 1. Bos qaldi'ri'lg'an wori'nlardi' logikali'q jaqtan duri's so'zler menen toli'qti'ri'n'.

1. U'shmu'yeshliktin' ishki mu'yeshine ..... u'shmu'yeshliktin' si'rtqi' mu'yeshi dep ataladi'.
2. U'shmu'yeshlik .....  $180^\circ$  qa ten'.
3. Yeki mu'yeshinin' qosi'ndi'si'  $90^\circ$  qa ten' bolg'an u'shmu'yeshlik ..... boladi'.
4. U'shmu'yeshliktin' si'rtqi' mu'yeshi wog'an qon'si'las bolmag'an ..... boladi'.
5. Yeger u'shmu'yeshliktin' bir mu'yeshi dog'al mu'yesh bolsa, qalg'an yeki .....
6. Tuwri' mu'yeshli u'shmu'yeshliktin' mu'yeshleri ..... bola almaydi'.
7. U'shmu'yeshliktin' ha'r bir ta'repi qalg'an ta'replerinin' qosi'ndi'si'nan .....

8. Yeki tuwri' mu'yeshli u'shmu'yeshliktin' gipotenuzasi' ha'm ..... ten' bolsa, bul u'shmu'yeshlikler ten' boladi'.
9. Tuwri' mu'yeshli u'shmu'yeshliktin' katetleri ten' bolsa, wol ..... boladi'.
10. Tuwri' mu'yeshli u'shmu'yeshliktin' gipotenuzasi'na tu'sirilgen ..... usi' gipotenuzani'n' yari'mi'na ten'.
11. Tuwri' mu'yeshli u'shmu'yeshliktin' kateti ..... bolsa, wol  $30^\circ$  li' mu'yesh qarama-qarsi'si'nda jatadi'.
12. Mu'yesh ta'replerinen ten'dey arali'qta uzaqlasqan noqat usi' mu'yeshstin' ..... jatadi'.

## 2. To'mende keltirilgen ga'plerde qa'te bolsa, woni' tabi'n' ha'm du'zetin'.

1. Tuwri' mu'yeshli u'shmu'yeshliklerdin' gipotenuzasi' ha'm bir mu'yeshi ten' bolsa, bul u'shmu'yeshlikler ten' boladi'.
2. U'shmu'yeshliktin' ishki ha'm si'rtqi' mu'yeshlerinin' qosi'ndi'si'  $180^\circ$  qa ten'.
3. U'shmu'yeshliktin' si'rtqi' mu'yeshi, yeki ishki mu'yeshlerinin' qosi'ndi'si'na ten'.
4. U'shmu'yeshliktin' u'lken ta'repi qarama-qarsi'si'nda kishi mu'yeshi, u'lken mu'yeshi qarama-qarsi'si'nda kishi ta'repi jatadi'.
5. U'shmu'yeshliktin' ha'r bir ta'repi qalg'an ta'replerinin' ayi'rmasi'nan kishi.
6. Tuwri' mu'yeshli u'shmu'yeshliktin' tek g'ana bir biyikligi bar.
7. Tuwri' mu'yeshli u'shmu'yeshliktin' kateti gipotenuzasi'ni'n' yari'mi'na ten'.
8. Tuwri' mu'yeshli u'shmu'yeshliktin' biyikligi gipotenuzasi'ni'n' yari'mi'na ten'.
9. Tuwri' mu'yeshli u'shmu'yeshliklerdin' gipotenuzalari' ten' bolsa, bul u'shmu'yeshlikler de ten' boladi'.
10. U'shmu'yeshliktin' ishki mu'yeshi woni'n' qalg'an yeki mu'yeshinin' qosi'ndi'si'nan barqulla kishi boladi'.
11. U'shmu'yeshliktin' si'rtqi' mu'yeshleri barqulla dog'al mu'yesh boladi'.

## 3. Kestede keltirilgen qa'siyetler ha'm talqi'lawg'a sa'ykes keliwshi geometriyalıq tu'siniklerdi tabi'n'.

|    |                                                          |  |
|----|----------------------------------------------------------|--|
| 1. | Ishki mu'yeshlerinin' qosi'ndi'si' $180^\circ$ qa ten'   |  |
| 2. | Su'yir mu'yeshlerinin' qosi'ndi'si' $90^\circ$ qa ten'   |  |
| 3. | Ta'repleri kesindilerden ibarat                          |  |
| 4. | U'shmu'yeshliklerdin' ta'repleri arasi'ndag'i' qatnas    |  |
| 5. | Gipotenuzani'n' yari'mi'na ten'                          |  |
| 6. | U'sh biyikligi de bir to'bede kesilisedi                 |  |
| 7. | Katetten barqulla u'lken                                 |  |
| 8. | Noqatlari' mu'yeshstin' ta'replerinen ten'dey uzaqlasqan |  |

---

#### 4. Testler.

1. Yeger u'shmu'yeshliktin' mu'yeshleri 2:3:4 qatnasta bolsa, wonin' mu'yeshlerin tabi'n.  
A)  $20^\circ$ ,  $30^\circ$ ,  $40^\circ$ ;    B)  $40^\circ$ ,  $60^\circ$ ,  $80^\circ$ ;    D)  $36^\circ$ ,  $54^\circ$ ,  $90^\circ$ ;    E)  $18^\circ$ ,  $27^\circ$ ,  $36^\circ$ .
2. Yeger u'shmu'yeshliktin' mu'yeshleri 3:2:1 qatnasta bolsa, wonin' tu'rin ani'qlan?  
A) Su'yir mu'yeshli;    B) Dog'al mu'eshli;  
D) Tuvri' mu'yeshli;    E) Ani'qlar bolmaydi'.
3. Yeger u'shmu'yeshliktin' birsi'rtqi' mu'yeshi su'qir bolsa, woni'n' tu'rin ani'qlan'.  
A) Su'yir mu'yeshli;    B) Dog'al mu'eshli;  
D) Tuvri' mu'yeshli;    E) Ani'qlar bolmaydi'.
4. Yeger u'shmu'yeshliktin' bir mu'yeshi woni'n' qalg'an yeki mu'yeshlerinin' qosi'ndi'si'nan u'lken bolsa, woni'n' tu'rin ani'qlan'.  
A) Su'yir mu'yeshli;    B) Dog'al mu'eshli;  
D) Tuvri' mu'yeshli;    E) Ani'qlar bolmaydi'.
5. Qaysi' u'shmu'yeshliktin' biyiklikleri woni'n' bir to'besinde kesilisedi?  
A) Ten' qaptalli' u'shmu'yeshlik;    B) Ten' ta'repli u'shmu'yeshlik;  
D) Tuvri' mu'yeshli u'shmu'yeshlik;    E) Bunday u'shmu'yeshlik joq.
6.  $ABC$  u'shmu'yeshlikte  $A$  to'besindegi si'rtqi' mu'yeshi  $120^\circ$  qa,  $C$  to'besindegi ishki mu'yeshi bolsa  $80^\circ$  qa ten'.  $B$  to'besindegi si'rtqi' mu'yeshin tabi'n'  
A)  $120^\circ$ ;    B)  $140^\circ$ ;    D)  $160^\circ$ ;    E)  $40^\circ$ .
7. U'shmu'yeshliktin' si'rtqi' mu'yeshlerinen biri  $120^\circ$  qa, usi' mu'yeshke qon'si'las bolmag'an ishki mu'yeshlerinin' ayi'rmasi'  $30^\circ$  qa ten'. U'shmu'yeshliktin' ishki mu'yeshlerinen u'lkenin tabi'n'.  
A)  $70^\circ$ ;    B)  $75^\circ$ ;    D)  $85^\circ$ ;    E)  $90^\circ$ .
8. U'shmu'yeshliktin yeki mu'yeshinin' ma'nislerinin' qatnasi' 1 : 2 tu'rinde bolsi'n. U'shinshi mu'yeshi usi' mu'yeshlerdin' kishisinen  $40^\circ$  qa u'lken. U'shmu'yeshliktin' u'lken mu'yeshin tabi'n'.  
A)  $105^\circ$ ;    B)  $75^\circ$ ;    D)  $80^\circ$ ;    E)  $90^\circ$ .
9. Ten' qaptalli' u'shmu'yeshliktin' perimetri 48 ge ten'. Woni'n' ta'replerinin' biri 12 ten' bolsa qalg'an ta'replerin tabi'n'.  
A) 18; 12;    B) 16; 16;    D) 18; 24;    E) 18; 18.

10. Tuvri' mu'yeshli u'shmu'eshliktin' tuvri' mu'yeshinen bissektisa ha'm biyiklik ju'rgizilgen boli'p, wolardi'n' arasi'ndag'i' mu'yesh  $24^\circ$  qa ten'. U'shmu'yeshliktin' kishi mu'yeshin tabi'n'.

A)  $21^\circ$ ; B)  $24^\circ$ ; D)  $36^\circ$ ; E)  $16^\circ$ .

11. 1-su'wrette  $\angle A = ?$

A)  $10^\circ$ ; B)  $20^\circ$ ; D)  $60^\circ$ ; E)  $100^\circ$ .

12. Uzi'nli'qlari' 3, 5, 7 ha'm 11 ge ten' kesindilerden neshe ha'r tur'li ta'repli u'shmu'yeshlik jasaw mu'mkin?

A) 2 B) 3 D) 5 E) 6.

13. 2-su'wrette  $x + y = ?$

A)  $90^\circ$ ; B)  $180^\circ$ ; D)  $270^\circ$ ;

E) ani'qlap bolmaydi'.

14. 3-su'wrette  $\angle BCA = ?$

A)  $90^\circ$ ; B)  $96^\circ$ ; D)  $144^\circ$ ; E)  $84^\circ$ .

15. 4-su'wrette  $a \parallel b$  bolsa,  $x = ?$

A)  $35^\circ$ ; B)  $45^\circ$ ; D)  $25^\circ$ ; E)  $20^\circ$ .

16. 5-su'wrette  $x = ?$

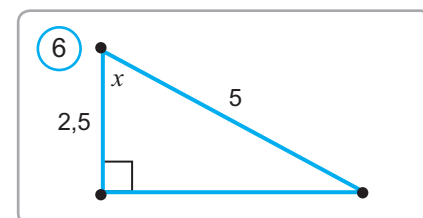
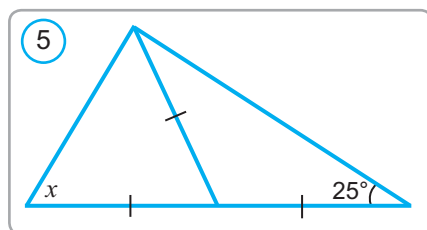
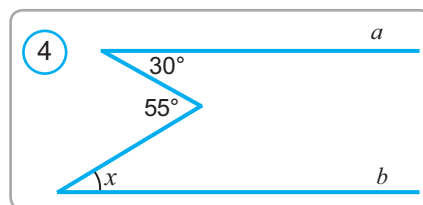
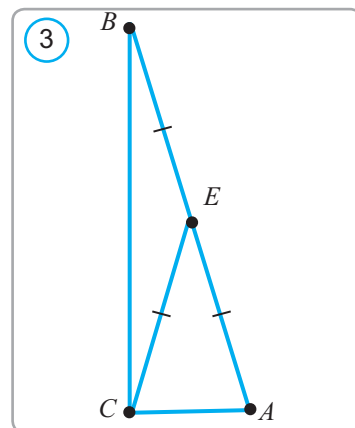
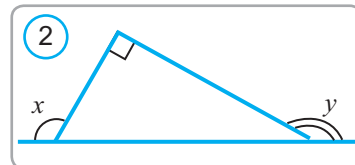
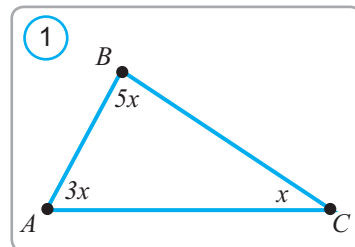
A)  $60^\circ$ ; B)  $55^\circ$ ; D)  $65^\circ$ ; E)  $70^\circ$ .

17. 6-su'wrettegi  $x$  ti tabi'n'.

A)  $30^\circ$ ; B)  $45^\circ$ ; D)  $15^\circ$ ; E)  $75^\circ$ ;

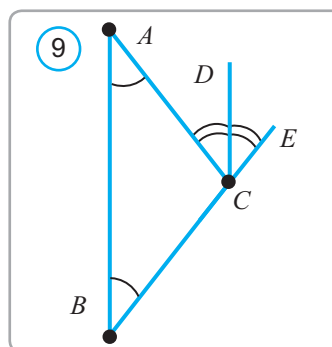
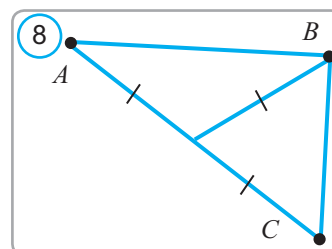
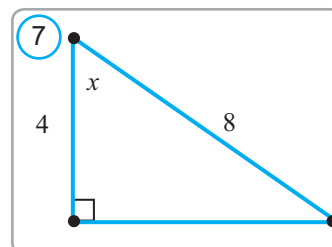
18. Uzunli'g'i' 2 sm, 3 sm, 4 sm va 5 sm bolga'n kesimelerden neshe u'shmu'yeshlik jasaqg'a boladi'?

A) 1; B) 2; D) 3; E) 4.

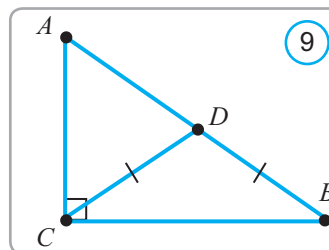


## 5. Ma'seleler

1. Buwi'nlari'ni'n' usi'nli'g'i'  $1\text{ m}$ ,  $2\text{ m}$ ,  $4\text{ m}$ ,  $8\text{ m}$  va  $16\text{ m}$  bolg'an jabi'q si'zi'q jasawg'a bolama?
2. Yeger u'shu'yesliktin' ta'replari pu'tin sanlar bolip, perimetri 15 ke ten' bolsa, oni'n' ta'replerin ani'qlan'.
3. U'shmu'yeshliktin' ta'replerinen barli'q waqi't kishi boladi'?
4. U'lken ta'repi 36g'a ten' bolg'an u'shmu'yesliktin' mu'yeshlerinin' kishi ta'replerin tabi'n'?
5. U'shmu'yesliktin' tiykarin tu'sirilgen biyiklik oni'n' qaptal ta'replari menen  $27^\circ$  ha'm  $36^\circ$  li mu'yeshlerden ibarat. U'shmu'yeshliktin' mu'yeshlerin tabi'n'.
6. Tuwri' mu'yeshli  $ABC$  ha'm  $A_1B_1C_1$  u'shmu'yesliktin'  $A$  ha'm  $A_1$  tuwri' mu'yeshli,  $BD$  ha'm  $B_1D_1$  bissektrisalari ha'm  $\angle B = \angle B_1$ ,  $BD = B_1D_1$  bolsa,  $\triangle ABC = \triangle A_1B_1C_1$  yekenligin da'lillen'.
7. 7-su'wrettegi  $x$  ti tabi'n'.
8. 8-su'wrettegi  $\angle ABC$  ti tabin'.
9. 9-su'wrettegi  $AB \parallel CD$  ekenligin dalillen'.
10. Ten' ta'repli u'shum'yeshliktin' bir mu'yeshi  $100^\circ$  ga ten'. U'shmu'yesliktin' qalg'an ta'replerin' tabi'n'.
11. Egqr ten' ta'repli u'shmu'yesliktin' mu'yeshlerinin' birewi  $60^\circ$  ga ten' bolsa bul u'shmu'yeslik ten' ta'repli bolama?
12. Tiykar  $AC$  ha'm  $B$  mu'yeshi  $36^\circ$  ga ten' bolg'an ten' ta'repli  $ABC$  u'shum'yeshliktin'  $AD$  bissektrisasi wo'tkizelgen.  $CDA$  ha'm  $ADB$  u'shmu'yesliktin' ten' ta'repli yekenligin da'lillen'.

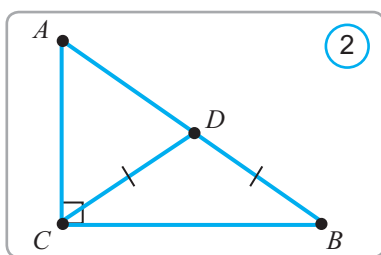
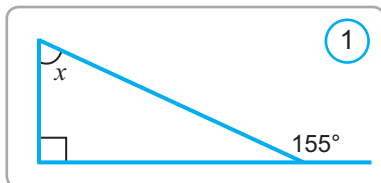


13. Bir u'shmu'yeshlik  $60^\circ$  ha'm  $38^\circ$  li mu'yeshlarga, ikkinshi u'shmu'yeshlik bolsa  $38^\circ$  ha'm  $82^\circ$  li mu'yeshlarga iye. Bul u'shmu'yeshlik ten' bo'li'wi' mu'mkinbe?
14. U'shmu'yeshliktin' perimetri ta'replerinen  $14\text{ sm}$ ,  $16\text{ sm}$  ha'm  $24\text{ sm}$  u'lken bolsa, u'shmu'yeshlik yen' u'lken ta'repin tabi'n?
15. Tuwri' mu'yeshli  $ABC$  u'shmu'yeshliktin' tuwri' mu'yeshinin' ushinan  $CD$  biyiklik tu'sirilgen. Yeger 1)  $A = 24^\circ$ ; 2)  $A = 70^\circ$  bolsa,  $CDB$  mu'yeshinin' tabi'n'.
16. Ten' ta'repli u'shmu'yeshliktin' bir si'rtqi' mu'yeshi  $70^\circ$  ga ten'. Onin' ishki mu'yeshinin' tabin'.
17.  $ABC$  u'shmu'yeshliktin'  $A$  ha'm  $C$  ushlari'nan tu'sirilgen biyiklikler  $N$  noqatta kesisedi. Yeger  $\angle A = 50^\circ$  ha'm  $\angle C = 84^\circ$  bolsa,  $ANC$  mu'yeshin tabin'?
19.  $ABC$  u'shmu'yeshliktin'  $BD$  mediana  $AC$  ta'repinin' yari'mi'na ten'. U'shmu'yeshliktin'  $B$  mu'yeshin tabi'n'.
20. 9-su'wrette  $BD = CD = 10$  bolsa,  $AB$  ni tabi'n'.



47

### 5-baqlaw jumi'si'



U'lgili baqlaw jumi'si' yeki bo'limnen ibarat:

- I. 125-bettegi testlarga uqsas 5 test;
  - II. To'mendegi ma'selelarga uqsas 3 ma'sele (4-ma'sele jaqsi' o'zlestirip ati'rg'an oqi'wshi'lar ushi'n).
1. Belgisiz mu'yeshi tabi'n' (1-su'wret).
  2. U'shmu'yeshliktin' si'rtqi' mu'yeshi  $120^\circ$  boli'p, wog'an qon'si'las bolg'an ishki mu'yeshi  $1 : 2$  qatnasta bolsa, u'shmu'yeshliktin' mu'yeshlerin tabi'n'.
  3. Yeger 2-su'wrette  $\angle ACB = 90^\circ$ ,  $CD = BD$  ha'm  $AB = 24\text{ sm}$  bolsa,  $CD$  kesindisin tabi'n'.
  4.  $ABC$  u'shmu'yeshliginin'  $BD$  bissektrisasi'  $AC$  ta'repin  $100^\circ$  mu'yesh asti'nda kesedi. Yeger  $BD = BC$  bolsa, u'shmu'yeshliktin' ta'replerin tabi'n'.

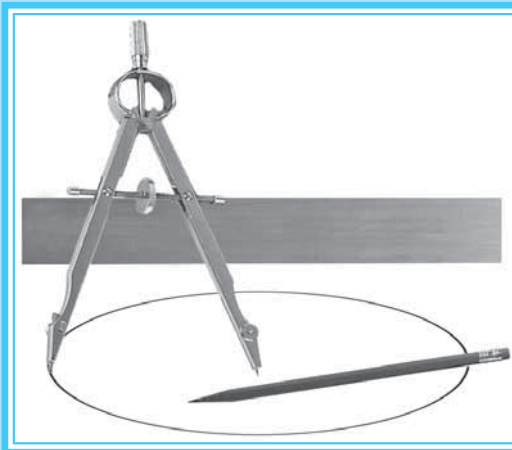


### Qa'biliyetli woqi'wshi'lar ushi'n qosi'msha tapsi'rma.

«Geometriya-7» yelektron sabaqli'g'i'ni'n' tiyisli baptag'i' betleri menen tani'si'p shi'g'i'n'. Usi' bapqa kiritilgen temalarg'a tiyisli interaktiv animatsiya qosi'mshalari'nda berilgen tapsi'rmalardi' wori'nlap ha'm test tapsi'rmalari'n sheship, wo'z bilimin'izdi si'nap ko'rin'.



## V BAP



### SIZILMA SIZIWG'A BAYLANISLI MA'SELELER

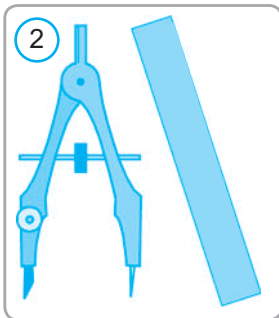
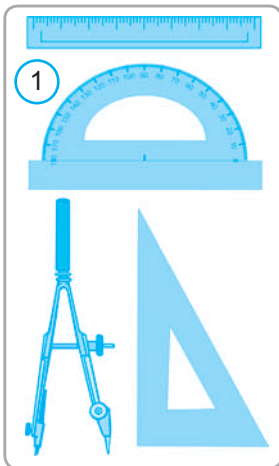
**Bul bapti' u'yrenip shi'qqannan keyin to'mendegi bilim ha'm ko'nlikpelerga iye bolami'z:**

**Bilimler:**

- shen'ber, shen'berdin' worayi', radiusi' ha'm diametrinin' ta'riyplemelerin biliw;
- cirkul ha'm a'piwayi' si'zg'i'sh ja'rdeminde qanday ma'seleler sheshiw mu'mkinligin biliw.

**Ko'nlikpeler:**

- Si'zg'i'sh ha'm cirkul ja'rdeminde jasaw islerin a'melge asi'ri'w;
- Berilgen mu'yeshke ten' bolg'an mu'yeshti jasay ali'w;
- Mu'yeshdin' bissektisasi'n jasay ali'w;
- Perpendikulyar tuwri'lardi' jasay ali'w;
- Kesindini ten' yekige bo'liw;
- Berilgen yelementleri boyi'nsha u'shmu'yeshliklerdi jasay ali'w.



Si'zi'lmani' si'zi'wg'a tiyisli ma'selelerdi tek a'piwayi' si'zg'i'sh ha'm cirkul ja'rdeminde sheshiw A'yyengi Gretsiyada o'ner da'rejesine jetken. A'llette wo'mirde geometriyalı'q figuralardi' jasaw, qa'legen a'sbap penen wori'nlawg'a boladi' ha'm qolayli'. Biraq a'piwayi' si'zg'i'sh ja'rdeminde ma'sele sheshiw logikalı'q ko'z qarasta qa'biliyetin arttı'radi'.

Usi' waqi'tqa shekem a'sbablar ja'rdeminde ha'r qi'yli' geometriyalı'q figuralardi' jasap keldik. Ma'selen, si'zg'i'shlar ja'rdeminde, tuwri', nur, kesindi, u'shmu'yeshlik ha'm basqa da figuralardi' si'zdi'q. Si'zg'i'sh ha'm transportir ja'rdeminde tu'rli u'shmu'yeshliklerdi si'zdi'q. Cirkul ja'rdeminde bolsa, shen'ber ha'm dog'alardi' ko'rsettik (1-su'wret).

Belgili bolg'ani'nday, ko'plep geometriyalı'q figuralardi' tek masshtabli' bo'linbelerge iye bolmag'an, bir ta'repi tuwri' si'zg'i'sh ha'm cirkul (2-su'wret) ja'rdeminde jasaw mu'mkin yeken. (Bunday si'zg'i'shti' a'piwayi' si'zg'i'sh dep ataymi'z.)

Sonli'qtan, geometriyada usi' yeki a'sbap ja'rdeminde jasawg'a tiyisli ma'seleler arawli' aji'rati'li'p qaraladi'.

Bul yeki a'sbaptan paydalani'wdi'n' arawli' qag'i'ydalari' bar – wolar arqali' tek to'mendegilerdi wori'nlawg'a ruxsat etiledi:

#### A'piwayi' si'zg'i'sh ja'rdeminde tek:

1. Qa'legen tuwri'ni' si'zi'w;
2. Berilgen noqattan wo'tiwshi tuwri'ni' si'zi'w;
3. Yeki noqattan wo'tiwshi tuwri'ni' si'zi'w.

#### Cirkul ja'rdeminde tek:

1. Qa'legen shen'berdi si'zi'w;
2. Worayi' berilgen noqatta bolg'an qa'legen radiusqa iye shen'berdi si'zi'w;
3. Belgili radiusli', worayi' bolsa yerkli bolg'an shen'berdi si'zi'w;
4. Worayi' berilgen noqatta, radiusi' berilgen kesindiden ibarat bolg'an shen'berdi si'zi'w;
5. Berilgen kesindige ten' bolg'an kesindini berilgen tuwri'g'a, woni'n' berilgen noqati'nan baslap ha'r yeki bag'darda qoyi'w.

Basqa ha'r qanday jasaw mine usi' a'mellerge keltiriliwi kerek. Ha'tteki si'zg'i'shta millimetrli bo'linbeler bolsada kesindilerdin' uzi'nli'qlari'n wo'lshe'w ha'm belgili uzi'nli'qtag'i' kesindini qaysi' bir tuwri'g'a qoyi'wg'a ruxsat berilmeydi.

Jasawg'a tiyisli ma'selelerde tek g'ana qaysi' bir geometriyalı'q figurani' jasaw joli'n, usi'li'n tabi'w talap yetilmeydi, ba'lkı payda bolg'an geometriyalı'q figurani' haqi'yqattanda



**1-ma'sele.**  $AB$  ha'm  $CD$  kesindileri ha'm  $OE$  nuri berilgen (2.a-su'wret). A'piwayi si'zi'g'i'sh ha'm cirkul ja'rdeminde  $OE$  nuri'nda uzi'nli'g'i'  $AB + CD$  g'a ten' kesindini qoyin'.

**Jasaw:**

**1-qa'dem.** Cirkul ja'rdeminde  $AB$  kesindige ten'  $A_1B_1$  kesindini  $OE$  nurg'a qoyamiz (2.b-su'wret).

**2-qa'dem.** Cirkul ja'rdeminde  $CD$  kesindige ten'  $C_1D_1$  kesindinu  $B_1E$  nurg'a qoyamiz (2.c-su'wret).

Payda bolg'an  $A_1D_1$  kesindi – uzi'nli'g'i'  $AB + CD$  g'a ten' bolg'an kesindiden ibarat boladi.

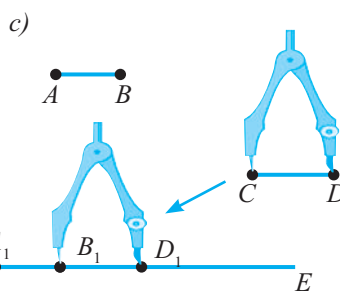
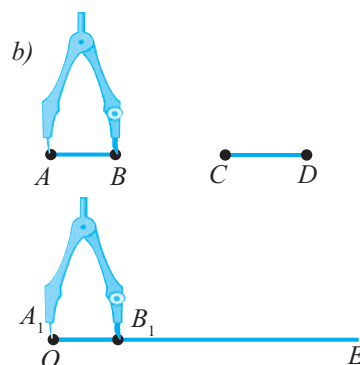
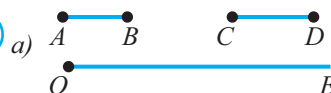


**2-ma'sele.**  $AB$  ha'm  $CD$  kesindi ha'm  $OE$  nuri berilgen (3.a-su'wret). Yeger  $AB > CD$  yekenligi ma'lum belqili bolsa, a'piwayi si'zi'g'i'sh ha'm cirkul ja'rdeminde  $OE$  nuri'na uzi'nlig'i'  $AB - CD$  g'a ten' kesindini qoyin'.

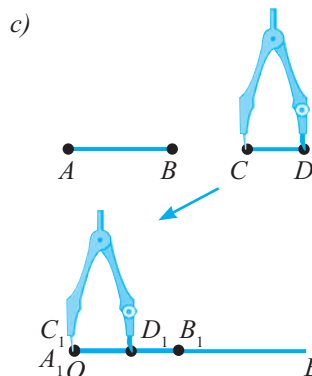
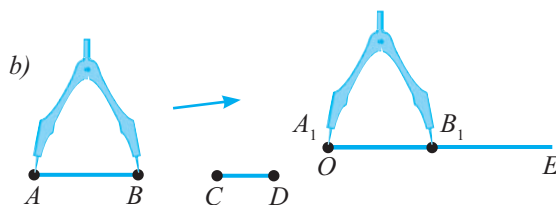
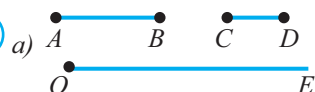
**Jasaw:**

$OE$  nurg'a woldi'n  $AB$  kesindige ten'  $A_1B_1$  kesindini (3.b-su'wret), son'  $CD$  kesindige ten'  $C_1D_1$  kesindini qoyamiz (3.d-su'wret). Payda bolg'an  $D_1B_1$  kesimdi – uzunli'g'i'  $AB - CD$  g'a ten' bolga'n kesindiden ibarat boladi.

2



3





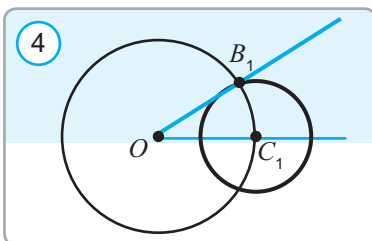
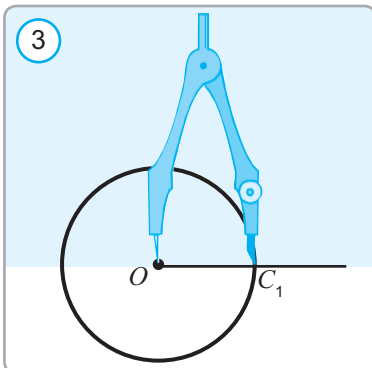
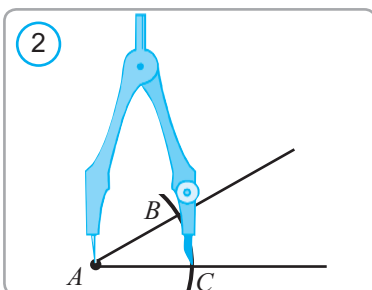
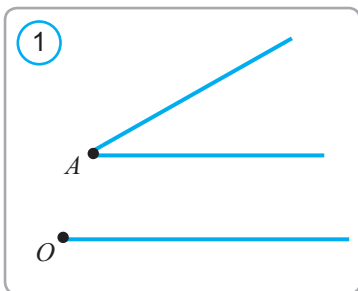
### Soraw, ma'sele ha'm tapsi'rmalar

1. A'piwayi' si'zg'i'sh ja'rdeminde qanday figuralardi' si'zi'w mu'mkin?
2. Cirkul ja'rdeminde jasawg'a tiyisli qanday islerdi a'melge asi'ri'w mu'mkin?
3. Tuwri'da  $A$  ha'm  $B$  noqatlari' berilgen.  $BA$  nuri'na  $B$  noqati'nan baslap  $BC$  kesindisin sonday yetip qoyi'n', na'tiyjede,  $BC = 2AB$  bolsi'n.
4. Yeger shen'ber si'rti'ndag'i' noqattan shen'berdin' yen' jaqi'n ha'm uzaq noqatlari'na shekem bolg'an araliqlar sa'ykes tu'rde 2 sm ha'm 10 sm bolsa, shen'berdin' radiusi'n tabi'n'.
5.  $A$  ha'm  $B$  noqatlari' berilgen. Tek cirkuldan paydalani'p sonday  $C$  noqati'n jasan', na'tiyjede  $AC = 3AB$  bolsi'n.
6.  $a$  ha'm  $b$  uzi'nli'qtag'i' kesindiler berilgen. a)  $a + b$ ; b)  $a - b$ ; c)  $2a + 3b$ ; d)  $2a - b$  uzi'nli'qtag'i' kesindilerdi jasan'.
7. Uzi'nli'g'i' 12 sm ha'm 5 sm bolg'an kesindileri berilgen. Uzi'nli'g'i': a) 17 sm; b) 7 sm; c) 12 sm; d) 22 sm; e) 29 sm bolg'an kesindilerdi jasan'.



### Geometriyalı'q basqati'rma

Sardar shen'ber si'zi'p bolg'annan keyin, woni'n' orayi'n qa'lem menen belgilewdi umi'tqani'n bilip qaldi'. Qi'rsi'g'i'na kelip, izi de qalmapti'. Biraq shen'berdin radiusi' 12 sm yekenligi woni'n' yadi'nda edi. Bul mag'li'wmattan paydalani'p, tek cirkul ja'rdeminde si'zi'lg'an shen'berdin' orayi'n tabi'wg'a bola ma?



**1-ma'sele.**  $A$  mu'yeshi berilgen.  $O$  nuri'na (1-su'wret)  $A$  mu'yeshine ten' bolg'an mu'yesh qoyi'n'.

**Jasaw:**

**1-qa'dem.** Worayi'  $A$  noqati'nda bolg'an qa'legen shen'berdi si'zami'z (2-su'wret). Bul shen'ber, berilgen  $A$  mu'yeshinin' ta'repin  $B$  ha'm  $C$  noqatlari'nda kesip wo'tsin.

**2-qa'dem.** Radiusi' si'zi'lg'an shen'berdin' radiusi'na ten' ha'm worayi'  $O$  noqati'nda bolg'an shen'ber si'zami'z (3-su'wret). Bul shen'berdin'  $O$  nuri' menen kesilisiw noqati'n  $C_1$  menen belgileymiz.

**3-qa'dem.** Worayi'  $C_1$  noqati'nda, radiusi' bolsa  $BC$  g'a ten' bolg'an u'shinshi shen'berdi si'zami'z (4-su'wret). Woni'n' yekinshi shen'ber menen kesilisiw noqati'nan birewin, aytayi'q joqari' yari'mtegislikte jatqani'n  $B_1$  menen belgileymiz.

**4-qa'dem.**  $OB_1$  nuri'n ju'rgizemiz (4-su'wret). Payda bolg'an  $B_1OC_1$  mu'yeshi  $O$  nurg'a qoyi'lg'an, berilgen  $A$  mu'yeshke ten' mu'yesh boladi'.

**Tiykarlaw:** 2-ha'm 4-su'wrette su'wretlengen  $ABC$  ha'm  $OB_1C_1$  u'shmu'yeshliklerde jasawg'a ko're:  $AB = OB_1$ ,  $AC = OC_1$  ha'm  $BC = B_1C_1$ .

Demek, u'shmu'yeshliklerdin' ten'liginin' TTT belgisi boyi'nsha  $\triangle ABC = \triangle OB_1C_1$ . Tiykari'nan,  $\angle B_1OC_1 = \angle A$ .

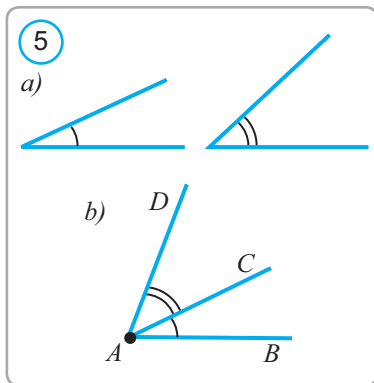
**Esletpe:** Bul ma'sele yeki sheshimge iye boli'p, sheshimler 3-qa'demde  $O$  nuri' jatqan tuwri' aji'ratqan qaysi' yari'm tegisliktin' ali'ni'wi'na baylani'sli' boladi'.



**2-ma'sele.** Berilgen yeki mu'yeshdin' qosi'ndi'si'na ten' bolg'an u'shmu'yeshlikti jasan' (5. a-su'wret).

**Jasaw:** 1-qa'dem. Da'slep birinshi mu'yeshke ten' bolg'an  $BAC$  mu'yeshi jasaymi'z (5. b-su'wret).

2-qa'dem.  $AC$  nuri'na yekinshi mu'yeshke ten' bolg'an  $CAD$  mu'yeshin qoyami'z. Payda bolg'an  $BAD$  mu'yesh berilgen mu'yeshlerdin' qosi'ndi'si'na ten' mu'yesh boladi'.



### Soraw, ma'sele ha'm tapsi'rmalar

1. a)  $30^\circ$ ; b)  $60^\circ$ ; c)  $15^\circ$ ; d)  $120^\circ$ ; e)  $45^\circ$  li' mu'yeshler berilgen. A'piwayi' si'zg'i'sh ha'm cirkuldan paydalani'p, wolarg'a ten' mu'yeshti jasan'.
2.  $\angle A = \alpha$  ha'm  $\angle B = \beta$  mu'yeshleri berilgen ( $\alpha > \beta$ ). Wo'lishemi: a)  $2\alpha$ ; b)  $\alpha - \beta$ ; c)  $2\alpha + \beta$  bolg'an mu'yeshlerdi jasan'.
3.  $45^\circ$  ha'm  $30^\circ$  mu'yeshler berilgen. Wo'lishemi a)  $15^\circ$ ; b)  $75^\circ$ ; c)  $105^\circ$ ; d)  $120^\circ$  bolg'an mu'yeshlerdi jasan'.

50

### Mu'yeshtin' bissektisasi'n jasaw

1-su'wrette su'wretlengen  $A$  mu'yeshi' berilgen bolsi'n. Bul mu'yeshti ten' yekige bo'liw ushi'n to'mendegishe jol tuti'ladi':

**Jasaw:**

**1-qa'dem.** Worayi'  $A$  noqati'nda bolg'an qa'-legen radiusli' shen'ber si'zi'ladi' ha'm woni'n' mu'yesh ta'replari menen kesilisiw noqatlari'  $B$  ha'm  $C$  belgilenedi.

**2-qa'dem.** Radiusi'n wo'zgartpesten, woraylari'  $B$  ha'm  $C$  noqatlari'nda bolg'an yeki shen'ber si'zi'ladi' (2-su'wret). Bul yeki shen'berdin' kesilisiwinen payda bolg'an  $D$  noqati' belgilenedi (3-su'wret).

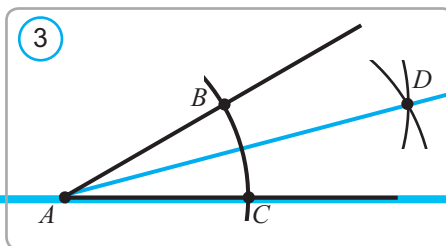
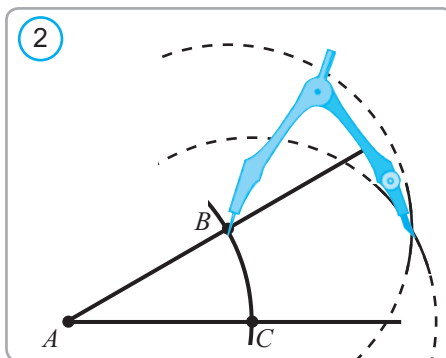
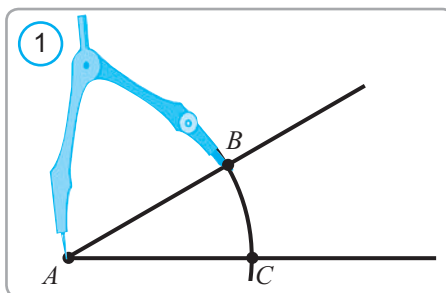
**3-qa'dem.**  $A$  ha'm  $D$  noqati'nan wo'tiwshi  $AD$  nuri' ju'rgiziledi (4-su'wret).

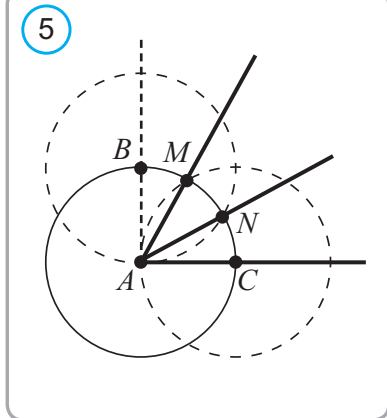
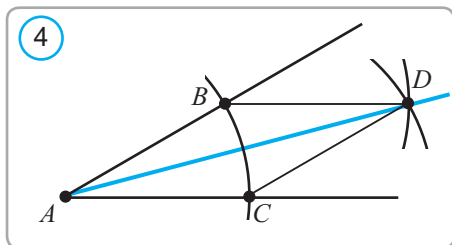
$AD$  nur – berilgen mu'yesh bissektisasi' boladi'.

**Tiykarlaw.**  $ABD$  ha'm  $ACD$  u'shmu'yeshliklerinde

- 1) jasawg'a qaray  $AB = AC$ ;
- 2) jasawg'a qaray  $BD = CD$ ;
- 3)  $AD$  — uli'wma ta'rep.

U'shmu'yeshliklerdin' ten'liginin' TTT belgisi boyi'nsha,  $\triangle ABD = \triangle ACD$ . Tiykari'nan,  $\angle BAD = \angle CAD$ .





**Ma'sele.** Berilgen tuwri' mu'yeshti ten' u'shke bo'lin'.

**Sheshiliwi:**  $\angle A$  tuwri' mu'yeshi berilgen bolsi'n. Woni'n' to'besin woray yetip, qa'legen radiusli' shen'ber si'zami'z. Shen'ber tuwri' mu'yesh ta'replerin  $B$  ha'm  $C$  noqatlari'nda kesip wo'tsin. Radiusi'n wo'zgeripesten worayi'  $B$  ha'm  $C$  noqatlari'nda bolg'an ja'ne yeki shen'ber si'zami'z. Bul shen'berler birinshi shen'ber menen kesiliskin noqatlari'nan tuwri' mu'yesh ishinde jatqanlari'n  $M$  ha'm  $N$  menen belgileyemiz.  $AM$  ha'm  $AN$  nurlari'n si'zami'z. Bul nurlar berilgen tuwri' mu'yeshti u'sh ten' mu'yeshke aji'ratadi'. Bul tasti'yi'qlawdi'n' duri'sli'g'i'n wo'z betinshe tiykarlan'.

**Yeletp.** Berilgen qa'legen mu'yeshti u'shke bo'liw ma'sele si'z ju'da' a'yyemgi ha'm belgili ma'sele boli'p, bul haqqi'nda ko'p ali'mlar bas qati'rg'an. Tek XIX a'sirge kelip, ayi'ri'm mu'yeshler ali'p taslanip, a'dette mu'yeshti ten' u'shke bo'lip bolmasli'g'i' da'lillengen. Ma'selen,  $60^\circ$  li' mu'yeshti ten' u'shke bo'liwge bolmaydi'. Ga'p, a'l'bette, a'piwayi' si'zg'i'sh ha'm cirkul ani'q jasaw haqqi'nda barmaqta. Bul a'sbaplar menen ju'da' u'lken ani'qli'qta shamalap jasaw yamasa basqa a'sbaplardan paydalani'p ani'q jasaw wori'nlani'wi' mu'mkin.



### Soraw, ma'sele ha'm tapsi'rmalar

1. A'piwayi' si'zg'i'sh ha'm cirkul ja'rdeminde: a)  $90^\circ$ ; b)  $60^\circ$ ; c)  $30^\circ$  ha'm mu'yeshlerdi ten' yekige bo'lin'.
2. Mu'yesh si'zi'n' ha'm woni' to'rt ten'dey mu'yeshke aji'rati'n'.
3.  $45^\circ$  li' mu'yeshti u'sh ten'dey bo'lekke bo'lin'.
4. Berilgen gipotenuzasi' ha'm su'yir mu'yeshi boyi'nsha tuwri' mu'yeshli u'shmu'yeshlik jasan'.
5.  $36^\circ$  li' mu'yesh berilgen. Cirkul ha'm a'piwayi' si'zg'i'sh ja'rdeminde  $99^\circ$  li' mu'yesh jasan'.
- 6\*.  $54^\circ$  li' mu'yesh berilgen. Cirkul ha'm si'zg'i'sh ja'rdeminde bul mu'yeshti ten' ushke bo'lin'.



**1-ma'sele.** Berilgen  $a$  tuwri'g'a woni'n'  $O$  noqati'nan wo'tiwshi perpendikulyar tuwri'ni' jasan'.

**Jasaw:**

**1-qa'dem.**  $O$  noqati'n woray yetip alg'an qa'legen shen'ber si'zami'z. Wol berilgen tuwri'ni'  $A$  ha'm  $B$  noqatlari'nda kesip wo'tsin (1-su'wret).

**2-qa'dem.**  $A$  ha'm  $B$  noqatlari'n woray yetip, radiusi'  $AB$  g'a ten' bolg'an shen'berler si'zami'z (2-su'wret). Bul shen'berlerdin' kesilisiw noqatlari'ni'n' birin  $C$  dep belgileymiz.

**3-qa'dem.**  $C$  ha'm  $O$  noqatlari'nan wo'tiwshi  $OC$  tuwri'ni' jasaymi'z (3-su'wret).

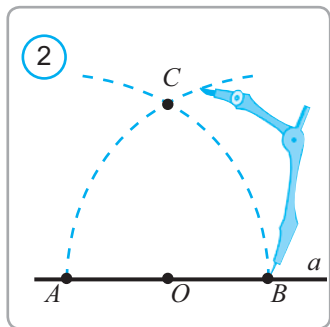
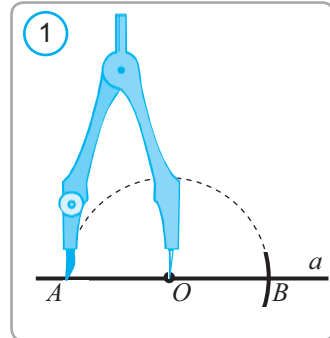
$OC$  tuwri'si' berilgen  $a$  tuwri'g'a woni'n'  $O$  noqati'nan wo'tiwshi perpendikulyar boladi'.

**Tiykarlaw.**  $AOC$  ha'm  $BOC$  u'shmu'yeshliklerin qaraymi'z. Wolarda, jasawg'a qaray:

1.  $AO = BO$ ;
2.  $AC = BC$ ;
3.  $CO$  bolsa uli'wmali'q ta'repi.

Demek, u'shmu'yeshliklerdin' ten'liginin' TTT belgisi boyi'nsha,  $\triangle AOC = \triangle BOC$ . Bul jag'dayda,  $\angle AOC = \angle BOC$ . Biraq  $\angle AOC + \angle BOC = 180^\circ$ . Bunnan  $\angle AOC = \angle BOC = 90^\circ$  yekenligi kelip shi'g'adi'.

Demek, haqi'yqati'nda da  $OC \perp a$ .

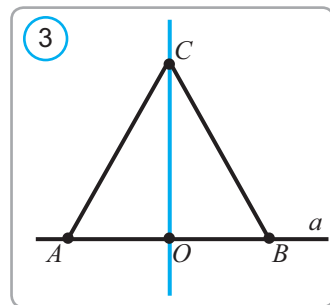


**2-ma'sele.** Berilgen  $a$  tuwri'si'na wonda jatpaytug'i'n  $O$  noqati'nan wo'tiwshi perpendikulyar tuwri'ni' jasan'.

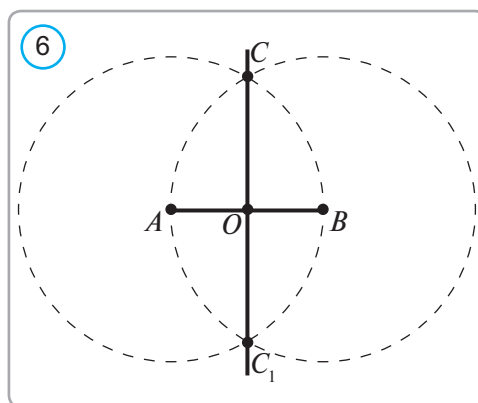
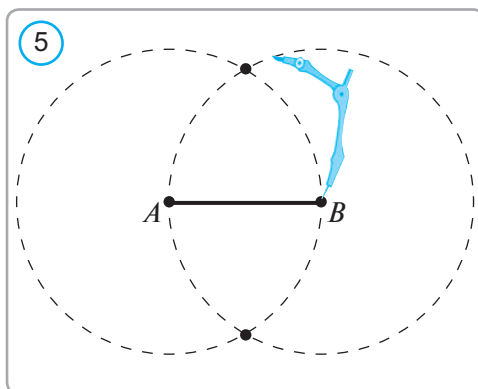
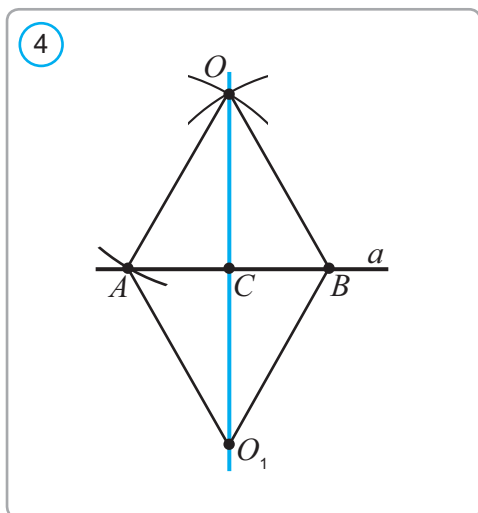
**Jasaw:**

**1-qa'dem.** Worayi'  $O$  noqati'nda bolg'an qa'legen shen'ber si'zami'z. Wol berilgen tuwri'ni'  $A$  ha'm  $B$  noqatlarda kesip wo'tsin (4-su'wret).

**2-qa'dem.** Woraylari'  $A$  ha'm  $B$  noqati'nda bolg'an,







radiusi' birinshi si'z'lg'an shen'ber radiusi'na ten' shen'berlerdi si'zami'z. Bul shen'berlerdin' kesilisiw noqatlari'nan biri  $O$  noqat boladi'. Ekinshisin  $O_1$  menen belgileymiz (4-su'wret).

**3-qa'dem.**  $O$  ha'm  $O_1$  noqatlari'nan wo'tiwshi tuwri' si'zami'z.  $OO_1$  — berilgen  $a$  tuwri'si'na perpendikulyar ha'm wonda jatpaytug'i'n  $O$  noqati'nan wo'tiwshi tuwri' boladi'.

Tiykarlawdi' wo'z betinshe wori'nlan'.

Bul ma'seleni sheship,  $a$  tuwri'si'ni'n si'rti'nda jatqan noqat arqali'  $a$  tuwri'si'na perpendikulyar tuwri' ju'rgiziw mu'mkin degen juwmaqqa kelemiz. Bunnan ha'm 14-sabaqta keltirilgen teorema na'tiyjesinen to'mendegi teoremani'n' wori'nli' yekenligi kelip shi'g'adi'.



**Teorema.** Tuwri'da jatpaytug'i'n noqati' arqali' bul tuwri'g'a perpendikulyar bolg'an jalg'i'z tuwri' ju'rgiziw mu'mkin.



**3-ma'sele.** Berilgen kesindini ten' yekige bo'liw.

**Jasaw:**

Aytayi'q,  $AB$  kesindisi berilgen bolsi'n. Bul kesindini ten' yekige bo'liwshi noqatti' tabi'w ushi'n to'mendegishe jol tuti'ladi':

**1-qa'dem.** Radiusi' berilgen  $AB$  kesindisine ten' bolg'an, woraylari' bolsa  $A$  ha'm  $B$  noqatlari'nda bolg'an shen'ber si'zi'ladi' (5-su'wret);

**2-qa'dem.** Shen'berlerdin' kesilisken  $C$  ha'm  $C_1$  noqatlari' tutasti'ri'ladi' (6-su'wret).

$CC_1$  tuwri'si' ha'm  $AB$  kesindisinin' kesilisiw noqati' berilgen kesindinin' wortasi' boladi'.

**Shi'ni'g'i'w.** Kesilisiw noqati'  $O$  haqiyqattan da  $AB$  kesindisinin' wortasi' bolatug'i'ni'n tiykarlan'.

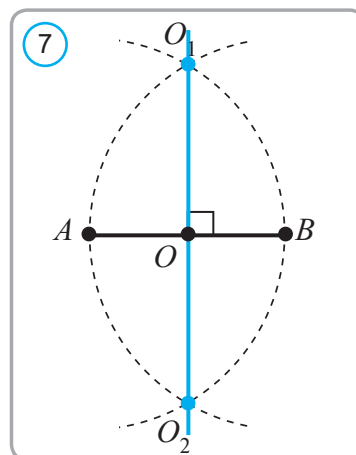


**4-ma'sele.** Berilgen kesindinin' wortasi'nan wo'tiwshi perpendikulyar jasan'.

**Sheshiliwi:**  $AB$  kesindisi berilgen bolsi'n. Woraylari'  $A$  ha'm  $B$  noqatlari'nda bolg'an  $AB$  radiusli' shen'berler si'zami'z (7-su'wret). Bul shen'berler  $O_1$  ha'm  $O_2$  noqatlari'nda kesilisedi:

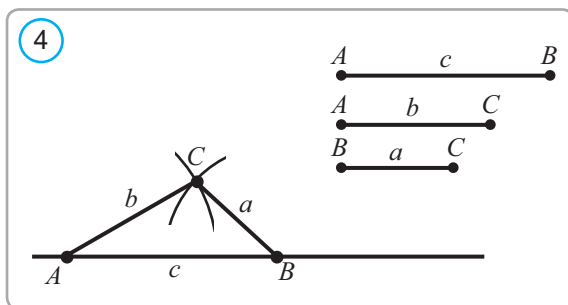
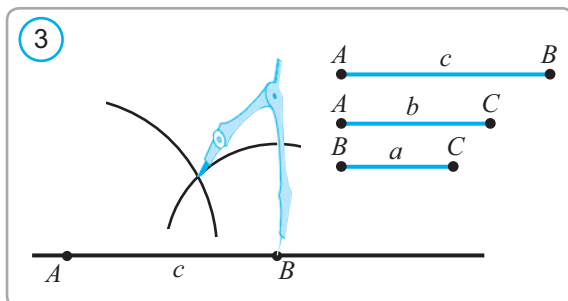
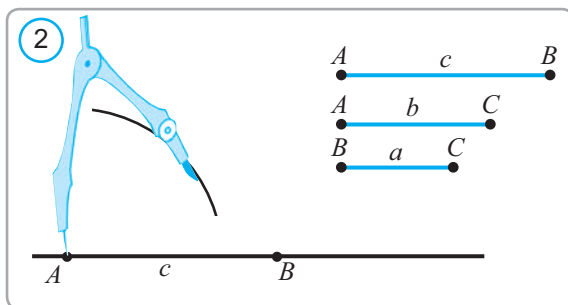
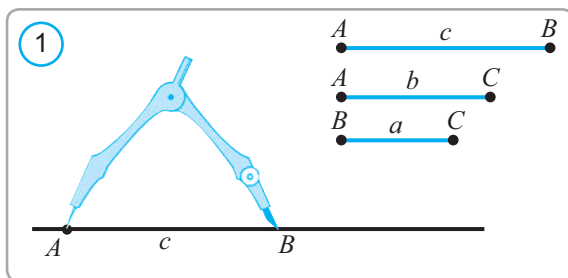
$$AO_1 = AO_2 = BO_1 = BO_2.$$

$O_1O_2$  tuwri'si'n ju'rgizemiz. Bul tuwri'  $AB$  kesindisinin' orta perpendikulyari' boladi'. Sebebi  $O_1$  ha'm  $O_2$  noqatlari'  $AB$  kesindisinin' ushlari'nan ten'dey qashi'qlasqani' ushi'n usi' kesindinin' wortasi'nan wo'tiwshi perpendikulyarda jatadi'.



**Soraw, ma'sele ha'm tapsi'rmalar**

1. Kesindini ten' yekige bo'liwdin' qanday usi'li'n bilesiz? Kesindini si'zi'n' ha'm woni' ten' yekige bo'lin'.
2. Tuwri' mu'yeshiti qalay jasaw mu'mkin?
3. Tek bir yari'mtegislikte jasaw islerin wri'nlap berilgen kesindini ten' yekige bo'lin'.
4. Tek u'shmu'yeshli si'zg'i'shtan paydalani'p berilgen kesindini ten' yekige bo'lin'.
5. Berilgen gipotenuza boyi'nsha ten' qaptalli' tuwri' mu'yeshli u'shmu'yeshlik jasan'.
6. Ultani' ten' qaptalli' ha'm wog'an tu'sirilgen biyikligi boyi'nsha ten' qaptalli' u'shmu'yeshlik jasan'.
7.  $AB$  kesindisinin' wortasi'n tuwri'dan-tuwri' ani'qlawdi'n' ila'ji bolmasa, woni'n' wortasi'nan wo'tiwshi perpendikulyardi' jasaw mu'mkin be?
8. Berilgen kesindini to'rt ten'dey bo'lekke bo'lin'.
9. U'shmu'yeshlik si'zi'n'. Woni'n' biyikliklerin jasan'.
10. Berilgen u'shmu'yeshliktin' medianalari'n jasan'.
- 11\*.  $A$  ha'm  $B$  noqatlari'nan birdey uzaqlasqan ha'mde  $a$  tuwri'da jati'wshi' noqatti' tabi'n'.
12. Tek si'zg'i'sh ja'rdeminde  $a$  tuwri'si'nda jatpaytug'i'n  $M$  noqati' arqali'  $a$  tuwri'si'na paral-lel bolg'an  $b$  tuwri'si'n ju'rgizin'.



Aytayiq, 1-su'wrette su'wretlendey, uzi'nliqlari' sa'ykes tu'rde  $a$ ,  $b$  ha'm  $c$  g'a ten' bolg'an kesindiler berilgen boli'p,  $c$  yen' u'lkeni bolsi'n. Ta'repleri sa'ykes tu'rde  $AB = c$ ,  $BC = a$  ha'm  $AC = b$  bolg'an  $ABC$  u'shmu'yeshligin jasaw ushi'n to'mendegishe jol tutiladi':

**1-qa'dem.** Qa'legen tuwri' si'zi'ladi'. Tuwri'da uzi'nli'gi'  $c$  g'a ten' bolg'an  $AB$  kesindisi cirkul ja'rdeminde aji'rati'ladi'.

**2-qa'dem.**  $AC = b$  boli'wi' kerek. Soni'n' ushi'n, worayi'  $A$  noqatta radiusi'  $b$  g'a ten' bolg'an shen'ber si'zi'ladi';

**3-qa'dem.**  $BC = a$  boli'wi' kerek. Soni'n' ushi'n, worayi'  $B$  noqatta radiusi'  $a$  ga' ten' bolg'an shen'ber si'zi'ladi';

**4-qa'dem.** Shen'berlerdin' kesilsiw noqati' —  $C$  noqati'  $A$  ha'm  $B$  noqatlari' menen tutastiri'ladi'. Payda bolg'an  $ABC$  u'shmu'yeshliginin' ta'repleri  $a$ ,  $b$  ha'm  $c$  g'a ten' boladi'.

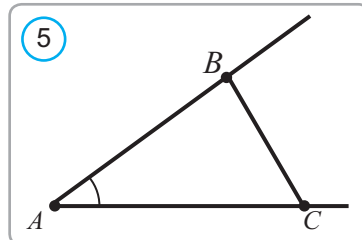
**Analiz.** Jasawdan ko'rinip turg'ani'nday, Yeger 2- ha'm 3-qa'demde jasalg'an shen'berler kesilisse g'ana sheshimi bar boladi'. Buni'n' ushi'n  $a + b > c$  boli'wi' kerek.

Payda bolg'an  $ABC$  u'shmu'yeshliktin' haqi'yqattan da ta'repleri  $a$ ,  $b$  ha'm  $c$  g'a ten' boli'wi'n wo'z betinshe tiykarlan'.



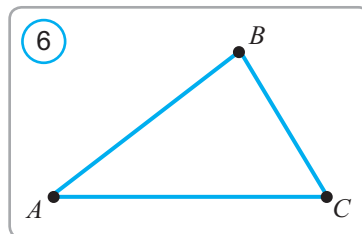
**1-ma'sele.** Berilgen mu'yeshke ten' bolg'an mu'yeshti jasan' (5-su'wret).

**Sheshiliwi:** Bul ma'seleni, berilgen u'shmu'yeshlikke ten' bolg'an u'shmu'yeshlikni jasan' arqali' sheshiwge boladi'. Buni'n' ushi'n berilgen mu'yeshtin' to'besin  $A$  menen belgileymiz, mu'yesh ta'replerinde de qal'egen  $B$  ha'm  $C$  noqatlardi' belgileymiz. Son'i'nan  $ABC$  u'shmu'yeshligine ten' bolg'an u'shmu'yeshlik jasan'  $A$  mu'yeshke ten' bolg'an mu'yeshti de jasan' bolami'z.



### Soraw, ma'sele ha'm tapsi'rmlar

1. Qal'egen uzi'nli'qtag'i' kesindilerden u'shmu'yeshlik jasan'g'a bola ma?
2. Ta'repleri  $a = 3 \text{ sm}$ ,  $b = 8 \text{ sm}$  ha'm  $c = 9 \text{ sm}$  bolg'an u'shmu'yeshlik jasan'.
3. a) Ta'repleri  $a = 3 \text{ sm}$ ,  $b = 4 \text{ sm}$  ha'm  $c = 7 \text{ sm}$  bolg'an u'shmu'yeshlik jasan' mu'mkin be?  
b) U'shmu'yeshlik jasan' ushi'n, woni'n'  $a$ ,  $b$  ha'm  $c$  ta'repleri qanday sha'rtti qanaatlandi'ri'wi' kerek?
4. Yeki kateti boyi'nsha tuwri' mu'yeshli u'shmu'yeshlik jasan'.
5. Gipotenuza ha'm kateti boyi'nsha tuwri' mu'yeshli u'shmu'yeshlik jasan'.
6.  $a$  tuwri'si' berilgen. Bir ta'repi  $a$  da jatatug'i'n, 6-su'wrette ko'rsetilgen  $ABC$  u'shmu'yeshlikke ten' bolg'an u'shmu'yeshlik jasan'.
- 7\*. Uzi'nli'g'i'  $a + b$ ,  $b + c$  ha'm  $a + c$  kesindileri berilgen. Ta'repleri  $a$ ,  $b$ ,  $c$  bolg'an u'shmu'yeshlik jasan'.
8. Yeki ta'repi ha'm wolardi'n' arasi'ndag'i' mu'yeshi boyi'nsha u'shmu'yeshlik jasan'.
9. Berilgen ta'repi boyi'nsha kvadrat jasan'.
10. Bir ta'repi ha'm wog'an irgeles jatqan mu'yeshleri boyi'nsha u'shmu'yeshlik jasan'.



### Qa'biliyetli oqi'wshi'lar ushi'n qosi'msha tapsi'rma.

1. «Geometriya-7» yelektron sabaqli'g'i'ni'n' tiyisli baptag'i' betleri menen tani'si'p shi'g'i'n'. Usi' bapqa kiritilgen temalarg'a tiyisli bapti' interaktiv animatsiya qosi'mshalari'nda berilgen tapsi'rmlardi' wori'nlap ha'm test tapsi'rmlari'n sheship wo'z bilimin'izdi si'nap ko'rin'.
2. Sonday-aq, 10-bette ketirilgen internet resurslari'nan usi' bapqa tiyisli materiallard'i tabi'n' ha'm u'yrenip shi'g'i'n'.

## 1. Testler.

- Kesindilardin' uzi'nli'qlari'  $a$ ,  $b$  ha'm  $c$  lardi'n' keltirilgen qaysi' ma'nislerinde kesindilerden u'shmu'yeshlik jasaw mu'mkin yemes?  
A)  $a=1, b=2, c=3$ ; B)  $a=2, b=3, c=4$ ; D)  $a=3, b=4, c=5$ ; E)  $a=6, b=4, c=3$ .
- Geometriyalı'q jasawlardı' wori'nlaw ushi'n qaysi' woqi'w qurallari'nan paydalani'wg'a ruxsat beriledi?  
A) Transportir; B) Transportir, si'zg'i'sh;  
D) Cirkul, si'zg'i'sh; E) Cirkul, transportir.
- Geometriyalı'q jasawlardı' ori'nlawda si'zg'i'shtan qanday wazi'ypalardı' wori'nlawg'a ruxsat beriledi. A) Kesindini wo'lshe'wge; B) Kesindi, tuwri' si'zi'wg'a;  
D) Noqattan wo'tiwshi ha'm berilgen tuwri'g'a perpendikulyar tuwri'ni' shamalap si'zi'wg'a; E) Kesindini wo'lshe'p, woni'n' wortasi'n tabi'wg'a.

## 2. Ma'seleler.

- Qanday da bir mu'yesh jasan'. Usi' mu'yeshke ten' basqa mu'yesh jasan'.
- Qanday da bir mu'yesh jasan'. Woni'n' bissektrisasi'n jasan'.
- Tuwri' si'zi'n' ha'm wonda jatpaytug'i'n noqatti' belgilen'. Usi' noqattan wo'tiwshi ha'm usi' tuwri'g'a perpendikulyar bolg'an tuwri'ni' jasan'.
- Tuwri' si'zi'n' ha'm wonda jatpaytug'i'n noqatti' belgilen'. Usi' noqattan wo'tiwshi ha'm usi' tuwri'g'a parallel bolg'an tuwri'ni' jasan'.
- Qanday da bir tuwri' si'zi'n' ha'm woni' ten' yekige bo'lin'.
- U'sh kesindi jasan'. Ta'repleri usi' kesindilerge ten' bolg'an u'shmu'yeshlik jasan'.
- Qanday da bir u'shmu'yeshlik jasan'. Woni'n' bir: a) medianasi'n; b) bissektrisasi'n; c) biyikligin jasan'.

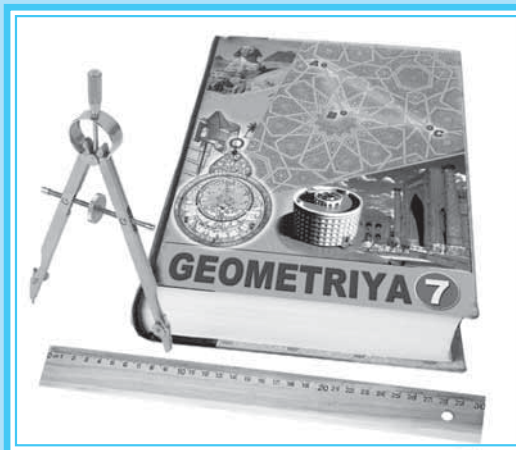
U'lgili baqlaw jumi'si' yeki bo'limnen ibarat boladi':

I. Teoriyalı'q 5 test.

II. To'mendegi ma'selelerge uqsas 3 m'asele (4-ma'sele jaqsi' wo'zlestiriwshi woqi'wshi'lar ushi'n qosi'msha beriledi)

- $120^\circ$  li' mu'yesh berilgen, cirkul ha'm si'zg'i'sh ja'rdeminde wog'an ten' mu'yesh jasan'.
- Ta'repleri  $a = 5\text{ sm}$ ,  $b = 6\text{ sm}$  ha'm  $c = 7\text{ sm}$  bolg'an u'shmu'yeshlik jasan'.
- 2-ma'selede jasalg'an u'shmu'yeshliktin'  $a$  ta'repine mediana ju'rgizin'.
- U'shmu'yeshlikti woni'n' ultani', bir ta'repi ha'm ultang'a tu'sirilgen biyikligi boyi'nsha jasan'.

## VI BAP



### TA'KIRARLAW

**Bul bapti' u'yrenip shi'qqannan keyin to'mendegi bilim ha'm a'meliy ko'nlikpelerge iye bolasi'z:**

**Bilimler:**

- Geometriyali'q ma'selelerdi sheshiw basqi'shlari'n biliw;
- geometriyali'q ma'seleler tu'rlerin pari'qlay ali'w;
- ma'selelerdi sheshiwde ushi'rasatug'i'n bazi'-bir qa'teliklerdi biliw.

**Ko'nlikpeler:**

- Geometriyali'q ma'selelerdi tu'rlerge aji'rati'w ha'm sheshiw basqi'shlari' boyi'nsha jumi'slari'n sho'lkemlestiriw ;
- ma'seleler sheshiwde ushi'rasatug'i'n qa'teliklerdin' aldi'n ali'w;
- planimetriya boyi'nsha ji'lli'q juwmaqlawshi' baqlaw jumi'si'na tayar boli'w.

Geometriyali'q ma'selelerdi sheshiwde to'mendegilerge itibar beriw kerek:

1. Geometriyani'n' tiykarg'i' tu'sinikleri, wolardi'n' qa'siyetlerin jaqsi' biliw ha'm yeste saqlaw;
2. Tu'rli geometriyali'q figuralardi'n' qa'siyetleri haqqi'ndag'i' teoremalardi' da'lillew usi'llari'n iyelew;
3. Berilgen geometriyali'q ma'selenin' ma'nisin tu'sinip ali'w;

A'dette geometriyali'q ma'selelerdi sheshiw protsesi to'mendegi basqi'shlardan ibarat boladi':

**1-basqi'sh. Ma'seleni tu'siniw.** Bul basqi'shta ma'selenin' sha'rti ha'm juwmag'i' bo'lek-bo'lek aji'rati'p ali'nadi'. Neler berilgen, neni tabi'w, da'lillew yamasa jasaw kerekligi ani'qlanadi'. Ma'selege tiyisli si'zi'lma si'zi'ladi'. Si'zi'lmani'n' u'lken ha'm ani'q boli'wi maqsetke muwapi'q. Berilgen barli'q mag'li'wmatlar si'zi'lmada belgilenedi.

**2-basqi'sh. Rejelestiriw.** Bul basqi'shta ma'seleni sheshiw usi'li' tan'lanadi'. Woni' qollani'w ushi'n qanday qosi'msha mag'li'wmatlar za'ru'r yekenligi ani'qlanadi'. Ja'rdemshi figuralar si'zi'ladi'.

**3-basqi'sh. Sheshiw.** Bul basqi'shta ma'sele tikkeley, berilgen reje tiykari'nda sheshiledi.

**4-basqi'sh. Tekseriw.** Bul basqi'shta ma'selenin' tabi'lg'an sheshimi tikkeley tekseriledi. Sheshiw protsesine kiritikali'q ko'z-qaras taslanadi'. Yeger qa'te ani'qlansa, wol du'zetiledi. Du'zetiwdin' imkani bolmasa, ma'seleni sheshiw din' baslang'i'sh basqi'shi'na qaytari'ladi' ha'm barli'q jumi's tazadan baslanadi'.

**Ma'seleni sheshiwdi u'yreniw ushi'n ko'birek ma'sele sheshiw kerek!**

**Ma'selege tiyisli si'zi'lmani' duri's si'zi'w – ma'selenin' yari'mi'n sheshiw degeni boladi'.**

Geometriyali'q ma'selelerdin' qoyi'li'wi' ha'm ma'nisine qarap u'sh qi'yli' tu'rde boli'wi mu'mkin:

1. Yesaplawg'a tiyisli ma'seleleri
2. Da'lillewge tiyisli ma'seleler
3. Jasawg'a tiyisli ma'seleler

Geometriyali'q ma'selelerdi sheshiw tek g'ana qanday da bir geometriyali'q figurani'n' qa'siyetin u'yreniwden ibarat yemes, a'l'bette. Bul duri's pikirlew, logikali'q pikir ju'ritiw h'am wolar tiykari'nda duri's ha'm aqi'lg'a muwapi'q qararlar qabi'l yetiw, juwmaq shi'g'ari'w, ko'nlikpe h'am ta'jriybelerin de qa'liplestiredi. Bunday ko'nlikpe

ha'm ta'jriybelerdi tek matematikada yemes, ba'lkı ku'ndelikli turmi'sta ushrasatug'i'n mashqalalardi' sheshiwde de qol keledi.

A'l'bette ma'seleni sheshiw – bul tek g'ana duri's juwapti' tabi'w degeni yemes. Ma'selelerdi sheshiw bari'si'nda belgili qa'siyetlerdi, teoremalardi' ha'm wolardi'n' na'tiyjelerin qollani'p biliw, tu'rli usi'llardan paydalana ali'wdi' biliw za'ru'r boladi'.

To'mendegi ma'selenin' sheshiliw protsesin baqlayi'q.



**Ma'sele.** To'beleri ten' ta'repli u'shmu'yeshliktin' ta'replerinin' wortalari' bolg'an u'shmu'yeshliktin' ten' ta'repli yekenin da'llilen'.

### 1. Ma'seleni tu'siniw basqi'shi'.



$\triangle ABC$  — ten ta'repli,  $M$  —  $AB$  ta'repinin' wortasi',  
 $N$  —  $BC$  ta'repinin' wortasi',  $L$  —  $AC$  ta'repinin' wortasi'



$\triangle MNL$  — ten' ta'repli

Ma'selenin' sh'artleri tiykari'nda si'zi'lma si'zi'p alami'z (1-su'wret).

**2. Rejelestiriw basqi'shi'.** Ten' ta'repli u'shmu'yeshliktin' qa'siyetinen ha'm u'shmu'yeshliktin' TMT belgisinen paydalanami'z.

**3. Sheshiw basqi'shi'.** Sha'rt boyi'nsha,

$LA = AK = KB = BN = NC = CL$  ha'm  $\angle A = \angle B = \angle C = 60^\circ$ . Wonda  $\triangle LAK$  ni'n'  $AL$ ,  $AK$  ta'repleri ha'm  $A$  mu'yeshi  $\triangle KBN$  ni'n'  $BK$ ,  $BN$  ta'repleri ha'm  $B$  mu'yeshine ha'mde  $\triangle NCL$  ni'n'  $CN$ ,  $CL$  ta'repleri ha'm  $C$  mu'yeshine sa'ykes tu'rde ten'.

Demek,  $\triangle LAK = \triangle KBN = \triangle NCL$ . Bul jag'dayda bul u'shmu'yeshliklerdin' u'shinshi ta'repleri de wo'z-ara ten' boladi':  $KL = KN = NL$ .

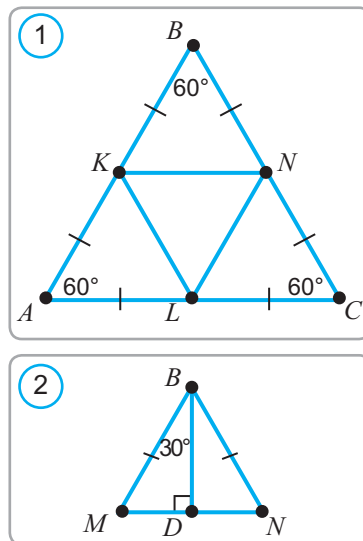
Demek,  $\triangle KNL$  — ten' ta'repli.

### 4. Tekseriw basqi'shi'.

Ma'selenin' sheshiliw protsesin ja'ne bir ma'rte ko'zden wo'tkerip, wondag'i' ha'r bir pikir logikali'q jaqtan duri's ali'p bari'lg'ani'n tekseremiz.

Bul ma'seleni basqa usi'lda da sheshiw mu'mkin. Bunda to'besindegi mu'yeshi  $60^\circ$  bolg'an ten' qaptalli' u'shmu'yeshliktin' qa'siyetinen paydalanami'z.  $\triangle KBN$  ten' qaptalli' u'shmu'yeshliginin'  $BD$  biyikligin tu'sire-miz (2-su'wret).  $BD$  bissektrisa da bolg'ani' ushi'n  $\angle KBD = 60^\circ / 2 = 30^\circ$  ha'm  $\angle BKD = \angle BND = 90^\circ - 30^\circ = 60^\circ$  boladi'.

Demek,  $\triangle KBN$  ten' ta'repli u'shmu'yeshlik yeken. Solay yetip  $\triangle KAL$  ha'm  $\triangle NCL$  lar da ten' ta'repli u'shmu'yeshlikler yekenligi ani'qlanadi' ha'm





$BK = KN = NL = LN$  yekenligi belgili boladi'. Bunnan bolsa  $\triangle KNL$  ni'n' ten' ta'repli u'shmu'yeshlik g'ana yemes, ba'lk i,  $\triangle KNL = \triangle KBN = \triangle NCL = \triangle KAL$  yekenligi de belgili boladi'.

56

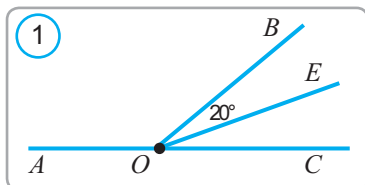
### Yesaplawg'a tiyisli ma'seleler

Yesaplawg'a tiyisli ma'seleler arifmetikali'q ha'm algebrali'q ma'selelerge uqsas boladi'. Tu'rli geometriyal i'q formulalar ja'rdeminde, berilgen sanli' shamalar tiykari'nda izbe-iz yesap-sanaq isleri wori'nlanadi' ha'm izlenip ati'rg'an shama tabi'ladi'.

Bul ma'selelerde ko'binshe si'zi'lmani' duri's si'zi'p ali'w ha'm kerekli belgilewlerdi kiritiw isin anag'urli'm an'satlasti'radi'.



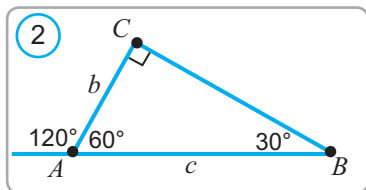
**1-ma'sele.** Qon'si'las mu'yeshlerden birinin' bissektrisasi' yekinshi mu'yesh tin' ta'replerinin' biri menen  $20^\circ$  li' mu'yesh ti payda yetedi. Usi' mu'yesh ti tabi'n'.



**Sheshiliw.** Ma'selenin' sha'rtin si'zi'lmada ko'r-setemiz (1-su'wret). Bunnan  $OE$  bissektrisasi' su'yer mu'yesh tin' bissektrisasi' yekenligi belgili boladi'. Demek,  $\angle BOC = 2 \cdot 20^\circ = 40^\circ$ ,  $\angle AOB = 180^\circ - 40^\circ = 140^\circ$  boladi'.



**2-ma'sele.**  $ABC$  tuwri' mu'yeshli u'shmu'yeshlikte  $\angle C$  –tuwri' mu'yesh,  $A$  to'besindegi si'rtqi' mu'yeshi  $AC + AB = 18$  sm bolsa, u'shmu'yeshliktin' gipotenuzasi'n tabi'n'.



**Sheshiliwi.** Ma'selenin' sha'rtine baylani'sli' si'zi'lmani' su'wretleyemiz (2-su'wret). U'shmu'yeshliktin' si'rtqi' mu'yeshinin' ani'qlamas i'nan,  $\angle A = 180^\circ - 120^\circ = 60^\circ$ ,  $\angle B = 90^\circ - \angle A = 30^\circ$  yekenligin ani'qlaymi'z.  $AC = b$ ,  $AB = c$  bolsi'n. Bul jag'dayda  $b + c = 18$ . Su'yir mu'yeshi  $30^\circ$  qa ten' bolg'an tuwri'

mu'yeshli u'shmu'yeshliktin' qa'siyeti boyi'nsha,  $c = 2b$  boladi'. Bunnan  $b + c = b + 2b = 18$ , yag'ni'y  $b = 6$ . Wonda  $c = 12$  yekenligi belgili boladi'. **Juwabi':** 12.

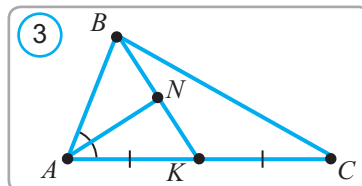


**3-ma'sele.**  $ABC$  u'shmu'yeshliginde  $AB = 1$ ,  $A$  mu'yeshinin' bissektrisasi'  $B$  to'besinen tu'sirilgen medianag'a perpendikulyar. Yeger  $BC$  ta'repinin' uzi'nli'g'i pu'tin san menen an'lati'lsa, u'shmu'yeshliktin' perimetrin tabi'n'.

**Sheshiliwi.** Ma'selenin' sha'rtin si'zi'lmada su'wretleyimiz (3-su'wret):  $AK = KC$ .  $AN \perp BK$ .  $\triangle ANB = \triangle ANK$  yekenligin ani'qlaymi'z, sebebi  $AN$  kateti uli'wma ha'm bir mu'yeshi ten' (katet ha'm wog'an irgeles bolg'an su'yir mu'yeshi boyi'nsha). Bunnan bolsa  $AB = AK = KC = 1$ , yag'ni'y  $AC = 1 + 1 = 2$  yekenligi belgili boladi'.

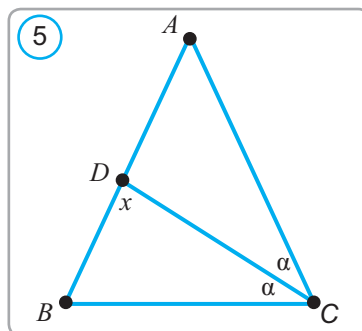
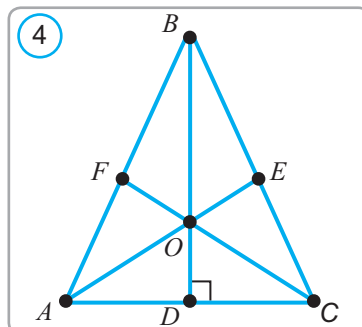
$BC = x$  – pu'tin san, u'shmu'yeshliktin' ten'sizligi boyi'nsha  $2 + 1 > x$  ha'm  $x + 1 > 2$ , yag'ni'y  $x < 3$  ha'm  $x > 1$ , yag'ni'y  $1 < x < 3$  boli'wi' kerek. 1 menen 3 tin' arasi'nda bir pu'tin san bar: 2. Demek.  $BC = 2$  ha'm  $P_{ABC} = 1 + 2 + 2 = 5$ .

**Juwabi':** 5



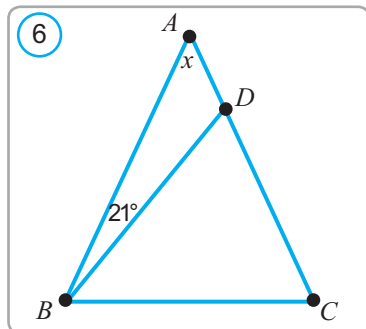
**Soraw, ma'sele ha'm tapsi'rmalar.**

1.  $AB$  kesindisinin' uzi'nli'qlari'  $1 : 2 : 3 : 4$  si'yaqli' qatnastag'i' kesindilerga (usi' izbe-izlikte) aji'rati'lg'an. Yeger shetki kesindilerinin' wortalari' arasi'ndag'i' arali'q 15 sm ge ten' bolsa,  $AB$  kesindisinin' uzi'nli'g'i'n tabi'n'.
2.  $\angle ABC = 160^\circ$  bolg'an mu'yeshitin' to'besinen usi' mu'yeshitin' ta'replari arasi'nda jati'wshi'  $BO$  ha'm  $BE$  nurlari' ju'rgizilgen. Yeger  $BO$  nuri' berilgen mu'yeshiti ten' yekige,  $BE$  nuri' bolsa 3 : 5 si'yaqli' qatnasta bo'lsa,  $OBE$  mu'yeshiti tabi'n'.
3.  $AOB$  mu'yeshi  $OC$  nuri' arqali' biri yekinishinen  $30^\circ$  qa u'lken bolg'an yeki mu'yeshke aji'rati'lg'an. Berilgen mu'yeshitin' bissektrisasi' menen  $OC$  nuri' arasi'ndag'i' mu'yeshiti tabi'n'.
4. Ten' qaptalli' u'shmu'yeshliktin' ultani'ndag'i' mu'yeshi  $30^\circ$  qa ten'. Usi' mu'yeshitin' qaptal ta'repi ha'm yekinishi qaptal ta'repine ju'rgizilgen biyikligi arasi'ndag'i' mu'yeshiti tabi'n'.
5. U'shmu'yeshliktin' bir si'rtqi' mu'yeshi  $100^\circ$ , wog'an qon'-si'las bolmag'an mu'yeshlerinin' qatnasi'  $2 : 3$  tu'rinde bolsi'n. U'shmu'yeshliklerdin' mu'yeshlerin tabi'n'.
6.  $A, B, C, D$  noqatlari' ko'rsetilgen ta'rtipte bir tuw-ri'da jatadi' ha'm  $AB = BC = 1$ ,  $CD = 2$ .  $K$  noqati'  $BC$  kesindide sonday jaylasadi',  $BC$  ha'm  $AD$  kesindilerinin' qatnasi' birdey qatnasta boladi':



$BK : KC = AK : KD$ . Bul qatnaslardi' tabi'n'.

7. U'shmu'yeshliktin' yeki mu'yeshinin' bissektisalari' kesilisiwinen payda bolg'an mu'yesh  $120^\circ$  qa ten'. U'shmu'yeshliktin' u'shinshi mu'yeshin tabi'n'.
8. Ten' qaptalli' u'shmu'yeshlikin' to'besindegi mu'yeshi  $96^\circ$  qa ten'. Ultani'ndag'i mu'yeshlerin' bissektisalari' kesilisiwinen payda bolg'an su'yir mu'yeshti tabi'n'.



9. Tuvri' mu'yeshli u'shmu'yeshliktin' tuvri' mu'yeshinen bissektisa ha'm biyiklik ju'rgizilgen boli'p, wolardi'n' arasi'ndag'i mu'yesh  $24^\circ$  qa ten'. U'shmu'yeshliktin' qalg'an mu'yeshlerin tabi'n'.
10. Yeger 4-su'wrette  $AB = BC$ ,  $\angle ABC = 50^\circ$ ,  $AE$  ha'm  $FC$  — bissektisalar bolsa,  $\angle AOB = ?$ ,  $\angle EOC = ?$
11. Yeger 5-su'wrette  $AB = AC$ ,  $AD = DC$  bolsa,  $x = ?$
12. Yeger 6-su'wrette  $AB = AC$ ,  $BD = BC$  bolsa,  $x = ?$

57

### Da'lillewge tiyisli ma'seleler

Da'lillewge tiyisli ma'seleler wo'zine ta'n kishkene teoremlar boladi'. Wolardi' sheshiw ma'selede keltirilgen tasti'yi'qlawdi' da'lillewden ibarat boladi'. Mi'sal retinde to'mendegi ma'selelerdi qaraymi'z.



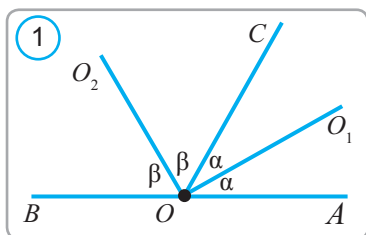
**1-masala.** Qon'si'las mu'yeshlerin' bissektisalari' wo'z-ara perpendikulyar yekenligin da'llilen'.



$\angle AOC$  ha'm  $\angle BOC$  — qon'si'las mu'yeshleri,  
 $OO_1$  ha'm  $OO_2$  — bissektisalari' (1-su'wrette).



$OO_1 \perp OO_2$ .



**Da'lillew.**  $OO_1$  ha'm  $OO_2$  bissektisalari' aji'rat-qan mu'yeshlerdi sa'ykes tu'rde (1-su'wrette ko'r-setilgenindey)  $\alpha$  ha'm  $\beta$  dep belgileymiz. Bul jag'-dayda,  $2\alpha + 2\beta = 180^\circ$ , yamasa  $\alpha + \beta = 90^\circ$ , yag'ni'y  $\angle O_1OO_2 = \alpha + \beta = 90^\circ$ . Demek  $OO_1 \perp OO_2$ . Usi'ni' da'lillew talap yetilgen yedi.

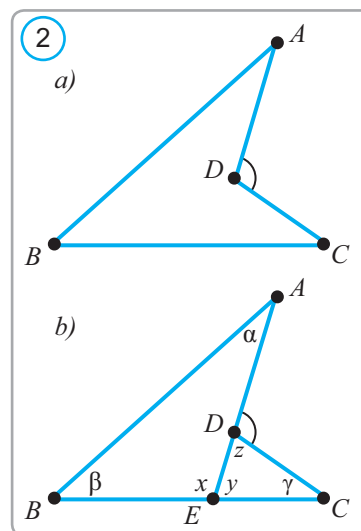


**2-ma'sele.** 2.a-su'wrette su'wretlengen  $ABCD$  to'rtmu'yeshlikte  $\angle D = \angle A + \angle B + \angle C$  yekenligin da'llilen'.

**Da'lillew.**  $AD$  tuwri'si'ni'n'  $BC$  ta'repi menen kesilisen noqati'n  $E$  menen belgileymiz ( $AD$  ta'repin dawam yettiremiz) ha'm mu'yeshler ushi'n za'ru'r belgilewlerdi kiritemiz (2.b-su'wret). Ma'lumki  $\alpha + \beta + x = 180^\circ$  va  $y + z + \gamma = 180^\circ$ . Bul ten'liklerdi qosi'p,  $\alpha + \beta + \gamma + x + y + z = 360^\circ$  ten'ligine iye bolami'z. Qon'si'las mu'yeshlin' qa'siyeti boyi'nsha,  $x + y = 180^\circ$  bolg'ani' ushi'n  $\alpha + \beta + \gamma + 180^\circ + z = 360^\circ$ , yamasa  $\alpha + \beta + \gamma = 180^\circ - z = \angle D$ , yag'ni'y  $\angle D = \alpha + \beta + \gamma = \angle A + \angle B + \angle C$  boladi'.

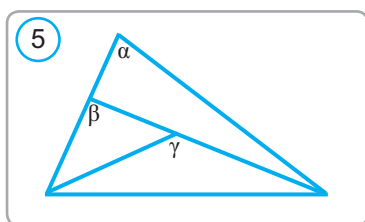
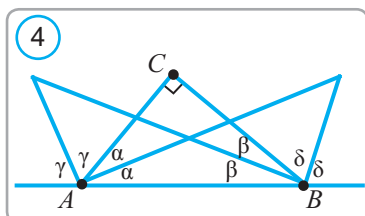
**Ten'lik da'lillendi.**

Joqari'dag'i' yeki ma'seleni tayar si'zi'Imag'a tiykarla-ni'p sheshtik, 2-ma'selede qosi'msha jasaw ha'm za'ru'r belgilewlerdi a'melge asi'rdi'q, bul bolsa ma'seleni an'sat sheshiwimizge ja'rdem berdi.



### Soraw, ma'sele ha'm tapsi'rmalar

1. U'shmu'yeshliklin' bir mu'yeshi wo'zine qon'si'las bolmag'an si'rtqi' mu'yeshlerinin' ayi'rmasi'na ten'. Bul u'shmu'yeshliklin' tuwri' mu'yeshli u'shmu'yeshlik yekenligin da'lillen'.
2. Bir mu'yeshi  $150^\circ$  bolg'an ten' qaptali' u'shmu'yeshliklin' ultani'ndag'i' to'belerinen ju'rgizilgen biyiklikleri ten' bolatug'i'ni'n da'lillen'.
3. Ten' tarepli u'shmu'yeshliklin' medianalari' kesilisiw noqati'nda 2 : 1 si'yaqli' qatnasta bolatug'i'ni'n da'lillen'.
4. Ten' qaptali' u'shmu'yeshliklin' to'besindegi si'rtqi' mu'yeshinin' bissektrisasi' u'shmu'yeshliklin' ultani'na parallel bolatug'i'ni'n da'lillen'.
5. 4-ma'selege kerı teoremani' an'lati'n' ha'm woni' da'lillen'.
6. Ten' tarepli u'shmu'yeshliklin' qa'legen yeki medianasi'  $60^\circ$  li' mu'yesh asti'nda kesilisiwin da'lillen'.
7. U'shmu'yeshliklerdin' ten'ligin wolardi'n' yeki ta'repi ha'm u'shinshi ta'repine tu'sirilgen medianasi' boyi'nsha da'lillen'.
8.  $ABC$  ha'm  $A_1B_1C_1$  u'shmu'yeshliklerinde  $BM$  ha'm  $B_1M_1$  medianalari' ju'rgizilgen. Yeger  $AB=A_1B_1$ ,  $AC=A_1C_1$  ha'm  $BM=B_1M_1$  bolsa,  $\triangle ABC = \triangle A_1B_1C_1$  yekenligin da'lillen'.
9.  $ABC$  ha'm  $A_1B_1C_1$  u'shmu'yeshliklerinde  $AD$ ,  $A_1D_1$  – bissektrisalari'. Yeger  $AB=A_1B_1$ ,  $BD=B_1D_1$  ha'm  $AD=A_1D_1$  bolsa,  $\triangle ABC = \triangle A_1B_1C_1$  yekenligin ko'rsetin'.



10.  $ABC$  ha'm  $A_1B_1C_1$  u'shmu'yeshliklerinde  $BH$  ha'm  $B_1H_1$  biyiklikleri ju'rgizilgen. Yeger  $\angle A = \angle A_1$ ,  $\angle B = \angle B_1$  ha'm  $BH = B_1H_1$  bolsa,  $\triangle ABC = \triangle A_1B_1C_1$  bolatug'i'ni'n da'lillen'.

11. U'shmu'yeshliktin' yeki biyikligi ten' bolsa, woni'n' ten' qaptalli' u'shmu'yeshlik yekenligin da'lillen'.

12. 4-su'wrette  $\alpha + \gamma = \beta + \delta = 90^\circ$  yekenligin da'lillen'.

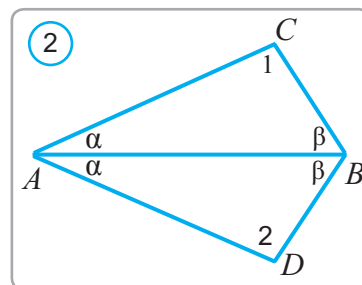
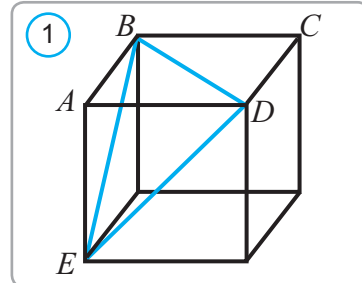
13. 5-su'wrette  $\alpha < \beta < \gamma$  yekenligin da'lillen'

## 58-59

### Ta'kirarlawg'a tiyisli ma'seleler

1. Yeki parallel tuwri' ha'm kesiwshi payda yetken ayqi'sh mu'yeshlerdin' bissektisalarini' parallel bolatug'i'ni'n da'lillen'.
2. U'shmu'yeshliktin' qa'legen bir ta'repi woni'n' qalg'an yeki tarepinin' ayi'rmasi'nan u'lken bolatug'i'ni'n da'lillen'.
3. U'shmu'yeshliktin'  $\alpha$ ,  $\beta$  ha'm  $\gamma$  mu'yeshleri ushi'n  $\alpha < \beta + \gamma$ ,  $\beta < \alpha + \gamma$ ,  $\gamma < \alpha + \beta$  qatnaslari' wori'nli' bolsa, bul qanday u'shmu'yeshlik boladi'?
4. Berilgen yeki noqattan wo'tiwshi shen'ber jasan'. Ma'sele neshe sheshimge iye?
5.  $ABC$  u'shmu'yeshliginin'  $AA_1$  ha'm  $BB_1$  bissektisalarini'  $O$  noqati'nda kesilisedi. Yeger a)  $\angle AOB = 136^\circ$ ; b)  $\angle AOB = 111^\circ$  bolsa,  $ACB$  mu'yeshin tabi'n'
6. 1-su'wrette su'wretlengen kubta  $BD = 6$  bolsa,  $BE = ?$ ,  $DE = ?$ ,  $AC = ?$ ,  $\angle BED = ?$
7. Perimetri 42 sm bolg'an  $ABC$  u'shmu'yeshliginin' medianasi' woni' perimetri 33 sm ha'm 35 sm bolg'an yeki u'shmu'yeshlikke aji'ratadi'. Medianani'n' uzi'nli'g'i'n tabi'n'.
8. Tuwri' mu'yeshli u'shmu'yeshliktin' su'yir mu'yeshlerinin' bissektisalarini' qanday mu'yesh asti'nda kesilisedi?
9. 2-su'wrette  $\angle 1 = \angle 2$  yekenligin da'lillen'.
10.  $MN$  ha'm  $NM$  nurlari'ni'n' uli'wma bo'legi qanday figura boladi'?
11.  $A$ ,  $B$  ha'm  $C$  noqatlari' bir tuwri'da jatadi'. Yeger  $AB = 2$  sm,  $BC = 3$  sm ha'm  $AC = 5$  sm bolsa,  $B$  noqati'  $AC$  kesindige tiyisli bola ma? Juwabi'n'i'zdi' tiykarlan'.
12.  $A$  noqati'  $BC$  tuwri'si'ni'n'  $B$  ha'm  $C$  noqatlari'ni'n' arasi'nda jatadi'. Yeger  $BC = 15$  sm,  $AC$  kesindisi bolsa  $AB$  kesindisinen 3 sm ge qi'sqa bolsa,  $AB$  kesindisinen uzi'nli'g'i'n tabi'n'.
13.  $60^\circ$  ham'  $30^\circ$  li' mu'yeshler jasan'.

14. Shen'berdin' wo'z-ara perpendikulyar diametrlerin jasan'.
15. Qon'si'las mu'yeshlerinin' biri yekinshisinen 4 ma'rte kishi bolsa, usi' mu'yeshlerdin' u'lkenin tabi'n'.
16. Yeki tuwri'ni'n' kesilisiwinen payda bolg'an mu'yeshlerdin' qatnasi' 7:3 ge ten'. Usi' mu'yeshlerdin' kishisin tabi'n'.
17.  $A$ ,  $B$  ha'm  $C$  noqatlari' bir tuwri'da jatadi'.  $BC$  kesindisinin' uzi'nli'g'i'  $AC$  kesindisinin' uzi'nli'g'i'nan 3 ma'rte u'lken,  $AB$  kesindinin' uzi'nli'g'i' bolsa  $BC$  ni'n' uzi'nli'g'i'nan 3,6 sm ge qi'sqa.  $AC$  kesindisinin' uzi'nli'g'i'n tabi'n'.
18. Yeki tuwri'ni' u'shinshi tuwri' keskende si'rtqi' bir ta'replemeli mu'yeshlerdin' qosi'ndisi'  $180^\circ$  qa ten' bolsa, bul tuwri'lardi'n' wo'z-ara parallel yekenligin da'llillen'.
19. Yeki parallel tuwri'ni' u'shinshi tuwri' keskende payda bolg'an mu'yeshlerdin' biri  $55^\circ$  qa ten'. Qalg'an mu'yeshlerin tabi'n'.



## 60-61

### Bilimlerin'izdi si'nap ko'r'in'

#### 1. Ga'plerdi ma'nisinen kelip shi'g'i'p toli'qti'ri'n':

1. Tegislikte ..... arqali' bir tuwri' ju'rgiziw mu'mkin.
2. Mu'yeshlin' ..... mu'yeshli yeki wo'z-ara ten' mu'yeshke aji'ratadi'.
3. Kesindinin' wortasi' woni' yeki ..... aji'ratadi'.
4. Tegislikte tuwri'g'a tiyisli bolg'an ..... da, tiyisli bolmag'an ..... da bar.
5. Yeger u'shmu'yeshlik ten' qaptalli' bolsa, ..... mu'yeshleri ten' boladi'.
6. Yeki ten'dey u'shmu'yeshliklerdin' sa'ykes ..... ha'm sa'ykes ..... ten' boladi'.
7. Ten' ta'repli u'shmu'yeshliklin' ha'r bir ..... gradusqa ten'.
8. Tuwri' mu'yeshli u'shmu'yeshliklin' su'yir .....  $90^\circ$  qa ten'.
9. Jayi'q mu'yeshlin' bissektrisasi' woni' yeki ..... mu'yeshke aji'ratadi'.
10. U'shinshi tuwri'g'a parallel bolg'an yeki tuwri' ..... boladi'.
12. Bir tuwri'g'a perpendikulyar bolg'an yeki tuwri' ..... boladi'.

13. Parallel tuwri'lardi' kesiwshi menen keskende, payda bolg'an ishki bir ta'replemeli mu'yeshler ..... boladi'.
14. Kesindinin' ushlari'nan ten' ..... kesindinin' worta perpendikulyari'nda jatadi'.
15. Shen'berdegi noqatlar shen'berdin' worayi'nan ten' ..... .

## 2. To'mende keltirilgen ga'plerde qa'te bolsa, woni' tabi'n' ha'm du'zetin':

1. Tegislikte yeki noqat arqali' yeki tuwri' ju'rgiziw mu'mkin.
2. Tuwri' mu'yesh  $180^\circ$  qa ten' boladi'.
3. Qon'si'las mu'yeshler ten' boladi'.
4. Vertikal mu'yeshlerdin' qosi'ndi'si'  $180^\circ$  qa ten'.
5. U'shmu'yeshliktin' to'besi menen usi' to'be qarama-qarsi'si'ndag'i' ta'repinin' wortasi'n tutastiri'wshi' kesindi, u'shmu'yeshliktin' bissektrisasi' delinedi.
6. U'shmu'yeshliktin' perimetri dep, woni'n' mu'yeshleri qosi'ndi'si'na ayti'ladi'.
7. U'shmu'yeshliktin' ta'replerinin' qosi'ndi'si'  $180^\circ$  qa ten'.
8.  $90^\circ$  qa ten' mu'yesh asti'nda kesilissen tuwri'lar parallel delinedi.
9. Parallel tuwri'lar bir noqatta kesilisedi.
10. Shen'berdin' diametri radiusi'na ten'.
11. Tuwri' mu'yeshli u'shmu'yeshliktin' katetleri ten' bolsa, woni'n' kishi mu'yeshi  $30^\circ$  qa ten' boladi'.
12. Ten' qaptalli' u'shmu'yeshliktin' ha'r bir mu'yeshi  $60^\circ$  qa ten'.
13. Mu'yesh bissektrisasi'nda jatqan noqatlar mu'yeshstin' ushlari'nan ten'dey uzaqli'qta jatadi'.

## 3. Berilgen qa'siyetke iye bolg'an geometriyalı'q figurani' won' bag'anadag'i' sa'ykes qatarg'a jazi'n':

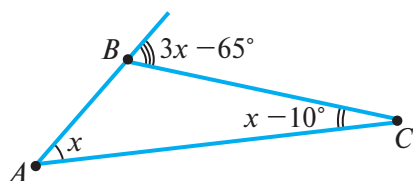
|    |                                                                              |  |
|----|------------------------------------------------------------------------------|--|
| 1. | Uzi'nli'g'i' 5 sm.                                                           |  |
| 2. | Noqat ha'm ushlari' usi' noqatlarda bolg'an yeki nurdan ibarat.              |  |
| 3. | Kesilispeytug'i'n tuwri'lar.                                                 |  |
| 4. | To'besinen shi'qqan biyikligi ha'm medianasi' ha'm bissektrisasi' boladi'.   |  |
| 5. | Barli'q ta'repleri ten' bolg'an u'shmu'yeshlik.                              |  |
| 6. | Yeki ta'repi ten' bolg'an u'shmu'yeshlik.                                    |  |
| 7. | Mu'yeshiti ten'dey yeki mu'yeshke aji'ratadi'.                               |  |
| 8. | Yeki kateti bar.                                                             |  |
| 9. | Yeki mu'yeshinin' qosi'ndi'si' $90^\circ$ dan u'lken bolg'an u'shmu'yeshlik. |  |

**4. Birinshi bag'anada berilgen geometriyalı'q tu'sinikke yekinshi bag'anadan tiyisli qa'siyet yamasa talqi'lawlardı' sa'ykes qoyı'n':**

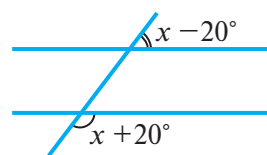
| <i>Geometriyalı'q tu'sinik</i>                          | <i>Talqi'law, qa'siyeti</i>                                                           |
|---------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1. Perpendikulyar tuwri'lar                             | A. Berilgen uzi'nli'qqa iye                                                           |
| 2. Ten' ta'repli u'shmu'yeshlik                         | B. Yeki mu'yeshi ten'                                                                 |
| 3. Shen'ber                                             | C. Gipotenuzani'n' yari'mi'na ten'                                                    |
| 4. Mu'yeshitin' bissektrisasi'ndag'i' noqat             | D. To'besi menen qarama-qarsi'si'ndag'i' ta'repinin' wortasi'n tutasti'radi'          |
| 5. U'shmu'yeshliktin' biyikligi                         | E. Bir ishki mu'yeshine qon'si'las ha'm qalg'an yeki mu'yeshinin' qosi'ndi'si'na ten' |
| 6. $30^\circ$ li' mu'yesh qarama-qarsi'si'ndag'i' katet | F. Kesilispeydi                                                                       |
| 7. Mediana                                              | G. $90^\circ$ li' mu'yesh asti'nda kesilisedi                                         |
| 8. U'shmu'yeshliktin' si'rtqi' mu'yeshi                 | H. Ta'repleri ten'                                                                    |
| 9. Ten' qaptalli' u'shmu'yeshlik                        | I. Noqatlari' worayi'nan ten'dey uzaqlasqan                                           |
| 10. Kesindi                                             | J. Woni'n' ta'replerinen ten'dey uzaqli'qta jatadi'                                   |
| 11. Parallel tuwri'lar                                  | K. Bir to'besinen wo'tedi ha'm bir ta'repine perpendikulyar                           |

**5. Testler**

- Berilgen noqattan berilgen tuwri'g'a parallel yetip neshe tuwri' ju'rgiziw mu'mkin?  
A) 1                      B) 2                      D) 3                      E) 4
- Jayi'q mu'yesh neshe gradusqa ten'?  
A)  $90^\circ$ ;                      B)  $90^\circ$  tan u'lken;                      D)  $90^\circ$  tan kishi;                      E)  $180^\circ$ .
- Su'wretke qarap  $\angle BCA$  mu'yeshin tabi'n'.                      4. Su'wretke qarap  $x$  ti' tabi'n'.



- A)  $25^\circ$                       B)  $35^\circ$   
D)  $45^\circ$                       E)  $55^\circ$



- A)  $80^\circ$                       B)  $90^\circ$   
D)  $100^\circ$                       E)  $70^\circ$

- Yeger  $ABC$  u'shmu'yeshliginde  $\angle B = 30^\circ$ ,  $\angle C = 90^\circ$  ha'm  $AC = 10 \text{ sm}$  bolsa,  $AB$  gipotenuzasi'n tabi'n'.  
A)  $10 \text{ sm}$                       B)  $12 \text{ sm}$                       D)  $15 \text{ sm}$                       E)  $20 \text{ sm}$



6.  $ABC$  u'shmu'yeshliginde  $AB = BC$ ,  $AB = AC + 7$  (sm). Yeger  $ABC$  u'shmu'yeshliginin perimetri 23 sm bolsa, u'shmu'yeshliktin' kishi ta'repin tabi'n'.

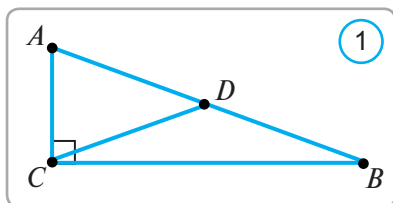
A) 3 sm B) 5 sm D) 7 sm E) 9 sm

7. Qon'si'las mu'yeshlerdin' biri yekinshisinen u'sh ma'rte u'lken. Bul mu'yeshlerdin' ayi'rmasi'n tabi'n'.

A)  $45^\circ$  B)  $60^\circ$  D)  $75^\circ$  E)  $90^\circ$

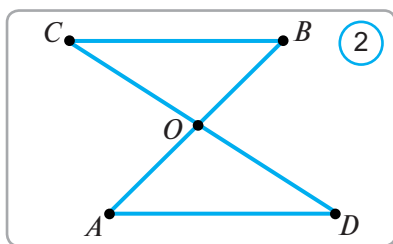
8. Shen'berdin' radiusi' 3,2 sm. Wonda diametrin tabi'n'.

A) 3,2 B) 5,2 D) 6,4 E) 1,6



9.  $ABC$  — tuwri' mu'yeshli u'shmu'yeshlik (1-su'wret),  $\angle C = 90^\circ$ ,  $CD$  — mediana.  $\angle BDC = 130^\circ$  bolsa,  $\angle A$  ni' tabi'n'.

A)  $45^\circ$  B)  $65^\circ$  D)  $75^\circ$  E)  $85^\circ$



10.  $ABC$  — ten' qaptalli' u'shmu'yeshliginin' to'besindegi  $B$  mu'yeshi  $80^\circ$  qa ten'. Woni'n'  $A$  to'besindegi si'rtqi' mu'yeshin tabi'n'.

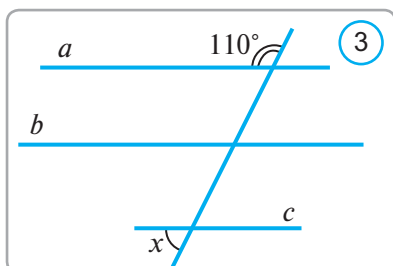
A)  $130^\circ$  B)  $120^\circ$  D)  $110^\circ$  E)  $100^\circ$

11. Yeger  $a \perp b$ ,  $b \perp c$ ,  $c \perp d$  bolsa, to'mendegi juwaplardan qaysi' biri naduri's?

A)  $a \parallel c$  B)  $b \perp d$  D)  $a \parallel d$  E)  $b \parallel c$

12. Yeger 2-su'wrette  $AO = OB$ ,  $OC = OD$ ,  $BC = 5$  sm ha'm  $AO + OC = 7$  sm bolsa,  $AOD$  u'shmu'yeshliginin' perimetrin tabi'n'.

A) 5 sm B) 7 sm  
D) 12 sm E) 17 sm

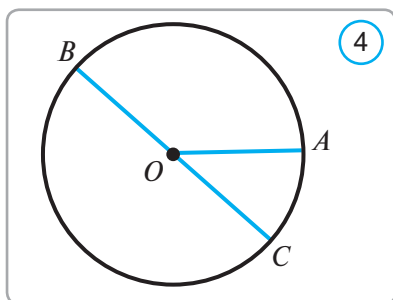


13. Yeger 3-su'wrette  $a \parallel b$  ha'm  $b \parallel c$  bolsa,  $x = ?$

A)  $60^\circ$  B)  $70^\circ$  D)  $80^\circ$  E)  $90^\circ$

14.  $ABC$  u'shmu'yeshligine  $\angle A = 50^\circ$  ha'm  $\angle B = 70^\circ$  bolsa, woni'n' u'lken ta'repin ani'qlan'.

A)  $AB$  B)  $BC$  D)  $AC$   
E) ani'qlap bolmaydi'.



15. Yeger 4-su'wrette  $O$  — shen'berdin' worayi',  $AO = 4$  sm bolsa,  $BC$  kesindisinin' uzi'nli'g'i'n tabi'n'.

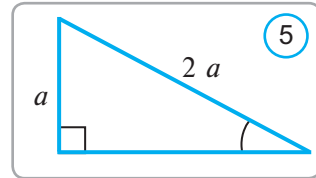
A) 4 sm B) 5 sm  
D) 2 sm E) 8 sm

16. 5-su'wrette su'wretlengen u'shmu'yeshliktin' kishi mu'yeshin tabi'n'.

A)  $30^\circ$  B)  $45^\circ$   
D)  $60^\circ$  E)  $90^\circ$

17. U'shmu'yeshliktin' bir biyikligi woni' perimetrleri 25 *sm* ha'm 29 *sm* bolg'an u'shmu'yeshliklarga aji'ratadi'. Yeger berilgen u'shmu'yeshliktin' perimetri 40 *sm* bolsa, woni'n' biyikligin tabi'n'.

A) 10 *sm*                      B) 7 *sm*                      D) 5 *sm*                      E) 9 *sm*



18.  $120^\circ$  qa ten' mu'yeshke qon'si'las bolg'an mu'yeshlerdin' qosi'ndi'si'n tabi'n'.

A)  $30^\circ$                       B)  $45^\circ$                       D)  $180^\circ$                       E)  $120^\circ$

19.  $ABC$  u'shmu'yeshliginin'  $C$  mu'yeshi  $70^\circ$  qa ten' bolsa,  $A$  ha'm  $B$  mu'yeshlerinin' bissektrisalari' arasi'ndag'i' mu'yeshi tabi'n'.

A)  $55^\circ$                       B)  $60^\circ$                       D)  $65^\circ$                       E)  $75^\circ$

20.  $ABCD$  tuwri'mu'yeshliginin'  $A$  ha'm  $D$  to'belerinen ju'rgizilgen bissektrisalari'  $BC$  ta'repin 3 ten'dey bo'lekke aji'ratadi'. Yeger tuwrmu'yeshliktin' ta'repleri pu'tin sanlardan ibarat boli'p,  $AB = 5$  bolsa, woni'n' perimetrin tabi'n'.

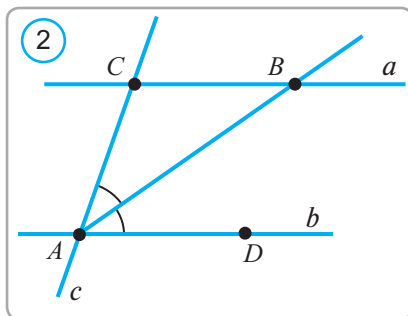
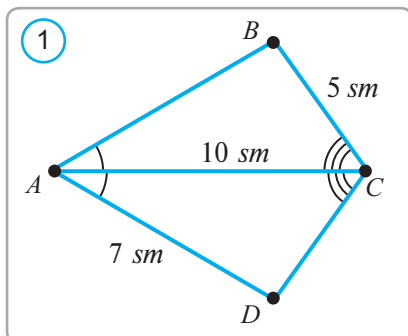
A) 20                      B) 30                      D) 40                      E) 80

## 6. Ma'seleler

1. Ten' qaptalli'  $ABC$  u'shmu'yeshliginin' to'besinen  $AB$  ultani'na ju'rgizilgen bissektrisasi' woni' yeki u'shmu'yeshlikke aji'ratadi'. Bul u'shmu'yeshliklardin' ten' yekenligin da'lillen'.
2. Perimetri 30 *sm* bolg'an u'shmu'yeshliktin' bir ta'repi yekinshi ta'repinen 2 *sm* u'lken, u'shinshi ta'repinen bolsa 2 *sm* kishi. U'shmu'yeshliktin' u'lken ta'repin tabi'n'.
3. U'shmu'yeshliktin' ultani'na tu'sirilgen medianasi' woni' perimetri 18 *sm* ha'm 24 *sm* ge ten' bolg'an yeki u'shmu'yeshlikke aji'ratadi'. Berilgen u'shmu'yeshliktin' kishi qaptal ta'repi 6 *sm* ge ten'. U'shmu'yeshliktin' u'lken qaptal ta'repin tabi'n'.
4. U'shmu'yeshliktin' 5 ke ten' bolg'an biyikligi woni' perimetri 18 ha'm 26 bolg'an yeki u'shmu'yeshlikke aji'ratadi'. Berilgen u'shmu'yeshliktin' perimetrin tabi'n'.
5. Ten' qaptalli' u'shmu'yeshliktin' perimetri 7,6 *sm* ge, ultani' bolsa 2 *sm* ge ten'. Qaptal ta'repin tabi'n'.
6.  $AB$  ha'm  $CD$  tuwri'lari'  $O$  noqatta kesilisedi.  $BOC$  ha'm  $AOD$  mu'yeshlerinin' qosi'ndi'si'  $194^\circ$  qa ten'.  $AOC$  mu'yeshi tabi'n'.
7.  $ABC$  u'shmu'yeshliginde  $A$  mu'yeshi  $C$  mu'yeshine ten',  $AD$  biyikligi bolsa  $BC$  ta'repin ten' yekige bo'ledi. Yeger  $BD = 7,8$  *sm* bolsa,  $AC$  ni' tabi'n'.
8. Ten' qaptalli' u'shmu'yeshliktin' qaptal ta'replerine tu'sirilgen biyikligi menen yekinshi qaptal ta'repi arasi'ndag'i' mu'yesh  $20^\circ$  qa ten'. U'shmu'yeshliktin' ultani'ndag'i' mu'yeshin tabi'n'.
9.  $B$  mu'yeshinin' bissektrisasi'nda jatqan  $D$  noqati'nan mu'yeshin' ta'replerine  $DA$  ha'm  $DC$  perpendikulyarlar ju'rgizilgen.  $DA = DC$  yekenligin da'lillen'.
10. Yeger  $A$ ,  $B$  ha'm  $C$  noqatlari' bir tuwri'da jati'p,  $AC = 7$  *m* va  $BC = 9$  *m* bolsa,  $AB$  kesindisinin' uzi'nli'g'i'n tabi'n'.

## 62-63

### Juwmaqlawshi' baqlaw jumi'si'



Juwmaqlawshi' baqlaw jumi'si' yeki bo'limnen ibarat boladi'. Birinshi bo'limde 65 – 66 - sabaqlarda ko'rilgan diktant ha'm test sorawlari'na uqsas 5 diktant ha'm 10 testni sheshiw usi'ni's etiledi. Baqlaw jumi'si'ni'n' yekinshi bo'liminde to'mendegi variantta berilgen ma'selelerge uqsas 5 ma'sele beriliwi mu'mkin.

#### Juwmaqlawshi' jazba baqlaw jumi'si'ni'n' u'lgisi.

1. Qon'si'las mu'yeshlerinin' biri yekinshisinen  $17^\circ$  kishi. Usi' mu'yeshlerdi tabi'n'.
2. 1-su'wrette berilgen mag'li'wmatlar tiykari'nda
  - a)  $\triangle ABC = \triangle ADC$  yekenligin da'lillen';
  - b)  $ACD$  u'shmu'yeshliginin' perimetrin tabi'n'.
3. 2-su'wrette  $a \parallel b$  ha'm  $AB - CAD$  mu'yeshinin' bissektisasi',  $AC = 7 \text{ sm}$ .  $BC$  kesindisinin' uzi'nlig'i'n tabi'n'.
4. Tuvri' mu'yeshli u'shmu'yeshliktin' tuwri' mu'yeshinen tu'sirilgen biyikligi woni'n' bissektisasi' da boladi'. Bul u'shmu'yeshliktin' mu'yeshlerin tabi'n'.
5. Berilgen mu'yeshke ten' mu'yesh ha'm woni'n' bissektisasi'n jasan'.

---

## Juwalpar ha'm ko'rsetpeler

---

- 2.** 7. 1. **9.** a) qa'legenshe; b) 1; c) 1 yamasa uliwma wo' tkerip bolmaydi'. **10.** 5; 10. **11.** a) 3; b) 6. **12.** 6; 10.
- 3.** 1. A ha'm C; A ha'm D; A ha'm B. **3.** Ha; yo'q. **5.** a) 2; b) 3; d) 11; e)  $(n+1)$ . **6.** 6. **7.** 6. **8.** 4, 6. **9.** 4. **10.** Awa.
- 4.** 4. a ha'm d. **5.** 2 menen 5; 6 menen 9. **7.** 3 ha'm 14; 4 ha'm 10; 6 ha'm 9; 5 ha'm 12. **11.** 6:  $AB, BC, CD; AC; AD; BD$ .
- 5.** 3. 4  $sm$ ; 5  $sm$ ; 6,5  $sm$ ; 1  $sm$ ; 2,5  $sm$ ; 1,5  $sm$ . **4.** 6,6. **5.** 1. **6.** 9. **7.** 12,8  $sm$ . **8.** 0,8. **10.** 2 hal boli'wi' mu'mkin.  $B$  noqat  $AC$  kesindi bolsa,  $AC=800\ m$ .  $C$  noqat  $AB$  kesindi bolsa,  $AC=400\ m$ . **11.** 5. **15.**  $B$  nuqta  $A$  va  $C$  noqatlar arasi'nda jatadi.
- 6.** 8. a) 36  $mm$ ; b) 90  $sm$ ; c) 4  $m$  22  $sm$ . **10.** a) 5  $sm$ ; b) 3,5  $sm$ ; c) 57  $sm$ . **13.** 130  $sm$ ; **14.** 16  $m$
- 8.** 4.  $\angle AOD, \angle COB, \angle DOB, \angle AOC$ . **5.** 10, bular:  $\angle AOE, \angle EOD, \angle DOC, \angle COB, \angle BOA, \angle EOB, \angle EOC, \angle AOC, \angle AOD, \angle BOD$ . **10.** Awa; Yaq, yaq.
- 9.** 4. Awa. **7.** a)  $72^\circ$ ; b)  $60^\circ$ ; c)  $50^\circ$ . **12.** a) Awa; b) Yaq; c) Yaq. **14.** a)  $90^\circ$ ; b)  $180^\circ$ . **15.**  $\angle AOB = 60^\circ, \angle AOC = 90^\circ, \angle AOD = 130^\circ, \angle BOC = 30^\circ, \angle BOD = 70^\circ, \angle COD = 40^\circ$ .
- 10.** 1-baqlaw jumi'si: 1.  $BC = 3\ sm$ . 2.  $BC = 12\ sm$ . 3.  $\angle BOC = 35^\circ$ . 4.  $150^\circ$ .
- 11.** 5.  $45^\circ$ . 6. a) 8; b) 8; c) 8; d) 8 ta. 7. 5 su'yir; 1 do'qal. 10. a)  $30^\circ$ ; b)  $180^\circ$ ; c)  $1^\circ$ . 11. a)  $0,5^\circ$ ; b)  $2,5^\circ$ ; c)  $15^\circ$ . 12. a)  $105^\circ$ ; b)  $75^\circ$ . 13.  $OC$  nur  $\angle AOD$  ni'n';  $OD$  nur  $\angle COE$  ni'n';  $OE$  nur  $\angle DOB$  ni'n';  $OD$  nur  $\angle AOB$  ni'n' bissektrisasi bo'ladi'.
- 12.** 2.  $180^\circ$ . 6. a)  $160^\circ$ ; b)  $150^\circ$ ; c)  $135^\circ$ ; d)  $90^\circ$ . 7.  $45^\circ$ ;  $135^\circ$ . 8. a) Yaq; b) Awa; c) Yaq. 9. Awa. 10. a)  $140^\circ$ ; b)  $45^\circ$ ; c)  $45^\circ$ . 11. a)  $45^\circ$ ; b)  $60^\circ$ ; c)  $30^\circ$ . 12. a)  $40^\circ$ ;  $140^\circ$ ; b)  $55^\circ$ ;  $125^\circ$ ; c)  $18^\circ$ ;  $162^\circ$ . 14.  $140^\circ, 40^\circ, 140^\circ$ . 15. Yaq.
- 13.** 6. 1), 2), 3), 6). 7. Yaq, kesindiler wortasi' u'stpe-u'st tu'spey qali'wi' mu'mkin.
- 14.** 2. 1. 5. qa'legenshe. 8.  $90^\circ$ . 9. Yaq. 10. Awa.
- 15.** 3.  $90^\circ$ . 5.  $OC$ . 6.  $60^\circ$ ;  $60^\circ$ .
- 17.** 5-testler: 1. E; 2. D; 3. D; 4. A; 5. E; 6. B; 7. E; 8. E; 9. B; 10. B; 11. A; 12. D; 13. E; 14. B; 15. A; 16. A; 17. B; 18. E. 6-ma'seleler: 2.  $90^\circ$ . 3.  $60^\circ$ . 4. Yaq. 5. Ma'sele 2 sheshimge iye: 1)  $15^\circ$ ; 2)  $65^\circ$ . 6.  $15^\circ$ . 9. Yaq. 10. Ma'sele yeki sheshimge iye: 1) 0,5  $m$ ; 2) 5,9  $m$ . 11. a)  $AC = 9\ m, BC = 6\ m$ ; b)  $AC = 7,5\ m, BC = 7,5\ m$ ; c)  $AC = 6\ m, BC = 9\ m$ . 13. a) 15; b) 21; c) 45. 15. 1,3. 16. 6. 17. 4.30 yaki 7.30. 18. 6. 19.  $\angle AOB = 110^\circ, \angle BOC = 70^\circ$ ; b)  $\angle AOB = 36^\circ, \angle BOC = 144^\circ$ ; c)  $\angle AOB = 112^\circ, \angle BOC = 68^\circ$ ; d)  $\angle AOB = 150^\circ$ ,

$\angle BOC = 30^\circ$ . **20.**  $50^\circ, 130^\circ, 50^\circ, 130^\circ$ . **21.** a)  $C \in AB$ ; b)  $A \in BC$ .

- 18. 2-baqlaw jumisi:** **1.**  $106^\circ$ . **2.**  $60^\circ$ . **3.**  $48^\circ$ .
- 19.** **7.** a) a, b, d, e, g; b) c, f, h; c) c, f.
- 20.** **2.** a)  $\angle QR$ ; b)  $\angle RPQ$  va  $\angle RQP$ ; c)  $\angle Q$  yoki  $\angle PQR$ ; d)  $\angle PQR$ . **4.** a) towri; b) su'yir; c) ten' qaptalli; d) ten' ta'repli; e) dog'al mu'yeshli. **7.** a) 3 ta; b) 3 ta; c) 3 ta.
- 21.** **7.** Tuvri' mu'yeshli u'shmu'yeshlikte. **8.** Awa. **9.** 3. **10.** 9. **11.** 16.
- 22.** **11.**  $85^\circ$ . **12.** e)  $\angle D = 35^\circ, \angle C = 62^\circ$ . **13.** Yaq.
- 23.** **2.** Ti'ykari'nda. **3.** 10. **4.**  $a = 12, b = 8$ . **10.** 8,8; 11.
- 24.** **4.** 4. **11.**  $AC = BD = 7$ .
- 25.** **6.**  $\triangle BAC = \triangle KAN, \triangle BAN = \triangle KAC$ . **9.** 3.
- 26.** **4.** Ten' ta'repli u'shmu'yeshlikte. **5.** 10,4 sm. **7.** 8 sm.
- 27.** **4.**  $\angle C_1 = 90^\circ, \angle A_1 = 30^\circ, \angle B_1 = 60^\circ$ . **5.** 10 sm, 10 sm.
- 28. 5-testler:** **1.** B; **2.** D; **3.** B; **4.** E; **5.** D. **6.** A. **7.** D; **8.** A; **9.** B; **10.** D; **11.** B; **12.** B; **13.** A; **14.** B; **15.** D; **16.** A. **6-ma'seleler:** **7.** Awa. **11.**  $85^\circ$ . **12.**  $48^\circ$ . **13.**  $120^\circ$ .
- 29. 3-baqlaw jumi'si':** **1.** 10. **3.**  $3\frac{11}{15}, 7\frac{1}{3}, 7\frac{1}{3}$ .
- 30.** **7.** Yaq, yaq. **10.** Awa.
- 31.** **3.**  $\angle 1 = \angle 3 = \angle 5 = \angle 7 = 117^\circ, \angle 4 = \angle 8 = 63^\circ$ . **4.**  $98^\circ, 82^\circ, 98^\circ; 70^\circ, 110^\circ, 70^\circ$ .
- 32.** **5.** a) Awa; b) Awa; c) Awa; d) Yaq. **7.** 1 ewi kesispewi yoki ha'mmesi kesisedi.
- 33.** **4.**  $\angle 3 = \angle 7 = 105^\circ; \angle 2 = \angle 4 = \angle 6 = \angle 8 = 75^\circ$ . **6.** Yaq.
- 34.** **7.** 1) tuwri'; 2) tuwri'; 3) tuwri'.
- 35.** **5.**  $45^\circ$ . **8.**  $\angle 2 = \angle 3 = 53^\circ$ . **9.**  $70^\circ, 110^\circ$ . **12.**  $70^\circ, 110^\circ$ .
- 36. 5-testler:** **1.** A; **2.** B; **3.** A; **4.** E; **5.** D; **6.** D; **7.** D; **8.** E; **9.** B; **10.** B; **11.** D; **12.** E; **13.** A; **14.** B; **15.** E; **16.** A. **6-ma'seleler:** **1.**  $55^\circ$ . **2.** Awa. **3.** Awa. **4.**  $\angle 3 = \angle 7 = 118^\circ; \angle 2 = \angle 4 = \angle 6 = \angle 8 = 62^\circ$ . **6.**  $128^\circ$ . **11.**  $59^\circ$ .
- 37. 4-baqlaw jumi'si':** **1.**  $34^\circ, 146^\circ, 146^\circ$ . **3.**  $48^\circ, 132^\circ$ .
- 38.** **2.** 1. **3.** 1. **4.** a) bar; b) joq; c) mavjud emas. **5.** a)  $80^\circ$ ; b)  $25^\circ$ ; c)  $45^\circ$ ; d)  $45^\circ$ . **6.** a)  $63^\circ$ ; b)  $90^\circ$ ; c)  $15^\circ$ . **7.** a)  $80^\circ, 50^\circ$ ; b)  $30^\circ, 60^\circ, 90^\circ$ ; c)  $50^\circ, 60^\circ, 70^\circ$ . **8.** a)  $65^\circ$ ; b)  $45^\circ, 90^\circ, 45^\circ$ . **9.** a)  $79^\circ$ ; b)  $100^\circ$ . **10.**  $x = 20^\circ, y = 50^\circ$ . **12.**  $60^\circ$ . **13.**  $60^\circ, 60^\circ, 60^\circ$ . **14.**  $45^\circ, 90^\circ, 45^\circ$ . **15.** a)  $50^\circ, 80^\circ$  yoki  $65^\circ, 65^\circ$ ; b)  $60^\circ$  ha'm  $60^\circ$ ; c)  $37,5^\circ; 37,5^\circ$ .

- 39.** 3.  $60^\circ$ ,  $45^\circ$ ,  $75^\circ$ . 4.  $30^\circ$ ,  $120^\circ$ . 5.  $75^\circ$ . 6.  $270^\circ$ . 7.  $90^\circ$ . 8.  $90^\circ$ . 9.  $110^\circ$ . 10.  $60^\circ$ . 11. birewi boli'wi' mu'mkin. 12.  $360^\circ$ .
- 40.** 1.  $50^\circ$ ;  $90^\circ$ ;  $40^\circ$ . 2.  $60^\circ$ ;  $48^\circ$ . 5. mu'mkin. 6.  $540^\circ$ . 7.  $24^\circ$ ,  $36^\circ$ ,  $60^\circ$ . 9. a)  $30^\circ$ ,  $30^\circ$ ; b)  $70^\circ$ ,  $40^\circ$  yoki  $55^\circ$ ,  $55^\circ$ . 10. a)  $15^\circ$ ,  $150^\circ$ ; b)  $75^\circ$ ,  $30^\circ$ . 12.  $15^\circ$ ;  $65^\circ$ . 13.  $30^\circ$ . 14.  $67,5^\circ$ .
- 41.** 5. Gipotenuza  $30^\circ$  qarama-qarsi'si'nda katetdan 2 yese u'lken boladi'. 7. a) 4; b) 6; c)  $60^\circ$ . 8. a) 5; b) 13,5; c) 9. 10. 8 ha'm 16.
- 42.** 3. a) Yaq; b) yaq; d) boladi'; e) yaq. 4. a) boladi'; b) boladi'; d) boladi'; e) yaq; f) yaq. 6. a) boladi'; b) boladi'; d) boladi'; e) yaq; f) boladi'.
- 43.** 2. 7 sm. 3. 7 sm, 7 sm.
- 44.** 2. yen' u'lkeni  $\angle ACB$ , yen' kishisi  $\angle ABC$ . 3. a)  $\angle ABC > \angle BAC > \angle ACB$  mu'mkin yemes; b)  $\angle ACB = \angle ABC < \angle BAC$  mu'mkin. 4. Tiykari', qaptal ta'repi. 5. Yaq. 6. a)  $BC > AC > AB$ ; b)  $BC < AC < AB$ . 7. Yaq, yaq. 8.  $60^\circ$ ;  $60^\circ$ ;  $120^\circ$ ;  $120^\circ$ . 9.  $0 < \angle B < 60^\circ$ . 10. Su'yir mu'yeshli. 12. Gipotenuzasi.
- 45.** 3. Yaq. 4. a) bar; b) yaq; c) bar; d) bar. 5. a) 7; b) 10; c) 8 yoki 5. 8. 7; 7; 11. 9. 6. 10. U'shmu'yeshlik yoki kesispe.
- 46.** 4-testler: 1. B; 2. D; 3. B; 4. B; 5. D; 6. B; 7. B; 8. B; 9. E; 10. A; 11. D; 12. A; 13. D; 14. A; 15. D; 16. D; 17. D; 18. D.
- 47.** 5-baqlaw jumi'si': 1.  $65^\circ$ . 2.  $40^\circ$ ,  $60^\circ$ ,  $80^\circ$ . 3. 12 sm 4.  $40^\circ$ ,  $60^\circ$ ,  $80^\circ$ .
- 53.** 1-Testler: 1. A; 2. D; 3. B.
- 56.** 1. 20 sm. 2.  $20^\circ$ . 3.  $15^\circ$ . 4.  $30^\circ$ . 5.  $40^\circ$ ;  $60^\circ$ ;  $80^\circ$ . 6. 1 : 2. 7.  $76^\circ$ . 8.  $42^\circ$ . 9.  $21^\circ$ ,  $69^\circ$ . 10.  $\angle AOB = 122,5^\circ$ . 11.  $72^\circ$ . 12.  $46^\circ$ .
- 58-59.** 3. Su'yir mu'yeshli. 5. a)  $92^\circ$ ; b)  $42^\circ$ . 6. 6; 6; 6;  $60^\circ$ . 8.  $45^\circ$ . 10. Kesispe. 11. Awa. 12. 9 sm. 15.  $144^\circ$ . 16.  $54^\circ$ . 17. 3,6 sm. 19. 4 ta  $55^\circ$  li' va 4 ta  $125^\circ$ .
- 60-61.** 5-Testler: 1. A; 2. E; 3. D; 4. B; 5. E; 6. A; 7. E; 8. D. 9. B. 10. A. 11. A; 12. D; 13. B; 14. D; 15. E; 16. A; 17. B; 18. E; 19. A; 20. D. 6-Ma'seleler: 2. 12 sm. 3. 12 sm. 4. 34. 5. 2,8 sm. 6.  $83^\circ$ . 7. 15,6 sm. 8.  $55^\circ$ . 10. 2 m yoki 16 m.
- 60-61.** Juwmaqlawshi baqlaw jumi'si': 1.  $81^\circ$ ,  $99^\circ$ . 2. b) 22 sm. 3. 7 sm.

**ABDULLA AZAMOV, BAHODIR HAYDAROV, ERGASHVOY SARIQOV  
ATAMURAT QO'CHQOROV, ULUG'BEK SAG'DIYEV**

## **“GEOMETRIYA”**

Umumta'lim maktablarining 7-sinfi uchun darslik

(Qoraqalpoq tilida)

Toshkent — “Yangiyul poligraph service” — 2013

Awdarmashi' — *D. Qoshqarov*

Redaktori' — *S. Yusupov*

Texnikali'q redaktori' —

Operator —

Original maketten basi'wg'a ruxsat yetilgen waqti' \_\_\_\_\_.2013. Qag'az formati' 70x90<sup>1</sup>/16.  
«Arial» garniturası'. Ofset baspa usi'li'nda basi'ldi'. Sha'rtli baspa tabaq 14,0. Baspa tabaq  
13,0. Nusqasi' \_\_\_\_\_. Buyi'rtpa N\_\_\_\_\_.

Sha'rtname N\_\_\_\_\_.

**“Yangiyul poligraph service” JSNJ baspaxanasi'nda basi'ldi'.**

**Yangiyo'l q., Samaqand ko'shesi, 44.**

### Ijarag'a berilgen sabaqli'q jag'dayi'n ko'rsetiwshi keste

| N | Woqi'wshi'ni'n' ati' ha'm familiyasi' | Woqi'w ji'li' | Sabaqli'qti'n' ali'ng'andag'i' jag'dayi' | Klass basshi'- si'ni'n' qoli' | Sabaqli'qti'n' tapsi'ri'l- g'andag'i' jag'dayi' | Klass basshi'- si'ni'n' qoli' |
|---|---------------------------------------|---------------|------------------------------------------|-------------------------------|-------------------------------------------------|-------------------------------|
| 1 |                                       |               |                                          |                               |                                                 |                               |
| 2 |                                       |               |                                          |                               |                                                 |                               |
| 3 |                                       |               |                                          |                               |                                                 |                               |
| 4 |                                       |               |                                          |                               |                                                 |                               |
| 5 |                                       |               |                                          |                               |                                                 |                               |
| 6 |                                       |               |                                          |                               |                                                 |                               |

### Sabaqli'q ijarag'a berilip woqi'w ji'li' aqi'ri'nda qaytari'p ali'ng'anda joqardag'i' keste klass basshi'si' ta'repinen to'mendegi bahalaw ta'rtibine tiykarlani'p tolti'ri'ladi':

|                     |                                                                                                                                                                                                                                                           |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Taza                | Sabaqli'qti'n' birinshi ret paydalani'wg'a berilgendegi jag'dayi'.                                                                                                                                                                                        |
| Jaqsi'              | Muqaba pu'tin, sabaqli'qti'n' tiykar'gi' bo'liminen ajratil'gan. Barli'q betleri bar, ji'rti'lmag'an, betleri almasti'ri'lmag'an, betlerinde jazil'w ha'm si'zi'q joq.                                                                                    |
| Qanaatlandi'rarli'  | Muqaba jelengen, biraz si'zi'li'p, shetleri qayril'gan, sabaqli'qti'n' tiykar'gi' bo'liminen ali'ni'p qali'w jag'dayi' bar, paydalani'wshi' ta'repinen qanaatlanarli' qal'pine keltirilgen. Ali'ng'an betler qayta islengen, ayi'ri'm betler si'zi'lg'an. |
| Qanaatlandi'rarsi'z | Muqabag'a si'zi'lg'an, ji'rti'lg'an tiykar'gi' bo'limnen aji'rati'lg'an ya-masa pu'tkilley joq, qanaatlandi'rarsi'z islengen. Betleri ji'rti'lg'an, betleri toli'q emes, si'zi'p, boyap taslang'an. Sabaqli'qti' qayta tiklewge bolmaydi'.                |