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ALGEBRA

7-SINF UCHUN O'QUV QO'LLANMA

O'zbekiston Respublikasi Xalq ta'limi vazirligi tavsiya etgan

Beshinchi nashri

G'afur G'ulom nomidagi nashriyot-matbaa ijodiy uyi
Toshkent — 2004

Assalomu alaykum, aziz o'quvchi!

Shuni yaxshi bilingki, Siz mustaqil O'zbekistonning ko'rar ko'zi, kelajagisiz. Mustaqil Vatanimiz Sizdan ko'p narsalarni kutishga haqli. Buning uchun o'qish, o'rganish kerak. Fan cho'qqilarini zabt etishingizda mazkur darslik ko'makchingiz bo'lsin.

G'afur G'ulom nomidagi nashriyot-matbaa ijodiy uyi

Qo'llanmadagi shartli belgilashlar

- ⓘ – bilish va eslab qolish foydali bo'lgan material
- △ – masalani yechish boshlandi
- ▲ – masalani yechish tugadi
- ○ – matematik tasdiqni asoslash yoki formulani keltirib chiqarish boshlandi
- ● – asoslash yoki keltirib chiqarish tugadi
- — – majburiy masalalardan qo'shimcha masalalarni ajratuvchi belgi
- * – boshqalariga nisbatan bir oz qiyinroq masalalar

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ALGEBRAIK IFODALAR

1-§. SONLI IFODALAR

Algebra so'zi mashhur o'zbek matematigi va astronomi, vatandoshimiz Abu Abdullo Muhammad ibn Muso al-Xorazmiyning «Kitob al-muxtasar fi hisob al-jabr va-l-muqobala» asaridagi al-jabr (lotinchasiga *algebra*) so'zidan olingan. Bu asarda al-Xorazmiy dunyoda birinchi marta algebra fanini izchillik bilan bayon qilgan.

Algebraning asosiy masalasi algebraik ifodalar ustida matematik amallarni o'rganishdir. Algebraik ifodalarning eng sodda ko'rinishi bo'lgan har hil sonli ifodalar V-VI sinflar matematika kursida qaralgan edi.

Sonli ifoda sonlardan tuzilib, amallar ishoralari bilan birlashtirilgan yozuv ekanligini eslatib o'tamiz.

Masalan,

$$2\cdot 3+7,\ 10:2-3,\ \frac{4\cdot 0{,}5+3}{5},\ \frac{1}{3}-\frac{1}{2}$$

yozuvlar sonli ifodalardir.

Sonli ifodaning qiymati deb, shu sonli ifodada ko'rsatilgan amallarni bajarish natijasida hosil bo'lgan sonni aytiladi.

Masalan, $2\cdot 3+7$ sonli ifodaning qiymati 13 soni, $\frac{1}{3}-\frac{1}{2}$ sonli ifodaning qiymati $-\frac{1}{6}$ sonidir.

Sonli ifoda bitta sondan iborat bo'lishi mumkin. Uning qiymati shu sonning o'zi bo'ladi.

Ba'zan sonli ifodada sonlar va amallar ishoralaridan tashqari amallarning ma'lum tartibda bajarilishini ko'rsatuvchi qavslardan foydalaniladi.

Masalan,

$$(2{,}5+3{,}5)\cdot 2{,}1$$

sonli ifodaning qiymatini hisoblashda avval qavs ichidagi qo'shish,

Abu Abdullo Muhammad ibn Muso al-Xorazmiy (783-850), buyuk o'zbek matematigi va astronomi

so'ngra esa ko'paytirish bajariladi.

$(2,5+3,5)\cdot 2,1$ ifodaning qiymatini hisoblab, 12,6 sonini hosil qilamiz. Shuning uchun

$$(2,5+3,5)\cdot 2,1=12,6$$

tenglikni yozish mumkin.

«=» belgisi bilan birlashtirilgan ikkita sonli ifoda *sonli tenglikni* tashkil qiladi.

Agar tenglikning chap va o'ng qismlarining qiymatlari bir xil son bo'lsa, u holda tenglik *to'g'ri tenglik* deyiladi.

Masalan, $\frac{15-1}{2}=8-1$ tenglik to'g'ri, chunki uning ikkala qismining ham qiymati birgina 7 soniga teng.

Sonli ifodalar va sonli tengliklardan hisoblashlar bilan bir qatorda sonlarning xossalarini yozishda ham foydalaniladi.

Masalan, $\frac{3}{4}=\frac{6}{8}$ tenglik kasrlarning asosiy xossasini, $35+21=$ $=21+35$ tenglik esa qo'shishning o'rin almashtirish qonunini ifodalaydi.

Endi $6+12\cdot 3$ sonli ifodani qaraylik. $6+12\cdot 3=6+36=42$ dan iborat bo'lgan to'g'ri natija amallarni qabul qilingan bajarish tartibiga rioya qilingan holdagina hosil bo'ladi.

Agar qabul qilingan hisoblash tartibi buzilsa va avval 6 bilan 12 ni qo'shib, so'ngra 3 ga ko'paytirilsa, u holda 54 dan iborat noto'g'ri natija hosil qilinadi. Bu natija dastlabki ifoda

$$(6+12)\cdot 3$$

kabi yozilgan bo'lganida to'g'ri bo'lar edi.

Demak, hisoblashning to'g'riligi sonli ifodalardagi amallarning bajarilish tartibiga bog'liq ekan.

Sonlar ustida amallarning bajarilish tartibi algebraik ifodalar-

ning son qiymatlarini topishga oid mashqlarni bajarishda ham saqlanib qoladi.

Qo'shish va ayirish *birinchi bosqich amallar*,. ko'paytirish va bo'lish esa *ikkinchi bosqich amallar* deyilishini eslatib o'tamiz. Kvadrat va kubga ko'tarish *uchinchi bosqich amallar* deyiladi.

Algebraik ifodaning son qiymatini topishda amallar bajarilishining quyidagi tartibi qabul qilingan:

1) Agar ifodada qavslar bo'lmasa, u holda avval uchinchi bosqich amallar, keyin ikkinchi bosqich amallar, va nihoyat, birinchi bosqich amallar bajariladi, shu bilan birga bir xil bosqich amallar ular qanday tartibda yozilgan bo'lsa, xuddi shu tartibda bajariladi.

Masalan,

$$3 \cdot 5^2 \cdot 4 - 5 \cdot 4 + 7 = 3 \cdot 25 \cdot 4 - 5 \cdot 4 + 7 =$$
$$= 300 - 20 + 7 = 280 + 7 = 287.$$

2) Agar ifodada qavslar bo'lsa, u holda avval qavslar ichidagi sonlar ustida barcha amallar, so'ngra esa qolgan barcha amallar bajariladi, bunda qavs ichidagi va undan tashqaridagi barcha amallar 1- bandda ko'rsatilgan tartibda bajariladi.

Masalan,

$$(2^3 \cdot 4 - 5) \cdot 6 + (2 + 2 \cdot 4) = (8 \cdot 4 - 5) \cdot 6 + (2 + 2 \cdot 4) =$$
$$= (32 - 5) \cdot 6 + (2 + 8) = 27 \cdot 6 + 10 = 162 + 10 = 172.$$

3) Agar kasrning qiymati hisoblanadigan bo'lsa, u holda kasrning suratidagi va maxrajidagi amallar bajariladi, so'ngra birinchi natija ikkinchisiga bo'linadi.

Masalan,

$$\frac{2 \cdot 3^3 - 3 \cdot 5}{3 + 5^2} = \frac{2 \cdot 27 - 3 \cdot 5}{3 + 25} = \frac{54 - 15}{28} = 1\frac{11}{28}.$$

4) Agar ifodada qavslar ichida boshqa qavslar bo'lsa, u holda avval eng ichkaridagi qavslar ichidagi amallar bajariladi.

Masalan,

$$(2 \cdot (8 - (5^2 - 4)) = 2 \cdot (8 - (25 - 4)) =$$
$$= 2 \cdot (8 - 21) = 2 \cdot (-13) = -26.$$

Mashqlar

1. Amallarni bajaring:

   1) $2{,}17+(3{,}2-0{,}17)$; 3) $13\frac{7}{9}-(2{,}64+2\frac{7}{9})$;

   2) $9{,}49-(1{,}5+0{,}99)$; 4) $6\frac{7}{8}-(3{,}14-2\frac{1}{8})$.

2. Sonli ifodaning qiymatini toping:

   1) $(\frac{1}{2}+\frac{1}{3})\cdot(\frac{1}{5}-\frac{1}{4})$; 3) $(0{,}3-\frac{1}{20}):(\frac{3}{4}-1{,}25)$;

   2) $(\frac{2}{7}-\frac{3}{4})\cdot(\frac{2}{13}-\frac{1}{2})$; 4) $(2{,}7-\frac{1}{5}):(\frac{1}{2}+4{,}5)$.

3. Qiymati: 1) 8; 2) 0; 3) 1; 4) –14 ga teng bir nechta sonli ifoda yozing.

4. Tenglik to'g'rimi:

   1) $4\frac{2}{3}+\frac{1}{4}\cdot(1\frac{7}{9}-\frac{4}{9})=5$; 3) $(90{,}9:3{,}03)\cdot(\frac{1}{3}-\frac{5}{6})=1$;

   2) $5\frac{1}{7}-\frac{1}{7}\cdot(1\frac{3}{4}+\frac{1}{4})=4$; 4) $(\frac{2}{5}+2\frac{3}{5})\cdot(12{,}4:3{,}1)=12$?

5. Tenglik to'g'rimi:

   1) $\frac{12{,}5-4{,}1}{4}=1{,}7+0{,}4$; 3) $\frac{2{,}13+4{,}33}{7{,}58-4{,}35}=1\frac{5}{12}+\frac{1}{3}+\frac{1}{4}$;

   2) $\frac{0{,}75-0{,}15}{2}=0{,}15+0{,}25$; 4) $\frac{8{,}92-6{,}61}{5{,}38-1{,}55}=2\frac{1}{9}-\frac{1}{2}-\frac{1}{3}$?

Sonli tenglik shaklida yozing **(6–7):**

6. 1) $\frac{1}{3}$ va $\frac{1}{5}$ sonlarining yig'indisi $\frac{2}{3}$ va $\frac{2}{15}$ sonlarining ayirmasiga teng; 2) 40 va 0,03 sonlarining ko'paytmasi 6 sonini 5 ga bo'lgandagi bo'linmaga teng.

7. 1) 10 va –2 sonlari ayirmasining ikkilangani shu sonlar yig'indisidan uch marta katta;
   2) 2 va 6 sonlari yig'indisining uchlangani shu sonlar ko'paytmasidan ikki marta ortiq.

8. Arifmetik amallar qonunlaridan foydalanib, sonli ifodaning qiymatini toping:

   1) (Og'zaki) $93\cdot 5$; $102\cdot 12$; $28\frac{7}{8}:7$; $0{,}25\cdot 72\cdot 4$.

2) $(51{,}8+44{,}3+48{,}2-24{,}3):\frac{1}{3}$;

3) $29\cdot 0{,}45+0{,}45\cdot 11$; 4) $9\frac{1}{3}\cdot(\frac{3}{4}-\frac{3}{7})$.

9. Amallar tartibini ko'rsating va hisoblang:

1) $1{,}7\cdot 3^2+\frac{2}{3}\cdot 12-15$; 2) $27{,}7-(\frac{1}{2})^2\cdot 100+6{,}4:0{,}8$;

3) $48\cdot 0{,}05-(\frac{1}{3})^2\cdot 54+1{,}7$; 4) $(2{,}5)^2+15\cdot\frac{3}{5}-0{,}24:0{,}6$.

10. Sonli ifodaning qiymatini toping:

1) $(\frac{1}{2}+\frac{1}{3})\cdot(\frac{1}{5}-\frac{1}{4})$; 3) $4\frac{2}{3}+\frac{1}{4}\cdot(1\frac{7}{9}-\frac{1}{9})$;

2) $(\frac{2}{7}-\frac{3}{4})\cdot(\frac{2}{13}-\frac{1}{2})$; 4) $5\frac{1}{7}-\frac{1}{7}\cdot(1\frac{3}{4}+\frac{1}{4})$.

11. Amallarni bajaring:

1) $\frac{0{,}3\cdot 5^2-15}{3{,}5+2^2}$; 2) $\frac{4{,}2:6-3\frac{1}{3}\cdot 0{,}3}{7{,}5:0{,}5}$;

3) $13\frac{1}{3}\cdot(18{,}1-(3^2+6{,}1))$; 4) $((7{,}8:0{,}3-3^3)+3{,}1):0{,}7$.

12. (Qadimiy masala). Bir oylik (30 kunlik) ish haqi 10 dirham bo'lgan xizmatchining 6 kunlik ish haqi qancha?

2- §. ALGEBRAIK IFODALAR

Quyidagi masalani qaraymiz.

1 - m a s a l a . Biror son o'ylang, uni 3 ga ko'paytiring, hosil bo'lgan natijaga 6 ni qo'shing, topilgan yig'indini 3 ga bo'ling va o'ylangan sonni ayiring. Qanday son hosil bo'ladi?

△ Aytaylik, o'ylangan son 8 bo'lsin. Barcha amallarni masala shartida ko'rsatilgan tartibda bajaramiz:

1) $8\cdot 3=24$; 2) $24+6=30$; 3) $30:3=10$; 4) $10-8=2$.

2 soni hosil bo'ldi.

Bu yechimni qiymati 2 ga teng bo'lgan $(8\cdot 3+6):3-8$ sonli ifoda shaklida yozish mumkin.

Bordi-yu, agar 5 soni o'ylangan bo'lsa, u holda qiymati yana 2 ga teng bo'lgan $(5\cdot 3+6):3-5$ sonli ifoda hosil qilingan bo'lar edi.

Biz qanday sonni o'ylamaylik, natijada 2 soni hosil bo'laverar ekan-da, degan faraz tug'iladi. Buni tekshirib ko'ramiz. O'ylangan sonni a harfi bilan belgilaymiz va amallarni yana masala shartida ko'rsatilgan tartibda yozamiz:

$$(a \cdot 3+6) : 3-a .$$

Arifmetik amallarning bizga ma'lum bo'lgan xossalaridan foydalanib, bu ifodani soddalashtiramiz:

$$(a \cdot 3+6) : 3-a=a+2-a=2 . \blacktriangle$$

Masalani yechishda istagan sonni bildiruvchi a harfi, 3 va 6 sonlari, amallar ishoralari va qavslardan iborat

$$(a \cdot 3+6) : 3-a$$

ifoda hosil qilindi. Bu algebraik ifodaga misoldir.

Yana algebraik ifodalarga misollar keltiramiz:

$$2(m+n),\ 3a+2ab-7,\ (a+b)(a-b),\ \frac{x+y}{a} .$$

Algebraik ifoda sonlar va harflardan tuzilib, amallar ishoralari bilan birlashtirilgan ifodadir.

Agar algebraik ifodaga kirgan harflar o'rniga biror sonni qo'yilsa va ko'rsatilgan amallar bajarilsa, u holda natijada hosil qilingan sonni *berilgan algebraik ifodaning son qiymati* deyiladi.

Masalan, $a=2$, $b=3$ bo'lganda

$$3a+2b-7$$

algebraik ifodaning qiymati 5 ga teng, chunki $3 \cdot 2+2 \cdot 3-7=5$; shu algebraik ifodaning qiymati $a=1$; $b=0$ bo'lganda -4 ga teng, chunki

$$3 \cdot 1+2 \cdot 0-7=-4.$$

a ning istagan qiymatida

$$(a \cdot 3+6) : 3-a$$

algebraik ifodaning qiymati 2 ga teng.

2-masala. $a=10$, $b=5$ bo'lganda

$$\frac{(3a+7)b}{a-b}$$

ifodaning qiymatini toping.

$\blacktriangle$ $\frac{(3 \cdot 10+7) \cdot 5}{10-5}=\frac{37 \cdot 5}{5}=37 . \blacktriangle$

Mashqlar

13. Algebraik ifodaning qiymatini toping:

1) $3a-2b$, bunda $a=\frac{1}{3}$, $b=1$; 2) $2a+3b$, bunda $a=3$, $b=-2$;

3) $0{,}25a-4c^2$, bunda $a=4$, $c=3$;

4) $(2a^2-\frac{1}{3}b)$, bunda $a=2$, $b=9$.

14. Algebraik ifodaning qiymatini toping:

1) $\frac{1}{4}x-\frac{3}{7}y$, bunda $x=8$, $y=-14$;

2) $\frac{2}{3}x+\frac{4}{5}y$, bunda $x=9$, $y=-10$;

3) $\frac{a-3b}{a+3b}$, bunda $a=4$, $b=-2$; 4) $\frac{a+3c}{2a-c}$, bunda $a=3$, $c=-1$.

15. Neft quvuridan 1 soatda 7 t neft oqadi, m soatda quvurdan necha tonna neft oqib o'tadi? Bir sutkada-chi?

16. 1) m soatda; 2) p sekundda; 3) m soat l minut va p sekundda necha minut bor?

17. x va y sonlar ayirmasining uchlanganini yozing. Shu ifodaning:

1) $x=-0{,}37$, $y=-0{,}42$; 3) $x=-\frac{5}{6}$, $y=-\frac{9}{4}$;

2) $x=-2{,}98$, $y=-4{,}48$; 4) $x=\frac{2}{15}$, $y=-0{,}7$

bol'gandagi son qiymatini toping.

18. x va y sonlar yig'indisi bilan ular ayirmasining ko'paytmasini yozing. Hosil bo'lgan algebraik ifodaning:

1) $x=-\frac{1}{8}$, $y=\frac{1}{4}$; 2) $x=-\frac{5}{8}$, $y=\frac{3}{4}$; 3) $x=0{,}15$, $y=-0{,}75$;

4) $x=1{,}32$, $y=-1{,}28$ bo'lgandagi son qiymatini toping.

Algebraik ifodalarning son qiymatini toping (**19–20**):

19. 1) $\frac{2mn(n+k)}{n-k}$, bunda $m=k=\frac{1}{3}$, $n=\frac{1}{2}$;

2) $\frac{(3p+1)2p}{p-l}+\frac{1}{3}$, bunda $p=\frac{1}{3}$, $l=1$.

20. 1) $\frac{3(x-y)}{2p+q}$, bunda $x=8{,}31$; $y=2{,}29$; $p=2{,}01$; $q=2$;

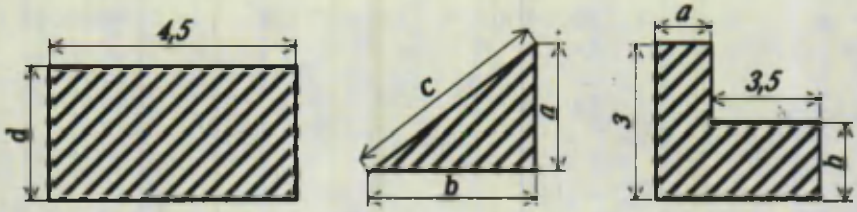
2) $\frac{5(bc+m)}{2q+4\frac{1}{4}}$, bunda $b=\frac{2}{3}$; $c=6$; $q=\frac{1}{2}$, $m=\frac{1}{5}$.

21. Toq son formulasi $n=2k+1$ dan foydalanib, $k=0$, $k=1$, $k=7$, $k=10$ bo'lganda n ning qiymatini toping.

22. Algebraik ifoda shaklida yozing:

1) kichigi n ga teng bo'lgan ikkita ketma-ket natural sonning yig'indisi; 2) kattasi m ga teng bo'lgan ikkita ketma-ket natural sonning ko'paytmasi; 3) kichigi $2k$ ga teng bo'lgan uchta ketma-ket juft natural sonning yig'indisi; 4) kichigi $2p+1$ ga teng bo'lgan uchta ketma-ket toq natural sonning ko'paytmasi.

23. Shtrixlangan shakllarning perimetri va yuzini algebraik ifoda shaklida yozing (1- rasm).



a) b) d)

1- rasm

24. Uyni isitish uchun p tonna ko'mir g'amlandi; shu zahiradan q tonna sarf qilindi. Necha tonna ko'mir qoldi? 1) $p=20$, $q=15$ bo'lganda hisoblang. 2) q son p sondan katta bo'lishi mumkinmi? p ga teng bo'lishi-chi?

25. Temir yo'l kassasida har biri 400 so'mdan n ta chipta va har biri 500 so'mdan m ta chipta sotildi. Hamma chiptalar uchun qancha pul olingan? $n=200$, $m=150$; $n=100$, $m=230$ bo'lganda hisoblang.

26. Bitta albomning bahosi 200 so'm, bitta daftarning bahosi 40 so'm, bitta ruchkaning bahosi 60 so'm. c ta albom, a ta daftar, b ta ruchkaning umumiy (so'mlardagi) bahosini p harfi

bilan belgilab, uni formula shaklida yozing. Agar $c=9$, $a=21$, $b=4$ bo'lsa, bu formula bo'yicha p ni hisoblang.

27. Issiqlik uzatish stansiyasi uchun mo'ljallangan gaz quvuri orqali har minutda 26 kub metr gaz o'tadi. 1 sutkada; 5 sutkada; m sutkada quvurdan necha kub metr gaz o'tadi?

28. Geologlar guruhi o'z yo'nalishi bo'yicha harakat qilib, otda soatiga c kilometr tezlik bilan 3 soat-u 10 minut yurdi; oqimining tezligi soatiga a kilometr bo'lgan daryoda oqim bo'yicha 1 soat-u 40 minut solda suzdi va soatiga b kilometr tezlik bilan 2 soat-u 30 minut piyoda yurdi. Yo'nalishning (km lardagi) uzunligini s harfi bilan belgilab, geologlar bosib o'tgan yo'l formulasini yozing. Agar $a=3{,}3$ km/soat, $b=5{,}7$ km/soat, $c=10{,}5$ km/soat bo'lsa, yo'nalishning uzunligini hisoblang.

29. 1) $s=\frac{1}{2}ah$ formuladan a ni;

2) $v=gt$ formuladan t ni toping.

30. Hisoblang:

1) $\frac{4{,}25:0{,}85+0{,}5}{(5{,}56-4{,}06):3}$;

2) $\frac{1}{13\frac{5}{8}:(2{,}6+\frac{1}{8})}$;

3) $\frac{1}{2}(\frac{3}{4}-0{,}25)\cdot 0{,}5-(\frac{1}{2})^2$;

4) $-\frac{1}{3}\cdot(\frac{1}{3}-\frac{4}{9})+(-\frac{1}{3})^3$.

3- §. ALGEBRAIK TENGLIKLAR. FORMULALAR

Ko'pgina amaliy masalalarni yechishda sonlarni belgilash uchun harflardan foydalanish qulaydir.

Masalan, agar a va b to'g'ri to'rtburchak tomonlarining uzunliklari bo'lsa, u holda $a\cdot b$ – uning yuzi; $2\cdot(a+b)$ – uning perimetri. Bu yerda a va b harflari bilan musbat sonlar – to'g'ri to'rtburchak tomonlarining uzunliklari belgilangan. Agar to'g'ri to'rtburchak yuzini S harfi bilan, perimetrini esa P bilan belgilasak, u holda quyidagi formulalarni hosil qilamiz:

$$S=a\cdot b,\quad P=2\cdot(a+b).$$

Agarda tomonlar uzunliklari santimetrlarda o'lchangan bo'lsa, u holda S yuz kvadrat santimetrlarda, P perimetr esa santimetrlarda ifodalanadi.

Yozuvni qisqartirish uchun ko'paytirish belgisi «nuqta» ko'pin-

cha tushirib qoldiriladi. Masalan, $S=ab$, $P=2(a+b)$ deb yoziladi.

Harflar bilan, shuningdek, tenglamalardagi noma'lum sonlar ham belgilanadi. Masalan:

$$x+12,3=95,1$$

tenglamadagi noma'lum son x harfi bilan belgilangan,

$$2y+3=7$$

tenglamadagi noma'lum son esa y harfi bilan belgilangan.

Harflar bilan arifmetik amallar qonunlari va xossalarini yozish ham qulaydir. Masalan:

$$a-(b+c)=(a-b)-c=a-b-c. \quad (1)$$

$$(a+b)\cdot c=a\cdot c+b\cdot c, \quad (2)$$

$$(a+b):c=a:c+b:c. \quad (3)$$

Algebrada birgina harfning o'zi har xil sonli qiymatlar qabul qilishi mumkin. Jumladan, (1) va (2) tengliklarda a, b, c – ixtiyoriy sonlar; (3) tenglikda esa a, b – istalgan sonlar, lekin $c\neq 0$, chunki nolga bo'lish mumkin emas.

Harflar yordamida juft va toq natural sonlar formulasini yozish mumkin.

Agar a juft son bo'lsa, u holda bu son 2 ga bo'linadi va uni bunday yozish mumkin:

$$a=2n,$$

bu yerda n – natural son.

Agar b toq son bo'lsa, u holda uni 2 ga bo'lgandagi qoldiq 1 ga teng, binobarin b sonni bunday yozish mumkin:

$$b=2n+1,$$

bu yerda n – natural son yoki nol.

Ba'zan toq natural sonlar formulasini quyidagicha ham yoziladi:

$$b=2k-1,$$

bu yerda k – natural son.

XVI asrning taniqli matematigi Fransua Viyet (1540-1603) algebraga harfiy simvolikani kiritishning asoschisi hisoblanadi

Harflardan foydalanish bir xil usulda yechiladigan ko'pgina masalalarni yechish yo'lini yozishga imkon beradi. Shunga doir masalalar qaraylik:

1-masala. Xo'jalikdagi bog' maydoni to'g'ri to'rtburchak shaklida bo'lib, uning bo'yi a kilometrga, eni esa b kilometrga teng. Qo'riq yer o'zlashtirilgandan keyin maydonning yuzi 0,88 km^2 ga ortdi. Bog' maydonining yuzi qancha bo'ldi? Hisoblashlarni 1) $a=2,2$ va $b=0,8$; 2) $a=1,4$ va $b=4,3$ uchun bajaring.

△ Qo'riq yer ochilguncha bog'ning yuzi $a \cdot b$ km^2 ga teng edi, qo'riq ochilgandan keyin u $(ab+0,88)$ km^2 ga teng bo'ldi.

1) $a=2,2$ va $b=0,8$ bo'lganda, $2,2 \cdot 0,8+0,88=2,64$.

2) $a=1,4$ va $b=4,3$ bo'lganda, $1,4 \cdot 4,3+0,88=6,9$. ▲

2-masala. Sayyoh qishloqdan chiqib, shahar tomon jo'nadi. U a kilometr piyoda yurganidan keyin avtobusga o'tirdi va avtobusda t soatda shaharga yetib keldi. Agar avtobus 60 km/soat tezlik bilan harakat qilgan bo'lsa: 1) $a=5$ va $t=0,5$ bo'lganda qishloq bilan shahar orasidagi S masofani hisoblang; 2) $S=70$, $a=10$ bo'lganda t ni toping.

△ Sayyoh avtobusda t soatda $60t$ kilometr yo'l bosgan. Shuning uchun qishloq bilan shahar orasidagi masofa

$$S=a+60t$$

formula bilan ifodalanadi.

1) $a=5$ va $t=0,5$ bo'lganda $S=5+60 \cdot 0,5=35$ km bo'ladi;

2) $S=a+60t$ formuladan t ni topamiz: $t=\frac{S-a}{60}$. Bu yerdan $S=70$, $a=10$ bo'lganda $t=(70-10):60=1$ soat. ▲

Mashqlar

31. Yozing:

1) m va n sonlarning yig'indisini;
2) a va b sonlar ayirmasini;
3) a va b sonlar ayirmasining ikkilanganini;
4) m va n sonlar ko'paytmasining ikkilanganini;
5) n va m sonlar yig'indisini ularning ayirmasiga bo'lgandagi bo'linmani;
6) a va b sonlar yig'indisini ularning ayirmasiga ko'paytmasini.

32. Yozing:

1) a, 3 va b sonlarning yig'indisini;
2) n, m va 5 sonlarning ko'paytmasini;
3) 12 soni bilan a va b sonlar ko'paytmasining yig'indisini;
4) n va m sonlar yig'indisini 17 soniga bo'lgandagi bo'linmani.

33. Quyidagi ifodalarda harflar qanday sonlarni ifodalashi mumkin:

1) tanaffus n minut davom etadi;
2) sinfimizda y nafar o'quvchi bor;
3) VII sinfda x ta o'quv fani o'qitiladi;
4) bir oyda k kun bor?

34. Quyidagi jadvalda keltirilgan ma'lumotlardan foydalanib, to'g'ri to'rtburchak perimetrining qiymatini $P=2(m+n)$ formula bo'yicha toping, bu yerda P – to'g'ri to'rtburchakning perimetri, m – asosi, n – balandligi:

m	6	25	5,4	17,2	$3\frac{5}{6}$
n	4	18	3,6	17,8	$4\frac{1}{3}$
$2(m+n)$					

35. Yerning sun'iy yo'ldoshi 9 km/sek tezlik bilan harakat qiladi. Ushbu jadvalni to'ldiring:

Bosib o'tilgan masofa, km	45 000	1 350 000
Harakat vaqti, sek		

36. Reaktiv samolyot 1000 km yo'lga a litr yonilg'i sarf qiladi. Ushbu jadvalni to'ldiring:

Bosib o'tilgan masofa, km	3000	8000	500			s
Yonilg'i sarfi, ℓ				$5a$	$0,1a$	

37. Birinchi qopda m kilogramm, ikkinchi qopda esa birinchi qopdagidan n kilogramm kam un bor. Ikkinchi qopda necha kilogramm un bor? Masalani 1) $m=50$ va $n=12$; 2) $m=45$ va $n=15$ hollar uchun yeching.

38. Piyoda 1 soatda 5 km yo'l bosadi. U 3 soatda necha kilometr yo'l bosadi? k soatda-chi?

39. Do'konga har birida 50 kg dan un bo'lgan a qop keltirildi. Do'konga necha kilogramm un keltirilgan?

40. Traktorchilar brigadasi 1 kunda 15 ga yerni haydaydi. Brigada a kunda necha ga yer haydaydi?

41. Har biri x so'mdan 6 ta daftar va har biri y so'mdan 3 o'ram qog'oz sotib olindi. Hamma xarid qancha turadi?

42. Yuk mashinasi do'konga ombordan har biri a kilogrammdan 15 yashik olxo'ri va har biri b kilogrammdan 20 yashik olma keltirdi. Do'konga necha kilogramm meva keltirilgan?

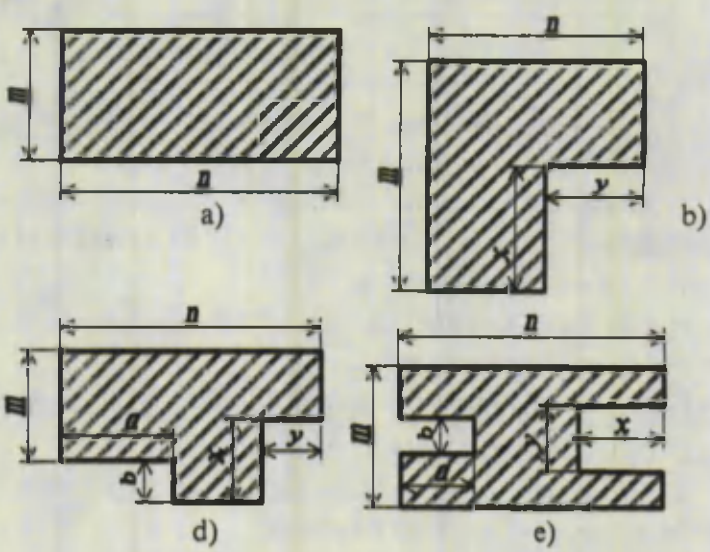
43. Mashinaga har biri m kilogrammdan a qop bug'doy va har biri n kilogrammdan c qop arpa yuklandi. Mashinaga necha kilogramm don yuklangan?

44. To'g'ri to'rtburchak shaklidagi maktab tajriba maydonining bo'yi a metrga teng, eni esa bo'yidan b metr qisqa. Shu maydonning yuzi (S) ning formulasini yozing.

45. Kinoteatrda har biri n ta o'rindiqqa ega bo'lgan m ta qator va yana k ta qo'shimcha o'rindiq bor. Kinoteatrda hammasi bo'lib nechta o'rindiq bor? Masalani yechish formulasini tuzing va $m=30$, $n=25$, $k=60$ bo'lganda hisoblashlarni bajaring.

46. Dars jadvalida 5 ta dars, ikkita 15 minutlik va ikkita 10 minutlik tanaffus bo'lgan kuni o'quvchi maktabda necha soat bo'ladi? Shu masalani yechish formulasini tuzing va zarur hisoblashlarni bajaring.

47. O'lchamlari 2- rasmda ko'rsatilgan shakllarning perimetrlarini va yuzlarini hisoblash uchun formulalar yozing.



2- rasm.

48. To'g'ri to'rtburchakning bo'yi kvadratning tomonidan 8 m uzun, eni esa shu kvadrat tomonidan 4 m qisqa. Kvadrat tomonini biror harf bilan belgilab, to'g'ri to'rtburchak uchun: 1) tomonlarning uzunligini; 2) perimetrini; 3) yuzini yozing.

49. Avtobus t soatda s kilometr yo'l bosadi. Avtomobil xuddi shu yo'lni avtobusdan 1 soat oldin bosib o'tishi uchun qanday tezlikka ega bo'lishi kerak?

50. $x=2a+3b$ (km) formula avtobusning harakati haqidagi masala yechilishini bildiradi. Masala shartini tuzing.

51. Maktab tajriba maydoni a kvadrat metr yuzga ega. Bog' yuzi 1500 m^2 bo'lgan joyni egallagan, qolgan maydon 20 ta bir xil maydonchaga bo'lingan. Shu maydonchalarning har biri qanday yuzaga ega?

52. Uchburchakning bir tomoni a santimetr, ikkinchisi undan 3 sm qisqa, uchinchi tomoni esa birinchisidan 2 sm uzun. Shu uchburchakning tomonlarini va perimetrini toping.

53. Bankka 5000 so'm qo'yildi. Bir yildan so'ng jamg'arma p% ga ko'paydi. Bir yildan keyin jamg'armaning miqdori necha so'mga yetdi?

54. Asosi a detsimetr, perimetri esa 42 dm bo'lgan to'g'ri to'rtburchakning yuzini hisoblash uchun ifoda tuzing. a ning ushbu jadvalda keltirilgan qiymatlari uchun to'g'ri to'rtburchak yuzi (S) ning qiymatini (dm^2 larda) hisoblang:

a	5	6	7,5	10	12	12,5	15
S							

55. Velosipedchi soatiga v kilometr tezlik bilan harakat qilmoqda. U jo'nash joyidan s kilometr uzoqlikda bo'lgan qishloqqa borishi kerak. Agar u 3 km yo'lni bosib o'tgan bo'lsa, unga qishloqqa yetib borishi uchun yana qancha vaqt talab qilinadi? Agar u 3 km yurgan va $s=36$, $v=12$ bo'lsa, qishloqqa 2,5 soatda yetib bora oladimi?

56. («Ming bir kecha» dan masala). Bir ayol bog'ga olma tergani kirdi. Bog'dan u 4 ta eshik orqali chiqishi kerak edi. Har bir eshik oldida qorovul turgan bo'lib, ayol birinchi qorovulga tergan olmalarining yarmini berdi. Ikkinchi qorovulga esa qolgan olmalarning yarmini berdi. Uchinchi va to'rtinchi qorovullarni ham xuddi shunday siyladi. Oxirida o'ziga 10 ta olma qoldi. Ayol bog'da necha dona olma uzgan?

57. Hisoblang:

1) $(18\frac{6}{7}+21\frac{3}{14}):3$;

2) $(19\frac{2}{3}-11\frac{7}{9})\cdot\frac{9}{71}$;

3) $(103{,}05-99{,}5)\cdot 20{,}4$;

4) $20+(7\frac{1}{3}-6\frac{7}{8}):0{,}75$.

4- §. ARIFMETIK AMALLARNING XOSSALARI

Algebrani puxta o'rganish uchun arifmetik amallarning xossalarini yaxshi bilish lozim. Eslatib o'taylik, arifmetik amallar deb qo'shish, ayirish, ko'paytirish va bo'lish amallarini aytiladi. Sonlar ustidagi bu amallarning xossalarini qisqacha formulalar ko'rinishida yozamiz. Amallarning asosiy xossalari odatda qonunlar deb ataladi. Qonunlardan foydalanib amallarning boshqa xossalarini ham asoslash mumkin.

1. Qo'shish va ko'paytirish.

Qo'shish va ko'paytirishning asosiy qonunlarini sanab o'tamiz.

1. O'rin almashtirish qonuni:

$$a+b=b+a,\ ab=ba.$$

2. Guruhlash qonuni:

$$(a+b)+c=a+(b+c),\ (ab)c=a(bc).$$

3. Taqsimot qonuni:

$$a(b+c)=ab+ac.$$

Bu tengliklarda a, b, c – ixtiyoriy sonlar. Masalan,

$$1{,}2+3{,}5=3{,}5+1{,}2;\quad \frac{3}{4}\cdot\left(-\frac{2}{7}\right)=\left(-\frac{2}{7}\right)\cdot\frac{3}{4};$$

$$(-8)\cdot(125+7)=(-8)\cdot 125+(-8)\cdot 7.$$

Qo'shish va ko'paytirish qonunlari yordamida amallarning boshqa xossalarini ham hosil qilish mumkin. Masalan:

$$a+b+c+d=a+(b+c+d),\ (abc)d=(ab)(cd),$$
$$(a+b+c)d=ad+bd+cd.$$

1-masala. Hisoblang: $75+37+25+13$.

Hisoblashlarni ko'rsatilgan tartibda olib borish mumkin: 75 ga 37 ni qo'shib, natijaga 25 ni qo'shish va oxirgi natijaga 13 ni qo'shish. Lekin qo'shishning xossalaridan foydalanib, hisoblashlarni soddalashtirish mumkin:

$$75+37+25+13=(75+25)+(37+13)=100+50=150.\blacktriangle$$

Bu misol shuni ko'rsatadiki, amallarning xossalaridan foydalanib, hisoblashlarni eng sodda (oqilona) usulda bajarish mumkin.

Amallarning xossalari algebraik ifodalarni soddalashtirish maqsadida bajariladigan almashtirishlarda ham qo'llaniladi.

2-masala. Ifodani soddalashtiring:

$$3(2a+4b)+5(7a+b).$$

$$\triangle\ 3(2a+4b)+5(7a+b)=3\cdot 2a+3\cdot 4b+5\cdot 7a+5\cdot b=$$
$$=6a+12b+35a+5b=(6a+35a)+(12b+5b)=$$
$$=(6+35)a+(12+5)b=41a+17b.\ \blacktriangle$$

Bu masalani yechish jarayonida quyidagi ifoda hosil bo'ldi:

$$6a+12b+35a+5b.$$

Bu ifodada $6a$ va $35a$ qo'shiluvchila r o'xshashdir, chunki ular bir-biridan faqat koeffitsientlari bilangina farq qiladi. $12b$ va $5b$ qo'shiluvchilar ham o'xshash. Shu sababli $6a+12b+35a+5b$ ifoda o'rniga $41a+17b$ ifodani yozish, ya'ni o'xshash hadlarni ixchamlash mumkin bo'ladi.

Oraliq hisoblashlarni og'zaki bajarib, almashtirishlar yozuvini qisqartirish mumkin. Masalan,

$$6(3x+4)+2(x+1)=18x+24+2x+2=20x+26.$$

2. Ayirish.

3-masala. Toshkent va Samarqand shaharlari orasida Jizzax shahri joylashgan. Toshkentdan Samarqandgacha bo'lgan masofa 300 km, Toshkentdan Jizzaxgacha bo'lgan masofa esa 180 km. Jizzaxdan Samarqandgacha bo'lgan masofani toping.

△ Jizzaxdan Samarqandgacha bo'lgan masofa x kilometr bo'lsin. U holda

$$180+x=300, \text{ bu yerdan } x=300-180=120.$$

Javob. 120 km. ▲

$180+x=300$ tenglikdan x qo'shish amaliga teskari deb ataluvchi ayirish amali yordamida topiladi.

Ayirishni qarama-qarshi sonni qo'shish bilan almashtirish mumkin:

$$a-b=a+(-b).$$

Shu sababli ayirish amalining xossalarini qo'shish amalining xossalari orqali asoslash mumkin. Masalan:

$$\begin{array}{l|l} 251+(49-13)=251+49-13=287, & a+(b-c)=a+b-c, \\ 123-(23+39)=123-23-39=61, & a-(b+c)=a-b-c, \\ 123-(83-77)=123-83+77=117, & a-(b-c)=a-b+c. \end{array}$$

4-masala. Ifodaning qiymatini hisoblang:

$$4(3x-5y)+6(x-y),$$

bunda $x=\frac{1}{2}$, $y=\frac{1}{13}$.

△ Avval berilgan ifodani soddalashtiramiz:

$$4(3x-5y)+6(x-y)=12x-20y+6x-6y=18x-26y.$$

Hosil bo'lgan ifodaning $x=\frac{1}{2}$, $y=\frac{1}{13}$ dagi qiymatini hisoblaymiz:

$$18\cdot\frac{1}{2}-26\cdot\frac{1}{13}=9-2=7.\ \blacktriangle$$

Shunday qilib, amallarning xossalaridan foydalanish algebraik ifodani avval soddalashtirib, so'ngra uning qiymatini ratsional yo'l bilan hisoblash imkonini beradi.

3. Bo'lish.

5-masala. To'g'ri to'rtburchakning yuzi 380 sm^2, tomonlaridan biri 95 sm. To'g'ri to'rtburchakning ikkinchi tomonining uzunligini toping.

△ $S=ab$ formuladan $b=\frac{S}{a}$ ni topamiz. $S=380$, $a=95$ bo'lgani uchun

$$b=\frac{380}{95}=4.$$

Javob. 4 sm. ▲

$ab=S$ tenglikdan b ko'paytirish amaliga teskari deb ataluvchi bo'lish amali yordamida topiladi.

Bo'lish bo'luvchiga teskari bo'lgan songa ko'paytirish bilan almashtirilishi mumkin:

$$\frac{a}{b}=a\cdot\frac{1}{b}.$$

Shu sababli bo'lishning xossalarini ko'paytirishning xossalaridan keltirib chiqarish mumkin.

6-masala. Tenglikni isbotlang:

$$\frac{a+b}{c}=\frac{a}{c}+\frac{b}{c},$$

bu yerda $c\neq 0$.

△ Bo'lishni ko'paytirish bilan almashtirib, quyidagini hosil qilamiz:

$$\frac{a+b}{c}=(a+b)\cdot\frac{1}{c}.$$

Taqsimot qonunini qo'llab,

$$(a+b)\cdot\frac{1}{c}=a\cdot\frac{1}{c}+b\cdot\frac{1}{c}$$

ni topamiz. Ko'paytirishni bo'lish bilan almashtirib,

$$a\cdot\frac{1}{c}+b\cdot\frac{1}{c}=\frac{a}{c}+\frac{b}{c}$$

ni hosil qilamiz. ▲

Mashqlar

58. Arifmetik amallar qonunlari va xossalarini qo'llab, sonli ifodaning qiymatini toping:

1) $29\cdot0{,}45+0{,}45\cdot11$;. 2) $(51{,}8+44{,}3+48{,}2-24{,}3)\cdot\frac{1}{3}$;

3) $4{,}07-5{,}49+8{,}93-1{,}51$; 4) $-11{,}401-23{,}17+4{,}401-10{,}83$.

59. O'xshash hadlarni ixchamlang:

1) $4a+2b+a-b$; 3) $0{,}1c-0{,}3+d-c-2{,}1d$;

2) $x-2y-3x+5y$; 4) $8{,}7-2m+n-\frac{1}{3}m+\frac{2}{3}n$.

60. O'xshash hadlarni ixchamlang:

1) $2{,}3a-0{,}7a+3{,}6a-1$; 3) $\frac{1}{3}x+\frac{1}{2}x-\frac{1}{6}a-\frac{5}{6}a+2$;

2) $0{,}48b+3+0{,}52b-3{,}7b$; 4) $\frac{5}{6}y-\frac{1}{3}b-\frac{1}{6}y+\frac{2}{3}b-3$;

5) $2{,}1m+n-3{,}2n+2m+1{,}1m-n$;

6) $5.7p-2.7q+0{,}3p+0{,}8q+0.9q-p$.

61. Ifodani soddalashtiring:

1) $3(2x+1)+5(1+3x)$; 3) $10(n+m)-4(2m+7n)$;

2) $4(2+x)-3(1+x)$; 4) $11(5c+d)+3(d+c)$.

62. Ifodani soddalashtiring va son qiymatini toping:

1) $5(3x-7)+2(1-x)$, bunda $x=\frac{1}{26}$;

2) $7(10-x)+3(2x-1)$, bunda $x=-0{,}048$;

3) $\frac{1}{3}(6x-3)+\frac{2}{5}(5x-15)$, bunda $x=3{,}01$;

4) $0{,}01(2{,}2x-0{,}1)+0{,}1(x-100)$, bunda $x=-10$.

63. Arifmetik amallarning xossalaridan foydalanib, hisoblang:

1) $\frac{1}{7}(0{,}14+2{,}1-3{,}5)$; 3) $(18\frac{6}{7}+21\frac{3}{4}):3$;

2) $\frac{1}{12}(4{,}8-0{,}24-1{,}2)$; 4) $(15\frac{5}{7}+20\frac{15}{16})\cdot\frac{1}{5}$.

5- §. QAVSLARNI OCHISH QOIDALARI

1. Algebraik yig'indi.

1-masala. Yigirma besh qavatli binoda lift ishlamoqda. U 8-qavatdan 6 qavat pastga tushdi, so'ngra 12 qavat yuqoriga ko'tarildi. 4 qavat pastga tushdi. 7 qavat yuqoriga ko'tarildi. 13 qavat pastga tushdi. Lift qaysi qavatda turibdi?

△ Liftning qaysi qavatda turganligini topish uchun $8-6+12-4+7-13$ ifodaning qiymatini hisoblash kerak. Bu qiymat 4 ga teng. Demak, lift 4- qavatda turibdi. ▲

Siz VI sinf matematika kursidan

$$8-6+12-4+7-13$$

ifoda *algebraik yig'indi* deb atalishini bilasiz, chunki uni yig'indi shaklida bunday yozish mumkin:

$$8+(-6)+12+(-4)+7+(-13).$$

Algebraik yig'indilarga oid yana misollar keltiramiz:

$$3-(-7)+(-2),\ a-b+c-d,\ a+(-b)-(-c).$$

$(-c)$ sonni ayirish $(-c)$ songa qarama-qarshi sonni, ya'ni c sonni qo'shishni bildirishini eslatib o'tamiz. Shuning uchun oxirgi algebraik yig'indini bunday yozish mumkin:

$$a+(-b)+c.$$

Algebraik yig'indi – bu «+» va «–» ishoralari bilan birlashtirilgan bir nechta algebraik ifodalardan tuzilgan yozuvdir.

Odatda $3-(-7)+(-2)$, $a+(-b)-(-c)$ ko'rinishidagi algebraik yig'indilarni qisqacha bunday yoziladi:

$$3-(-7)+(-2)=3+7-2;\quad a+(-b)-(-c)=a-b+c.$$

$3+7-2$ algebraik yig'indida qo'shiluvchilar 3, 7 va -2 sonlari bo'ladi, chunki $3+7-2=3+7+(-2)$; $a-b+c$ algebraik yig'indida qo'shiluvchilar a, $-b$, c sonlar bo'ladi, chunki $a-b+c=a+(-b)+c$.

2. Qavslarni ochish va qavs ichiga olish.

$a+(b+c)$ ifodani qaraymiz: qo'shishning guruhlash qonunini qo'llab, uni bunday yozish mumkin:

$$a+(b+c)=a+b+c.$$

Bu tenglikda c ni $-d$ bilan almashtiramiz:

$$a+(b-d)=a+b-d.$$

Qavs oldida «+» ishorasi turgan ifodalarda almashtirishlar bajarish shu tengliklarga asoslangan. Bu tengliklar *qavslarni ochishning* quyidagi *birinchi qoidasiga* olib keladi:

Agar algebraik ifodaga qavs ichiga olingan algebraik yig'indi qo'shiladigan bo'lsa, u holda shu algebraik yig'indidagi har bir qo'shiluvchining ishorasini saqlagan holda qavslarni tushirib qoldirish mumkin.

Masalan:

1) $14+(7-13+2)=14+7-13+2$;

2) $a+(b+c-d)=a+b+c-d$;

3) $(a-b)+c=a-b+c$.

Qavs oldida «–» ishorasi turgan ifodalarda almashtirishlar bajarish esa ayirish amalining quyidagi xossalariga asoslangan:

$$-(-a)=a,\ -(a+b)=-a-b,$$
$$a-(b+c)=a-b-c,$$
$$a-(b-c)=a-b+c.$$

Bu tengliklardan *qavslarni ochishning* quyidagi *ikkinchi qoidasi* kelib chiqadi:

Agar algebraik ifodadan qavs ichiga olingan algebraik yig'indi ayirilsa, u holda shu algebraik yig'indidagi har bir qo'shiluvchining ishorasini qarama-qarshisiga o'zgartirib, qavslarni tushirib qoldirish mumkin.

Masalan:

1) $14-(7-13+2)=14-7+13-2$;

2) $a-(b+c-d)=a-b-c+d$;

3) $-(a-b)+c=-a+b+c$.

2-masala. Qavslarni ochib soddalashtiring:

$$3x+(5-(8x+3)).$$

△ $3x+(5-(8x+3))=3x+5-(8x+3)=3x+5-8x-3=2-5x.$ ▲

Ba'zan bir necha qo'shiluvchini qavs ichiga olish foydali bo'ladi. Masalan:

1) $108-137+37=108-(137-37)=108-100=8;$

2) $\boxed{a+b-c+d=a+(b-c+d).}$

Bu yerda qavs oldiga «+» belgisi qo'yilgan, shuning uchun qavs ichidagi barcha qo'shiluvchilarning ishoralari saqlanib qoladi.

3) $\boxed{a-b-c+d=a-(b+c-d).}$

Bu yerda qavs oldiga «–» belgisi qo'yilgan, shuning uchun qavs ichiga olingan barcha qo'shiluvchilarning ishoralari qarama-qarshisiga o'zgartirildi.

Mashqlar

64. Algebraik yig'indini qavslarsiz yozing:

1) $(-4)+(-3)-(+7);$ 3) $(-a)+(-7b)+\frac{1}{3}c;$

2) $(-4)+(-9)-(-11);$ 4) $2a+(-3b)-4c.$

65. Algebraik yig'indining qo'shiluvchilarini ayting:

1) $15-c;$ 2) $m-7;$ 3) $-a+47;$ 4) $-13-b.$

66. Algebraik yig'indini yig'indi shaklida yozing:

1) $a-b+c;$ 2) $a-2-b;$ 3) $2+b-c;$ 4) $3+a-b-c.$

67. (Og'zaki.) Ifodani yig'indi sifatida qarab, o'qing. Bu yig'indining qo'shiluvchilarini ko'rsating:

1) $a-3+b+c;$ 3) $k+l-p-2;$

2) $m-n-11-d;$ 4) $t-m-n-l.$

Qavslarni oching **(68-69)**:

68. 1) $a+(2b-3c);$ 3) $a-(2b+3c);$

2) $a-(2b-3c);$ 4) $-(a-2b+3c).$

69. 1) $a+(b-(c-d))$; 3) $a-((b-c)-d)$;
2) $a-(b-(c-d))$; 4) $a-(b+(c-(d-k)))$.

70. Qavslarni oching va soddalashtiring:
1) $3a-(a+2b)$; 3) $3m-(5m-(2m-1))$;
2) $5x-(2y-3x)$; 4) $4a+(2a-(3a+2))$.

71. m yoki $(-m)$ sonlaridan boshlab, barcha qo'shiluvchilarni qavs oldiga «+» ishorasini qo'ygan holda qavs ichiga oling:
1) $a+2b+m-c$; 3) $a-m+3c+4d$;
2) $a-2b+m+c$; 4) $a-m+3b^2-2a^3$.

72. m yoki $(-m)$ sonlaridan boshlab, barcha qo'shiluvchilarni qavs oldiga «–» ishorasini qo'ygan holda qavs ichiga oling:
1) $2a+3b+m-c$; 3) $c-m-2a+3b^2$;
2) $2a+b+m+3c$; 4) $a-m+3b^2-2a^3$.

73. 1) $a+b-1$ ifodani biri a ga teng bo'lgan ikkita qo'shiluvchining yig'indisi shaklida yozing;
2) $a-b+1$ ifodani kamayuvchisi a bo'lgan ayirma shaklida yozing;
3) $2a-b+4$ ifodani kamayuvchisi $2a$ bo'lgan ayirma shaklida yozing;
4) $a-2b+8$ ifodani biri 8 ga teng bo'lgan ikkita qo'shiluvchining yig'indisi shaklida yozing.

74. $2x^2+5x^2y-4xy^2-y^3$ ifodada:
1) oxirgi uchta qo'shiluvchi oldiga «–» ishorasini qo'yib, qavslar ichiga oling;
2) oxirgi ikkita qo'shiluvchi oldiga «+» ishorasini qo'yib, qavslar ichiga oling;
3) ikkinchi va uchinchi qo'shiluvchilar oldiga «–» ishorasini qo'yib, qavslar ichiga oling;
4) birinchi va ikkinchi qo'shiluvchilar oldiga «–» ishorasini qo'yib, qavslar ichiga oling.

75. Ko'p nuqtalar o'rniga «+» va «–» ishoralarini shunday qo'yingki, natijada to'g'ri tenglik hosil bo'lsin:
1) $a-(b+c)=a+(...b\ ...c)$; 3) $m-(n-a)=m+(...n\ ...a)$;
2) $c-(a-b)=c+(...a\ ...b)$; 4) $n-(d-l)=n+(...d\ ...l)$.

76. Soddalashtiring:

1) $(5a-2b)-(3b-5a)$;
2) $(6a-b)-(2a+3b)$;
3) $7x+3y-(-3x+3y)$;
4) $8x-(3x-2y)-5y$.

77. Tenglamani yeching:

1) $(2x+1)+3x=16$;
2) $(x-4)+(x+6)=4$;
3) $(x-5)-(5-3x)=2$;
4) $23-(x+5)=13$.

78. Ifodani avval soddalashtirib, keyin uning son qiymatini toping:

1) $(2c+5d)-(c+4d)$, bunda $c=0{,}4$, $d=0{,}6$;
2) $(3a-4b)-(2a-3b)$, bunda $a=0{,}12$, $b=1{,}28$;
3) $(7x+8y)-(5x-2y)$, bunda $x=-\frac{3}{4}$, $y=0{,}025$;
4) $(5c-6b)-(3c-5b)$, bunda $c=-0{,}25$, $b=2\frac{1}{2}$.

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79. Hisoblang:

1) $3{,}64-(1{,}99-5{,}21-0{,}15)$;
2) $7{,}81-(23{,}04+5{,}43-3{,}66)$;
3) $13\frac{7}{9}-(2{,}64-3\frac{5}{9}+\frac{1}{3})$;
4) $17\frac{1}{6}-(9{,}21-4\frac{1}{2}-3\frac{1}{3})$.

80. Ifodaning qiymatini toping:

1) $\frac{2}{7}ab^2$, bunda $a=1{,}4$, $b=0{,}4$;
2) $(-\frac{1}{3}xy^2)^3x^2$, bunda $x=0{,}3$, $y=-1$.

I bobga doir mashqlar

81. (Og'zaki.) Ifodadagi amallarning bajarilish tartibini ko'rsating:

1) $(a-b)-c$;
2) $a-(b-c)$;
3) $a-bc+dm$;
4) p^3+2m+n^2;
5) $(a-b)c+dm$;
6) $p^3+(2m+n)^3$.

Algebraik ifodaning son qiymatini hisoblang **(82–88):**

82. 1) $a+bc$, bunda $a=-1$, $b=3$, $c=0$;
2) $a-bc$, bunda $a=2$, $b=-1$, $c=-3$;
3) $(a+b)c$, bunda $a=1$, $b=-3$, $c=2$;
4) $(a-b)c$, bunda $a=3$, $b=1{,}2$, $c=5$;

5) $(a-b)+(c-d)$, bunda $a=4,\ b=2,\ c=3,\ d=-1$;

6) $(a-b)-(c-d)$, bunda $a=0,\ b=-4,\ c=-2,\ d=3$;

7) $a-(b-c)$, bunda $a=0{,}5,\ b=\frac{1}{2},\ c=-1{,}2$;

8) $a-(b-c)-d$, bunda $a=5{,}2,\ b=1{,}3,\ c=2{,}8,\ d=2{,}8$.

83. 1) $2a^3$, bunda $a=0{,}9$; 3) $\frac{5}{4}a$, bunda $a=0{,}4$;

2) $0{,}3a^2$, bunda $a=0{,}3$; 4) $3a^2$, bunda $a=-\frac{1}{3}$.

84. 1) $5(x-y)^2$; 2) $3(x+y)^2$; 3) $(5x-y)^2$; 4) $(3x+y)^2$.

bunda $x=2{,}5,\ y=4{,}5$.

85. 1) $2((a-b)^2+1)$; 3) $((a-b)a-8):2$;

2) $4(3-(a-b)^2)$; 4) $(5a-(a+b)):3$, bunda $a=5,\ b=-1$.

86. 1) $3(a+b)-2ab$; 3) $3(a-b)+2ab$;

2) $3a+b-2ab$; 4) $3a-b+2ab$, bunda $a=1{,}2,\ b=1{,}8$.

87. 1) $\frac{1}{2}b^3-3c^2$, bunda $b=-2,\ c=-\frac{1}{3}$;

2) $-0{,}75a^2+1\frac{2}{3}b^3$, bunda $a=-2,\ b=3$;

3) $(a^2-26)^2$, bunda $a=-5$; 4) $(a^3+26)^3$, bunda $a=-3$;

88. 1) $7x^2-2ax$, bunda $x=-\frac{3}{7},\ a=1{,}5$;

2) $3ax-5x^2$, bunda $x=\frac{2}{5},\ a=-\frac{1}{3}$;

3) $2m^3(3m^2-k)^2$, bunda $m=-\frac{1}{2},\ k=0{,}75$;

4) $3n^2(2m^3-n)^2$, bunda $n=\frac{1}{4},\ m=-0.5$.

89. Hisoblang:

1) $\frac{(t-2)}{3t^2+4t-1}$, bunda $t=-2$; 2) $\frac{2a^2-4a-1}{(a+1)^2}$, bunda $a=-3$.

90. Ifodalarning qiymatlarini taqqoslang:

1) 2^2+2^3 va 2^{2+3}; 2) $(-2)^2+(-2)^3$ va $(-2)^{2+3}$;

3) $\frac{a^2}{2}$ va $(\frac{a}{2})^2$, bunda $a=-\frac{1}{2}$;

4) $\frac{m^2}{3}$ va $(\frac{m}{3})^2$, bunda $m=-\frac{1}{2}$.

91. Ifodalarning qiymatlarini taqqoslang:

1) $(a+b)^2$ va $4ab$; $(a+b)^2$ va $5ab$, bunda $a=3,\ b=2$;

2) $(a+b+c)^3$ va $27abc$, bunda $a=1,\ b=2,\ c=3$;

3) $(a+b+c)^3$ va $28abc$, bunda $a=1,\ b=2,\ c=3$.

92. Bir gektar ko'kalamzor bir yil davomida havoni 70 t changdan tozalashga qodir. 10 ga; 100 ga; m gektar ko'kalamzor bir yilda havoni necha tonna changdan tozalaydi? Umumiy maydoni 16000 ga bo'lgan ko'kalamzor havoni necha tonna changdan tozalaydi?

93. Avtomobilning harakat tezligi ikki marta ortishi bilan uning tormozlanish yo'li to'rt marta ortishi ma'lum. Jadvallardan foydalanib, harakat tezligi 30km/soat dan 60 km/soat gacha ortganda tormozlanish yo'lining uzunligini toping:

Yengil mashina uchun:	
v (km/soat)	t (m)
30	7,2

Yuk mashinasi uchun:	
v (km/soat)	t (m)
30	9,5

94. (Qadimiy masala.) Agar 10 dirham pul ikki oyda 5 dirham foyda keltirgan bo'lsa, 8 dirham puldan uch oyda qancha foyda olish mumkin?

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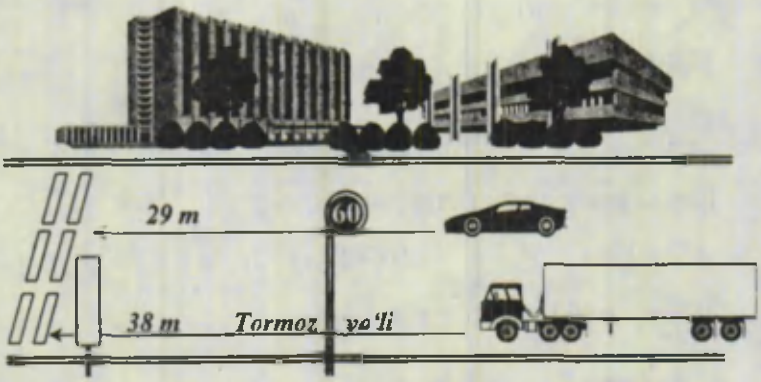
95. Hisoblang: 1) $(4\frac{1}{7}-0{,}005\cdot 700):0{,}125\cdot\frac{7}{12}$;

2) $(127\frac{1}{2}-11\frac{1}{2}\cdot 9\frac{1}{5})\cdot 10+6{,}3:2{,}1$.



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BIR NOMA'LUMLI TENGLAMALAR

6- §. TENGLAMA VA UNING YECHIMLARI

Ushbu masalani yechaylik.

M a s a l a . Qalam va chizg'ich 37 so'm turadi. Qalam chizg'ichdan 9 so'm arzon. Chizg'ichning bahosini toping.

△ Aytaylik, chizg'ich x so'm tursin, u holda qalam $(x-9)$ so'm turadi. Masalaning shartiga ko'ra

$$x+(x-9)=37,$$

bundan $2x-9=37$, $2x=46$, $x=23$.

J a v o b . Chizg'ich 23 so'm turadi. ▲

$x+(x-9)=37$ tenglikda x harfi noma'lum sonni yoki qisqacha *noma'lumni* bildiradi.

Harf bilan belgilangan noma'lum son qatnashgan tenglik tenglama deyiladi.

Tenglik ishorasidan chap va o'ngda turgan ifodalar tenglamaning chap va o'ng qismlari deyiladi. *Tenglamaning chap yoki o'ng qismidagi har bir qo'shiluvchi tenglamaning hadi* deyiladi.

$2x-9=37$ tenglamada chap qism $2x-9$, o'ng qism esa 37. So'ngra $x=23$ bo'lganda shu tenglamaning chap qismi 37 ga teng, chunki $2\cdot 23-9=37$; o'ng qismi ham 37 ga teng. Demak, $x=23$ bo'lganda bu tenglama to'g'ri tenglikka aylanadi: $2\cdot 23-9=37$. Shu 23 sonini berilgan *tenglamaning ildizi* deyiladi.

Tenglamaning ildizi deb, noma'lumning shu tenglamani to'g'ri tenglikka aylantiradigan qiymatiga aytiladi.

Masalan, 1 soni

$$2x+3=5$$

tenglamaning ildizi, chunki $2\cdot 1+3=5$ – to'g'ri tenglik.

Tenglama ikkita, uchta va hokazo ildizlarga ega bo'lishi mumkin. Masalan,

$$(x-1)(x-2)=0$$

tenglama ikkita ildizga ega: 1 va 2, chunki $x=1$ va $x=2$ da tenglama to'g'ri tenglikka aylanadi.

$$(x-3)(x+4)(x-5)=0$$

tenglama esa uchta ildizga ega: 3, –4 va 5.

Tenglama ildizlarining soni cheksiz ko'p bo'lishi mumkin. Masalan,

$$2(x-1)=2x-2$$

tenglamaning ildizlari soni cheksiz ko'p: x ning istalgan qiymati tenglamaning ildizi bo'ladi, chunki har bir x da tenglamaning chap qismi o'ng qismiga teng.

Tenglama ildizlariga ega bo'lmasligi ham mumkin. Masalan, $2x+5=2x+3$ tenglamaning ildizlari yo'q, chunki x ning istagan qiymatida bu tenglamaning chap qismi o'ng qismidan katta bo'ladi.

Tenglamani yechish – bu uning barcha ildizlarini topish yoki ularning yo'qligini ko'rsatish demakdir.

Sodda hollarda x ning tenglamaning ildizi bo'ladigan qiymatini tanlash oson bo'ladi. Masalan, $2x+1=3$ tenglamaning ildizi 1 soni ekanligini osongina ko'rish mumkin. Biroq ancha murakkab holda ildizni birdaniga topish oson bo'lmaydi. Masalan,

$$\frac{x-6}{5}+\frac{4(x+3)}{2}-1=\frac{x-1}{2}+3x-\frac{7x-1}{10}$$

tenglama $x=7$ bo'lganda to'g'ri tenglikka aylanishini bilish ancha qiyin. Shuning uchun tenglamalarni yechishni o'rganish muhim.

Ko'pgina amaliy masalalarni yechish

$$\boxed{ax=b} \qquad (1)$$

ko'rinishga keltiriladigan tenglamalarga olib keladi, bunda a va b – berilgan sonlar, x – noma'lum son. (1) tenglama *chiziqli tenglama* deb aytiladi. Masalan, $3x=1$, $-2x=3$, $\frac{3}{5}x=-\frac{1}{2}$ – chiziqli tenglamalardir.

Mashqlar

96. Tenglik shaklida yozing:

1) 34 soni x sondan 18 ta ortiq;
2) 56 soni 14 sonidan x marta ortiq;
3) x va 3 sonlari ayirmasining ikkilangani 4 ga teng;
4) x va 5 sonlari yig'indisining yarmi ularning ko'paytmasiga teng.

97. 3; -2; 2 sonlaridan qaysi biri tenglamaning ildizi bo'ladi:

1) $3x=-6$; 3) $4x-4=x+5$;
2) $x+3=6$; 4) $5x-8=2x+4$?

98. (Og'zaki.) x ning qanday qiymatlarida tenglama to'g'ri tenglikka aylanadi?

1) $x+5=-6$; 2) $4-x=-1$; 3) $2x-1=0$; 4) $3x+2=0$?

99. -1; $\frac{1}{2}$; 1 sonlari orasida tenglamaning ildizi bormi?

1) $4(x-1)=2x-3$; 3) $3(x+2)=4+2x$;
2) $7(x+1)-6x=10$; 4) $5(x+1)-4x=4$.

100. Ildizi:

1) 5 soni; 2) 3 soni; 3) -6 soni; 4) -4 soni bo'lgan tenglama tuzing.

101. a sonni shunday tanlangki, $4x-3=2x+a$ tenglama

1) $x=1$; 2) $x=-1$; 3) $x=\frac{1}{2}$; 4) $x=0{,}3$

ildizga ega bo'lsin.

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102. $(1{,}2a^3b-\frac{2}{5}ab^3):0{,}4ab-(a-b)(a+b)$ ifodaning qiymati $a=-\frac{5}{6}$ bo'lganda $1\frac{7}{18}$ ga teng bo'lishini ko'rsating.

103. Ifodani soddalashtiring va $x=-\frac{1}{2}$, $y=\frac{3}{4}$ bo'lganda uning son qiymatini toping:

$$(4x^2+y^2)(4x^2-y^2)-(12x^6y^2+x^2y^6):x^2y^2.$$

7- §. BIR NOMA'LUMLI TENGLAMALARNI YECHISH

Al-Xorazmiyning «Kitob al-muxtasar fi hisob al-jabr val-muqobala» asaridagi al-jabr musbat hadlarni tiklash, ya'ni manfiy hadlarni tenglamaning ikkinchi qismiga musbat qilib o'tkazishni, val-muqobala esa tenglamaning ikkala qismidan teng hadlarni tashlab yuborishni bildirgan.

Bu bir noma'lumli tenglamalarni yechish to'g'ri tengliklarning sizlarga ma'lum xossalariga asoslangan ekanini ko'rsatadi.

Shu xossalarni eslatib o'tamiz.

Xossaning so'z bilan ifodalanishi	Xossaning umumiy ko'rinishda yozilishi	Misol
1. Agar to'g'ri tenglikning ikkala qismiga bir xil son qo'shilsa yoki ikkala qismidan bir xil son ayirilsa, u holda to'g'ri tenglik hosil bo'ladi.	Agar $a=b$ bo'lib, l ixtiyoriy son bo'lsa, u holda $a+l=b+l$, $a-l=b-l$ bo'ladi.	$7=7$ $7+2=7+2$ $7-2=7-2$
2. Agar to'g'ri tenglikning ikkala qismini bir xil songa ko'paytirilsa yoki ikkala qismini nolga teng bo'lmagan bir xil songa bo'linsa, u holda to'g'ri tenglik hosil bo'ladi	Agar $a=b$ bo'lib, $m\neq 0$ bo'lsa, u holda $a\cdot m=b\cdot m$ va $a:m=b:m$ bo'ladi.	$27=27$ $27\cdot 3=27\cdot 3$ $27:3=27:3$

Birinchi hossadan qo'shiluvchilarni, ularning ishoralarini qarama-qarshisiga almashtirib, tenglikning bir qismidan ikkinchi qismiga olib o'tish mumkinligi kelib chiqadi.

○ Aytaylik, $a=b+m$ bo'lsin. U holda

$$a+(-m)=b+m+(-m);\quad a-m=b.$$ ●

Tengliklarning bu xossalari tenglamalarni yechishda qanday qo'llanishini ko'raylik.

1 - m a s a l a . $9x-23=5x-11$ tenglamani yeching.

△ x son berilgan tenglamaninig ildizi, ya'ni x shunday sonki, bunda tenglama to'g'ri tenglikka aylanadi, deb faraz qilamiz.

Noma'lum qatnashgan $5x$ hadni «–» ishora bilan tenglikning chap qismiga, –23 hadni «+» ishora bilan o'ng qismiga olib o'tamiz.

Natijada yana to'g'ri tenglik hosil bo'ladi:

$$9x-5x=23-11.$$

Tenglamaning ikkala qismidagi o'xshash hadlarni ixchamlab,

$$4x=12$$

tenglamani hosil qilamiz.

Bu tenglamaning ikkala qismini 4 ga bo'lib, $x=3$ ekanini topamiz.

Shunday qilib, tenglama ildizga ega, deb faraz qilib, bu ildiz faqat 3 soniga teng bo'lishi mumkinligini ko'rdik. $x=3$ haqiqatan ham berilgan tenglamaning ildizi bo'lishini tekshiramiz: $9\cdot 3-23=$ $=5\cdot 3-11$. Bu to'g'ri tenglik, chunki uning chap va o'ng qismlari birgina 4 soniga teng.

Shunday qilib, berilgan tenglama faqat bitta ildizga ega: $x=3$. ▲

Tekshirishni bajarmaslik ham mumkinligini ta'kidlaymiz, chunki tenglikning foydalanilgan xossalari bir to'g'ri tenglikni ikkinchi to'g'ri tenglik bilan almashtirishga imkon beradi. Yechishning bu usulida har doim to'g'ri natija hosil qilinadi (agar hisoblashlarda xatoga yo'l qo'yilmasa, albatta).

Tenglama yechilishini yozishda 1-masalani yechishdagidek batafsil yozma tushuntirishlarni bajarish shart emas.

Masalan, $5x+17=2x+5$ tenglamaning yechilishini shunday yozish mumkin:

$$5x-2x=5-17,\ 3x=-12,\ x=-4.$$

Javob: $x=-4$.

2-masala. $2(x+3)-3(x+2)=5-4(x+1)$ tenglamani yeching.

△ Tenglamaning chap va o'ng qismlarini soddalashtiramiz: qavslarni ochamiz va o'xshash hadlarni ixchamlaymiz. Natijada $2x+6-$ $-3x-6=5-4x-4$, $-x=-4x+1$ tenglamani hosil qilamiz.

Demak, $3x=1$, bundan $x=\frac{1}{3}$. ▲

3-masala. $\frac{5x}{2}-\frac{x-3}{3}=1+\frac{x-5}{6}$ tenglamani yeching.

Tenglamaning ikkala qismini kasrlarning umumiy maxrajiga, ya'ni 6 ga ko'paytiramiz. U holda

$$\frac{5x}{2}\cdot 6-\frac{x-3}{3}\cdot 6=1\cdot 6+\frac{x-5}{6}\cdot 6,\ 15x-2(x-3)=6+(x-5).$$

Qavslarni ochamiz va o'xshash hadlarni ixchamlaymiz:

$$15x-2x+6=6+x-5,\ 13x+6=x+1,$$

bundan $12x=-5,\ x=-\frac{5}{12}$. ▲

Shunday qilib, tenglamani yechishda tenglamaning quyidagi asosiy xossalaridan foydalaniladi.

1-xossa. *Tenglama istagan hadi ishorasini qarama-qarshisiga o'zgartirib, uning bir qismidan ikkinchi qismiga o'tkazish mumkin.*

2-xossa. *Tenglamaning ikkala qismini nolga teng bo'lmagan bir xil songa ko'paytirish yoki bo'lish mumkin.*

Bu hossalar istagan bir noma'lumli tenglamani yechish imkonini beradi.

Buning uchun:

1) noma'lum qatnashgan hadlarni tenglikning chap qismiga, noma'lum qatnashmagan hadlarni esa o'ng qismiga o'tkazish lozim (1-xossa);

2) o'xshash hadlarni ixchamlash kerak;

3) tenglamaning ikkala qismini noma'lum oldida turgan koeffitsiyentga (agar u nolga teng bo'lmasa) bo'lish (2-xossa) kerak.

Ko'rib chiqilgan misollarda har bir tenglama bitta ildizga ega bo'ldi. Ammo ba'zi hollarda bir noma'lumli tenglama ildizlarga ega bo'lmasligi mumkin yoki cheksiz ko'p ildizlarga ega bo'lishi mumkin. Shunday tenglamalarga misol keltiramiz.

4-masala. $2(x+1)-1=3-(1-2x)$ tenglama ildizlarga ega emasligini ko'rsating.

△ Tenglamaning ikkala qismini soddalashtiramiz:

$$2x+2-1=3-1+2x,\ 2x+1=2+2x,$$

bundan

$$2x-2x=2-1,\ 0\cdot x=1.$$

Bu tenglama ildizlarga ega emas, chunki uning $0\cdot x$ dan iborat chap qismi nolga teng va, demak, 1 ga teng emas. ▲

5-masala. $3(1-x)+2=5-3x$ tenglama cheksiz ko'p yechimlarga ega ekanligini ko'rsating.

△Tenglamani soddalashtiramiz: $3-3x+2=5-3x$; $5-3x=5-3x$.

Oxirgi tenglik x ning istagan qiymatida to'g'ri bo'ladi. Demak, x ning istagan qiymati tenglamaning ildizi bo'ladi. ▲

Mashqlar

104. (Og'zaki.) Tenglamani yeching:

1) $x+3=5$; 2) $x+8=11$; 3) $x-0,25=0,75$; 4) $x-1,3=2,7$.

105. (Og'zaki.) Tenglamani yeching:

1) $-2x=10$; 2) $18x=-9$; 3) $10x=0$; 4) $15x=-15$.

Tenglamani yeching **(106–117):**

106. 1) $11x=50$; 2) $-9x=243$; 3) $4x=0,24$; 4) $7x=7,063$.

107. 1) $9x=\frac{2}{5}$; 2) $3x=2\frac{1}{7}$; 3) $\frac{1}{2}x=3$; 4) $\frac{3}{4}x=\frac{1}{2}$.

108. 1) $0,3x=6$; 2) $1,3x=-1,69$; 3) $0,7x=49$; 4) $10x=0,5$.

109. 1) $8x=8$; 2) $\frac{1}{4}x=16$; 3) $3^2x=243$; 4) $16x=16$.

110. 1) $5x=(\frac{5}{7})^2$; 2) $4x=-(\frac{4}{5})^2$; 3) $-0,1x=10^3$; 4) $-0,3x=10^2$.

111. 1) $25x-1=9$; 2) $7x+8=11$; 3) $3x-5=10-x$; 4) $4x+4=x+5$.

112. 1) $5x+3(3x+7)=35$; 2) $8x-(7x+8)=9$;

3) $8y-9-4y+5=12y-4-5y$; 4) $4+8y+8=2y-10-7y+9$.

113. 1) $\frac{11}{7}=\frac{2-x}{5}$; 2) $\frac{3x}{5}=\frac{6+x}{3}$; 3) $\frac{x}{3}+\frac{x}{5}=8$; 4) $\frac{y}{3}+\frac{y}{4}=14$.

114. 1) $3y+5=4(9-\frac{y}{2})$; 3) $3(5+\frac{x}{2})=4+2x$;

2) $8(11-\frac{3}{4}z)=16z-44$; 4) $2(3-\frac{x}{3})=5+x$.

115. 1) $0,71x+1,98=0,37x-1,76$; 2) $0,18y-7,4=0,05y-5,71$;

3) $5(5x-1)-2,7x+0,2x=6,5-0,5x$;

4) $0,36x-0,6=0,3(0,4x-1,2)$.

116. 1) $11\frac{2}{3}x-5\frac{1}{6}=3\frac{3}{4}+2\frac{3}{4}x$; 3) $\frac{6x+7}{7}=3-\frac{5x-3}{8}$;

2) $12\frac{3}{4}+\frac{3}{7}y=\frac{y}{2}-10\frac{1}{28}$; 4) $10-\frac{3x-1}{2}=\frac{6x+3}{11}$.

117. 1) $\frac{4x-51}{3}-\frac{17-3x}{4}=\frac{x+5}{2}$; 3) $\frac{9x-5}{2}-\frac{3+5x}{3}-\frac{8x-2}{4}=2$;

2) $\frac{3x-7}{4}-\frac{9x+11}{8}=\frac{3-x}{2}$; 4) $\frac{4x-3}{2}-\frac{5-2x}{3}=\frac{3x-4}{3}$.

118. Tenglamani ildizlarga ega emasligini ko'rsating:

1) $28-20x=2x+25-16x-12-6x$;

2) $25x-17=4x-5-13x+14+34x$;

3) $\frac{x-1}{3}+\frac{5x+2}{12}=\frac{5+3x}{4}$; 4) $\frac{2x+1}{3}-\frac{7x+5}{15}=\frac{x-2}{5}$.

119. x ning istagan qiymati tenglamaning ildizi bo'la olishini ko'rsating:

1) $10-4x+3=9x-2-6x+9-7x+6$;

2) $9x+4-5x=8+7x-9-3x+5$;

3) $6(1{,}2x-0{,}5)-1{,}3x=5{,}9x-3$;

4) $8(1{,}3x+0{,}25)-6{,}6x=3{,}8x+2$.

120. Tenglamani yeching;

1) $(x-2)(x-1)-x^2=5$; 2) $(x+2)(x-3)=x^2-7$;

3) $(3x+2)(x-1)-3(x+1)(x-2)=4$;

4) $2(x+3)(x-4)=(2x-1)(x+2)-27$.

121*. Tenglamani yeching:

1) $\frac{96}{7{,}2}=\frac{4x+300}{21}$; 3) $4{,}2:(2x-7)=10:7\frac{1}{7}$;

2) $\frac{3x+14{,}7}{20{,}4}=\frac{7{,}5}{10}$; 4) $4\frac{1}{11}:10=4{,}5:(3x-1)$.

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122. Algebraik ifoda shaklida yozing:

1) x va y sonlarining yig'indisi bilan ular ayirmasining ko'paytmasi;

2) m^2 va $2n^3$ sonlarning ayirmasi bilan ular yig'indisining ko'paytmasi.

123. Ko'paytirishni bajaring:

1) $(0{,}3ab-1{,}75ab)0{,}01a^2b^2$; 3) $(\frac{1}{3}xy+y)(\frac{1}{3}xy-y)$;

2) $(\frac{3}{7}xy+0{,}7xz)0{,}7yz$; 4) $(\frac{2}{7}m+n)(\frac{2}{7}m-n)$.

124. Ifodani soddalashtiring va uning son qiymatini $m=\frac{16}{37}$, $n=-2\frac{5}{16}$ bo'lganda toping:

$$(\frac{3}{5}m-n)(m-\frac{3}{5}n)+\frac{9}{25}mn-(m^2+n^2)0{,}6\,.$$

8- §. MASALALARNI TENGLAMALAR YORDAMIDA YECHISH

Tenglamalarni qo'llash ko'pgina masalalarni osonlashtiradi. Bunda masalani yechish odatda ikki bosqichdan iborat bo'ladi:

1) masalaning sharti bo'yicha tenglama tuzish;

2) hosil bo'lgan tenglamani yechish.

Ushbu masalani yechaylik.

M a s a l a . Sayyohlar tushgan teploxod sohildagi bekatdan daryo oqimi bo'yicha jo'nab 5 soatdan keyin qaytib kelishi kerak. Daryo oqimining tezligi 3 km/soat; teploxodning turg'un suvdagi tezligi 18 km/soat. Agar sayyohlar qaytishdan oldin qirg'oqda 3 soat dam olgan bo'lsalar, ular sohildagi bekatdan qancha masofaga suzib borganlar?

△ 1) Izlanayotgan masofa x kilometr bo'lsin. Teploxod bu masofani oqim bo'yicha $18+3=21$ km/soat tezlik bilan o'tadi va $\frac{x}{21}$ soat sarf qiladi. Teploxod $18-3=15$ km/soat tezlik bilan orqasiga qaytadi va bunga $\frac{x}{15}$ soat sarf qiladi. Sayyohlar qirg'oqda 3 soat dam oladilar. Demak, sayohat $(\frac{x}{21}+\frac{x}{15}+3)$ soat davom etadi, bu esa masala shartiga ko'ra 5 soatga teng. Shunday qilib, biz noma'lum x masofani aniqlash uchun quyidagi tenglamani hosil qildik:

$$\frac{x}{21}+\frac{x}{15}+3=5\,.$$

2) Endi hosil qilingan

$$\frac{x}{21}+\frac{x}{15}=2$$

tenglamani yechamiz. Bu tenglamaning ikkala qismini 105 ga (21 va 15 sonlarining eng kichik umumiy bo'linuvchisiga) ko'paytirib, $5x+7x=210$, $12x=210$ tenglikni hosil qilamiz, bundan $x=17{,}5$.

Shunday qilib, teploxod sohildagi bekatdan 17,5 km masofaga suzib boradi. ▲

Masalani yechishning birinchi bosqichida (ya'ni tenglama tuzishda) teploxod bilan daryo oqimi tezliklari oqim bo'yicha harakatda qo'shilishi, oqimga qarshi harakatda esa ayirilishi va tezlikka bo'lingan yo'l harakat vaqti ekanligini bilish zarur bo'ldi.

Ikkinchi bosqichda (ya'ni hosil bo'lgan tenglamani yechishda) tenglamalarning bundan oldingi paragrafda o'rganilgan xossalarini qo'llash talab etildi.

Masalaning shartidan foydalanib, yechimning to'g'riligini tekshirish mumkin. Bunda topilgan natijani ma'lum deb qarab, berilgan biror boshqa kattalik topiladi. Masalan, masala yechimining to'g'riligini bunday tekshirish mumkin.

Sayyohlar sohildagi bekatdan 17,5 km ga suzib bordilar. Demak, ular daryo oqimi bo'yicha $17{,}5:21=\frac{5}{6}$ soat suzdilar. Sayyohlar qaytish uchun $17{,}5:15=1\frac{1}{6}$ soat vaqt sarfladilar.

Ular qirg'oqda 3 soat dam olganliklarini e'tiborga olinsa, sayohatga ketgan umumiy vaqt $\frac{5}{6}+3+1\frac{1}{6}=5$ soat, ya'ni masala shartidagi kabi bo'ladi.

Mashqlar

125. 1) O'quvchi bir son o'yladi. Agar uni 4 ga ko'paytirilsa, ko'paytmaga esa 8 soni qo'shilsa va hosil bo'lgan yig'indini 2 ga bo'linsa, u holda 10 hosil bo'ladi. O'quvchi qanday sonni o'ylagan?

2) Bir kishi bir son o'yladi va unga 5 ni qo'shdi, so'ngra yig'indini 3 ga bo'ldi, hosil bo'lgan bo'linmaga 5 ni qo'shdi va o'ylagan sonini hosil qildi. U qanday sonni o'ylagan?

126. 1) Uchta sinfda hammasi bo'lib 119 nafar o'quvchi bor. Birinchi sinfda ikkinchisidagidan 4 ta o'quvchi ko'p, uchinchisidan esa 3 ta kam. Har bir sinfda nechtadan o'quvchi bor?

2) Poyezd tarkibida sisternalar, platformalar va yuk vagonlari bor. Sisternalar platformalardan 4 ta kam, yuk vagonlaridan esa 8 ta kam. Agar sisterna, platforma va yuk vagon-

larining umumiy soni 60 ta bo'lsa, poyezd tarkibida ularning har biridan nechtadan bor?

127. 1) Zavodning uchta sexida 624 ishchi ishlaydi. Ikkinchi sexda birinchisidagiga qaraganda ishchilar 5 marta ko'p, uchinchi sexda esa birinchi va ikkinchi sexlarda birgalikda nechta ishchi bo'lsa, shuncha ishchi bor. Har bir sexda nechtadan ishchi bor?

2) Uchta sexda 869 ta detal tayyorlandi. Ikkinchi sexda birinchi sexga qaraganda 3 marta ko'p, uchinchi sexda esa ikkinchisidagidan 2 marta kam detal tayyorlandi. Har bir sexda nechtadan detal tayyorlangan?

128. 1) Teng yonli uchburchakning perimetri 25 sm ga teng. Agar uning yon tomoni asosidan 5 sm ortiq bo'lsa, uchburchak tomonlari uzunliklarini toping.

2) Teng yonli uchburchakda asos yon tomonning $\frac{3}{4}$ qismini tashkil etadi. Agar uchburchakning perimetri 22 sm ga teng bo'lsa, uning tomonlari uzunliklarini toping.

129. 1) Eni 200 m bo'lgan to'g'ri to'rtburchak maydonning chegarasi bo'ylab ariq qaziladi. Ariqning uzunligi 1 km. Maydonning bo'yini toping.

2) Bo'yi enidan 2 marta uzun bo'lgan to'g'ri to'rtburchak maydonni uzunligi 120 m bo'lgan panjara bilan o'rashdi. Maydonning bo'yi va enini toping.

130. Tanga yig'uvchi kolleksioner (numizmat)da 1, 3, 5 tiyinlik 98 ta tanga bor. 3 tiyinlik tangalar 1 tiyinliklardan 10 ta ortiq, 5 tiyinlik tangalar esa 3 tiyinliklardan 7 marta ko'p. Numizmatda 1, 3, 5 tiyinlik tangalarning har biridan nechtadan bor?

131. Yig'indisi 81 ga teng bo'lgan uchta ketma-ket toq sonni toping.

132. To'rtta ketma-ket juft son berilgan. Agar chetki sonlar yig'indisining ikkilanganidan o'rtadagi sonlar musbat ayirmasining uchlangani ayirilsa, 22 hosil bo'ladi. Shu sonlarni toping.

133. 1) Paxta teruvchilar guruhi har kuni belgilangan rejani 5 sr ga ortiq bajarib, haftalik (6 ish kuni) topshiriqni 4 kunda ba-

jardi. Terimchilar bir kunda necha sentner paxta terishgan?

2) Sexga avtomat o'rnatildi. U bir soatda ishchiga qaraganda 8 ta detal ortiq ishlab chiqaradi. 2 soatdan keyin avtomat ishchining 6 soatlik rejasini bajardi. Avtomat bir soatda nechta detal ishlab chiqaradi?

134. 1) Onasi 50 yoshda, qizi esa 28 yoshda. Necha yil oldin qizi onasidan 2 marta yosh bo'lgan?

2) Otasi 40 yoshda, o'g'li esa 16 yoshda. Necha yildan keyin otasi o'g'lidan 2 marta katta bo'ladi?

135. 1) Birinchi qopda 50 kg, ikkinchisida esa 80 kg shakar bor edi. Ikkinchi qopdan birinchisidan olinganidan 3 marta ko'p shakar olishdi va natijada birinchi qopda ikkinchidagiga qaraganda ikki marta ko'p shakar qoldi. Har bir qopdan necha kilogrammdan shakar olishgan?

2) Bir elevatorda ikkinchisiga qaraganda 2 marta ko'p don bor edi. Birinchi elevatordan 750 t donni olib ketishdi, ikkinchisiga esa 350 t don olib kelishdi, natijada ikkala elevatordagi don miqdori bir xil bo'lib qoldi. Dastlab har bir elevatorda qanchadan don bo'lgan?

136. 1) Uzumni har bir yashikka 9,2 kg dan solish mo'ljallangan edi. Bu yashiklar o'rniga har biriga 13,2 kg uzum sig'adigan boshqa yashiklar olishdi va shunda mo'ljaldagidan 50 ta yashik kam talab qilindi. Hammasi bo'lib yashiklarga necha kilogramm uzum joylangan?

2) A va B stansiyalar orasidagi masofani passajir poyezdi yuk poyezdiga nisbatan 45 minut tez bosib o'tadi. Agar passajir poyezdining tezligi 48 km/soat, yuk poyezdiniki esa 36 km/soat ekanligi ma'lum bo'lsa, shu stansiyalar orasidagi masofani toping.

137. 1) Neft bazasida 6340 t benzin bor edi. Ikkinchi kuni baza birinchi kundagidan 423 t ko'p, uchinchi kuni esa ikkinchi kundagidan 204 t kam benzin tarqatdi. Shundan so'ng bazada 3196 t benzin qoldi. Baza birinchi kuni necha tonna benzin tarqatgan?

2) Do'konda uch kunda 110 kg moy sotildi. Ikkinchi kuni birinchi kundagining $\frac{3}{8}$ qismicha, uchinchi kuni esa dastlabki

ikki kunda qancha moy sotilgan bo'lsa, shuncha sotildi. Do'konda birinchi kuni necha kilogramm moy sotilgan?

138. 1) Brigada buyurtmani 10 kunda bajarishi kerak edi. Brigada har kuni rejadan tashqari 27 ta detal tayyorlab, 7 kunda topshiriqni bajaribgina qolmasdan, balki ortiqcha yana 54 ta detal tayyorladi. Brigada bir kunda nechta detal tayyorlagan?

2) Zavod mashina ishlab chiqarish bo'yicha buyurtmani 15 kunda bajarishi kerak edi. Lekin zavod har kuni rejadan tashqari 2 tadan ortiq mashina ishlab chiqarib, muddatga 2 kun qolganda faqat rejani bajaribgina qolmasdan, shu bilan birga rejadan ortiq yana 6 ta mashina ishlab chiqardi. Zavod reja bo'yicha nechta mashina ishlab chiqarishi kerak edi?

139. (Qadimiy masala.) G'ozlar galasi uchib ketayotgan edi, ularga qarshi bir g'oz uchib keladi. U, «Assalomu alaykum, yuz g'oz» dedi. Gala boshlig'i javob berdi: «Bizlar yuzta g'oz emasmiz. Agar bizga o'zimizcha, uning yarmicha, yarmisining yarmicha g'oz qo'shilsa va siz ham qo'shilsangiz, o'shanda yuzta bo'lamiz». Galada nechta g'oz bo'lgan?

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140. Ikkita $2a$ va $3b$ ifoda berilgan, shu ifodalarning:

1) yig'indisini; 2) ayirmasini;
3) ayirmasining kvadratini;
4) kvadratlarining ayirmasini;
5) yig'indisining kvadratini;
6) ko'paytmasining ikkilanganini algebraik ifoda shaklida yozing.

141. Ifodani soddalashtiring:

$$(a+\tfrac{1}{2})(a-\tfrac{1}{2})-(a+\tfrac{1}{2})(a+\tfrac{1}{2})+a.$$

142. $3ab$ va $\frac{1}{2}a^2$ ifodalar berilgan. Shu ifodalar yig'indisi bilan ular ayirmasining ko'paytmasi $(3ab)^2-(\frac{1}{2}a^2)^2$ ga tengligini isbotlang.

143. $(5+n)(5+n)-n^2$ ifoda n ning istagan natural qiymatida 5 ga bo'linishini isbotlang.

144. Tenglamani yeching:

1) $5(x-3)-2(x-7)+7(2x+6)=7$;
2) $11(y-4)+10(5-3y)-3(4-3y)=-6$;
3) $5(8z-1)-7(4z+1)+8(7-4z)=9$;
4) $10(3x-2)-3(5x+2)+5(11-4x)=25$.

145. 1) $\frac{x-4}{5}=9+\frac{2x+4}{9}$; 3) $\frac{8-y}{6}+\frac{5-4y}{3}=\frac{y+6}{2}$;

2) $2-\frac{3x-7}{4}+\frac{x+17}{5}=0$; 4) $\frac{4x+7}{5}+\frac{3x-2}{2}-\frac{5x-2}{2}=32$.

146. Yerning birinchi ikkita sun'iy yo'ldoshi massasi 592,4 kg ni tashkil qildi. Birinchi sun'iy yo'ldosh uchinchisidan 1243,4 kg yengil, ikkinchisi esa 818,2 kg yengil. Yerning birinchi uchta sun'iy yo'ldoshining har birining massasini toping.

147. 1) Qayiq daryo oqimiga qarshi 4,5 soat va oqim bo'yicha 2,1 soat suzdi. Qayiq hammasi bo'lib 52,2 km suzdi. Agar daryo oqimining tezligi 3 km/soat bo'lsa, qayiqning turg'un suvdagi tezligini toping.

2) Qayiq daryo oqimi bo'yicha 2,4 soat va oqimga qarshi 3,2 soat yurdi. Qayiqning oqim bo'yicha bosib o'tgan yo'li oqimga qarshi bosib o'tgan yo'lidan 13,2 km ortiq bo'ldi. Agar daryo oqimining tezligi 3,5 km/soat bo'lsa, qayiqning turg'un suvdagi tezligini toping.

148. 1) Suzish bo'yicha maktab musobaqalarida o'quvchi ma'lum masofani daryo oqimi bo'yicha 24 sekundda va shu masofani oqimga qarshi 40 sekundda suzib o'tdi. Agar daryo oqimining tezligi 25 sm/sek bo'lsa, suzuvchining tezligini suzishning boshidan oxirigacha bir xil deb hisoblab, uning o'z tezligini aniqlang.

2) Kater ikki bekat orasidagi masofani oqim bo'yicha 3 soat-u 30 minutda, oqimga qarshi esa 6 soat-u 18 minutda bosib o'tdi. Agar daryo oqimining tezligi 2,4 km/soat bo'lsa, shu bekatlar orasidagi masofani aniqlang.

149. 1) Bir qishloqdan avval piyoda kishi, undan 1,5 soat keyin esa shu yo'nalishda velosipedchi yo'lga chiqdi. Agar piyoda

kishi 4,25 km/soat, velosipedchi esa 17 km/soat tezlik bilan yurgan bo'lsa, velosipedchi piyodani qishloqdan qancha masofada quvib yetadi?

2) Ikki teploxod bir bekatdan bir yo'nalish bo'yicha jo'nadi. Birinchi teploxod har 1,5 soatda 37,5 km, ikkinchisi esa har ikki soatda 45 km yo'l bosadi. Qancha vaqtdan keyin birinchi teploxod ikkinchisidan 10 km oldinda bo'ladi?

150. 1) Bir fermada 7 t 680 kg, ikkinchisida esa 9 t 600 kg silos g'amlashdi. Birinchi fermada kuniga 352 kg, ikkinchisida esa 480 kg silos sarflanadi. Necha kundan keyin ikkala fermadagi g'amlangan siloslar teng bo'lib qoladi?

2) Bir sabzavot omboriga 145 t 480 kg, ikkinchisiga esa 89 t 7 sr kartoshka keltirishdi. Birinchi ombordan do'kondan har kuni 4 t 40 kg dan, ikkinchisidan esa 2 t 550 kg dan kartoshka jo'natiladi. Necha kundan keyin ikkinchi omborda birinchidagidan 2 marta kam kartoshka qoladi?

151. 1) Oralaridagi masofa 340 km bo'lgan ikki bekatdan bir vaqtda bir-birlariga qarab ikki poyezd yo'lga chiqdi. Ulardan birining tezligi ikkinchisinikidan 5 km/soat ortiq. Agar harakat boshlanganidan 2 soat o'tgandan keyin poyezdlar orasidagi masofa 30 km ekanligi ma'lum bo'lsa, ularning tezligini toping.

2) Oralaridagi masofa 230 km bo'lgan A va B shaharlaridan bir vaqtda bir-birlariga qarab ikki mototsiklchi yo'lga chiqdi. Harakat boshlanganidan 3 soat o'tgandan keyin ularning oralaridagi masofa 20 km bo'ldi. Agar mototsiklchilardan birining tezligi ikkinchisinikidan 10 km/soat kam bo'lsa, mototsiklchilarning tezliklarini toping.

9- §. NATURAL KO'RSATKICHLI DARAJA

Teng sonlarni qo'shishni ko'paytirish bilan almashtirish mumkin:

$$\underbrace{3+3+3+3+3}_{5\text{ marta}}=3\cdot 5 \qquad \underbrace{a+a+a+a+\ldots+a}_{n\text{ marta}}=a\cdot n$$

Bir xil sonlarning ko'paytmasini ham ko'p hollarda ixchamroq yozuv bilan almashtirish maqsadga muvofiq bo'ladi. Tomonining uzunligi 5 birlikka teng kvadratni qaraylik (3- rasm). U $5\cdot 5=25$ ta birlik kvadratni o'z ichiga oladi. Tomonining uzunligi 5 birlikka teng kub (4- rasm) esa $5\cdot 5\cdot 5=125$ ta birlik kubni o'z ichiga oladi.

Sizga ma'lumki, $5\cdot 5$ ko'paytmani 5^2 (o'qilishi: «beshning kvadrati»); $5\cdot 5\cdot 5$ ko'paytmani esa 5^3 (o'qilishi: «beshning kubi») kabi belgilanadi:

$$5\cdot 5=5^2,\quad 5\cdot 5\cdot 5=5^3.$$

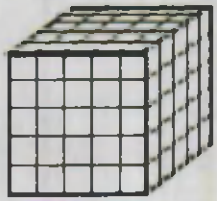
Xuddi shu kabi, ko'paytuvchilari bir xil sonlardan iborat ko'paytmani yangi amal - *darajaga ko'tarish* bilan almashtirish mumkin:

$$\underbrace{3\cdot 3\cdot 3\cdot 3\cdot 3}_{5\text{ marta}}=3^5,\qquad \underbrace{\frac{1}{7}\cdot\frac{1}{7}\cdot\frac{1}{7}\cdot\ldots\cdot\frac{1}{7}}_{9\text{ marta}}=\left(\frac{1}{7}\right)^9,$$

$$0{,}4=(0{,}4)^1.$$

Umuman, n ta teng ko'paytuvchining ko'paytmasini belgilash uchun a^n yozuvdan foydalaniladi:

3- rasm



4- rasm

$$\underbrace{a\cdot a\cdot a\cdot a\cdot\ldots\cdot a}_{n\text{ marta}}=a^n.$$

U bunday o'qiladi: «a sonning n ko'rsatkichli darajasi». Odatda, qisqacha qilib: «a ning n- darajasi» deb aytiladi.

a sonning n natural ko'rsatkichli darajasi deb, har biri a ga teng bo'lgan n ta ko'paytuvchining ko'paytmasiga aytiladi:

$$a^n = \underbrace{a \cdot a \cdot a \cdot \ldots \cdot a}_{n \text{ marta}}$$

a sonni (takrorlanuvchi ko'paytuvchini) *darajaning asosi, n* sonni (ko'paytuvchi necha marta takrorlanishini ko'rsatuvchini) *daraja ko'rsatkichi* deyiladi.

Masalan,

$$3^4 = 3 \cdot 3 \cdot 3 \cdot 3 = 81,$$

bu yerda 3 – darajaning asosi, 4 – daraja ko'rsatkichi, 81 esa 3^4 – darajaning qiymati.

Xususan, sonning birinchi darajasi deb, shu sonning o'zini aytiladi:

$$a^1 = a.$$

Masalan, $5^1 = 5$, $25^1 = 25$, $(\frac{1}{7})^1 = \frac{1}{7}$.

Darajaning asosi istagan son bo'lishi mumkinligini aytib o'tamiz, masalan,

$$2^5 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 32; \quad (\frac{2}{5})^3 = \frac{2}{5} \cdot \frac{2}{5} \cdot \frac{2}{5} = \frac{8}{125};$$

$$(-2)^5 = (-2) \cdot (-2) \cdot (-2) \cdot (-2) \cdot (-2) = -32;$$

$$(-\frac{2}{3})^4 = (-\frac{2}{3}) \cdot (-\frac{2}{3}) \cdot (-\frac{2}{3}) \cdot (-\frac{2}{3}) = \frac{16}{81};$$

$$0{,}2^3 = 0{,}2 \cdot 0{,}2 \cdot 0{,}2 = 0{,}008;$$

$$(-1)^6 = (-1) \cdot (-1) \cdot (-1) \cdot (-1) \cdot (-1) \cdot (-1) = 1;$$

$$0^3 = 0 \cdot 0 \cdot 0 = 0; \quad 10^4 = 10 \cdot 10 \cdot 10 \cdot 10 = 10000.$$

Darajaga ko'tarish amali – uchinchi bosqich amal. Agar ifodada qavslar bo'lmasa, u holda avval uchinchi bosqich amallar, keyin ikkinchi bosqich amallar (ko'paytirish va bo'lish), va nihoyat, birinchi bosqich amallar (qo'shish va ayirish) bajarilishini eslatib o'tamiz.

Masala. Hisoblang: $7 \cdot 2^4 - 5 \cdot 3^2$.

$\triangle$ $7 \cdot 2^4 - 5 \cdot 3^2 = 7 \cdot 16 - 5 \cdot 9 = 112 - 45 = 67$. $\blacktriangle$

Sonlarni daraja yordamida yozishdan juda ko'p hollarda, masalan, natural sonlarni qo'shiluvchilarning xona birliklari yig'indisi shaklida yozish uchun foydalaniladi:

$\triangle 3245 = 3 \cdot 1000 + 2 \cdot 100 + 4 \cdot 10 + 5 = 3 \cdot 10^3 + 2 \cdot 10^2 + 4 \cdot 10 + 5.$ ▲

Katta sonlarni yozish uchun ko'pincha 10 sonining darajalari qo'llaniladi. Masalan, Yerdan Quyoshgacha bo'lgan masofa taxminan 150 mln km ga teng bo'lib, uni $1{,}5 \cdot 10^8$ km shaklida yoziladi: Yer sharining radiusi taqriban 6,37 mln m ga teng, uni $6{,}37 \cdot 10^6$ m shaklida yoziladi; Yerdan eng yaqin yulduz (alfa Sentavr)gacha bo'lgan masofani $4 \cdot 10^{13}$ km shaklida yoziladi.

10 dan katta bo'lgan har bir sonni $a \cdot 10^n$ shaklida yozish mumkin, bunda $1 \le a < 10$ va n – natural son. Bunday yozuv *sonning standart shakli* deyiladi.

Masalan,

$$4578 = 4{,}578 \cdot 10^3, \quad 45{,}78 = 4{,}578 \cdot 10, \quad 103000 = 1{,}03 \cdot 10^5.$$

Fizika va ximiya fanlarini o'rganishda, mikrokalkulyatorda hisoblashlarda va boshqa ko'p hollarda sonning standart shakldagi yozuvidan foydalaniladi.

Mashqlar

Yig'indini ko'paytma shaklida yozing (152–154):

152. 1) $4+4+4+4+4$; 3) $c+c+c$;
2) $6+6+6+6$; 4) $a+a+a+a+a$.

153. 1) $2m+2m+2m$; 3) $(c-2d)+(c-2d)$;
2) $17ab+17ab+17ab$; 4) $(3b-a)+(3b-a)+(3b-a)$.

154. 1) $\underbrace{3+3+\ldots+3}_{21\text{ marta}}$; 3) $\underbrace{m+m+\ldots+m}_{n\text{ marta}}$;
2) $\underbrace{5+5+\ldots+5}_{17\text{ marta}}$; 4) $\underbrace{b+b+\ldots+b}_{k\text{ marta}}$;

Ko'paytmani daraja shaklida yozing (155-157):

155. 1) $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$; 2) $\frac{1}{3} \cdot \frac{1}{3} \cdot \frac{1}{3} \cdot \frac{1}{3} \cdot \frac{1}{3}$; 3) $(\frac{3}{4}) \cdot (\frac{3}{4}) \cdot (\frac{3}{4})$;
4) $(-2{,}7) \cdot (-2{,}7) \cdot (-2{,}7) \cdot (-2{,}7)$.

156. 1) $x \cdot x \cdot x \cdot x \cdot x$;
2) $m \cdot m \cdot m \cdot m \cdot m$;
3) $(2a) \cdot (2a) \cdot (2a)$;
4) $(-3b) \cdot (-3b) \cdot (3b) \cdot (3b)$.

157. 1) $(x-y) \cdot (x-y) \cdot (x-y)$;
2) $(a+b) \cdot (a+b)$;
3) $\frac{3x}{2} \cdot \frac{3x}{2}$;
4) $\frac{m}{n} \cdot \frac{m}{n} \cdot \frac{m}{n} \cdot \frac{m}{n} \cdot \frac{m}{n}$.

Ko'paytmaning daraja shaklidagi yozuvidan foydalanib, ifodani soddalashtiring **(158–161)**:

158. 1) $2 \cdot 2 \cdot 2 \cdot 15$;
2) $4 \cdot 4 \cdot 4 \cdot 4 \cdot 21$;
3) $5 \cdot 5 \cdot 8 \cdot 8 \cdot 8 \cdot 2 \cdot 2$;
4) $6 \cdot 6 \cdot 7 \cdot 7 \cdot 3 \cdot 3 \cdot 3$.

159. 1) $1{,}2 \cdot 1{,}2 \cdot 2 \cdot 2 \cdot 5 \cdot 5$;
2) $0{,}5 \cdot 0{,}5 \cdot 0{,}5 \cdot 2 \cdot 2 \cdot 4 \cdot 4$;
3) $0{,}3 \cdot 0{,}3 \cdot \frac{1}{7} \cdot \frac{1}{7} \cdot \frac{1}{7} \cdot \frac{1}{7}$;
4) $\frac{2}{3} \cdot \frac{2}{3} \cdot \frac{2}{3} \cdot 2{,}3 \cdot 2{,}3$.

160. 1) $9 \cdot 9 \cdot 9 \cdot a \cdot a \cdot a$;
2) $x \cdot x \cdot x \cdot x \cdot 3 \cdot 3$;
3) $\frac{x}{y} \cdot \frac{x}{y} \cdot \frac{x}{y} (x-y) \cdot (x-y)$;
4) $\frac{a}{b} \cdot \frac{a}{b} \cdot (8a-b) \cdot (8a-b) \cdot (8a-b)$.

161. 1) $\underbrace{3 \cdot 3 \cdot \ldots \cdot 3}_{21 \text{ marta}} \cdot \underbrace{x \cdot x \cdot \ldots \cdot x}_{12 \text{ marta}}$;
2) $\underbrace{5 \cdot 5 \cdot \ldots \cdot 5}_{16 \text{ marta}} \cdot \underbrace{b \cdot b \cdot \ldots \cdot b}_{31 \text{ marta}}$;
3) $\underbrace{7 \cdot 7 \cdot \ldots \cdot 7}_{n \text{ marta}} \cdot \underbrace{p \cdot p \cdot \ldots \cdot p}_{15 \text{ marta}}$;
4) $\underbrace{6 \cdot 6 \cdot \ldots \cdot 6}_{13 \text{ marta}} \cdot \underbrace{a \cdot a \cdot \ldots \cdot a}_{k \text{ marta}}$.

Ifodani soddalashtiring **(162-165)**:

162. 1) $p \cdot p \cdot p \cdot p + q \cdot q$;
2) $a \cdot a + b \cdot b \cdot b \cdot b$;
3) $a \cdot a + a \cdot a + a \cdot a$;
4) $x \cdot x \cdot x + x \cdot x \cdot x$.

163. 1) $x + x + x + x + x + x \cdot x \cdot x$;
2) $a + a + a + a \cdot a \cdot a \cdot a$;
3) $a \cdot x \cdot x \cdot x + b \cdot b \cdot y \cdot y \cdot y \cdot y$.
4) $a \cdot a \cdot b \cdot b + x \cdot x \cdot x \cdot y \cdot y \cdot y$.

164. 1) $\underbrace{c \cdot c + c \cdot c + \ldots + c \cdot c}_{k \text{ marta}}$;
2) $\underbrace{a \cdot a \cdot a + a \cdot a \cdot a + \ldots + a \cdot a \cdot a}_{n \text{ marta}}$;
3) $\underbrace{a \cdot a \cdot \ldots \cdot a}_{n \text{ marta}} + \underbrace{b \cdot b \cdot \ldots \cdot b}_{m \text{ marta}}$;
4) $\underbrace{5 \cdot 5 \cdot \ldots \cdot 5}_{k \text{ marta}} + \underbrace{a \cdot a \cdot \ldots \cdot a}_{17 \text{ marta}}$.

165. Ifodani o'qing, darajaning asosini, daraja ko'rsatkichini ayting:

1) 3^2; 3) $(-\frac{2}{9})^{41}$; 5) $(4m+n)^{15}$;

2) $(1\frac{3}{8})^3$; 4) $(-1,2)^{39}$; 6) $(\frac{2a}{3b})^7$.

Darajani bir xil ko'paytuvchilarning ko'paytmasi shaklida yozing **(166–167)**:

166. 1) 3^5; 2) 11^3; 3) $(-1\frac{3}{8})^3$; 4) $(-1,25)^4$.

167. 1) $(\frac{3}{a})^5$; 2) $(\frac{m}{7})^4$; 3) $(a+b)^4$; 4) $(2a)^5$.

Hisoblang **(168–175)**:

168. 1) 2^3; 2) 3^2; 3) 4^4; 4) 5^3.

169. 1) 1^5; 2) $(-1)^7$; 3) 0^{15}; 4) 0^5.

170. 1) $(\frac{2}{3})^3$; 2) $(\frac{3}{5})^2$; 3) $(1\frac{2}{7})^2$; 4) $(2\frac{1}{3})^3$.

171. 1) $(2,5)^2$; 2) $(1,7)^2$; 3) $(-0,2)^3$; 4) $(-0,2)^4$.

172. 1) $(-5)^3$; 2) -5^3; 3) $(-2\frac{1}{4})^2$; 4) $-(2\frac{1}{4})^2$.

173. 1) $\frac{(-0,2)^4}{(0,1)^5}$; 2) $\frac{(0,3)^3}{(-0,1)^4}$; 3) $\frac{(3,2)^2}{(1,6)^2}$; 4) $\frac{(2,6)^2}{(1,3)^2}$.

174. 1) $2(-3)^2$; 2) $-5(-2)^3$; 3) $-\frac{1}{2}(-4)^2$; 4) $-\frac{2}{3}(-3)^2$.

175. 1) $(-5)^2(+\frac{3}{5})$; 2) $(-3)^3(-\frac{2}{3})$; 3) $-(-3)^2 2^3$; 4) $-(-3)^2(-2)^3$.

176. $-x^2$; $(-x)^2$; $(-x)^3$ ifodaning qiymatini $x = 1\frac{1}{2}$; -5 da toping.

177. x^2 ifodaning qiymatini x ning jadvalda keltirilgan qiymatlari uchun hisoblang:

x	0	1	−1	2	−2	3	−3	4	−4	5	−5	6	−6
x^2													

178. x^3 ifodaning qiymatini x ning jadvalda ko'rsatilgan qiymatlari uchun hisoblang:

x	0	1	−1	2	−2	3	−3	4	−4	5	−5	6	−6
x^3													

179. Ikki xonali son xona qo'shiluvchilari yig'indisi shaklida quyidagicha yozilishi mumkin: $a \cdot 10 + b$, bu yerda a – o'nliklar soni, b – birliklar soni; uch xonali sonni $a \cdot 10^2 + b \cdot 10 + c$ ko'rinishida yozish mumkin, bu yerda a – yuzliklar soni, b – o'nliklar soni; c – birliklar soni. Aytaylik, to'rt xonali sonda a – minglikar soni, b – yuzliklar soni; c – o'nliklar soni, d – birliklar soni bo'lsin. Shu sonni xona qo'shiluvchilari yig'indisi shaklida yozing.

180. Sonni xona qo'shiluvchilari yig'indisi shaklida yozing:

1) 127 359; 2) 5 432 135; 3) 1 027 305; 4) 12 350 107.

181. Xona qo'shiluvchilari yig'indisi shaklida tasvirlangan sonni yozing:

1) $2 \cdot 10^5 + 3 \cdot 10^4 + 5 \cdot 10^3 + 1 \cdot 10^2 + 2 \cdot 10 + 1$;

2) $3 \cdot 10^6 + 5 \cdot 10^5 + 3 \cdot 10^4 + 2 \cdot 10^3 + 3 \cdot 10 + 7$;

3) $7 \cdot 10^5 + 1 \cdot 10^3 + 5 \cdot 10^2 + 8$; 4) $1 \cdot 10^5 + 1 \cdot 10^3 + 1$.

182. («Ming bir kecha»dan masala.) Bir gala kaptarlar daraxt yoniga uchib kelishdi. Ularning bir qismi daraxt shoxiga, bir qismi daraxt tagiga qo'ndi. Daraxt shoxidagi kaptarlar pastdagi kaptarlarga shunday deyishdi: "Agar sizlardan biringiz bizning yonimizga o'tib qo'nsangiz, biz sizlardan uch marta ko'p bo'lamiz, agar bizdan bir kaptar sizga qo'shilsa, bizning to'da sizning to'dangizga tenglashadi". Daraxt shoxida va ostida nechtadan kaptar qo'nib turgan edi?

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183. Hisoblang:

1) $(3\frac{7}{8} - 5\frac{5}{6}) \cdot 1\frac{9}{47} + 2\frac{1}{3} \cdot \frac{19}{28}$; 3) $-\frac{12}{25} : 3 - \frac{5}{6} : 12{,}5 - 0{,}4 \cdot (-\frac{2}{5})$;

2) $4{,}9 : 0{,}07 + (-1{,}6) \cdot (-12{,}5) - 49{,}5$.

184. Kasrni qisqartiring: 1) $\frac{(-17)}{51 \cdot 1{,}5}$; 2) $\frac{4{,}9 \cdot (-7{,}7)}{(-33) \cdot 70 \cdot 4{,}2}$; 3) $\frac{2{,}88 \cdot 2{,}6}{15{,}6}$.

10- §. NATURAL KO'RSATKICHLI DARAJANING XOSSALARI

Darajaga ko'tarish bir nechta muhim xossalarga ega.

1- xossa.

$$a^m \cdot a^n = a^{m+n}$$

Bir xil asosli darajalarni ko'paytirishda asos o'zgarmasdan qoladi, daraja ko'rsatkichlari esa qo'shiladi.

○ Natural ko'rsatkichli darajaning ta'rifiga ko'ra

$2^2 \cdot 2^3 = \underbrace{(2 \cdot 2)}_{2\text{ marta}} \cdot \underbrace{(2 \cdot 2 \cdot 2)}_{3\text{ marta}} =$

$a^m \cdot a^n = \underbrace{(a \cdot a \cdot a \cdot \ldots \cdot a)}_{m\text{ marta}} \times$

$\times \underbrace{(a \cdot a \cdot a \cdot \ldots \cdot a)}_{n\text{ marta}} =$

ko'paytirishning guruhlash qonuniga ko'ra

$= \underbrace{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2}_{5\text{ marta}} =$

$= \underbrace{a \cdot a \cdot a \cdot \ldots \cdot a}_{(m+n)\text{ marta}}$

natural ko'rsatkichli darajaning ta'rifiga ko'ra

$= 2^5$

$= a^{m+n}$

Shunday qilib,

$2^2 \cdot 2^3 = 2^{2+3}$

$a^m \cdot a^n = a^{m+n}$ ●

2- xossa.

$$a^m : a^n = a^{m-n},\ m > n,\ a \neq 0$$

Bir xil asosli darajalarni bo'lishda asos o'zgarmasdan qoladi, daraja ko'rsatkichlari esa ayiriladi.

○ Shartga ko'ra

$5 > 3$

$m > n,\ a \neq 0$

Darajaning birinchi xossasiga ko'ra

$2^{5-3} \cdot 2^3 = 2^5$

$a^{m-n} \cdot a^n = a^m$

Shuning uchun

$2^{5-3} = 2^5 : 2^3$

$a^{m-n} = a^m : a^n$

Shunday qilib,

$2^5 : 2^3 = 2^{5-3}$

$a^m : a^n = a^{m-n},\ m > n,\ a \neq 0$ ●

$\frac{a^n}{a^n} = 1$, $a \neq 0$ ekanligini ta'kidlaymiz.

3- xossa.

$$(a^m)^n = a^{mn}$$

Darajani darajaga ko'tarishda asos o'zgarmasdan qoladi, daraja ko'rsatkichlar esa o'zaro ko'paytiriladi.

○ Natural ko'rsatkichli darajaning ta'rifiga ko'ra

$(2^3)^2 = 2^3 \cdot 2^3 =$ | $(a^m)^n = \underbrace{a^m \cdot a^m \cdot a^m \cdot \ldots \cdot a^m}_{n \text{ marta}} =$

darajaning birinchi xossasiga ko'ra

$= 2^{3+3} =$ | $= a^{\overbrace{m+m+\ldots+m}^{n \text{ marta}}}$

ko'paytirishning ta'rifiga ko'ra

$= 2^{3 \cdot 2} =$ | $= a^{mn}$

Shunday qilib,

$(2^3)^2 = 2^{3 \cdot 2}$ | $(a^m)^n = a^{mn}$ ●

4- xossa.

$$(ab)^n = a^n b^n$$

Ko'paytmani darajaga ko'tarishda har bir ko'paytuvchi shu darajaga ko'tariladi.

○ $(2 \cdot 3)^3 = \underbrace{(2 \cdot 3) \cdot (2 \cdot 3) \cdot (2 \cdot 3)}_{3 \text{ marta}} =$ | $(ab)^n = \underbrace{(ab)(ab)\ldots(ab)}_{n \text{ marta}}$

ko'paytirishning guruhlash va o'rin almashtirish qonuniga ko'ra

$= \underbrace{(2 \cdot 2 \cdot 2)}_{3 \text{ marta}} \underbrace{(3 \cdot 3 \cdot 3)}_{3 \text{ marta}} =$ | $= \underbrace{(a \cdot a \cdot \ldots \cdot a)}_{n \text{ marta}} \underbrace{(b \cdot b \cdot \ldots \cdot b)}_{n \text{ marta}} =$

natural ko'rsatkichli darajaning ta'rifiga ko'ra

$= 2^3 \cdot 3^3$ | $= a^n \cdot b^n$

Shunday qilib,

$(2 \cdot 3)^3 = 2^3 \cdot 3^3$ | $(ab)^n = a^n b^n$ ●

5- xossa.

$$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n};\ b \neq 0$$

Kasrni darajaga ko'tarishda uning surat va maxraji xuddi shu darajaga ko'tariladi.

○ Natural ko'rsatkichli darajaning ta'rifiga ko'ra

$$\left(\frac{2}{3}\right)^3 = \underbrace{\left(\frac{2}{3}\cdot\frac{2}{3}\cdot\frac{2}{3}\right)}_{3\text{ marta}} = \qquad \left(\frac{a}{b}\right)^n = \underbrace{\left(\frac{a}{b}\cdot\frac{a}{b}\cdots\frac{a}{b}\right)}_{n\text{ marta}} =$$

kasrlarni ko'paytirish qoidasiga ko'ra

$$= \frac{\overbrace{2\cdot 2\cdot 2}^{3\text{ marta}}}{\underbrace{3\cdot 3\cdot 3}_{3\text{ marta}}} = \qquad = \frac{\overbrace{a\cdot a\ldots\cdot a}^{n\text{ marta}}}{\underbrace{b\cdot b\ldots\cdot b}_{n\text{ marta}}} =$$

natural ko'rsatkichli darajaning ta'rifiga ko'ra

$$= \frac{2^3}{3^3} \qquad \frac{a^n}{b^n}$$

Shunday qilib,

$$\left(\frac{2}{3}\right)^3 = \frac{2^3}{3^3} \qquad \left(\frac{a}{b}\right)^n = \frac{a^n}{b^n},\ b \neq 0 \bullet$$

1 - m a s a l a . Hisoblang: $\frac{11^7\cdot 7^3\cdot 3^4}{11^6\cdot 7\cdot 3^4}$.

△ $\frac{11^7\cdot 7^3\cdot 3^4}{11^6\cdot 7\cdot 3^4} = 11^{7-6}\cdot 7^{3-1}\cdot 1 = 11\cdot 49 = 539$. ▲

2 - m a s a l a . Yorug'likning tarqalish tezligi $3\cdot 10^8$ m/sek ga yaqin. Yerdan Quyoshgacha bo'lgan o'rtacha masofa $1{,}5\cdot 10^{11}$ m. Yorug'lik nuri Quyoshdan Yergacha bo'lgan masofani qancha vaqtda bosib o'tadi?

△ Tekis harakatda bosib o'tilgan yo'lning $s = vt$ formulasiga asosan:

$$1{,}5\cdot 10^{11} = 3\cdot 10^8\cdot t,$$

bu yerdan $t = \frac{1{,}5\cdot 10^{11}}{3\cdot 10^8} = 0{,}5\cdot 10^3 = 500$.

J a v o b . 500 sek = 8 min 20 sek.

Ko'paytmani daraja shaklida yozing **(185–192):**

185. 1) $3^5 \cdot 3^4$; 2) $7^2 \cdot 7^4$; 3) $6^3 \cdot 6$; 4) $5 \cdot 5^5$.

186. 1) $c^3 \cdot c^2$; 2) $a^3 \cdot a^4$; 3) $(\frac{1}{2}a)^7 (\frac{1}{2}a)$; 4) $(3b)(3b)^6$.

187. 1) $(-2)^2 \cdot (-2)^3$; 3) $(-0,5)^4 \cdot (-0,5)^2$;
2) $(-3)^2 \cdot (-3)^2$; 4) $(-1,2)^3 \cdot (-1,2)^4$.

188. 1) $2^3 \cdot 2^2 \cdot 2^4$; 3) $(-5)^6 \cdot (-5)^3 \cdot (-5)^4$;
2) $3^2 \cdot 3^5 \cdot 3^3$; 4) $(-6)^3 \cdot (-6)^2 \cdot (-6)^7$.

189. 1) $(1,3)^2 \cdot (1,3) \cdot (1,3)^5$; 3) $y^4 y^3 y^7$;
2) $(\frac{2}{3}) \cdot (\frac{2}{3})^3 \cdot (\frac{2}{3})^4$; 4) $b^6 b^8 b$.

190. 1) $(-2,5a)^3 \cdot (-2,5a)^8$; 3) $(x-a)^7 (x-a)^{10}$;
2) $(-\frac{5x}{6})^5 \cdot (-\frac{5x}{6})^7$; 4) $(n+m)^{15} (n+m)^5$.

191. 1) $4^4 \cdot 4^5$; 2) $3^8 \cdot 3^n$; 3) $c^{28} \cdot c^n$; 4) $a^n a^{13}$ (n – natural son).

192. 1) $y^n y^m$; 2) $b^n b^k$; 3) $5^{4k} \cdot 5^{4l}$; 4) $3^{3n} \cdot 3^{3m}$ (n, m, k, l – natural sonlar).

193. Darajani bir xil asosli ikkita darajaning ko'paytmasi shaklida yozing:

1) 3^4; 2) $(\frac{5}{9})^5$; 3) y^3; 4) c^{10}; 5) $(-x)^{17}$; 6) $(-11b)^{43}$.

Asosi 2 bo'lgan daraja shaklida yozing **(194–197):**

194. 1) 32; 2) 4; 3) 2; 4) 128.

195. 1) 16; 2) 64; 3) 256; 4) 1024.

196. 1) $2 \cdot 2^6$; 2) $2^4 \cdot 2^3 \cdot 2^7$; 3) $8 \cdot 2^7$; 4) $16 \cdot 2^5$.

197. 1) $2^7 \cdot 128$; 3) $2^n \cdot 8$;
2) $2^{10} \cdot 32 \cdot 256$; 4) $16 \cdot 2^n$ (n – natural son).

Asosi 3 bo'lgan daraja shaklida yozing **(198–201):**

198. 1) 9; 2) 3; 3) 27; 4)81.

199. 1) 729; 2) 243; 3) $3 \cdot 3^4$; 4) $3^6 \cdot 3$.

200. 1) $3^5 \cdot 3^{17} \cdot 3$; 2) $3^2 \cdot 3^{11} \cdot 3^5$; 3) $3^5 \cdot 27$; 4) $81 \cdot 3^2$.

201. 1) $3^n \cdot 3^2$; 3) $3^{n+1} \cdot 81$;
2) $3 \cdot 3^n$; 4) $27 \cdot 3^n$ (n – natural son).

202. Ifodaning qiymatini toping:

1) $k^2 \cdot k$, bunda $k = 3$; $\frac{2}{5}$; $-0{,}05$.

2) $a \cdot a^3$, bunda $a = 0$; 1; -1; -2; $\frac{2}{3}$; $-0{,}2$.

Bo'linmani daraja shaklida yozing **(203–206):**

203. 1) $7^{10} : 7^8$; 2) $4^3 : 4$; 3) $(0{,}2)^4 : (0{,}2)^3$; 4) $10^{12} : 10^4$.

204. 1) $(-\frac{9}{7})^8 : (-\frac{9}{7})^5$; 2) $(\frac{1}{17})^{18} : (\frac{1}{17})^{17}$; 3) $x^{21} : x^7$; 4) $d^{24} : d^{12}$.

205. 1) $(\frac{3y}{4})^6 : (\frac{3y}{4})^2$; 3) $(a-b)^7 : (a-b)^5$;
2) $(2a)^5 : (2a)^3$; 4) $(m+n)^{10} : (m+n)^5$.

206. 1) $3^{4n} : 3^{2n}$; 3) $a^{6n+4} : a^{3n}$;
2) $5^{3n} : 5^n$; 4) $x^{4n-1} : x^{2n}$ (n – natural son).

Asosi 2 bo'lgan daraja shaklida yozing **(207–209):**

207. 1) $2^3 : 2$; 2) $2^4 : 4$; 3) $64 : 4$; 4) $32 : 2^3$.

208. 1) $8 : 2^2$; 2) $256 : 32$; 3) $\frac{2^7}{2^5}$; 4) $\frac{2^{10}}{2}$.

209. 1) $2^{2n} : 2^n$; 3) $2^{4n+1} : 2^{2n}$;
2) $2^{3n} : 2^{2n}$; 4) $2^{4n+5} : 2^{n+2}$ (n – natural son).

Asosi 3 bo'lgan daraja shaklida yozing **(210–212):**

210. 1) $3^5 : 3^2$; 2) $3^4 : 3$; 3) $3^4 : 9$; 4) $27 : 3^2$.

211. 1) $243 : 27$; 2) $81 : 9$; 3) $\frac{3^{15}}{3}$; 4) $\frac{3^8}{3^4}$.

212. 1) $3^{4n} : 3^{3n}$; 3) $3^{n+3} : 3^{n+1}$;
2) $3^{6n} : 3^{2n}$; 4) $3^{n+6} : 3^{n+2}$ (n – natural son).

Hisoblang **(213–215):**

213. 1) $\frac{2\cdot 3^3}{3^2}$; 2) $\frac{2^4\cdot 3^2}{2^3\cdot 3}$; 3) $\frac{3^5\cdot 3^{10}}{3^6\cdot 3^7}$; 4) $\frac{5^8\cdot 5^7}{5^4\cdot 5^9}$.

214. 1) $\frac{8\cdot 3^3}{2\cdot 3^2}$; 2) $\frac{11^3\cdot 4^2}{11^2\cdot 4}$; 3) $\frac{2^4\cdot 2^6\cdot 2^3}{2^5\cdot 2^7}$; 4) $\frac{3^6\cdot 3^3}{3^5\cdot 3\cdot 3}$.

215. 1) $\frac{(-5)^9}{5^7}$; 2) $\frac{6^8}{(-6)^7}$; 3) $\frac{6^6}{3^4\cdot 2^3}$; 4) $\frac{3^6\cdot 2^7}{6^5}$.

216. Tenglik to'g'rimi:

1) $\frac{2^5\cdot 2^3}{2^4}=\frac{2^{11}}{2^7}$; 3) $\frac{3^4\cdot 3^5}{3^8}=\frac{3^9}{3^7}$.

2) $\frac{3^{11}\cdot 9}{3^{12}}=\frac{3^8}{3^7}$; 4) $\frac{2^6\cdot 16}{2^5}=\frac{2^{11}}{2^5}$?

217. Ifodaning qiymatini toping:

1) $\frac{p^{13}}{p^{11}}$ bunda $p=0{,}5;\ -0{,}2;\ -4;\ 1$;

2) $\frac{x^{17}}{x^{14}}$ bunda $x=1;\ -1;\ -0{,}1;\ \frac{1}{2}$;

3) $\frac{b^{11}\cdot b^{10}}{b^{18}}$ bunda $b=7;\ -6;\ 0{,}2;\ -0{,}1$;

4) $\frac{a^9\cdot a^8}{a^{15}}$ bunda $a=13;\ -11;\ 1{,}2;\ -\frac{3}{5}$.

Tenglamani yeching **(218–220):**

218. 1) $x:3^2=3^3$; 2) $x:2^4=2^2$; 3) $x\cdot 2^6=2^8$; 4) $x\cdot 3^5=3^8$.

219. 1) $5^5x=5^7$; 2) $4^6x=4^8$; 3) $3^8:x=4^8$; 4) $2^{11}:x=2^9$.

220. 1) $\frac{x}{2^3}=2^2$; 2) $\frac{x}{3^2}=3^3$; 3) $\frac{2^8}{x}=2^5$; 4) $\frac{3^9}{x}=3^7$.

Asosi 5 bo'lgan daraja shaklida yozing **(221–222):**

221. 1) $(5^3)^4$; 2) $(5^4)^3$; 3) $(5^4)^{11}$; 4) $(5^9)^4$.

222. 1) $(5^n)^3$; 2) $(5^3)^n$; 3) $(5^4)^n$; 4) $(5^n)^5$ (n – natural son).

Asosi 7 bo'lgan daraja shaklida yozing **(223–224):**

223. 1) $(7^2)^3 7^4$; 2) $7^4(7^3)^2$; 3) $(7^5)^2 : 7^3$; 4) $7^{17} : (7^2)^5$.

224. 1) $\frac{7^5 \cdot (7^4)^3}{7^{14}}$; 2) $\frac{7^{15}}{(7^2)^3 \cdot 7^7}$; 3) $(7^5)^6 : (7^3)^4$; 4) $(7^7)^5 : (7^2)^7$.

Asosi a bo'lgan daraja shaklida yozing **(225–228):**

225. 1) $(a^5)^6$; 2) $(a^8)^7$; 3) $(a^2)^5 a^8$; 4) $a^5(a^2)^8$.

226. 1) $a^7 a^5 (a^2)^4$; 2) $a^3(a^3)^3 a^3$; 3) $(a^3)^2 a^4 (a^4)^3$; 4) $a^5(a^3)^4(a^2)^3$.

227. 1) $(a^7)^5 : (a^3)^4$; 2) $(a^6)^4 : (a^3)^5$; 3) $\frac{(a^3)^5 a^4}{a^{12}}$; 4) $\frac{a^8 (a^4)^4}{(a^3)^4}$.

228. 1) $(a^n)^3$; 2) $(a^2)^n$; 3) $a^n(a^3)^n$; 4) $(a^n)^4 a^{2n}$ (n – natural son).

229. Ifodaning qiymatini toping:

1) $\frac{(c^2)^3 c^8}{(c^3)^4}$ bunda $c = -3;\ \frac{2}{7};\ 1\frac{1}{3}$;

2) $\frac{b^3 b^5}{(b^2)^3}$ bunda $b = 5;\ \frac{1}{4};\ -10$;

3) $\frac{(x^4)^9}{x^{12} x^9}$ bunda $x = 1{,}1;\ -0{,}2;\ \frac{3}{4}$;

4) $\frac{(a^3)^7}{(a^4)^3 a^6}$ bunda $a = -0{,}3;\ 9;\ \frac{2}{5}$.

230. 2^{20} ni asosi:

1) 2^2; 2) 2^4; 3) 2^5; 4) 2^{10} bo'lgan daraja shaklida tasvirlang.

231. n ning qanday qiymatida tenglik to'g'ri bo'ladi:

1) $3^n = 9$; 2) $128 = 2^n$; 3) $(2^2)^n = 16$; 4) $(3^n)^2 = 81$?

Ko'rsatkichi 2 bo'lgan daraja shaklida yozing **(232–234):**

232. 1) 0,01; 2) $\frac{25}{36}$; 3) $1\frac{9}{16}$; 4) 0,0004.

233. 1) 5^4; 2) 7^6; 3) $(-0{,}7)^{14}$; 4) $(-\frac{2}{3})^{24}$.

234. 1) a^4; 2) b^6; 3) c^{10}; 4) x^{20}.

Ko'paytmani darajaga ko'taring (**235–240**):

235. 1) $(3 \cdot 5)^4$; 2) $(7 \cdot 6)^5$; 3) $(1{,}3 \cdot 8)^5$; 4) $(4 \cdot \frac{1}{7})^3$.

236. 1) $(2a)^3$; 2) $(3x)^4$; 3) $(-4x)^5$; 4) $(-8b)^2$.

237. 1) $(ax)^7$; 2) $(6y)^6$; 3) $(2{,}5cd)^2$; 4) $(3nm)^3$.

238. 1) $(abc)^4$; 2) $(xyz)^7$; 3) $(3 \cdot 5 \cdot 11)^8$; 4) $(2 \cdot 4 \cdot 9)^9$.

239. 1) $(xy^3)^2$; 2) $(a^2b)^3$; 3) $(2b^4)^5$; 4) $(0{,}1c^3)^2$.

240. 1) $(10n^2m^3)^3$; 2) $(8a^4b^7)^3$; 3) $(-2{,}3a^3b^4)^2$; 4) $(-2nm^3)^4$.

241. (Og'zaki.) Agar kvadratning har bir tomoni uzunligini 2 marta; 3 marta; 10 marta uzaytirilsa, uning yuzi necha marta ortadi?

242. (Og'zaki.) Qirrasi berilgan kub qirrasining $\frac{1}{2}$; $\frac{1}{10}$ qismini tashkil qiluvchi kubning hajmi berilgan kub hajmining qanday qismini tashkil qiladi?

Ko'paytmani daraja shaklida $3^2b^2=(3b)^2$ namunaga qarab yozing (**243-245**):

243. 1) 4^5x^5; 2) 2^3a^3; 3) 5^47^4; 4) 2^53^5.

244. 1) $(\frac{2}{5})^2a^2$; 2) $(3{,}4)^4b^4$; 3) $(-1{,}2)^3y^3$; 4) $(-\frac{2}{3})^2a^2$.

245. 1) $16a^2$; 2) $81r^2$; 3) $9^7n^7m^7$; 4) $15^3a^3b^3$.

Ifodani ko'rsatkichi 2 bo'lgan daraja shaklida yozing (**246–248**):

246. 1) c^2d^{10}; 2) a^4b^6; 3) $25a^4$; 4) $81m^2$.

247. 1) $a^4b^6c^2$; 2) $x^2y^4z^8$; 3) $49x^8y^6$; 4) $100c^8x^6$.

248. 1) $0{,}25a^{10}b^6$; 2) $0{,}49n^2m^{10}$; 3) $\frac{49}{81}x^{12}y^{14}$; 4) $\frac{16}{625}a^{10}b^{16}$.

Ifodani ko'rsatkichi 3 bo'lgan daraja shaklida yozing (**249–252**):

249. 1) a^6; 2) b^9; 3) 5^{15}; 4) 4^6.

250. 1) $(-0{,}2)^{12}$; 2) $(-\frac{2}{3})^{15}$; 3) $-0{,}125$; 4) $-0{,}001$.

251. 1) x^3y^9; 2) a^6b^3; 3) $b^9c^{12}d^3$; 4) $x^{12}y^9z^6$.

252. 1) $-27a^3$; 2) $-1000b^6$; 3) $-125n^6m^6$; 4) $-0{,}008x^3y^9$.

Hisoblang **(253–257):**

253. 1) $(0{,}25)^7 4^7$; 2) $[\frac{4}{5}]^{17} \cdot [\frac{5}{4}]^{17}$; 3) $(-0{,}125)^{11} 8^{11}$; 4) $(-0{,}2)^5 5^5$.

254. 1) $(-0{,}25)^9(-4)^9$; 3) $[\frac{6}{11}]^3 \cdot (8{,}5)^3$;

2) $[-\frac{2}{7}]^7 \cdot (-3{,}5)^7$; 4) $[\frac{1}{9}]^5 \cdot (4{,}5)^5$.

255. 1) $\frac{2^8 \cdot 3^8}{6^5}$; 2) $\frac{4^5 \cdot 3^5}{12^3}$; 3) $\frac{10^5}{2^5 \cdot 5^5}$; 4) $\frac{14^4}{2^3 \cdot 7^3}$.

256. 1) $\frac{6^{12} \cdot 4^{12}}{3^{12} \cdot 8^{12}}$; 2) $\frac{4^{10} \cdot 3^{10}}{2^{10} \cdot 6^{10}}$; 3) $\frac{15^4}{3^4 \cdot 5^2 \cdot 25}$; 4) $\frac{4^{16}}{8^{10}}$.

257. 1) $\frac{8 \cdot 27^3}{3^8}$; 2) $\frac{2^8 \cdot (7^2)^4}{14^7}$; 3) $\frac{16^2 \cdot 3^5}{12^4}$; 4) $\frac{2^9 \cdot (2^2)^5}{(2^5)^3}$.

Kasrni darajaga ko'taring **(258–261):**

258. 1) $[\frac{2}{3}]^2$; 2) $[\frac{5}{7}]^2$; 3) $[\frac{3}{a}]^2$; 4) $[\frac{b}{8}]^3$.

259. 1) $[-\frac{m}{11}]^2$; 2) $[-\frac{13}{n}]^2$; 3) $[\frac{d}{-2}]^3$; 4) $[\frac{-4}{c}]^3$.

260. 1) $[\frac{a}{2b}]^4$; 2) $[\frac{3b}{5c}]^4$; 3) $[\frac{2^3}{3^2}]^7$; 4) $[\frac{5^2}{7^4}]^3$.

261. 1) $[\frac{a+b}{3}]^3$; 2) $[\frac{7}{2+c}]^2$; 3) $[\frac{m+n}{m-n}]^5$; 4) $[\frac{a+b}{a-b}]^7$

Kasrni daraja shaklida yozing **(262–264):**

262. 1) $\frac{3^1}{4^7}$; 2) $\frac{2^5}{5^5}$; 3) $\frac{m^3}{2^3}$; 4) $\frac{5^7}{a^7}$.

263. 1) $\frac{x^6}{y^6}$; 2) $\frac{a^3}{b^3}$; 3) $\frac{25}{36}$; 4) $\frac{49}{100}$.

264. 1) $\frac{(2b)^2}{(3b)^2}$; 2) $\frac{(4x)^4}{(3y)^4}$; 3) $\frac{1}{-8}$; 4) $\frac{-1}{27}$.

Hisoblang (265–266):

265. 1) $(\frac{3}{5})^4 \cdot \frac{5^3}{3^2}$; 2) $\frac{7^5}{5^7} \cdot (\frac{5}{7})^6$; 3) $(\frac{2}{3})^3 \cdot (\frac{3}{2})^4$; 4) $(\frac{3}{4})^6 \cdot (\frac{4}{3})^8$

266. 1) $(\frac{35}{48})^2 \cdot (\frac{6}{7})^3 \cdot (1\frac{3}{5})^2$;

2) $(\frac{14}{15})^4 \cdot (\frac{3}{7})^4 \cdot (2{,}5)^3$;

3) $(\frac{5^3}{6^2})^4 \cdot (\frac{2}{5})^5 \cdot (\frac{3}{5})^7$;

4) $(\frac{7^4}{15^2})^3 \cdot (\frac{5}{7})^6 \cdot (\frac{3}{7})^5$.

267. 1) Yerning massasi $6 \cdot 10^{24}$ kg ga teng. Quyoshning massasi $2 \cdot 10^{30}$ kg. Yerning massasi Quyoshning massasidan necha marta kam?

2) Yerdan Sirius yulduzigacha bo'lgan masofa 83 000 000 000 000 km. Yorug'lik nuri Yerdan Siriusgacha necha yilda yetib borishini taqriban hisoblang.

268. Agar sonning

1) kvadrati 0,25; 400; $11\frac{1}{9}$ ga teng;

2) kubi 0,008; 125; $3\frac{3}{8}$; $37\frac{1}{27}$ ga teng bo'lsa, shu sonning oltinchi darajasini toping.

269. Ifodaning qiymatini toping:

1) $\frac{2-b^2}{2b}$, bunda $b=-2$; 2) $\frac{3a}{a^3-3}$, bunda $a=-3$.

270*. Ko'paytmani daraja shaklida yozing:

1) $4^{2n} \cdot 4^{3n-1} \cdot 4^{n+2}$; 3) $x^{n+2}x^8x^{4n-1}$;

2) $6^{n+3} \cdot 6^{2n-1} \cdot 6^{3n}$; 4) $a^7a^{2n}a^{3n-2}$ (n – natural son).

271*. Ifodani daraja shaklida yozing:

1) $5^{3n+4} \cdot 5^{2n-1} : 5^{n+2}$; 3) $\frac{a^{6n-4}a^{4n+1}}{a^{5n-2}}$;

2) $3^{4n+3} \cdot 3^{3n-2} : 3^{2n-1}$; 4) $\frac{b^{5n-3}b^{3n+2}}{b^{4n-1}}$ (n – natural son).

272*. n ning qanday qiymatida tenglik to'g'ri bo'ladi:

1) $(4^4)^n=4^{12}$; 2) $(5^n)^2=5^{14}$; 3) $2^{2n}=4^5$; 4) $3(3^2)^n=3^{11}$?

273[273]***.** Ko'paytmani darajaga ko'taring:

1) $(8a^2b^4c^3)^3$; 2) $(9x^4y^3z^7)^2$; 3) $(-1{,}2x^5y^7z^7)^2$; 4) $(-1{,}2a^3b^2c^4)^5$

274*. Ifodani asosi a bo'lgan daraja shaklida yozing:

1) $\frac{a^8a^5}{a^3a^6}$; 2) $\frac{a^9a^6}{a^5a^8}$; 3) $\frac{(a^3)^4(a^4)^3}{a^6a^9}$; 4) $\frac{a^6(a^3)^5}{(a^4)^2a^9}$.

275*. Ifodani asosi 3 bo'lgan daraja shaklida yozing:

1) $\frac{4^9b^{12}}{2^{15}a^6}$; 2) $\frac{3^{15}a^{12}}{5^6b^3}$; 3) $\frac{(4^3)^2a^9}{5^{12}(b^5)^3}$; 4) $\frac{6^9(a^3)^4}{(7^4)^3b^{18}}$.

276*. Sonlardan qaysi biri katta:

1) 54^4 mi yoki 21^{12} mi; 3) 100^{20} mi yoki 9000^{10} mi;

2) 10^{20} mi yoki 20^{10} mi; 4) 6^{20} mi yoki 3^{40} mi?

277*. Hisoblang:

1) $\frac{2\cdot5^{22}-9\cdot5^{21}}{25^{10}}$; 3) $\frac{(4\cdot3^{22}+7\cdot3^{21})\cdot57}{(19\cdot27^4)^2}$.

2) $\frac{5\cdot2^{32}-4\cdot2^{30}}{4^{16}}$; 4) $\frac{5(3\cdot7^{15}-19\cdot7^{14})}{7^{16}+3\cdot7^{15}}$.

278. Tenglamani yeching:

1) $x:1{,}75=7{,}125-3\frac{1}{8}$; 3) $18{,}9:x=0{,}021\cdot100$;

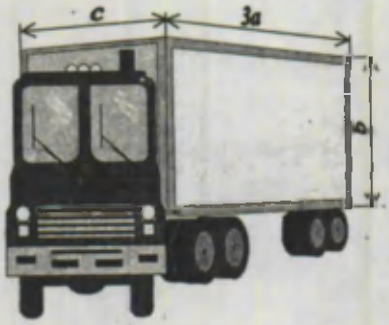
2) $\frac{5}{12}+\frac{1}{18}=\frac{17}{12}x$; 4) $754{,}5:(37{,}1+x)=15$.

279. Sonni standart shaklda yozing:

1) 26000; 2) 8647000;

3) Yerdan Quyoshgacha bo'lgan 149 500 000 km masofa.

11-§. BIRHADLAR



5- rasm

Turli masalalarni yechishda ko'pincha ab, $\frac{1}{2}abc$, $3a^2b$ ko'rinishdagi algebraik ifodalarga duch kelinadi. Masalan, o'lchamlari 5- rasmda ko'rsatilgan sovutkichli mashina sig'imi $3abc$ ga teng.

$3abc$ ifoda birinchisi raqam bilan, qolgan uchtasi a, b, c harflari bilan belgilangan to'rtta ko'paytuvchining ko'paytmasidir.

Raqamlar bilan yozilgan ko'paytuvchilarni *sonli ko'paytuvchilar*, harflar bilan belgilangan ko'paytuvchilarni esa *harfiy ko'paytuvchilar* deyiladi. *Son va harfiy ko'paytuvchilar ko'paytmasidan iborat algebraik ifoda birhad deyiladi.*

Masalan, ushbu ifodalar birhadlardir:

$$abc,\ (-4)a\cdot 3ab,\ \ \frac{1}{4}a(-0{,}3)bab.$$

Teng ko'paytuvchilar ko'paytmasini natural ko'rsatkichli daraja shaklida yozish mumkin bo'lganligi uchun sonning darajasi va sonlar darajalarining ko'paytmasi ham birhadlar deyiladi.

Masalan, ushbu ifodalar birhadlar bo'ladi:

$$(\frac{3}{4})^2,\ (-7)^2,\ c^5,\ 4a^2,\ (-\frac{1}{2})a^2b.$$

Har bir sonni shu son bilan birning ko'paytmasi shaklida yozish mumkin bo'lgani uchun a, 2, $\frac{3}{8}$ ko'rinishdagi ifodalar ham birhadlar deb hisoblanadi.

M a s a l a . Birhadning qiymatini hisoblang:

$$16ac\cdot(0{,}5)a\cdot(0{,}25)b,$$

bunda $a=\frac{1}{3}$, $b=34$, $c=\frac{9}{17}$.

△ Harflarning qiymatlarini birhadga qo'yib, uning qiymatini topamiz, ya'ni yettita sonning ko'paytmasini hisoblaymiz:

$$16\cdot\frac{1}{3}\cdot\frac{9}{17}\cdot 0{,}5\cdot\frac{1}{3}\cdot 0{,}25\cdot 34.$$

Sonlarning birinchisini ikkinchisiga, ular qanday yozilgan bo'lsa, xuddi shu tartibda ko'paytirish mumkin:

$$16\cdot\frac{1}{3}=\frac{16}{3};\ \frac{16}{3}\cdot\frac{9}{17}=\frac{48}{17};\ \frac{48}{17}\cdot 0{,}5=\frac{24}{17};$$

$$\frac{24}{17}\cdot\frac{1}{3}=\frac{8}{17};\ \frac{8}{17}\cdot\frac{1}{4}=\frac{2}{17};\ \frac{2}{17}\cdot 34=4.$$

Ko'paytirishning o'rin almashtirish va guruhlash qonunlarini qo'llab, hisoblashni qisqacha bajarish ham mumkin:

$$16ac(0{,}5)a(0{,}25)b=(16\cdot 0{,}5\cdot 0{,}25)(a\cdot a)bc=2a^2bc.$$

Endi $a=\frac{1}{3}$, $b=34$, $c=\frac{9}{17}$ bo'lganda $2a^2bc$ birhadning qiymatini topamiz:

$$2\cdot(\frac{1}{3})^2\cdot 34\cdot\frac{9}{17}=\frac{2\cdot 34\cdot 9}{9\cdot 17}=4.\ ▲$$

Masalani ikkinchi usul bilan yechishda berilgan birhad ancha sodda ko'rinishda yozilgan edi: $2a^2bc$. Bu – birhadning *standart shakliga* misol.

Umuman, birinchi o'rinda turgan faqat bitta son ko'paytuvchidan va har xil asosli harfiy darajalardan tuzilgan birhadni *standart shakldagi birhad* deyiladi.

Har qanday birhadni standart shaklda yozish mumkin. Buning uchun barcha son ko'paytuvchilarni o'zaro ko'paytirish va ularning ko'paytmasini birinchi o'ringa yozish kerak. So'ngra bir xil harfiy ko'paytuvchilar ko'paytmasini daraja shaklida yozish kerak. Harfiy ko'paytuvchilar ko'pincha, shart bo'lmasa ham, alvafit tartibida joylashtiriladi.

Birhadning standart shaklida bir xil harflar yo'qligini eslatib o'tamiz.

Standart shaklda yozilgan birhadning son ko'paytuvchisini shu *birhadning koeffitsiyenti* deyiladi.

Masalan, $2a$ birhadning koeffitsiyenti 2 ga teng; $\frac{5}{6}ab^2$ birhadning koeffitsiyenti $\frac{5}{6}$ ga teng, $(-7)a^2b^3c$ birhadning koeffitsiyenti (-7) ga teng. Oxirgi holda birhadni qavssiz yozish mumkin:

$$(-7)a^2b^3c = (-7)a^2b^3c.$$

1 ga teng bo'lgan koeffitsiyentni odatda yozilmaydi, chunki birga ko'paytirgan bilan son o'zgarmaydi. Masalan, $1 \cdot abc^2 = abc^2$, ya'ni abc^2 birhadning koeffitsiyenti birga teng.

Agar koeffitsiyent (-1) ga teng bo'lsa, bu holda ham birni va qavslarni yozmasdan, faqat «–» ishorasini qoldirish mumkin. Masalan, $(-1)abc = -abc$, ya'ni $-abc$ birhadning koeffitsiyenti -1 ga teng.

Mashqlar

280. (Og'zaki.) Birhadning son va harfiy ko'paytuvchilarini ayting:

1) $6a(0,3)b2c$; 2) $3p(-0,1)q7a$; 3) $0,5a\frac{1}{4}b3c$; 4) $2,5m\frac{1}{3}n4k$.

So'z orqali aytilgan fikrni algebraik ifoda yordamida yozing **(281–283):**

281. 1) a va b sonlar ko'paytmasining ikkilangani;

2) b va c sonlar ko'paytmasining uchlangani;

3) x va y sonlar kvadratlarining ko'paytmasi;

4) a son bilan b son kvadratining ko'paytmasi.

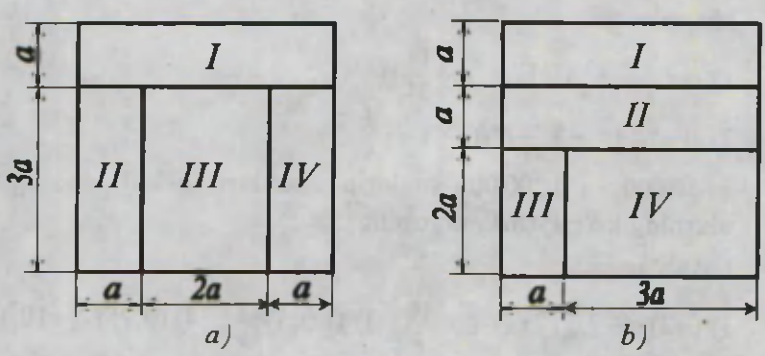
282. 1) m sonning kubi bilan p sonning ko'paytmasi;

2) a son kvadrati bilan b son ko'paytmasining uchlangani.

283. 1) t soatdagi sekundlar soni;

2) n metrdagi santimetrlar soni.

284. Kvadrat o'lchamlari 6- rasmda ko'rsatilganidek to'rtta to'g'ri to'rtburchakka bo'lingan. Ularning yuzlarini toping.



6- rasm

Birhadning son qiymatini toping **(285–287):**

285. 1) $\frac{3}{4}a^3$, bunda $a=-2$; 2) $0{,}5b^2$, bunda $b=-4$;

3) $3abc$, bunda $a=2$, $b=\frac{1}{2}$, $c=\frac{1}{3}$;

4) $4pqr$, bunda $p=\frac{1}{2}$, $q=3$, $r=\frac{1}{6}$;

5) $\frac{1}{7}m^2(-0{,}2)n$, bunda $m=3$, $n=-35$;

6) $\frac{1}{9}y(-0{,}3)x^2$, bunda $y=-15$, $x=6$.

286. Birhadni standart shaklda yozing:

1) $3m^2m$; 3) $ab \cdot 0{,}5$; 5) $5^2pq^2(-4)qp$;

2) z^5z^5z; 4) $(-m)(-m^3)$; 6) $2^3qp^2(-3)^2pq$.

287. Birhadni standart shaklda yozing va son qiymatini toping:

1) $ac12c$, bunda $a=-\frac{1}{3}$, $c=4$;

2) $\frac{1}{6}a8b^2\frac{3}{4}ba^3$, bunda $a=-2$, $b=\frac{1}{2}$.

288. (Qadimiy masala.) Hovuzga 4 ta quvur yo'naltirilgan bo'lib, birinchi quvur hovuzni bir kunda, ikkinchi quvur ikki kunda, uchinchi quvur uch kunda, to'rtinchi quvur to'rt kunda to'ldiradi. To'rtala quvur birgalikda hovuzni qancha vaqtda to'ldiradi?

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289. Hisoblang:

1) $((2\frac{3}{5}-3\frac{1}{2})-(70-68\frac{19}{24}))\cdot\frac{120}{127}$;

2) $((-1\frac{6}{7})^2-3\frac{6}{49})\cdot((1\frac{3}{4})\cdot(1\frac{3}{4})^2)$.

290. 8 880 000 va 3 200 000 sonlarini standart shaklda yozing va ularning ko'paytmasini toping.

291. Hisoblang:

1) $(-2)\cdot(-7)$; 2) $(-\frac{2}{7})\cdot\frac{14}{3}$; 3) $(-0{,}5):\frac{2}{5}$; 4) $(0{,}75)\cdot(-10^2)$.

12- §. BIRHADLARNI KO'PAYTIRISH

Quyidagi masalani yechaylik.

M a s a l a . To'g'ri burchakli parallelepipedning hajmi $V=abc$ formula bo'yicha hisoblanadi, bu yerda a – parallelepipedning bo'yi, b – eni va c – balandligi. Agar shu parallelepipedning bo'yini 5 marta, enini $2n$ marta, balandligini $3n$ marta uzaytirilsa, yangi parallelepipedning hajmi qanday bo'ladi?

Yangi parallelepipedning o'lchamlarini topamiz: bo'yi $5a$, eni $2nb$, balandligi $3nc$.

Bu holda uning hajmi $V_1=(5a)\cdot(2nb)\cdot(3nc)$ ga teng. ▲

$(5a)(2nb)(3nc)$ ifoda quyidagi uchta birhadning ko'paytmasidir: $5a$, $2nb$, $3nc$.

Sonlarni ko'paytirish qoidalariga ko'ra bunday tenglikni yozish mumkin:

$$(5a)\cdot(2nb)\cdot(3nc)=5a2nb3nc=(5\cdot 2\cdot 3)(annbc)=30n^2abc.$$

Birhadlarni ko'paytirish natijasida yana birhad hosil bo'ladi va uni standart shaklda yozib, soddalashtirish lozim, masalan:

$$(3a^2b^3c)\cdot(4ab^2)=3a^2b^3c\cdot 4ab^2=12a^3b^5c.$$

Ikki yoki bir nechta bir xil birhadlarning ko'paytmasini, ya'ni birhadning darajasini qaraymiz, masalan: $(5a^3b^2c)^2$. Bu birhad 5, a^3b^2c ko'paytuvchilarning ko'paytmasi bo'lgani uchun ko'paytmani darajaga ko'tarish xossasiga ko'ra:

$$(5a^3b^2c)^2=5^2(a^3)^2(b^2)^2c^2=25a^6b^4c^2.$$

Xuddi shu kabi:

$$(2pq^2)^3=2^3p^3(q^2)^3=8p^3q^6.$$

Birhadni natural ko'rsatkichli darajaga ko'tarish natijasida yana birhad hosil bo'ladi.

Mashqlar

Birhadlarni ko'paytiring **(292–299):**

292. 1) $(2a)(3b)$; 2) $(3a)(2b)$; 3) $b^2(-3b^3)$; 4) $(-2a)a^2$.

293. 1) $(2p)(-3c^2)$; 2) $(-5m^2)(-7n)$; 3) $(4a^2)(6a^3)$; 4) $(-\frac{1}{2}b^3)(8b^2)$.

294. 1) $(0,3a^2)(\frac{1}{4}b^3)$; 3) $(0,2p)(-1,3q^2)$;

2) $(-8m^3)(0,25n)$; 4) $(-\frac{3}{7}c^2)(-\frac{5}{6}b^3)$.

295. 1) $(3ab)(-2a^2b)$; 3) $(8ab^2)(\frac{1}{4}ac^2)$;

2) $(-4x^2y)(-7xy^2)$; 4) $(6a^2b)(\frac{1}{3}bc^2)$.

296. 1) $(3a^2b^5c)(6a^3bc^2)$; 3) $(\frac{2}{3}a^2b^3x)(\frac{3}{4}a^3bx^2)$;

2) $(7a^5b^2c)(-3ab^4c)$; 4) $(-\frac{3}{2}a^3xy^3)(\frac{3}{4}ax^2y)$.

297. 1) $(-0,4x^5y^6z^2)(-1,2xyz^3)$; 3) $(-1\frac{1}{3}x^2y^3z)(-1\frac{1}{2}xy^2z^3)$;

2) $(-2,5n^4m^5r^2)(3nm^2r^5)$; 4) $(2\frac{1}{4}a^2b^5c^3)(-3\frac{1}{3}a^3b^2c^4)$.

298. 1) $(-\frac{1}{3}m^2)(-24n)(4mn)$; 3) $(\frac{1}{3}ay^3)(\frac{3}{4}x^2y)(0,2a^3x)$;

2) $(-18n)(-\frac{1}{6}m^2)(-5mn)$; 4) $(-13a^2bc)(-5ab^2c)(-0,4abc^3)$.

299. 1) $(-a)(3b)(4a^2b)(5ab^2)$; 3) $(-1,5ab)(\frac{1}{4}bc)(2ac)(24ab)$;

2) $(5a)(a^2b^2)(-2b)(-3a)$; 4) $(1,2a^2)(-\frac{1}{3}ab)(-5bc)(2c^2)$.

Birhadni darajaga ko'taring **(300–303):**

300. 1) $(2a)^3$; 2) $(5b)^2$; 3) $(3b^2)^4$; 4) $(2a^3)^2$.

301. 1) $(-3ab)^4$; 2) $(-4ab)^2$; 3) $(-abc)^5$; 4) $(-2xyz)^3$.

302. 1) $(-2a^2b)^3$; 2) $(-a^2bc)^5$; 3) $(-3x^3y)^2$; 4) $(-2x^2y^3)^4$.

303. 1) $(\frac{1}{2}nm^2)^3$; 2) $(\frac{1}{3}n^2m^2)^4$; 3) $(-0,1a^3b^3)^3$; 4) $(0,4a^3b^2)^2$.

Amallarni bajaring **(304–305):**

304. 1) $(-2a)^3(-3a)$; 3) $(-0,2bc^2)^2(20cx^2)$;

2) $(-a)^3(2a)$; 4) $(-0,1ab^2c)^2(100by^2)$.

305. 1) $(-1\frac{3}{5}x^3y^2)(-\frac{1}{2}c^2x^2)^3$; 3) $(-3bc^2)^3(2ab^2)^2$;

2) $(2\frac{1}{4}x^3y)(\frac{2}{3}xy^2)^2$; 4) $(-2a^2b)^2(-a^2b^3)^3$.

306. Birhadni boshqa birhadning kvadrati shaklida yozing:

1) $9a^2$; 2) $16x^4$; 3) $25a^2b^4$;

4) $81x^6y^2$; 5) $36x^{10}y^4$; 6) $1,21a^8b^4$.

307. Birhadni boshqa birhadning kubi shaklida yozing:

1) $27a^3$; 2) $8b^6$; 3) $27a^3b^{12}$;

4) $8a^9b^6$; 5) $\frac{1}{125}x^9y^{12}$; 6) $-0,027x^3y^{15}$.

308. Birhadlarni ko'paytiring va hosil bo'lgan ifodaning qiymatini toping:

1) $\frac{1}{3}a^2 \cdot 3a^2b$, bunda $a=-2$, $b=\frac{5}{7}$;

2) $\frac{2}{5}mn \cdot 10n^2$, bunda $m = 0{,}8$, $n = 4$;

3) $4a \cdot \frac{1}{16}a^2b^2c$, bunda $a = 4$, $b = \frac{1}{4}$, $c = 3$;

4) $0{,}7m^2n \cdot 100np$, bunda $m = 0{,}3$, $n = -0{,}2$, $p = 4$.

309. (Qadimiy masala.) Baliqning uchdan bir qismi loyda, to'rtdan bir qismi suv tagida va uch qarichi suv ustida. Baliqning uzunligi necha qarich?

---

310. Amallarni bajaring:

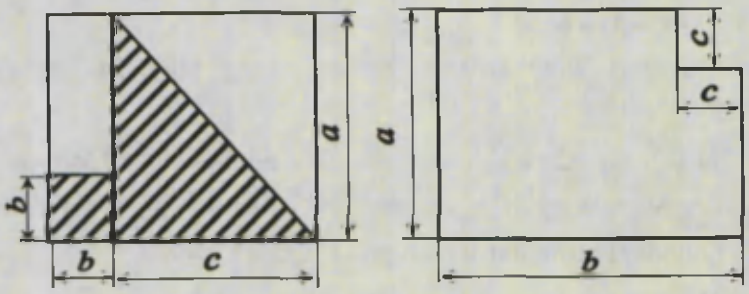
1) $(\frac{7}{2})^2 \cdot \frac{4}{7} \cdot 10 + (1\frac{1}{69} - \frac{1}{23}) \cdot 69$; 2) $\frac{15^4}{3^4 \cdot 5^2} \cdot \frac{7}{25} - \frac{14^2}{2^4 \cdot 7^2}$.

311. a sonning 50% i, 75% i, 14,7% i, 8,03% i, 0,6% i, 0,002% i shu sonning qanday qismini tashkil qiladi?

13- §. KO'PHADLAR

Algebrada ko'pincha birhadlarning yig'indisi yoki ayirmasidan iborat bo'lgan algebraik ifodalar qaraladi.

Masalan, 7- *a* rasmda tasvirlangan shaklning shtrixlangan qismining yuzi $\frac{1}{2}ac + b^2$ ga teng, 7- *b* rasmda tasvirlangan shaklning yuzi esa $ab - c^2$ ga teng. $\frac{1}{2}ac + b^2$ ifoda ushbu ikkita birhadning yig'indisi: $\frac{1}{2}ac$ va b^2; $ab - c^2$ ifoda ab va c^2 birhadlarning ayirmasi yoki ab va $(-c^2)$ birhadlarning yig'indisi. Bu ifodalar birhadlarning algebraik yig'indisi bo'ladi. Bunday ifodalar *ko'phadlar* deyiladi.



a) *b*)

7- rasm

Bir nechta birhadlarning algebraik yig'indisi ko'phad deyiladi.

Ko'phadni tashkil qiluvchi birhadlarni shu *ko'phadning hadlari* deyiladi.

Masalan, $5nm^2-3m^2k-7nk^2+4nm$ ko'phadning hadlari $5nm^2$, $-3m^2k$, $-7nk$, $4nm$ bo'ladi.

Ikkita haddan tuzilgan ko'phad ikkihad deyiladi, uchta haddan tuzilgan ko'phad uchhad deyiladi va hokazo.

Ikkihadga misollar: a^2-b^2, $5ab+4c$.

Uchhadga misollar: $a+2b-3c$, $\frac{1}{2}-bc+3ab$.

Birhadni ham ko'phad deb hisoblaymiz.

Agar ko'phadning ba'zi hadlari standart shaklda yozilmagan bo'lsa, u holda shu ko'phadning barcha hadlarini standart shaklda yozib, uni soddalashtirish mumkin.

M a s a l a . $2a4b-5abac+9bc\frac{1}{3}c$ ko'phadni soddalashtiring.

△ Berilgan ko'phadning barcha hadlarini standart shaklda yozamiz: $2a4b=8ab$, $-5abac=-5a^2bc$, $9bc\frac{1}{3}c=3bc^2$.

Demak, $2a4b-5abac+9bc\frac{1}{3}c=8ab-5a^2bc+3bc^2$. ▲

Mashqlar

312. Quyidagi ko'phadlarni tashkil qiluvchi birhadlarni ayting:

1) $-2x^2+3x-1$;
2) $4x^2-3x+6$;
3) $7a^2-\frac{1}{3}b-\frac{2}{5}c$;
4) $-3a+0,5x-2x^2$.

313. Quyidagi ko'phadlarni birhadlarning yig'indisi shaklida yozing:

1) $7a^4-9a^3-2a+11$;
2) $-6x^5+3x^4-12x^2+5$;
3) $1,6a^3b-4a^2b^2+13ab^3-b^4$;
4) $2,5x^4-18x^3y-16x^2y-3xy^2$.

314. Quyidagi birhadlardan ko'phad tuzing:

1) $6x^2$, $7x$ va 9;
2) $2x^2$, $-11x$ va 3;
3) $-x^4$, x^3 va $-x$;
4) a^5, $-a^4$ va a;
5) $8a^3$, $4a^2b$, $-2ab^2$ va b^3;
6) $4a^3b$, $-2a^2b^2$ va $-5ab^3$.

315. Ko'phadni uning har bir hadini standart shaklga keltirib, soddalashtiring:

1) $12a^2 3ba - 2ab 3ab^2 + 11aba$; 3) $1{,}5xy^2(-4)xyz - 4mnk 5m^2nk$;

2) $2ab^2 4ab - 3a^2 8aba - 2abab^2$; 4) $4cc^2c(-\frac{1}{4})bc + 5xy^2xy^2$.

316. Ifodani uning har bir qo'shiluvchisini standart shaklga keltirib, soddalashtiring:

1) $3aaa(-1\frac{2}{3}ab) + 4xxx3xy$;

2) $1{,}5yyy(-4xyz) - 4mnk \cdot 5m^2nk^2$;

3) $(2ab)(\frac{1}{4}a^2b^2) - (3a^2b)(\frac{1}{9}b)$;

4) $(3a)(\frac{1}{9}ab^2) - (4b^2)(\frac{1}{2}a^2b)$.

317. Ko'phadning son qiymatini toping:

1) $2a^3 + 3ab + b^2$, bunda $a = 0{,}5$, $b = \frac{2}{3}$;

2) $2a^4 - ab + 2b^2$, bunda $a = -1$, $b = -0{,}5$;

3) $x^2 - 2xy + y^2$, bunda $x = y = -4{,}2$;

4) $x^2 + 2xy + y^2$, bunda $x = 1{,}2$, $y = -1{,}2$.

318. Ko'phadni soddalashtiring va uning son qiymatini toping:

1) $-aba + a^2b2ab + 4$, bunda $a = 2$, $b = \frac{1}{2}$;

2) $b^2 5ab - 5a5a^2b$, bunda $a = \frac{1}{5}$, $b = -2$;

3) $x^2yxy - xy^2xy + xy$, bunda $x = -3$, $y = 2$;

4) $xy^2x^2y - xyxy$, bunda $x = -2$, $y = 3$.

---

319. Hisoblang:

1) $7{,}7 - 0{,}182 : (0{,}455 \cdot 6{,}85 - 0{,}455 \cdot 4{,}85)$;

2) $(0{,}15^2 - 0{,}3) : 0{,}15 - 9^5 : 3^9$.

320. 1) 200 ning; 2) 4 ning; 3) 0,6 ning; 4) $\frac{4}{5}$ ning 35% ini toping.

14- §. O'XSHASH HADLARNI IXCHAMLASH

Ushbu masalani yechaylik.

1-masala. Har bir sahifasida bir xil sondagi harflar bo'lgan ikkita kitob bor; bir sahifada n ta satr joylashgan va har bir satrda

m ta harf bor. Birinchi kitob 300 sahifalik, ikkinchisi 500 sahifalik. Ikkala kitobda hammasi bo'lib nechta harf bor?

1-usul. Har bir sahifadagi harflar soni mn ta. Birinchi kitobda 300 nm ta harf, ikkinchisida 500nm ta harf, ikkalasida esa

$$300nm + 500\ nm = 800nm$$

ta harf bor.

2-usul. Har bir sahifadagi harflar soni mn ga teng. Ikkala kitobdagi sahifalar soni $300 + 500 = 800$ ga, ulardagi harflar soni 800nm ga teng. ▲

Ikkala javob ham to'g'riligi ko'rinib turibdi, shuning uchun

$$300nm + 500\ nm = 800nm.$$

Ammo hisoblashlarda ikkinchi javob ancha qulay bo'ladi. Masalan, agar $n = 40$, $m = 50$ bo'lsa, u holda $nm = 2000$ va $300nm + 500nm$ ifodani hisoblash uchun yana uchta hisoblashni bajarish kerak:

$$300 \cdot 2000 + 500 \cdot 2000 = 600000 + 1000000 = 1600000.$$

800nm ifodani hisoblash uchun esa bor-yo'g'i bitta amalni bajarish kerak, xolos: $800 \cdot 2000 = 1600000$.

Mana shuning uchun ham algebraik ifodalarni soddalashtirishni bilish muhim ahamiyatga ega.

$300nm + 500nm$ ikkihad ikkita birhadning yig'indisidan iborat: $300nm$ va $500nm$.

Bu birhadlar bir-birlaridan faqat koeffitsientlari bilan farq qiladi. Bunday birhadlarni *o'hxshash* deyiladi.

Masalan, abc va $3abc$ birhadlar o'xshash, $2pq^2$ va $5q^2p$ birhadlar ham o'xshash, lekin a^2b va ab^2 birhadlar o'xshash emas.

Bir xil birhadlarni ham o'xshash deb hisoblaymiz.

Masalan, $2a^2b$ va $2a^2b$ birhadlar o'xshash.

2-masala. $3ab - 2bc + 4ac - ab + 3bc + 4ab$ ko'phadni soddalashtiring.

△ O'xshash birhadlarni ajratamiz: $3ab$, $-ab$, $4ab$ birhadlar o'xshash, ularning tagiga bittadan chiziq chizamiz, $-2bc$ va $3bc$ o'xshash birhadlarning tagiga ikkitadan chiziq chizamiz. $4ac$ birhadga o'xshash had yo'q, uning tagiga chizmaymiz, ya'ni:

$$\underline{3ab} - \underline{\underline{2bc}} + 4ac - \underline{ab} + \underline{\underline{3bc}} + \underline{4ab}.$$

Ko'phad hadlarining o'rinlarini o'xshash hadlar yonma-yon turadigan qilib almashtiramiz va o'xshash hadlarni qavs ichiga olamiz:

$$(3ab - ab + 4ab) + (-2bc + 3bc) + 4ac.$$

Ammo

$$3ab - ab + 4ab = (3 - 1 + 4)ab = 6ab,$$
$$-2bc + 3bc = (-2 + 3)bc = bc$$

bo'lgani uchun:

$$3ab - 2bc + 4ac - ab + 3bc + 4ab = 6ab + bc + 4ac. \blacktriangle$$

Ko'phadlarni o'xshash birhadlar algebraik yig'indisi bitta birhad bilan almashtiriladigan bunday soddalashtirish *o'xshash hadlarni ixchamlash* deyiladi.

$6ab + bc + 4ac$ ko'phadda har bir had standart shaklda yozilgan va ular orasida o'xshash hadlar yo'q. Ko'phadning bunday shakli *standart shakl* deyiladi.

Har qanday ko'phadni standart shaklda yozish mumkin. Buning uchun avval ko'phadning har bir hadini standart shaklda yozish va so'ngra o'xshash hadlarni ixchamlash kerak.

3 - m a s a l a . Ko'phadni standart shaklga keltiring:

$$6ab\frac{1}{3}ac - 3aca - 8a^2\frac{1}{2}b + 25a^2\frac{1}{5}c + aba - a^2bc.$$

$$\triangle\ 6ab\frac{1}{3}ac - 3aca - 8a^2\frac{1}{2}b + 25a^2\frac{1}{5}c + aba - a^2bc =$$

$$= \underline{2a^2bc} - \underline{\underline{3a^2c}} - \underline{\underline{4a^2b}} + \underline{\underline{5a^2c}} + \underline{\underline{a^2b}} - \underline{a^2bc} =$$

$$= (2a^2bc - a^2bc) + (-3a^2c + 5a^2c) + (-4a^2b + a^2b) =$$

$$= a^2bc + 2a^2c - 3a^2b. \blacktriangle$$

Mashqlar

321. (Og'zaki.) Berilgan birhadlar orasida o'xshashlarini ayting:

1) $2a^2b, \frac{1}{3}ab^2, -3a^2b, -ab^2$; 2) $\frac{1}{3}xy, 5x^2y, -3xy, \frac{1}{3}x^2y$.

O'xshash hadlarni ixchamlang **(283–286):**

322. (Og'zaki.)

1) $3a + 5a$; 2) $9a + 11a$; 3) $11z - 5z$; 4) $-3x - 6x$.

323. (Og'zaki.)

1) $-2b-7b$; 2) $2a-5a$; 3) $3a^2-8b^2$; 4) $5b^2-b^2$.

324. 1) $\frac{1}{3}x+\frac{1}{2}x+\frac{1}{6}x$; 3) $\frac{3}{2}y^4-\frac{1}{16}y^4+\frac{1}{32}y^4-\frac{1}{4}y^4$;

2) $\frac{5}{6}y-\frac{1}{3}y-\frac{1}{6}y$; 4) $\frac{3}{2}a^2b-\frac{5}{8}a^2b+\frac{1}{8}a^2b-\frac{3}{16}a^2b$.

325. 1) $2m+q+q-4m$; 3) $x^2+3y^2+4x-y^2$;

2) $3a+2b-b-a$; 4) $5a^2-4b^2-3a^2+b^2$.

Ko'phadni standart shaklga keltiring **(326–331):**

326. 1) $11x^2+4x-x^2-4x$; 3) $0,3c^2-0,1c^2-0,5c^2$;

2) $2y^2-3y+2y-2y^2$; 4) $1,2a^2+3,4a^2-0,8a^2$.

327. 1) $\frac{1}{3}x^2-\frac{1}{3}y+\frac{2}{3}x^2+\frac{1}{3}y$; 2) $\frac{1}{5}a^2+\frac{3}{4}b^2+\frac{4}{5}a^2-\frac{3}{4}b^2$;

3) $2ab+0,7b^2-5ab+1,2b^2+8ab$; 4) $5xy-3,5y^2-2xy+1,3y^2-xy$

328. 1) $-\frac{3}{4}xy+\frac{2}{3}x^2y+xy-\frac{5}{6}x^2y-\frac{1}{2}xy$;

2) $\frac{1}{2}ab^2-\frac{7}{8}ab^2+\frac{3}{4}a^2b-\frac{3}{8}a^2b-\frac{1}{2}ab^2$;

3) $-9,387a-3,89b+8,197a-1,11b-0,81a$;

4) $8,53x-4,73y-5,126x+2,27y+0,59x$.

329. 1) $2a^2b-8b^2+5a^2b+5c^2-3b^2+4c^2$;

2) $3xy^2+4x^3-5x^2y-3x^3+4x^2y-4xy^2$;

3) $\frac{1}{7}ab+\frac{3}{8}a^2-\frac{2}{5}b^3+\frac{6}{7}ab-\frac{3}{8}a^2+\frac{3}{5}b^3$;

4) $\frac{3}{5}ab^2-\frac{2}{3}ab+\frac{1}{4}a^3+\frac{8}{3}ab-\frac{2}{5}ab^2-\frac{3}{4}a^3+\frac{1}{2}a^3$.

330. 1) $5b3b-4c3b-5b2c-4c(-2)c$; 2) $b8b-3c8b+5cb-3c5c$;

3) $6a^22a^2+5b^22a^2-6a^24b^2-5b^24b^2$;

4) $2x^2\frac{1}{2}y-\frac{1}{3}ab3a+1\frac{1}{4}y\frac{4}{5}x^2+aab$.

331. 1) $-9a^2\frac{1}{3}b+a^2b+24a^2\frac{1}{4}c$; 2) $2ab\frac{1}{3}ac-4aca-a^2bc$;

3) $4x^2\frac{1}{2}y-\frac{1}{3}ab9a+4y\frac{4}{5}x^2+aba$;

4) $5a\frac{1}{5}b+\frac{2}{3}a(\frac{1}{4}b^2)-5b(0,5a)-\frac{1}{3}a^2(\frac{1}{15}ab)$.

332. Tenglamani yeching va tekshiring:

1) $\frac{3}{4}(2\frac{1}{3}x+2\frac{2}{5})=3\frac{4}{5}$; 2) $\frac{3}{5}(2\frac{2}{3}x-1\frac{3}{7})=\frac{2}{7}$.

333. Hisoblang:

1) $4+7\frac{14}{17}-(9\frac{2}{9}-6\frac{3}{17})+(2\frac{2}{3}-10\frac{7}{9})$;

2) $6{,}5\cdot 4{,}3-(18{,}63+3{,}002-15{,}132)\cdot 3{,}7$.

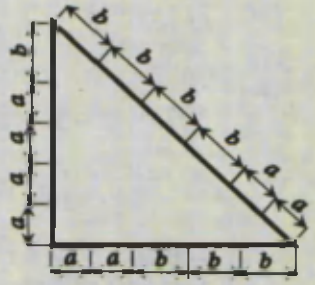
334. 1) 48 so'mning 15% ini;

2) 105 tiyinning 3,5% ini toping.

15- §. KO'PHADLARNI QO'SHISH VA AYIRISH

O'lchamlari 8- rasmda ko'rsatilgan uchburchakni qaraymiz. Uning P perimetri tomonlar uzunliklarining yig'indisiga teng:

$$P=(2a+3b)+(4a+b)+(2a+4b).$$



8- rasm

Bu ifoda quyidagi uchta ko'phadning yig'indisidir:

$$2a+3b,\ 4a+b,\ 2a+4b.$$

Qavslarni ochish qoidasiga ko'ra bunday yozish mumkin:

$$P=2a+3b+4a+b+2a+4b.$$

O'xshash hadlarni ixchamlasak,

$$P=8a+8b$$

tenglik hosil bo'ladi.

Ko'phadlarning istagan algebraik yig'indisi ham xuddi shunga o'xshash soddalashtiriladi, masalan,

$$(2n^2-m^2)-(n^2-m^2+3q^2)=2n^2-m^2-n^2+m^2-3q^2=n^2-3q^2;$$

$$(3ab-4bc)+(bc-ab)-(ac-3bc)=3ab-4bc+bc-ab-$$
$$-ac+3bc=2ab-ac.$$

Bir nechta ko'phadlarni qo'shish va ayirish natijasida yana ko'phad hosil bo'ladi.

Bir nechta ko'phadlarning algebraik yig'indisini standart shakldagi ko'phad ko'rinishida yozish uchun qavslarni ochish va o'xshash hadlarni ixchamlash kerak.

Ba'zi ko'phadlarning yig'indisi yoki ayirmasini sonlarni qo'shish va ayirishga o'xshash qilib «ustuncha» usulida topish qulay bo'ladi. Bunda o'xshash hadlarning birining ostiga ikkinchisi turadigan qilib yoziladi, masalan,

1) $\begin{array}{l} 5a-4bc+3ac \\ +\quad 3bc-7ac \\ \hline 5a-bc-4ac; \end{array}$

2) $\begin{array}{l} 5abc-2ab+4ac-bc \\ -\quad 3abc-3ab-ac+3bc \\ \hline 2abc+ab+5ac-4bc. \end{array}$

Mashqlar

Ko'phadlarning algebraik yig'indisini toping **(335–341):**

335. 1) $8a+(-3b+5a)$; 3) $(6a-2b)-(5a+3b)$;

2) $5x-(2x-3y)$; 4) $(4x+2)+(-x-1)$.

336. 1) $3x^2-(4x^2+2y)$; 3) $0{,}6a^2-(0{,}5a^2-0{,}4a)$;

2) $2a^2-(b^2-3a^2)$; 4) $1\frac{1}{2}b^2-(2b^2-1\frac{1}{4})$.

337. 1) $(2\frac{3}{5}b-\frac{3}{4}b^2)+(\frac{1}{4}b^2-1\frac{3}{5}b)$;

2) $(0{,}1c-0{,}4c^2)-(0{,}1c-0{,}5c^2)$;

3) $(13x-11y+10z)-(-15x+10y-15z)$;

4) $(17a+12b-14c)-(11a-10b-14c)$.

338. 1) $(7m^2-4mn-n^2)-(2m^2-mn+n^2)$;

2) $(5a^2-11ab+8b^2)+(-2b^2-7a^2+5ab)$;

3) $11ac+13bc+17b^2-(10ac+10bc-3b^2)$;

4) $41z+13az+26az^2-(16z+13az-4az^2)$.

339. 1) $(\frac{1}{2}a+\frac{1}{3}b)-(\frac{5}{2}a-\frac{2}{3}b)+(a+b)$;

2) $(0{,}3a-1{,}2b)+(a-b)-(1{,}3a-0{,}2b)$;

3) $11p^3-2p^2-(p^3-p^2)+(-5p^2-3p^3)$;

4) $5x^2+6x^3+(x^3-x^2)-(-2x^3+4x^2)$.

340. 1) $(-2x^3+xy^2)+(x^2y-1)+(x^2y-xy^2+3x^3)$;

2) $(3x^2+5xy+7x^2y)-(5xy+3x^2)-(7x^2y-3x^2)$;

3) $(8a^2-10ab-b^2)+(-6a^2+2ab-b^2)-(a^2-8ab+4b^2)$;

4) $(4a^2-2ab-b^2)-(-a^2+b^2-2ab)+(3a^2+b^2-ab)$.

341. 1) $3{,}5ab^2-(0{,}3a^2-1{,}2a^2b+2{,}3b^2)-(1{,}7a^2-3{,}5b^2a+0{,}8a^2b-1{,}1b^2)$

2) $4{,}3x-(5{,}2x^2+3{,}4x^3-0{,}8x^4)-(0{,}8x^4+1{,}6x^3-4{,}2x^2+4{,}3x)$;

3) $\frac{2}{3}y-(\frac{1}{2}y^2-\frac{1}{4}y^3)-(y^4+\frac{1}{4}y^3-0{,}5y^2+\frac{2}{3}y)$;

4) $\frac{3}{4}a^2-(\frac{1}{3}a^3+\frac{1}{2}a^2)-(-8a-0{,}5a^2-2\frac{1}{3}a^3+\frac{3}{4}a^4)$.

342. Ko'phadlarning yig'indisi va ayirmasini toping:

1) $0{,}1x^2+0{,}02y^2$ va $0{,}17x^2-0{,}08y^2$;

2) $0{,}1x^2-0{,}02y^2$ va $-0{,}17x^2+0{,}08y^2$;

3) $a^3-0{,}12b^3$ va $0{,}39a^3-b^3$; 4) $a^3+0{,}12b^3$ va $-0{,}39a^3+b^3$.

343. Ko'phadlarning yig'indisini «ustuncha» usulida toping:

1) $3ab+a^2-2b^2$ va $2a^2-3ab$;

2) $3x^2+2xy-4y^2$ va $4y^2-2xy+3x^2y^2-x^3$.

344. Ko'phadlarning ayirmasini «ustuncha» usulida toping:

1) $3a^2+8a-4$ va $3+8a-5a^2$; 2) b^3-3b^2+4b va $b+2b^2+b^3$.

345. 1) Agar $P=5a^2+b$, $Q=-4a^2-b$ bo'lsa, $P+Q$ ifoda nimaga teng?

2) Agar $P=2p^2-3q^3$, $Q=2p^2-4q^3$ bo'lsa, $P-Q$ ifoda nimaga teng?

3) Agar $A=a^2-b^2+ab$, $B=2a^2+3ab-5b^2$, $C=-4a^2+2ab-3b^2$ bo'lsa, $A+B+C$ ni toping;

4) Agar $A=2a^2-3ab+4b^2$, $B=3a^2+4ab-b^2$, $C=a^2+2ab+3b^2$ bo'lsa, $A-B+C$ ni toping.

346. Isbotlang:

1) beshta ketma-ket natural sonning yig'indisi 5 ga bo'linadi;

2) to'rtta ketma-ket natural sonning yig'indisi 4 ga bo'linmaydi;

3) to'rtta ketma-ket toq natural sonning yig'indisi 8 ga bo'linadi;

4) to'rtta ketma-ket juft natural sonning yig'indisi 4 ga bo'linadi.

347. To'rtburchak tomonlarining uzunliklari a, b, $\frac{1}{2}a+\frac{1}{2}b$, $\frac{3}{2}a-\frac{3}{2}b$ ga teng. Agar $a=3$ bo'lib, b ning qiymati berilmagan bo'lsa, shu to'rtburchakning perimetrini topish mumkinmi?

348. Avtobusda n nafar yo'lovchi bor edi. Dastlabki ikki bekatning har birida m nafardan yo'lovchi avtobusdan tushdi, uchinchi bekatda esa hech kim tushmadi, lekin bir necha kishi avtobusga chiqdi, shundan so'ng avtobusdagi yo'lovchilar soni k nafar bo'ldi. Uchinchi bekatda avtobusga necha kishi chiqqan?

349. (Qadimiy masala.) Ikki kishi birgalikda ot sotib olishmoqchi bo'libdi. Biri ikkinchisiga aytibdi: «Agar senda bor pulning uchdan birini mendagi pulga qo'shsak, u holda menda otning narxiga barobar pul bo'ladi». Ikkinchisi esa birinchisiga debdi: «Agar mendagi bor pulga sendagi pulning to'rtdan birini qo'shsak, otning narxiga barobar pul bo'ladi». Agar birinchi odamda 24 dinor pul bo'lsa, ikkinchisida qancha pul bor va otning narxi qancha?

---

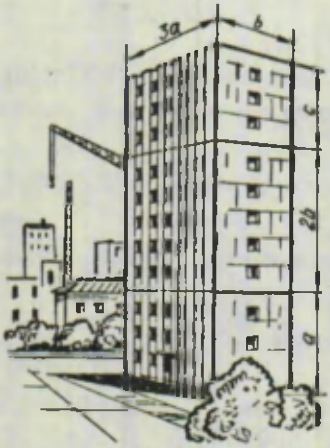
350. Soddalashtiring:

1) $12{,}5x^2-y^2-(8x^2-5y^2-(-10x^2+(5{,}5x^2-6y^2)))$;

2) $0{,}6ab+(2a^3+b^3-(3ab^2-(a^3+2{,}4ab^2-b^3)))$.

351. 1) y^2-5y+6 ko'phadni ikkita ikkihadning ayirmasi shaklida ifodalang;

2) $x^2-9x+20$ ko'phadni ikkita ikkihadning ayirmasi shaklida ifodalang.



9- rasm

16- §. KO'PHADNI BIRHADGA KO'PAYTIRISH

O'lchamlari 9- rasmda ko'rsatilgan to'g'ri burchakli parallelepipedni qaraymiz. Uning hajmi asosining yuzi bilan balandligining ko'paytmasiga teng:

$$(a+2b+c)(3ab).$$

Bu ifoda $a+2b+c$ ko'phad bilan $3ab$ birhadning ko'paytmasi bo'ladi.

Ko'paytirishning taqsimot xossasini qo'llab, bunday yozish mumkin:

$$(a+2b+c)(3ab)=a(3ab)+2b(3ab)+c(3ab)=3a^2b+6ab^2+3abc.$$

Istagan ko'phadni birhadga ko'paytirish ham xuddi shunday bajariladi, masalan:

$$(2n^2m-3nm^2)(-4nm)=(2n^2m)(-4nm)+(-3nm^2)(-4nm)=$$
$$-8n^3m^2+12n^2m^3;$$
$$(3a^2-4ab+5c^2)(-5bc)=3a^2(-5bc)-4ab(-5bc)+5c^2(-5bc)=$$
$$=-15a^2bc+20ab^2c-25bc^3.$$

Ko'phadni birhadga ko'paytirish uchun ko'phadning har bir hadini shu birhadga ko'paytirish va hosil bo'lgan ko'paytmalarni qo'shish kerak.

Ko'phadni birhadga ko'paytirish natijasida yana ko'phad hosil bo'ladi. Hosil bo'lgan ko'phadni uning barcha hadlarini standart shaklda yozib, soddalashtirish kerak. Oraliqdagi natijalarni yozmasdan, birhadlarni og'zaki ko'paytirib, birdaniga javobni yozish ham mumkin, masalan:

$$(-3ab+2a^2-4b^2)(-\tfrac{1}{2}ab)=\tfrac{3}{2}a^2b^2-a^3b+2ab^3.$$

Birhadni ko'phadga ko'paytirish ham shunga o'xshash bajariladi, chunki ko'paytuvchilarning o'rinlarini almashtirish bilan ko'paytma o'zgarmaydi, masalan: $4pq(3p^2-q+2)=12p^3q-4pq^2+8pq$.

Mashqlar

352. (Og'zaki.) Birhadlarni ko'paytiring:

1) $(-4x)(-\frac{1}{2}x^2y)$;
2) $(-0{,}2a^2b)(5ab^2)$;
3) $(1{,}2a^8b^4)(-2a^5b^2)$;
4) $(3xy^2)(\frac{2}{3}x^7y^5)$.

Ko'phad va birhad ko'paytmasini toping **(353–357):**

353. 1) $-5(10+m)$;
2) $-\frac{1}{2}(-2+x)$;
3) $(2y-5)(-\frac{1}{7})$;
4) $(-2m+3n)(-10)$;
5) $2(3a^2-4a+8)$;
6) $(-\frac{1}{3})(m-n+p)$;
7) $(3a-5b+bc)(-3)$;
8) $(-5)(3x^3+7x^2-x)$.

354. 1) $(a-b)n$; 2) $(-5x+4y)2z$; 3) $-6x(5y-2x)$; 4) $(x^2-x+1)x$.

355. 1) $7ab(2a+3b)$; 3) $12p^2q(q^2p-q^2)$;
2) $5a^2b(15b+3)$; 4) $3xy^2(xy-2x^3)$.

356. 1) $17a(5a+6b-3ab)$; 3) $3x^2y(5x+6y+7z)$;
2) $8ab(2b-3ac+c^2)$; 4) $xyz(x^2+2y^2+3z^2)$.

357. 1) $(\frac{1}{2}a^3b^2-\frac{3}{4}ab^4)\frac{4}{3}a^3b$; 2) $(\frac{2}{3}a^2b^4+\frac{1}{2}a^3b)\frac{3}{2}ab^3$;
3) $(1\frac{4}{7}a^3x^3-2\frac{3}{4}a^2x^3-11ax^4)(-2\frac{6}{11}ax^6)$.

Ifodani soddalashtiring **(358–360):**

358. 1) $6(2t-3n)-3(3t-2n)$; 3) $-2(3x-2y)-5(2y-3x)$;
2) $5(a-b)-4(2a-3b)$; 4) $7(4p+3)-6(5+7p)$.

359. 1) $(x^2-1)3x-(x^2-2)2x$; 3) $2(3a+4)+3(a-7)-7(2a-7)$;
2) $(4a^2-3b)2b-(3a^2-4b)3b$; 4) $3(2x-1)-5(x-3)+6(3x-4)$.

360. 1) $5(0,8y-0,1)-0,7(4y+1)+8(0,7-0,4y)$;
2) $3(\frac{1}{2}x-1\frac{1}{2})+2(\frac{1}{4}x+\frac{1}{2})$; 3) $\frac{5}{4}(\frac{1}{5}x-\frac{1}{5})-\frac{4}{5}(\frac{1}{4}x-\frac{3}{4})$;
4) $0,2(5y+6)-4(0,25y-1,3)+5(0,1y-1,62)$.

361. Algebraik ifodaning qiymatini toping:
1) $7(4a+3b)-6(5a+7b)$, bunda $a=2$, $b=-3$;
2) $a(2b+1)-b(2a-1)$, bunda $a=10$, $b=-5$;
3) $3ab(4a^2-b^2)+4ab(b^2-3a^2)$, bunda $a=10$, $b=-5$;
4) $4a^2(5a-3b)-5a^2(4a+b)$, bunda $a=-2$, $b=-3$.

---

362. Algebraik ifodaning son qiymatini toping:
1) $\frac{4x^2y}{3x+2y^2}$, bunda $x=-\frac{1}{4}$, $y=0,2$;
2) $\frac{4a^2-5b^2}{5ab}$, bunda $a=-\frac{1}{2}$, $b=\frac{3}{5}$.

363. 1) Avtobus birinchi soatda hamma yo'lning $\frac{2}{5}$ qismini, ikkinchi soatda hamma yo'lning $\frac{1}{3}$ qismini, uchinchi soatda esa qolgan 28 km yo'lni bosib o'tdi. Avtobus 3 soat ichida qancha masofani bosib o'tadi?

2) Sayyoh birinchi kuni hamma yo'lning 25%ini, ikkinchi

kuni hamma yo'lning 35%ini, uchinchi kuni esa qolgan 38,4 km yo'lni bosib o'tdi. Sayyoh uch kun ichida qancha masofani bosib o'tgan?

17- §. KO'PHADNI KO'PHADGA KO'PAYTIRISH

Ushbu masalani qaraylik.

Masala. O'lchamlari 10- rasmda ko'rsatilgan shkaflar bilan band devor sirtining yuzini toping.

△ Shkaflar bilan band bo'lgan devorning sirti tomonlari $2a+c+2a=4a+c$ va $a+b+a=2a+b$ bo'lgan to'g'ri to'rtburchakdan iborat. Bu to'g'ri to'rtburchakning yuzi $S=(4a+c)(2a+b)$ ga teng. ▲

$(4a+c)(2a+b)$ ifoda $(4a+c)$ va $(2a+b)$ ko'phadlarning ko'paytmasidir.

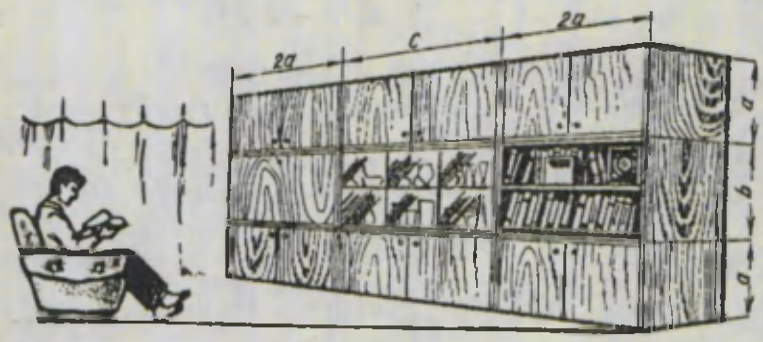
Sonlarni ko'paytirishning taqsimot xossasini qo'llab,

$$S=(4a+c)(2a+b)=4a(2a+b)+c(2a+b)$$

kabi yozish mumkin.

So'ngra $4a(2a+b)=8a^2+4ab$ va $c(2a+b)=2ac+bc$ bo'lgani uchun

$$S=8a^2+4ab+2ac+bc.$$



10- rasm

Shunday qilib, mazkur ko'phadlarning ko'paytmasini topish uchun $4a+c$ ko'phadning har bir hadini $2a+b$ ko'phadning har bir hadiga ko'paytirish va natijalarni qo'shishga to'g'ri keladi. Ixtiyoriy ikkita ko'phadni ko'paytirish ham xuddi shunday bajariladi, masalan:

$$(7n-2m)(3n-5m)=(7n)(3n)+(7n)(-5m)+(-2m)(3n)+$$
$$+(-2m)(-5m)=21n^2-35nm-6nm+10m^2=21n^2-41nm+10m^2.$$

Ko'phadni ko'phadga ko'paytirish uchun birinchi ko'phadning har bir hadini ikkinchi ko'phadning har bir hadiga ko'paytirish va hosil bo'lgan ko'paytmalarni qo'shish kerak.

Ko'phadni ko'phadga ko'paytirish natijasida yana ko'phad hosil bo'ladi. Hosil qilingan ko'phadni standart shaklda yozish kerak. Bunda birhadlarni ko'paytirishni og'zaki bajarib, oraliq natijalarni yozmaslik mumkin, masalan:

$$(2a-4b+3c)(5b-c)=10ab-2ac-20b^2-4bc+15bc-3c^2=$$
$$=10ab-2ac-20b^2=19bc-3c^2.$$

Bir nechta ko'phadlarni ko'paytirishni navbatma-navbat bajarish kerak, masalan:

$$(a+b)(a+2b)(a-3b)=(a^2+3ab+2b^2)(a-3b)=$$
$$=a^3-3a^2b+9ab^2+2ab^2-6b^3=a^3-7ab^2-6b^3.$$

Mashqlar

Ko'phadlarni ko'paytiring **(364–372):**

364. 1) $(a+2)(a+3)$; 3) $(m+6)(n-1)$;
2) $(z-1)(z+4)$; 4) $(b+4)(c+5)$.

365. 1) $(c-4)(d-3)$; 3) $(x+y)(x+1)$;
2) $(a-10)(-a-2)$; 4) $(-p+q)(-1-q)$.

366. 1) $(2x+1)(x+4)$; 3) $(3m-2)(2m-1)$;
2) $(2a+3)(5a-4)$; 4) $(5p-3q)(4p-q)$.

367. 1) $(\frac{1}{2}a+3b)(\frac{1}{2}a-3b)$; 3) $(\frac{1}{3}a-2b)(\frac{1}{3}a+2b)$;
2) $(0,3-m)(m+0,3)$; 4) $(0,2a+0,5x)(0,2a-0,5x)$.

368. 1) $(a^2+b)(a+b^2)$; 3) $(a^2+2b)(2a+b^2)$;
2) $(5x^2-6y^2)(6x^2-5y^2)$; 4) $(x^2+2x+1)(x+3)$.

369. 1) $(2a-b)(4a^2+2ab+b^2)$; 3) $(5x+3y)(25x^2-15xy+9y^2)$;
2) $(3a-2b)(9a^2+6ab+4b^2)$; 4) $(3a+2b)(9a^2-6ab+4b^2)$.

370. 1) $(5c-4y)(-8c-2x+6y)$; 3) $(4x-3y+2z)(3x-3y)$;
2) $(4b-c)(-5b+3c-4y)$; 4) $(3a-3b+4c)(3a-5b)$.

371. 1) $(0{,}2x+0{,}2y-z)(x-y)$; 3) $(\frac{1}{3}m-\frac{1}{3}n+\frac{1}{5}p)(60m+12)$;

2) $(0{,}3x-0{,}3y+z)(x+y)$; 4) $(0{,}1a^2-0{,}3a+1)(3a^2-10)$.

372. 1) $(a-b)(a+b)(a-3b)$; 3) $(x+3)(2x-1)(3x+2)$;

2) $(a+b)(a-b)(a+3b)$; 4) $(x-2)(3x+1)(4x-3)$.

373. Algebraik ifodani avval soddalashtirib, keyin qiymatini toping:

1) $(a-4)(a-2)-(a-1)(a-3)$, bunda $a=1\frac{3}{4}$;

2) $(m-5)(m-1)-(m+2)(m-3)$, bunda $m=-2\frac{3}{5}$;

3) $(x+1)(x+2)+(x+3)(x+4)$, bunda $x=-0{,}4$;

4) $(a-1)(a-2)+(a-3)(a-4)$, bunda $a=0{,}2$.

374. 1) $(5x-1)(x+3)-(x-2)(5x-4)$ ifodaning qiymati $x=2\frac{1}{7}$ bo'lganda 49 ga tengligini ko'rsating;

2) $(a+3)(9a-8)-(2+a)(9a-1)$ ifodaning qiymati $a=-3{,}5$ bo'lganda -29 ga tengligini ko'rsating.

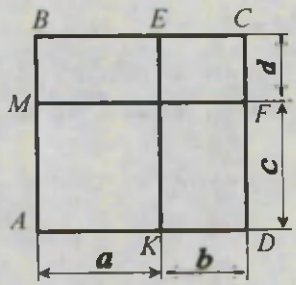
375. Ifodaning qiymatini hisoblang:

1) $(n+\frac{1}{2})(n^2+\frac{1}{2}n+\frac{1}{4})$, bunda $n=-2\frac{1}{2}$;

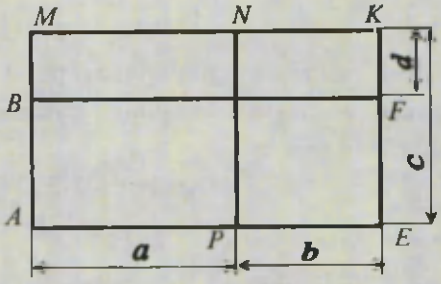
2) $(n-\frac{1}{3})(n^2+\frac{1}{3}n+\frac{1}{9})$, bunda $n=-\frac{7}{3}$.

376. 1) $ABCD$ to'g'ri to'rtburchakning (11- rasm) yuzi $(a+b)\times(c+d)=ac+bc+ad+bd$ ekanligini ko'rsating.

2) $ABFE$ to'g'ri to'rtburchakning (12- rasm) yuzi $(a+b)\times(c-d)=ac+bc-ad-bd$ ekanligini ko'rsating.



11- rasm



12- rasm

377. (Qadimiy masala.) Bir kishidan tunda soatni so'rashdi. U shunday javob qildi: «O'tgan vaqtning uchdan biri kunduz soat 12 gacha qolgan vaqtning o'n uchdan biriga teng». Soat necha bo'lgan?

---

378. Hisoblang:

1) $\frac{(15,351:5,1+4,19)\cdot 7,2}{3,6^2}$; 2) $\frac{5^2\cdot(3,16+12\frac{21}{25})}{(49-6\frac{2}{5}:\frac{4}{15})\cdot 2^4}$.

379. Proporsiya xossasidan foydalanib, tenglikning to'g'ri yoki noto'g'riligini aniqlang:

1) $\frac{2\frac{1}{7}}{2,7}=\frac{3\frac{1}{3}}{4,2}$; 2) $\frac{2\frac{1}{3}}{1,47}=\frac{10}{0,3^3}$.

18-§. BIRHAD VA KO'PHADNI BIRHADGA BO'LISH

Bir nechta birhad va ko'phadlarni qo'shish, ayirish, ko'paytirish va natural ko'rsatkichli darajaga ko'tarish natijasida yana ko'phad hosil bo'lishi oldingi paragraflarda ko'rsatildi. Sanab o'tilgan bu amallar ichida bo'lish amali uchramadi. Bo'lish amalini o'z ichiga olgan ifodalar V bobda batafsil qaraladi. Ba'zan bo'lish natijasida ham ko'phad hosil bo'ladi.

1. Birhadni birhadga bo'lish.

M a s a l a . $32a^3b^2$ birhadni $4a^2$ birhadga bo'ling.

△ Sonni sonlar ko'paytmasiga bo'lish xossasidan foydalanamiz: sonni ko'paytmaga bo'lishda shu sonni ko'paytmaning birinchi ko'paytuvchisiga bo'lish kerak, so'ngra hosil bo'lgan natijani ikkinchi ko'paytuvchiga bo'lish kerak va hokazo. Natijada

$$(32a^3b^2):(4a^2)=((32a^3b^2):4):a^2.$$

Endi qoidani qo'llaymiz: ko'paytmani songa bo'lishda ko'paytmaning ko'paytuvchilaridan birini shu songa bo'lish kerak. U holda:

$$(32a^3b^2):4=(32:4)a^3b^2=8a^3b^2;$$
$$(8a^3b^2):a^2=(8a^3:a^2)b^2=8ab^2.$$

Shunday qilib,

$$(32a^3b^2):(4a^2)=8ab^2.$$

Birhadlar boshqa hollarda ham xuddi shunday bo'linadi, masalan:

$$4a^2b^3 : (4a^2b^3) = 1;$$
$$(66a^4b^2c) : (22a^2b) = 3a^2bc;$$
$$(9k^2n^2m^2) : (-3kn^2m^2) = -3k.$$

Bo'lish natijasini ko'paytirish bilan tekshirish mumkin: bo'linuvchi bo'luvchining bo'linmaga ko'paytmasiga teng bo'lishi kerak.

Masalan, $(56a^5b^3c) : (7a^2b^2c) = 8a^3b$ bo'lish to'g'ri bajarilgan, chunki $56a^5b^3c = (7a^2b^2c)8a^3b$.

2. Ko'phadni birhadga bo'lish.

Masala. $2a^2b + 4ab^2 + 8abc$ ko'phadni $2ab$ birhadga bo'ling.

△ Ushbu qoidadan foydalanamiz: yig'indini songa bo'lishda har bir qo'shiluvchini shu songa bo'lish kerak, ya'ni

$$(2a^2b + 4ab^2 + 8abc) : (2ab) =$$
$$= (2a^2b) : (2ab) + (4ab^2) : (2ab) + (8abc) : (2ab) = a + 2b + 4c. \blacktriangle$$

Ko'phadni birhadga boshqa hollarda ham xuddi shunday bo'linadi, masalan:

$$(9a^3b^2 - 3a^2b^3 + a^2b^2) : (3a^2b^2) =$$
$$= (9a^3b^2) : (3a^2b^2) + (-3a^2b^3) : (3a^2b^2) + (a^2b^2) : (3a^2b^2) =$$
$$= 3a - b + \frac{1}{3}.$$

Ko'phadni birhadga bo'lish uchun ko'phadning har bir hadini shu birhadga bo'lish va hosil bo'lgan natijalarni qo'shish kerak.

Ko'phadni birhadga bo'lish natijasini ko'paytirish bilan tekshirish mumkin. Masalan, $(36n^4m^2 - 45n^2m^4) : (9n^2m^2) = 4n^2 - 5m^2$ bo'lish to'g'ri bajarilgan, chunki

$$36n^4m^2 - 45n^2m^4 = (4n^2 - 5m^2)(9n^2m^2).$$

Ko'rilgan misollarda birhad (ko'phad)ni birhadga bo'lish natijasida birhad (ko'phad) hosil bo'ladi. Bunday hollarda birhad (ko'phad)ni birhadga qoldiqsiz (butun) bo'lish hamma vaqt ham mumkin bo'lavermaydi. Masalan, $ab + ac$ ko'phad ab birhadga qoldiqsiz (butun) bo'linmaydi.

Birhad (ko'phad)ni birhadga bo'lishda harflar bo'luvchi nolga teng bo'lmaydigan qiymatlarni qabul qiladi, deb faraz qilinadi.

Hisoblang **(380–381):**

380. (Og'zaki.) 1) $3\frac{5}{7} : 3$; 2) $2\frac{1}{4} : 2$; 3) $(-2) : \frac{3}{4}$; 4) $3 : (\frac{1}{4})$.

381. (Og'zaki.) 1) $4^3 : 4$; 2) $3^5 : 3^2$; 3) $(\frac{1}{2})^3 : (\frac{1}{2})^2$; 4) $(1\frac{1}{2})^5 : (1\frac{1}{2})^4$.

Bo'lishni bajaring **(382–392):**

382. 1) $b^5 : b^2$; 2) $y^{11} : y^7$; 3) $a^7 : a^7$; 4) $b^9 : b^9$.

383. 1) $12x : 4$; 2) $-15a : 5$; 3) $-18y : 6$; 4) $10c : (-2)$.

384. 1) $(8c) : (-2)$; 2) $\frac{2}{3}a : 5$; 3) $-\frac{1}{2}b : 2$; 4) $3c : (-\frac{1}{3})$.

385. 1) $\frac{2}{5}x : (-2)$; 2) $-7m : (-\frac{7}{9})$; 3) $-\frac{3}{4}a : (-\frac{8}{9})$; 4) $\frac{16}{25}b : \frac{4}{5}$.

386. 1) $5a : a$; 2) $8x : x$; 3) $5a : (-a)$; 4) $(-7y) : (-y)$.

387. 1) $(-6x) : (2x)$; 2) $15z : (5z)$; 3) $(-6xy) : (-3xy)$; 4) $12ab : (-4ab)$.

388. 1) $3a : (\frac{1}{2}a)$; 3) $(-5c) : (\frac{1}{3}c)$;

2) $\frac{2}{3}b : (-\frac{2}{5}b)$; 4) $(-1{,}69n) : (1{,}3n)$.

389. 1) $8abc : (-4a)$; 3) $-6{,}4xy : (-4x)$;

2) $(-10pq) : (6q)$; 4) $(-0{,}24abc) : (-0{,}6ab)$.

390. 1) $14a^5 : (7a^2)$; 3) $-0{,}2a^{10} : (-a^{10})$;

2) $(-42m^7) : (6m)$. 4) $(-2\frac{1}{3}a^{17}) : (-2a^{17})$.

391. 1) $\frac{1}{3}m^3n^2p^2 : (-\frac{2}{3}m^2n^2p^2)$;

2) $(-1\frac{1}{2}a^4b^3c^2) : (-\frac{2}{3}a^3bc^2)$;

3) $(-1{,}7p^2q^2y^3) : (28{,}9p^2y^3)$; 4) $-6a^3b^2c : (-2a^2bc)$.

392. 1) $20m^4n^3 : (-5m^2n^3)$; 3) $(-\frac{2}{5}a^4x^3y^2) : (-\frac{1}{2}a^3xy^2)$;

2) $-1{,}3a^3x^2y^3 : (16{,}9a^2xy)$; 4) $(-\frac{3}{4}a^5b^3c) : (-1\frac{1}{2}a^2b^2c)$.

393. Ifodani soddalashtiring:

1) $(4a^3b^2)^3 : (2a^2b)^2$; 3) $(-abc^2)^5 : (-a^2bc^3)^2$;

2) $(9x^2y)^3 : (3xy)^2$; 4) $(-x^2y^3z)^4 : (xyz)$.

Bo'lishni bajaring **(394–397):**

394. 1) $(12a+6):3$;
2) $(10b-5):5$;
3) $(14m-8):(-2)$;
4) $(-6+3x):(-3)$.

395. 1) $(5mn-6np):n$;
2) $(4a^2-3ab):a$;
3) $(x-xy):x$;
4) $(cd-d):(-d)$.

396. 1) $(3a^2b-4ab^3):(5ab)$;
2) $(2c^5b^4+3c^4b^3):(-3c^4b^3)$;
3) $(-27k^4l^5+21k^3l^2):(-10k^3l^2)$;
4) $(-a^5b^3+3a^6b^2):(4a^4b^2)$.

397. 1) $(6a-8b+10):2$;
2) $(8x+12y-16):(-4)$;
3) $(10a^2-12ab+8a):2a$;
4) $(2ab+6a^2b^2-4b):(2b)$.

398. Ifodani soddalashtiring:
1) $(6a^3-3a^2):a^2+(12a^2+9a):(3a)$;
2) $(8x^3-4x^2):(2x^2)-(4x^2-3x):x$;
3) $(3x^3-2x^2y):x^2-(2xy^2+x^2y):(\frac{1}{3}xy)$;
4) $(a^2b-3ab^2):(\frac{1}{2}ab)+(6b^3-5ab^2):b^2$.

399. Algebraik ifodaning qiymatini toping:
1) $(15a^3+25a^2):(5a)-9a^4:(3a^2)$, bunda $a=7$;
2) $(18a^4-27a^3):(9a^2)-10a^3:(5a)$, bunda $a=-8$;
3) $(3x^3+4x^2y):x^2-(10xy+15y^2):(5y)$, bunda $x=2, y=-5$;
4) $(2xy^2-5y^3):y^2+(12xy+6x^2):(3x)$, bunda $x=-3, y=-12$.

400. Ifodani soddalashtiring:
1) $5x^3:x-(2x)^2+x^4:(2x^2)$;
2) $6x^4:x-5x^5:x^2+(2x)^3$;
3) $(3x^4+\frac{1}{3}x^2):x-x^3:(3x^2)+(3x)^3$;
4) $(12x^3-8x):4x-4x(3x+0{,}25)$.

401. Korxonaga asbob-uskuna olish uchun bir yilga 32 mln. so'm ajratildi. Korxona ajratilgan barcha mablag'ning 20,5% ini birinchi chorakda, 23,5% ini ikkinchi chorakda va 31,6% ini uchinchi chorakda sarfladi. Korxona to'rtinchi chorakda necha so'mlik asbob-uskuna sotib olishi mumkin?

402. Hisoblang:
1) $\frac{3}{4}\cdot 1\frac{1}{7}:\frac{2}{5}\cdot 12\frac{1}{4}:7\frac{1}{2}$;
2) $15:\frac{5}{18}:3\frac{3}{8}:\frac{4}{27}\cdot 4\frac{1}{5}$.

Sonlardan qaysinisi katta ekanligini aniqlang **(403–404):**

403. 1) 2^3 yoki 3^2; 3) $(\frac{1}{2})^3$ yoki $(\frac{1}{3})^2$;

2) 2^4 yoki 4^2; 4) $(\frac{2}{3})^2$ yoki $(\frac{4}{3})^2$.

404. 1) $(-\frac{1}{2})^3$ yoki $(-\frac{1}{2})^2$; 3) $(-0,2)^2$ yoki $(0,2)^2$;

2) $(-\frac{1}{2})^2$ yoki $(-\frac{1}{2})^4$; 4) $(-0,2)^3$ yoki $(0,2)^2$.

405. Yozing:

1) m sonning kvadratini; 2) a sonning kubini;
3) c va 3 sonlar yig'indisining kvadratini;
4) c va 3 sonlar kvadratlarining yig'indisini.

406. Yozing:

1) n va m sonlar ayirmasining kvadratini;
2) n va m sonlar kvadratlarining ayirmasini;
3) n va m sonlar ayirmasining kubini;
4) $\frac{1}{2}$ va b sonlar kublarining ayirmasini.

407. Kvadratning tomoni c metrga teng. Uning perimetri va yuzini yozing.

408. Kubning qirrasi k santimetrga teng. Uning sirtining yuzini va hajmini yozing.

409. Bir tomoni ikkinchi tomonidan 3 marta katta bo'lgan to'g'ri to'rtburchakning bir tomonini x bilan belgilab, uning yuzi formulasini yozing.

410. Agar bir kub metrni kub santimetrlarga ajratilsa va ularni ustma-ust qo'yilsa, qanday balandlikdagi ustun hosil bo'ladi?

411. Agar odamning yuragi 1 minutda o'rtacha 75 marta ursa, uning yuragi bir sutka davomida necha marta uradi?

412. O'quvchi 1 m^3 po'kakni ko'tara oladimi? (1 sm^3 po'kakning massasi 0,2 g).

413. Quyidagi sonlarni standart shaklda yozing:

1) 0° C va 760 mm sim. ust. bosimli 1 sm^3 gazdagi molekulalar soni 27 000 000 000 000 000 000 ga teng;

2) parsek (astronomiyada qabul qilingan uzunlik birligi) 30 800 000 000 000 km ga teng;

3) elektron hisoblash mashinasi 1 sekundda 1 000 000 ta amal bajarishi mumkin.

414. Yer shari sirti 510 mln. km^2 dan ortiq. Yer hajmi 1 000 mlrd. km^3 dan ortiq. Bu sonlarni standart shaklda yozing.

415*. 1 ℓ dengiz suvida o'rtacha 0,00001 mg oltin bor. 1 km^3 dengiz suvida qancha oltin bor?

416*. Hisoblashlarni bajarmasdan, sonlarni joylashtiring:

1) $(-1\frac{1}{3})^3$; $(-1,8)^2$; $(\frac{3}{7})^3$ ni kamayish tartibida;

2) $(-0,4)^3$; $(-1,5)^2$; $(\frac{1}{7})^3$; $(-7)^3$ ni ortib borish tartibida.

417*. Ko'phadni standart shaklga keltiring:

1) $(2m)(4n)-3a(2b)-(0,2n)(5m)+b(5a)-5nm+8ab$;

2) $13ab-0,2xy-(2a)(5b)+(6x)(0,2y)+a(-3)b$;

3) $2abc5a+1\frac{5}{7}a^2\ \frac{7}{12}bc-2\frac{2}{3}ab(-\frac{3}{8})a$;

4) $3nmk4n-\frac{3}{8}nm(2\frac{2}{3})nk+\frac{2}{9}n^2m(-4\frac{1}{2})k$.

418. Ko'phadning qiymatini toping:

1) $-0,08x+73xy^2+27xy^2$, bunda $x=4$, $y=0,2$;

2) $-2a^2b+4b+11a^2b$, bunda $a=-\frac{1}{3}$, $b=2\frac{3}{4}$;

3) $5p^3-3p^2+11p-7p-6p^2-7p^2+p$, bunda $p=-1$;

4) $8x^2-7x^3+6x-5x^2+2x^3+3x^2-8x$, bunda $x=1$.

Ko'phadlarning algebraik yig'indisini toping **(419-420):**

419. 1) $(-2x^3+xy^2)+(x^2y-1)+(x^2y-xy^2+3x^3)$;

2) $(3x^2+5xy+7x^2y)-(5xy+3x^2)-(7x^2y-3x^2)$;

3) $(8a^2-10ab-b^2)+(-6a^2+2ab-b^2)-(a^2-8ab+4b^2)$;

4) $(4a^2-2ab-b^2)-(-a^2+b^2-2ab)+(3a^2+b^2-ab)$.

420. 1) $3,5ab^2-(0,3a^2-1,2a^2b+2,3b^2)-(1,7a^2-3,5b^2a+0,8a^2b-1,1b^2)$

2) $4,3x-(5,2x^2+3,4x^3-0,8x^4)-(0,8x^4+1,6x^3-4,2x^2+4,3x)$;

3) $\frac{2}{3}y-(\frac{1}{2}y^2-\frac{1}{4}y^3)-(y^4+\frac{1}{4}y^3-0,5y^2+\frac{2}{3}y)$;

4) $\frac{3}{4}a^2-(\frac{1}{3}a^3+\frac{1}{2}a^2)-(-8a-0,5a^2-2\frac{1}{3}a^3+\frac{3}{4}a^4)$.

Ko'phadlarni ko'paytiring **(421–422):**

421. 1) $(0{,}2x+0{,}2y-z)(x-y)$; 3) $(\frac{1}{3}m-\frac{1}{3}n+\frac{1}{5}p)(60m+12)$;

2) $(0{,}3x-0{,}3y+z)(x+y)$; 4) $(0{,}1a^2-0{,}3a+1)(3a^2-10)$.

422. 1) $(a-b)(a+b)(a-3b)$; 3) $(x+3)(2x-1)(3x+2)$;

2) $(a+b)(a-b)(a+3b)$; 4) $(x-2)(3x+1)(4x-3)$.

Bo'lishni bajaring **(423–424):**

423. 1) $(3x^3y^2-5x^2y^3+4x^3y^3):(x^2y^2)$;

2) $(a^4b^4+2a^4b^3-3a^3b^2):(-a^3b^2)$;

3) $(\frac{1}{3}a^3b+\frac{1}{3}a^2b^2-\frac{1}{4}ab^3):(5ab)$;

4) $(-\frac{2}{3}x^5y^2+\frac{3}{4}x^4y^3-\frac{4}{5}x^3y^4):(-6x^2y^2)$.

424. 1) $(0{,}01a^4-0{,}2a^3+0{,}04a^2+0{,}002a):(0{,}01a)$;

2) $(-0{,}05x^5-0{,}08x^4-0{,}09x^3+0{,}01x^2):(-0{,}01x^2)$;

3) $(-4m^5n^2-\frac{4}{9}m^4n^5+\frac{2}{3}m^3n^6):(\frac{2}{3}m^3n^2)$;

4) $(\frac{3}{4}a^6x^3+\frac{6}{5}a^3x^4-\frac{9}{10}ax^5):(\frac{3}{5}ax^3)$.

19- §. UMUMIY KO'PAYTUVCHINI QAVSDAN TASHQARIGA CHIQARISH

Aytaylik, a^2-b^2 ifodaning qiymatini $a=573$ va $b=427$ bo'lganda topish talab qilinayotgan bo'lsin.

Agar son qiymatlarni qo'yib, hisoblashlarni bajarilsa, u holda 573 va 427 sonlarini kvadratga ko'tarishga, so'ngra esa ayirishni bajarishga to'g'ri keladi.

Agar a^2-b^2 ifodani unga teng bo'lgan $(a+b)(a-b)$ ifoda bilan almashtirilsa, hisoblashni ancha sodda yo'l bilan olib borish mumkin.

$a=573$ va $b=427$ bo'lganda:

$$a^2-b^2=(a+b)(a-b)=(573+427)(573-427)=1000\cdot 146=146000.$$

Hisoblashlarni soddalashtirish uchun a^2-b^2 ko'phad $(a+b)(a-b)$ ko'paytma bilan almashtirildi.

Ko'phadni ikkita yoki bir nechta ko'phadlar ko'paytmasi shaklida ifodalash *ko'paytuvchilarga ajratish (yoyish)* deyiladi.

Bunga o'xshash almashtirish bilan natural sonlarni ko'paytuvchilarga yoyishda (ajratishda) duch kelingan edi. Masalan, murakkab son 60 ni tub sonlarning ushbu ko'paytmasi shaklida ifodalash mumkin:

$$60=2\cdot 2\cdot 3\cdot 5=2^2\cdot 3\cdot 5.$$

Sonlarni ko'paytuvchilarga ajratishdan kasrlarni qisqartirishda, ularni umumiy maxrajga keltirishda va boshqa masalalarni yechishda foydalaniladi. Ko'phadni ko'paytuvchilarga ajratish algebraik ifodalar ustida amallar bajarishda ham keng qo'llaniladi.

1-masala. $ab+ac-ad$ ifodaning $a=43$, $b=26$, $c=17$, $d=23$ bo'lganda son qiymatini toping.

△ Hisoblashlarni quyidagicha olib boramiz:

$$43\cdot 26+43\cdot 17-43\cdot 23=43\cdot(26+17-23)=43\cdot 20=860.\ ▲$$

Bu yerda ko'paytirishning taqsimot xossasi qo'llanilgan:

$$ab+ac-ad=a(b+c-d).$$

$43\cdot 26+43\cdot 17-43\cdot 23$ sonli ifodada umumiy ko'paytuvchi 43 soni bo'ladi: $ab+ac-ad$ algebraik ifodada esa umumiy ko'paytuvchi a bo'ladi.

Agar ko'phadning barcha (son yoki harfiy) hadlari umumiy ko'paytuvchiga ega bo'lsa, u holda shu ko'paytuvchini qavsdan tashqariga chiqarish mumkin.

Qavs ichida berilgan ko'phadni shu umumiy ko'paytuvchiga bo'lish natijasida hosil qilingan ko'phad qoladi.

2-masala. Ushbu ko'phadni ko'paytuvchilarga ajrating:

$$6ab+3b-12bc.$$

△ Berilgan ko'phadning barcha hadlari $3b$ umumiy ko'paytuvchiga ega, chunki $6ab=3b\cdot 2a$, $3b=3b\cdot 1$, $-12bc=3b\cdot(-4c)$.

Demak, $6ab+3b-12bc=3b(2a+1-4c)$.▲

Ko'phadning umumiy hadini tayin sharoitga qarab, qavsdan tashqariga «+» ishorasi bilan ham, «–» ishorasi bilan ham chiqarish mumkin. Misollar keltiramiz:

1) $ab-b=b(a-1)=-b(1-a)$;

2) $4a^2b^3-6a^3b^2=2a^2b^2(2b-3a)$ yoki

$4a^2b^3-6a^3b^2=-2a^2b^2(-2b+3a)=-2a^2b^2(3a-2b)$.

Shunday qilib, *ko'phadni umumiy ko'paytuvchini qavsdan tashqariga chiqarish yo'li bilan ko'paytuvchilarga ajratish uchun:*

1) shu umumiy ko'paytuvchini topish;

2) uni qavsdan tashqariga chiqarish kerak.

Agar ko'phad hadlarining koeffitsientlari natural sonlar bo'lsa, u holda umumiy ko'paytuvchini topish uchun ko'phad hadlari koeffitsientlarining eng katta umumiy bo'luvchisini topish va bir xil asosli darajalar orasidan esa eng kichik ko'rsatkichli darajani topish lozimligini ta'kidlab o'tamiz.

Masalan, $28x^2b^3-21x^3b^2$ ko'phadni ko'paytuvchilarga ajratib quyidagini hosil qilamiz: $7x^2b^2(4b-3x)$.

Bu yerda 7 soni 28 va 21 sonlarining eng katta umumiy bo'luvchisi, x^2 va b^2 esa x va b ning eng kichik ko'rsatkichli darajalaridir.

Ko'phadni ko'paytuvchilarga ajralganligining to'g'riligini hosil bo'lgan ko'phadlarni ko'paytirish yo'li bilan tekshirish mumkin. Masalan, ko'paytirishni bajarib, hosil qilamiz:

$$7x^2b^2(4b-3x)=28x^2b^3-21x^3b^2.$$

Umumiy ko'paytuvchi ko'phad bo'lishi ham mumkin, masalan:

1) $5(a+b)+x(a+b)=(a+b)(5+x)$;

2) $3x(a-2b)+5y(a-2b)+2(a-2b)=(a-2b)\cdot(3x+5y+2)$.

Ba'zan umumiy ko'paytuvchini qavsdan tashqariga chiqarishdan oldin $a-b=-(b-a)$ tenglikni qo'llash foydali bo'ladi, masalan:

1) $(a-3)x-(3-a)y=(a-3)x+(a-3)y=(a-3)(x+y)$;

2) $15a^2b(x^2-y)-20ab^2(x^2-y)+25ab(y-x^2)=15a^2b(x^2-y)-$
$-20ab^2(x^2-y)-25ab(x^2-y)=5ab(x^2-y)(3a-4b-5)$.

Mashqlar

425. Sonlarni tub ko'paytuvchilarga ajrating: 70, 121, 240, 168, 225.

426. Kasrlarni qisqartiring: $\frac{45}{60}$; $\frac{18}{24}$; $\frac{75\cdot15}{25\cdot24}$; $\frac{40\cdot14}{7\cdot15}$.

427. (Og'zaki.) Ko'paytmaning ko'paytuvchilarini ayting:

1) $2ab$; 2) $c(a+b)(a-b)$; 3) $0{,}7x(y+z)$; 4) $-\frac{1}{2}by$.

428. (Og'zaki.) Berilgan ko'phad qanday ko'paytuvchilarga ajratilgan:

1) $ab+b=b(a+1)$; 3) $\frac{1}{2}a^2-a=\frac{1}{2}a(a-2)$;

2) $2x^2+2xy=2x(x+y)$; 4) $7ab+ab^2=ab(7+b)$?

429. Ko'paytirishning taqsimot qonunini qo'llang va hisoblang:

1) $81\cdot17-15\cdot81$; 3) $15\cdot17+15\cdot67$;

2) $24\cdot2{,}78+41\cdot2{,}78$; 4) $14\frac{3}{8}\cdot1\frac{1}{4}-4\frac{3}{8}\cdot1\frac{1}{4}$.

430. Ko'paytmani ko'phad shaklida yozing:

1) $(a+2)(a+3)$; 3) $3c^3(2c^3-5)$;

2) $2x(x-1)$; 4) $(a^2+b)(a-b^2)$.

431. A bekatdan B bekatga tomon motorli qayiq 20 km/soat tezlik bilan jo'nadi. Oradan ikki soat o'tgandan keyin A dan B ga

tomon ikkinchi motorli qayiq 24 km/soat tezlik bilan yo'lga chiqdi. Ikkala qayiq ham B ga bir vaqtda yetib keldi. A dan B gacha bo'lgan masofani toping.

432. Hisoblang:

1) $13 \cdot 512 + 13 \cdot 488$;
2) $125 \cdot 375 + 275 \cdot 375$;
3) $25 \cdot 734 - 25 \cdot 726$;
4) $26 \cdot 1\frac{1}{3} - 1\frac{1}{3} \cdot 23$.

Umumiy ko'paytuvchini qavsdan tashqariga chiqaring **(433–441):**

433. 1) $2m + 2n$; 2) $3a - 3x$; 3) $8 - 4x$; 4) $6a + 12$.

434. 1) $9a + 12b + 3$;
2) $8a - 4b - 2$;
3) $-10x + 15y - 5z$;
4) $9x - 3y + 12z$.

435. 1) $ax - ay$; 2) $cd + bc$; 3) $xy + 2x$; 4) $3x - xy$.

436. 1) $9mn + 9n$; 2) $3bd - 3ab$; 3) $11z - 33yz$; 4) $6pk - 3p$.

437. 1) $ab - ac + a^2$;
2) $xy - x^2 + xz$;
3) $6a^2 - 3a + 12ba$;
4) $4b^2 + 8ab - 12a^2b$.

438. 1) $a^4 + 2a^2$; 2) $a^4 - 3a^3$; 3) $a^4b^2 + ab^3$; 4) $x^2y^3 - x^3y^2$.

439. 1) $18y^7 + 12y^4$; 2) $6x^4 - 24x^2$; 3) $15x^5 - 5x^3$; 4) $6a^5 + 3a^2$.

440. 1) $9a^2b^2 - 12ab^3$;
2) $20x^3y^2 + 4x^2y$;
3) $7a^2bc + 14ab^2c$;
4) $9xyz^2 - 12xy^2z$.

441. 1) $6y^5 + 12y^4 - 3y^3$;
2) $20a^4 - 5a^3 + 15a^5$;
3) $4a^2b^2 + 36a^2b^3 + 6ab^4$;
4) $2x^2y^4 - 2x^4y^2 + 6x^3y^3$.

442. Hisoblang:

1) $137^2 + 137 \cdot 63$;
2) $187^2 - 187 \cdot 87$;
3) $0{,}7^3 + 0{,}7 \cdot 9{,}51$;
4) $0{,}9^3 - 0{,}81 \cdot 2{,}9$.

Ko'paytuvchilarga ajrating **(443–447):**

443. 1) $a(m+n) + b(m+n)$;
2) $b(a+5) - c(a+5)$;
3) $a(b-5) - (b-5)$;
4) $(y-3) + b(y-3)$.

444. 1) $2a(a-b)+3b(a-b)$; 3) $5a(x+y)-4b(x+y)$;

2) $3n(m-3)+5m(m-3)$; 4) $7a(c-d)-2b(c-d)$.

445. 1) $a^2(x-y)+b^2(x-y)$; 3) $a(x^2+y^2)-b(x^2+y^2)$;

2) $a^2(x+y)-b^2(x+y)$; 4) $x(a^2-2b^2)+y(a^2-2b^2)$.

446. 1) $2b(x-1)-3a(x-1)+c(x-1)$;

2) $c(p-q)-a(p-q)+d(p-q)$;

3) $x(a^2+b^2)+y(a^2+b^2)-z(a^2+b^2)$;

4) $m(x^2+1)-n(x^2+1)-l(x^2+1)$.

447. 1) $a(x+y+z)+b(x+y+z)+c(x+y+z)$;

2) $a(x-y+z)-b(x-y+z)+c(x-y+z)$;

3) $5x(a+b-c)-4y(a+b-c)-(a+b-c)$;

4) $2a(m-n+k)-b(m-n+k)+(m-n+k)$.

Ko'paytuvchilarga ajrating **(448-450):**

448. 1) $c(a-b)+b(b-a)$; 3) $(x-y)+b(y-x)$;

2) $a(b-c)-c(c-b)$; 4) $2b(x-y)-(y-x)$.

449. 1) $7(y-3)-a(3-y)$; 3) $b^2(a-1)-c(1-a)$;

2) $6(a-2)+a(2-a)$; 4) $a^2(m-2)+b(2-m)$.

450. 1) $a(b-c)+b^2(b-c)-7(c-b)$; 3) $x(a-2)+y(2-a)+(2-a)$;

2) $x(x-y)+y(y-x)-3(x-y)$; 4) $a(b-3)+(3-b)-b(3-b)$.

451. Tenglikni isbotlang:

1) $(a-b)^2-(b-a)^2=0$; 2) $(a-b)^3-(b-a)^3=0$.

452*. Tenglamani yeching:

1) $x(x-2)=0$; 3) $(x-5)(x+4)=0$;

2) $3x^2-9x=0$; 4) $x(x-6)+10(x-6)=0$.

453. Tenglamani yeching:

1) $8-(x-3)(x+3)=10-(x-1)^2$; 3) $x:15=2\frac{1}{12}:14{,}5$;

2) $(2x+1)^2-(2x-3)^2=4(7x-5)$; 4) $\frac{x}{2{,}3}=\frac{2{,}1}{9\frac{6}{7}}$.

454. It tulkining orqasidan quvdi. It sekundiga 8 m, tulki esa 6 m tezlik bilan chopdi. Ularning orasidagi masofa dastlab 360 m bo'lgan, tulkining o'z uyasiga yetib olishi uchun 1 km qolgan edi. Tulki o'z uyasiga chopib borishga ulguradimi?

20- §. GURUHLASH USULI

Guruhlash usuli hamma hadlari uchun umumiy ko'paytuvchi mavjud bo'lmagan ko'phadlarga qo'llaniladi.

Ba'zan, berilgan ko'phadning bir nechta hadlarini qavs ichiga olib, umumiy ko'paytuvchini aniqlash mumkin. Guruhlash usuli qo'shish va ko'paytirishning guruhlash, o'rin almashtirish va taqsimot qonunlariga asoslangan.

Misollar qaraymiz:

1) $a(b+c)+b+c=a(b+c)+(b+c)=(b+c)(a+1)$;

2) $a(b-c)-b+c=a(b-c)-(b-c)=(b-c)(a-1)$.

Birinchi misolda ko'phadning oxirgi ikkita hadini «+» ishorasi bilan, ikkinchi misolda ko'phadning oxirgi ikkita hadini «–» ishorasi bilan qavs ichiga olish yetarli bo'ldi.

3) $m(3x-y)+3nx-ny=m(3x-y)+(3nx-ny)=$
$=m(3x-y)+n(3x-y)=(3x-y)(m+n)$;

4) $-mx^2-my^2+n(x^2+y^2)=(-mx^2-my^2)+n(x^2+y^2)=$
$=-m(x^2+y^2)+n(x^2+y^2)=(x^2+y^2)(n-m)$.

Uchinchi va to'rtinchi misollarda ko'phadning ikkita hadini qavs ichiga olishdan tashqari hosil qilingan har bir guruhda umumiy ko'paytuvchi qavsdan tashqariga: birinchi holda «+» ishorasi bilan, ikkinchisida esa «–» ishorasi bilan chiqarildi.

Ba'zan ko'phad hadlarini turli usullar bilan guruhlash mumkin. Masalan, $2am+2an-3bm-3bn$ ko'phadni ko'paytuvchilarga ikki usul bilan ajratish mumkin:

I usul	II usul
$2am+2an-3bm-3bn=$	$2am+2an-3bm-3bn=$
$=(2am+2an)-(3bm+3bn)=$	$=(2am-3bm)+(2an-3bn)=$
$=2a(m+n)-3b(m+n)=$	$=m(2a-3b)+n(2a-3b)=$
$=(m+n)(2a-3b)$.	$=(m+n)(2a-3b)$.

Oltita haddan iborat ko'phadni ko'paytuvchilarga ajratishga doir misol qaraymiz:

$$ax + bx - ay - by + az + bz = (ax + bx) - (ay + by) + (az + bz) =$$
$$= x(a+b) - y(a+b) + z(a+b) = (a+b)(x - y + z).$$

Bu yerda ko'phadlar ikkitadan guruhlarga ajratilgan; ularni uchtadan guruhlash ham mumkin edi:

$$ax + bx - ay - by + az + bz =$$
$$= (ax - ay + az) + (bx - by + bz) =$$
$$= a(x - y + z) + b(x - y + z) =$$
$$= (a+b)(x - y + z).$$

Shunday qilib, ko'phadni guruhlash usuli bilan ko'paytuvchilarga ajratish uchun:

1) ko'phadning hadlarini, ular ko'phad shaklidagi umumiy ko'paytuvchiga ega bo'ladigan qilib, guruhlarga birlashtiriladi;

2) shu umumiy ko'paytuvchini qavsdan tashqariga chiqariladi.

Mashqlar

Ko'paytuvchilarga ajrating **(455–460):**

455. 1) $a+b+c(a+b)$; 3) $x+3a(x+y)+y$;

2) $m-n+p(m-n)$; 4) $x+2a(x-y)-y$.

456. 1) $(x+y)+(x+y)^2$; 3) $2m(m-n)+(m-n)^2$;

2) $(a-b)^2+a-b$; 4) $4q(p-1)+(p-1)^2$.

457. 1) $2m(m-n)+m-n$; 3) $2m(m-n)-n+m$;

2) $4q(p-1)+p-1$; 4) $4q(p-1)+1-p$.

458. 1) $a(x-c)+bc-bx$; 3) $3a(2b+c)+8b+4c$;

2) $a(b+c)+db+dc$; 4) $2x(3x-4y)-6x+8y$.

459. 1) $ac+bc-2ad-2bd$; 3) $2bx-3ay-6by+ax$;

2) $ac-3bd+ad-3bc$; 4) $5ay-3bx+ax-15by$.

460. 1) $xy^2-by^2-ax+ab+y^2-a$; 2) $ax^2-ay-bx^2+cy+by-cx^2$.

461. Hisoblang:

1) $139 \cdot 15 + 18 \cdot 139 + 15 \cdot 261 + 18 \cdot 261$;

2) $125 \cdot 48 - 31 \cdot 82 - 31 \cdot 43 + 125 \cdot 83$;

3) $14{,}7 \cdot 13 - 2 \cdot 14{,}7 + 13 \cdot 5{,}3 - 2 \cdot 5{,}3$;

4) $3\frac{1}{3} \cdot 4\frac{1}{5} + 4{,}2 \cdot \frac{2}{3} + 3\frac{1}{3} \cdot 2\frac{4}{5} + 2{,}8 \cdot \frac{2}{3}$.

462. Ifodaning son qiymatini toping:

1) $5a^2 - 5ax - 7a + 7x$, bunda $x = -3$, $a = 4$;

2) $m^2 - mn - 3m + 3n$, bunda $m = 0{,}5$, $n = 0{,}25$;

3) $a^2 + ab - 5a - 5b$, bunda $a = 6{,}6$, $b = 0{,}4$;

4) $a^2 - ab - 2a + 2b$, bunda $a = \frac{7}{20}$, $b = 0{,}15$.

463. Hisoblang:

1) $287^2 - 287 \cdot 48 + 239 \cdot 713$; 2) $73{,}4^2 + 73{,}4 \cdot 17{,}2 - 90{,}6 \cdot 63{,}4$.

464. Tenglamani yeching:

1) $x(x-4) + x - 4 = 0$; 2) $t(t+7) - 4t - 28 = 0$.

---

465. Ifodaning son qiymatini toping:

1) $(0{,}13x^2 - 2x)^2 - 6x^2(\frac{2}{3}x^2 - 0{,}3x)$, bunda $x = -\frac{1}{3}$;

2) $-\frac{2}{3}(x-1)^2 - 2\frac{1}{3}(x-3)(x+3)$, bunda $x = 3$;

3) $(\frac{1}{3}x + 2a)(2a - \frac{1}{3}x) - (\frac{2}{9}x + \frac{4}{7}a)(7a - \frac{1}{2}x) + 1\frac{5}{9}ax$, bunda $a = \frac{5}{16}$, $x = 28$;

4) $(3x + 2y)(9x^2 - 6xy + 4y^2) - 8(x^3 + y^3)$, bunda $x = 0{,}1$, $y = 4$.

466. Avtomobil shahardan qishloqqacha bo'lgan masofani 80 km/soat tezlik bilan bosib o'tdi. Orqaga qaytishda u masofaning 75% ini avvalgi tezlik bilan, qolgan yo'lni esa 60 km/soat tezlik bilan bosib o'tdi va shuning uchun ham qaytishda yo'lga shahardan qishloqqa borishdagiga qaraganda 10 minut ortiq vaqt sarf qildi. Shahardan qishloqqacha bo'lgan masofani toping.

21- §. YIG'INDINING KVADRATI. AYIRMANING KVADRATI

O'rta Osiyo xalqlari madaniyatini o'rta asrlarda dunyo madaniyatining oldingi qatoriga olib chiqqan buyuk mutafakkirlardan biri Abu Ali ibn Sinoning matematikaga oid ishlarida sonlarni kvadrat

Abu Ali ibn Sino (973-1048), buyuk mutafakkir, yurtdoshimiz

va kubga ko'tarish amallari o'rganilgan.

Ikkita son yig'indisining kvadrati $(a+b)^2$ ni qaraymiz. Ko'phadni ko'phadga ko'paytirish qoidasidan foydalanib, hosil qilamiz:

$$(a+b)^2=(a+b)(a+b)=$$
$$=a^2+ab+ab+b^2=a^2+2ab+b^2,$$

ya'ni

$$\boxed{(a+b)^2=a^2+2ab+b^2} \qquad (1)$$

Ikki son yig'indisining kvadrati birinchi son kvadrati plyus birinchi son bilan ikkinchi son ko'paytmasining ikkilangani plyus ikkinchi son kvadratiga teng.

(1) formulani 13- rasmda tasvirlangan kvadratning yuzini ko'z-dan kechirib, osongina hosil qilish mumkinligini aytib o'tamiz.

Endi ikki son ayirmasining kvadratini qaraymiz:

$$(a-b)^2=(a-b)(a-b)=a^2-ab-ab+b^2=a^2-2ab+b^2,$$

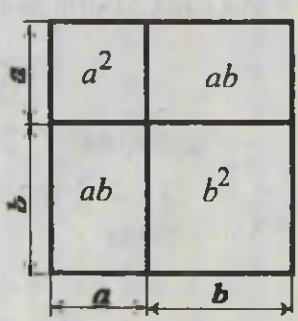
ya'ni

$$\boxed{(a-b)^2=a^2-2ab+b^2} \qquad (2)$$

Ikki son ayirmasining kvadrati birinchi son kvadrati minus birinchi son bilan ikkinchi son ko'paytmasining ikkilangani plyus ikkinchi son kvadratiga teng.

(1) va (2) tengliklarda a va b istalgan sonlar yoki algebraik ifodalardir.

(1) va (2) formulalarni qo'llashga doir misollar:



13- rasm

1) $(2m+3k)^2=(2m)^2+2(2m)(3k)+(3k)^2=4m^2+12mk+9k^2$;

2) $(5a^2-3)^2=(5a^2)^2-2\cdot 5a^2\cdot 3+3^2=25a^4-30a^2+9$;

3) $(-a-3b)^2=((-1)(a+3b))^2=(-1)^2(a+3b)^2=(a+3b)^2=$
$=a^2+2a(3b)+(3b)^2=a^2+6ab+9b^2$.

Zaruriy hisoblashlarni og'zaki bajarib, oraliq natijalarni yozmaslik mumkin. Masalan, birdaniga bunday yozish mumkin:

$$(5a^2-7b^2)^2=25a^4-70a^2b^2+49b^4.$$

Yig'indi yoki ayirmaning kvadrati formulasini qisqa ko'paytirish formulalari deyiladi va ba'zi hollarda hisoblashlarni soddalashtirish uchun qo'llanadi. Masalan:

1) $99^2=(100-1)^2=10000-200+1=9801$;

2) $52^2=(50+2)^2=2500+200+4=2704$.

(1) formula $(1+a)^2$ ifodaning qiymatlarini taqribiy hisoblashlarda ham qo'llaniladi. a son musbat yoki manfiy son bo'lib, uning moduli 1 ga nisbatan kichik bo'lsa (masalan, $a=0{,}0032$ yoki $a=-0{,}0021$), u holda a^2 son yanada kichik bo'ladi va shu sababli

$$(1+a)^2=1+2a+a^2$$

tenglikni $(1+a)^2\approx 1+2a$ taqribiy tenglik bilan almashtirish mumkin. Masalan:

1) $(1{,}002)^2=(1+0{,}002)^2\approx 1+2\cdot 0{,}002=1{,}004$;

2) $(0{,}997)^2=(1-0{,}003)^2\approx 1-2\cdot 0{,}003=0{,}994$.

Yig'indining kvadrati va ayirmaning kvadrati formulalari ko'paytuvchilarga ajratishda ham qo'llaniladi, masalan:

1) $x^2+10x+25=x^2+2\cdot 5\cdot x+5^2=(x+5)^2$;

2) $a^4-8a^2b^3+16b^6=(a^2)^2-2\cdot a^2\cdot 4b^3+(4b^3)^2=(a^2-4b^3)^2$.

M a s a l a . Formulani isbotlang:

$$\boxed{(a+b)^3=a^3+3a^2b+3ab^2+b^3} \qquad (3)$$

$\triangle (a+b)^3=(a+b)(a+b)^2=(a+b)(a^2+2ab+b^2)=$
$=a^3+2a^2b+ab^2+a^2b+2ab^2+b^3=a^3+3a^2b+3ab^2+b^3$. ▲

Xuddi shunga o'xshash,

$$\boxed{(a-b)^3=a^3-3a^2b+3ab^2-b^3} \qquad (4)$$

formulani ham isbotlash mumkin.

(3) va (4) formulalar mos ravishda *yig'indining kubi va ayirmaning kubi* deb ataladi.

(3) va (4) formulalar ham qisqa ko'paytirish formulalari hisoblanadi.

Mashqlar

Quyidagi mashqlarda ikkihadning kvadratini ko'phad shaklida tasvirlang **(467–474)**:

467. 1) $(c+d)^2$; 3) $(2+x)^2$; 5) $(y+3)^2$;
2) $(x-y)^2$; 4) $(x+1)^2$; 6) $(7+m)^2$.

468. 1) $(m-2)^2$; 3) $(7-m)^2$; 5) $(a+\frac{1}{3})^2$;
2) $(x-3)^2$; 4) $(y-6)^2$; 6) $(b+\frac{1}{2})^2$.

469. 1) $(q+2p)^2$; 2) $(3x+2y)^2$; 3) $(6a-4b)^2$; 4) $(5z-t)^2$.

470. 1) $(3a^2+1)^2$; 2) $(a^2+1)^2$; 3) $(2x^2+3n^2)^2$; 4) $(x^2+y^2)^2$.

471. 1) $(m-\frac{1}{5})^2$; 2) $(a-\frac{1}{3})^2$; 3) $(\frac{a}{2}-\frac{b}{3})^2$; 4) $(\frac{x}{3}+\frac{y}{4})^2$.

472. 1) $(0,2x+0,3y)^2$; 3) $(\frac{2}{3}x^3-\frac{3}{4})^2$;
2) $(0,4b-0,5c)^2$; 4) $(\frac{1}{4}a^3-\frac{4}{5})^2$.

473. 1) $(\frac{1}{2}a^3+\frac{2}{3}a)^2$; 3) $(-8p^3+5p^2)^2$;
2) $(\frac{1}{3}x^2+\frac{1}{2}x)^2$; 4) $(10x^2-3xy^3)^2$.

474. 1) $(-4ab-5a^2)^2$; 3) $(0,2x^2+5xy)^2$;
2) $(-3b^2-2ab)^2$; 4) $(4xy+0,5y^2)^2$.

Qisqa ko'paytirish formulalaridan foydalanib, amallarni bajaring **(475–477)**:

475. 1) $(90-1)^2$; 2) $(40+1)^2$; 3) 101^2; 4) 98^2.

476. 1) 999^2; 2) 1003^2; 3) 51^2; 4) 39^2.

477. 1) 72^2; 2) 57^2; 3) 997^2; 4) 1001^2.

Ifodani soddalashtiring **(478–479):**

478. 1) $(x-y)^2+(x+y)^2$; 3) $(2a+b)^2-(2a-b)^2$;
2) $(x+y)^2-(x-y)^2$; 4) $(2a+b)^2+(2a-b)^2$.

479. 1) $(3a-1)^2+2(1+a)^2$; 3) $(x-1)^2-4(x+1)^2$;
2) $3(2-a)^2+4(a-5)^2$; 4) $-(3+x)^2+5(1-x)^2$.

Tenglamani yeching **(480–481):**

480. 1) $16x^2-(4x-5)^2=15$; 3) $-5x(x-3)+5(x-1)^2=-20$;
2) $64x^2-(3-8x)^2=87$; 4) $(2x-3)^2-(2x+3)^2=12$.

481. 1) $(3x-1)^2-(3x-2)^2=0$; 3) $(x+3)(x+7)-(x+4)^2=0$;
2) $(y-2)(y+3)-(y-2)^2=5$; 4) $(y+8)^2-(y+9)(y-5)=117$.

482. Ifodaning qiymatini toping:

1) $9a^3-a(3a+2)^2+4a(3a+7)$, bunda $a=-1\frac{1}{6}$;

2) $(2y-5)^2-4(y-3)^2-4y$, bunda $y=-\frac{2}{7}$;

3) $42m(m-1)-(5m-3)^2-6m$, bunda $m=-0{,}3$;

4) $24x^2-(7x-2)^2+(5x-3)(5x+1)$, bunda $x=-\frac{5}{9}$.

483. y ning istagan qiymatida tenglik to'g'ri bo'lishini ko'rsating:

1) $(2y-5)^2-(2y+5)^2+40y=0$; 2) $(30-3y)^2-9y(y-20)=900$;
3) $(7y+1)^2-(y+7)^2=48(y-1)(y+1)$;
4) $(6y+8)^2+(8y-6)^2=100(y^2+1)$.

484. Ifodani birhadning kvadrati shaklida ifodalang:

1) $36m^4n^2$; 2) $\frac{4}{81}x^2y^4$; 3) $100a^4b^8$; 4) $\frac{64}{121}m^6n^4$.

485. x ni birhad bilan shunday almashtiringki, natijada tenglik bajarilsin:

1) $(x-4b^7)^2=25a^4b^2-40a^2b^8+16b^{14}$;

2) $(x+7c)^2=25b^6+70b^3c+49c^2$;

3) $(10m^5+x)^2=100m^{10}+120m^7n^3+36m^4n^6$;

4) $(5b^2-x)^2=25b^4-30a^2b^3+9a^4b^2$.

486. Ifodani ikkihadning kvadrati shaklida ifodalang:

1) $a^2 - 10ab + 25b^2$; 3) $k^4 + 2k^2 + 1$;

2) $25 + 10x + x^2$; 4) $p^2 - 1{,}6p + 0{,}64$.

x ni birhad bilan shunday almashtiringki, natijada ikkihadning kvadrati hosil bo'lsin **(487–488):**

487. 1) $a^2 + 4a + x$; 3) $36a^2 - x + 49b^2$;

2) $p^2 - 0{,}5p + x$; 4) $a^2 - 6ab + x$.

488. 1) $m^4 - 3m^2 + x$; 3) $4a^2 - 5a + x$;

2) $a^2 + ab + x$; 4) $x + 6a + 9a^2$.

489. Isbot qiling:

1) $(a-b)^2 = (b-a)^2$; 4) $(a-b)^3 = -(b-a)^3$;

2) $(-a-b)^2 = (b+a)^2$; 5) $(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$;

3) $(-a-b)(a+b) = -(a+b)^2$; 6) $(a-b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$.

490. Tenglamani yeching:

1) $(\frac{7}{8} - x) + \frac{5}{12} = \frac{1}{6}$; 2) $\frac{11}{12} - (\frac{7}{8} - x) = \frac{1}{6}$.

491. Tezyurar poyezd soatiga 60 km, yo'lovchi poyezdi 40 km yo'l bosadi. Agar tezyurar poyezd ikki shahar orasidagi masofani yo'lovchi poyezdiga nisbatan 2 soat tez bosib o'tishi ma'lum bo'lsa, shu shaharlar orasidagi masofani aniqlang.

22- §. KVADRATLAR AYIRMASI FORMULASI

Ikki son yig'indisini ularning ayirmasiga ko'paytiramiz:

$$(a+b)(a-b) = a^2 - ab + ab - b^2 = a^2 - b^2,$$

ya'ni

$$(a+b)(a-b) = a^2 - b^2 \qquad (1)$$

$$\boxed{a^2 - b^2 = (a-b)(a+b)} \qquad (2)$$

Ikki son kvadratlarining ayirmasi bu sonlar ayirmasi bilan ular yig'indisining ko'paytmasiga teng.

(1) va (2) tenglikda a, b istagan sonlar yoki algebraik ifodalardir, masalan:

1) $(nm+3k)(nm-3k)=n^2m^2-9k^2$;

2) $4a^4b^2-25a^2b^4=(2a^2b+5ab^2)(2a^2b-5ab^2)$;

3) $(a+b)^2-16=(a+b-4)(a+b+4)$.

(1) formulani ham qisqa *ko'paytirish formulasi* deyiladi. Uni hisoblashlarni soddalashtirish uchun qo'llaydilar.

Masalan:

1) $63\cdot 57=(60+3)(60-3)=3600-9=3591$;

2) $98\cdot 102=(100-2)(100+2)=100^2-2^2=10000-4=9996$.

(2) tenglikni *kvadratlar ayirmasi formulasi* deyiladi. U ko'paytuvchilarga ajratishda qo'llaniladi.

Masalan:

1) $a^2-9=(a-3)(a+3)$;

2) $4b^4-0{,}64c^2=(2b^2)^2-(0{,}8c)^2=(2b^2-0{,}8c)(2b^2+0{,}8c)$;

3) $(a-b)^2-1=(a-b-1)(a-b+1)$;

4) $(a+b)^2-(a-c)^2=(a+b-a+c)(a+b+a-c)=(b+c)(2a+b-c)$.

Mashqlar

(1) formuladan foydalanib, ko'paytirishni bajaring **(492–500):**

492. 1) $(c+d)(c-d)$; 3) $(a+c)(c-a)$; 5) $(a-b)(-a-b)$;
2) $(p+q)(p-q)$; 4) $(m-n)(m+n)$; 6) $(2-m)(-2-m)$.

493. 1) $(x+5)(x-5)$; 3) $(a-4)(4+a)$; 5) $(1+a)(1-a)$;
2) $(a+3)(a-3)$; 4) $(7+x)(x-7)$; 6) $(b-1)(1+b)$.

494. 1) $(2b+a)(2b-a)$; 3) $(c+3d)(c-3d)$;
2) $(y+6x)(6x-y)$; 4) $(3m-2n)(2n+3m)$.

495. 1) $(4d-\frac{1}{2})(\frac{1}{2}+4d)$; 3) $(\frac{1}{2}y-\frac{1}{3}x)(\frac{1}{2}y+\frac{1}{3}x)$;
2) $(\frac{5}{6}a-b)(b+\frac{5}{6}a)$; 4) $(\frac{2}{3}m+\frac{3}{4}n)(\frac{2}{3}m-\frac{3}{4}n)$.

496. 1) $(c^2+d^2)(c^2-d^2)$; 3) $(x^4-y^3)(y^3+x^4)$;
2) $(a^2+b^3)(a^2-b^3)$; 4) $(m^3-n^3)(m^3+n^3)$.

497. 1) $(3a^2+4b^3)(3a^2-4b^3)$; 3) $(0,2t^3+0,5p^4)(0,5p^4-0,2t^3)$;

2) $(2m^4-5n^2)(5n^2+2m^4)$; 4) $(1,2a^2-0,3b^2)(1,2a^2+0,3b^2)$.

498. 1) $(\frac{3}{4}a^2-\frac{1}{2}b^3)(\frac{1}{2}b^3+\frac{3}{4}a^2)$;

2) $(\frac{2}{3}x^4-\frac{4}{5}y^5)(\frac{2}{3}x^4+\frac{4}{5}y^5)$;

3) $(0,5q+\frac{1}{3}p^2)(0,5q-\frac{1}{3}p^2)$; 4) $(1,5c^2-\frac{3}{4}b)(\frac{3}{4}b+1,5c^2)$.

499. 1) $(3x^2y-4xy^2)(3x^2y+4xy^2)$; 3) $(7ab+x^2y^3)(7ab-x^2y^3)$;

2) $(5ab^2+2a^2b)(5ab^2-2a^2b)$; 4) $(ab^3-4xy)(ab^3+4xy)$.

500. 1) $(3+x)(3-x)(9+x^2)$; 3) $(4x^2+y^2)(2x+y)(2x-y)$;

2) $(x^2+1)(x+1)(x-1)$; 4) $(3a-2b)(3a+2b)(9a^2+4b^2)$.

Qisqa ko'paytirish formulalaridan foydalanib hisoblang **(501–502):**

501. 1) $48\cdot 52$; 2) $68\cdot 72$; 3) $43\cdot 37$; 4) $47\cdot 53$.

502. 1) $47\cdot 33$; 2) $44\cdot 36$; 3) $84\cdot 76$; 4) $201\cdot 199$.

503. Soddalashtiring:

1) $(c-3)^2-(c+3)(3-c)$; 4) $(3a-4b)(3a+4b)-(3a-4b)^2$;

2) $(a+2)^2-(a+2)(2-a)$; 5) $(-b-a)(a+b)+a^2+b^2$;

3) $(2x+3y)(2x-3y)+(2x+3y)^2$; 6) $(b-a)(-a-b)+2b^2$.

504. Ifodaning qiymatini toping:

1) $4m-(m+3)^2+(m-3)(m+3)$, bunda $m=-2,4$;

2) $(3x+4)^2-10x-(x-4)(4+x)$, bunda $x=-0,1$;

3) $2(k-7)(k+5)-(k-5)^2-(k-7)(7+k)$, bunda $k=-\frac{1}{2}$;

4) $(a+3)^2+(a-3)(3+a)-2(a+2)(a-4)$, bunda $a=-\frac{1}{5}$.

505. Tenglamani yeching:

1) $(2x+3)^2-4(x-1)(x+1)=49$;

2) $(3x+4)^2-(3x-1)(1+3x)=49$;

3) $(3x+2)(3x-2)-(3x-4)^2=28$;

4) $(3x+1)^2-(3x-2)(2+3x)=17$.

506. Kvadratning ikki qarama-qarshi tomonining har biri 8 sm ga uzaytirildi, qolgan ikki tomoni esa shuncha qisqartirildi. Shaklning yuzi qanday o'zgardi?

507. Qaysi biri katta va qancha katta:

1) $126{,}5^2$ mi yoki $128 \cdot 125$ mi; 2) 37^2 mi yoki $36 \cdot 38$ mi;

3) 37^2 mi yoki $37\frac{1}{2} \cdot 36\frac{1}{2}$ mi;

4) $(2n-3)(2n+3)$ mi yoki $(2n-5)(2n+5)$ mi ?

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508. Proporsiyaning noma'lum hadini toping:

1) $x:3=27:18$; 2) $3:x=12:17$; 3) $\frac{20}{x}=\frac{12}{45}$; 4) $\frac{81}{18}=\frac{18}{x}$.

509. To'g'ri to'rtburchakning bir tomoni ikkinchisining $\frac{2}{3}$ qismini tashkil qiladi. Shu to'g'ri to'rtburchakning perimetri 40 m. Uning yuzini toping.

510. Hisoblang: $\frac{5^4 \cdot 0{,}128 - 5^3 \cdot 0{,}628 \cdot 5}{125 \cdot 0{,}25}$.

23- §. KO'PHADNI KO'PAYTUVCHILARGA AJRATISHNING BIR NECHA USULLARINI QO'LLASH

Ko'phadni ko'paytuvchilarga ajratishda ba'zan bir emas, balki bir necha usullar qo'llaniladi. Misollar keltiramiz:

1) a^3-a ko'phadni ko'paytuvchilarga ajrating:

$$\triangle\ a^3-a=a(a^2-1)=a(a-1)(a+1).\ \blacktriangle$$

Bu yerda ikkita usuldan foydalanilgan: umumiy ko'paytuvchini qavsdan tashqariga chiqarish va kvadratlar ayirmasi formulasini qo'llash.

2) $(a^2+1)-4a^2$ ko'phadni ko'paytuvchilarga ajrating:

$$\triangle\ (a^2+1)-4a^2=((a^2+1)-2a)((a^2+1)+2a)=(a^2+1-2a)(a^2+1+2a)=$$
$$=(a^2-2a+1)(a^2+2a+1)=(a-1)^2(a+1)^2.\ \blacktriangle$$

Bu yerda qo'shiluvchilar umumiy ko'paytuvchiga ega emasligi sababli, avval kvadratlar ayirmasi formulasidan foydalanildi, so'ngra yig'indi va ayirma kvadratlarining formulalaridan foydalanildi.

3) $4x^2-y^2+4x+2y=(4x^2-y^2)+(4x+2y)=$

$=(2x-y)(2x+y)+2(2x+y)=(2x+y)(2x-y+2).$

Birhadlar umumiy ko'paytuvchiga ega bo'lmagani va biror formulani qo'llash mumkin bo'lmagani uchun, avval guruhlash usulidan foydalanildi, so'ngra esa kvadratlar ayirmasi formulasi qo'llanildi.

Ko'rib chiqilgan bu misollar ko'phadni ko'paytuvchilarga ajratishga doir topshiriqlarni bajarishda quyidagi tartibga rioya qilish foydali ekanligini ko'rsatadi:

1) umumiy ko'paytuvchini (agar u bor bo'lsa) qavsdan tashqariga chiqarish;

2) ko'phadni qisqa ko'paytirish formulalari bo'yicha ko'paytuvchilarga ajratishga urinib ko'rish;

3) guruhlash usulini, agar oldingi usullar maqsadga olib kelmasa, qo'llashga harakat qilish.

M a s a l a . Tenglikni isbotlang:

$$a^3+b^3=(a+b)(a^2-ab+b^2). \qquad (1)$$

△ Tenglikning o'ng tomonidagi qavslarni ochamiz:

$$(a+b)(a^2-ab+b^2)=a^3-a^2b+ab^2+a^2b-ab^2+b^3=a^3+b^3.$$

Tenglikning o'ng tomoni chap tomoniga tengligi kelib chiqdi, ya'ni (1) tenglik isbot qilindi. ▲

Xuddi shu kabi

$$a^3-b^3=(a-b)(a^2+ab+b^2) \qquad (2)$$

tenglikning to'g'riligi isbotlanadi.

(1) va (2) tengliklar mos ravishda *kublar yig'indisi va ayirmasi* deb ataladi. Bu formulalar ham ko'phadni ko'paytuvchilarga ajratishda qo'llaniladi.

Masalan:

1) $27+b^3=(3+b)(9-3b+b^2)$;

2) $x^4-8xy^3=x(x^3-8y^3)=x(x-2y)(x^2+2xy+4y^2)$.

511. Hisoblang:

1) 47^2-37^2; 2) 54^2-44^2; 3) $50{,}7^2-50{,}6^2$; 4) $29{,}4^2-29{,}3^2$.

512. (Og'zaki.) Ko'paytuvchilarga ajrating:

1) $36-x^2$; 2) a^2-25; 3) y^2-1; 4) $1-b^2$.

513. (Og'zaki.) Ifodani birhadning kvadrati shaklida tasvirlang:

$100a^2$; $0{,}01b^2$; $\frac{9}{16}m^2n^2$; $0{,}25x^6$; $1\frac{9}{16}x^2$; x^4y^6.

Ko'paytuvchilarga ajrating **(514–525):**

514. 1) $25x^2-9$; 2) $4a^2-9$; 3) $64y^2-36x^2$; 4) $81a^2-16b^2$.

515. 1) c^2d^2-9; 2) a^2b^2-16; 3) $4a^2-9b^2$; 4) $16x^2-25y^2$.

516. 1) $\frac{1}{9}y^2-\frac{16}{25}x^2$; 3) $0{,}25a^2-49b^2$;

2) $\frac{4}{9}a^2-\frac{1}{16}b^2$; 4) $0{,}09x^2-16y^2$.

517. 1) $36x^2y^2-1$; 2) x^2y^4-16; 3) $81a^6-49b^4$; 4) $25a^2-9b^6$.

518. 1) a^4-b^4; 2) a^4-b^8; 3) a^4-16; 4) b^4-81.

519. 1) $(a+b)^2-c^2$; 3) $(a+2b)^2-9a^2$;

2) $(m-n)^2-k^2$; 4) $(3x-y)^2-4y^2$.

520. 1) $(a+b)^2-(a-c)^2$; 3) $(2a+b)^2-(2b+a)^2$;

2) $(a+b)^2-(b+c)^2$; 4) $(a-3b)^2-(3a+b)^2$.

521. 1) $9a^2-6a+1$; 3) $36b^2+12b+1$;

2) $1+2c+c^2$; 4) $81-18x+x^2$.

522. 1) $9x^2+24x+16$; 3) $36m^2+12mn+n^2$;

2) $100-60a+9a^2$; 4) $a^2+10ab+25b^2$.

523. 1) $x^4+2x^2y+y^2$; 3) $4c^2+12c^2b^3+9b^6$;

2) $p^4-2p^2q+q^2$; 4) $25a^6+30a^3b+9b^2$.

524. 1) a^4-8a^2+16; 3) $25a^4-10a^2b+b^2$;

2) b^4-18b^2+81; 4) $16-8a^2b^2+a^4b^4$.

525. 1) $-a^2-2a-1$; 3) $-2a^2+8ab-8b^2$;

2) $-9+6b-b^2$; 4) $-12ab-3a^2-12b^2$.

526. Ifodaning son qiymatini toping:

1) $5m^2-10mn+5n^2$, bunda $m=142$, $n=42$;

2) $6m^2+12mn+6n^2$, bunda $m=56$, $n=44$;

3) $-36a^3+4a^2b-\frac{1}{9}ab^2$, bunda $a=4$, $b=48$;

4) $-64a^3-8a^2b-\frac{1}{4}ab^2$, bunda $a=-6$, $b=84$.

527*. Tenglamani yeching:

1) $x^2-36=0$; 3) $4x^2+4x+1=0$;

2) $\frac{1}{4}-x^2=0$; 4) $25-10x+x^2=0$.

528. Hisoblang:

1) $101^2-202\cdot 81+81^2$; 3) $\frac{48^2+2\cdot 48\cdot 18+18^2}{48^2-18^2}$;

2) $37^2+126\cdot 37+63^2$; 4) $\frac{85^2-17^2}{85^2+2\cdot 85\cdot 17+17^2}$.

529. Ikkita birhad berilgan: $5a$ va $7b$. Algebraik ifoda shaklida yozing:

1) shu birhadlar yig'indisini; 2) shu birhadlar kublarining yig'indisini; 3) shu birhadlar ko'paytmasini; 4) shu birhadlar kublarining ayirmasini.

530. Ikkita birhad berilgan: a va $3b$. 1) shu birhadlar yig'indisining kvadrati; 2) ular yig'indisining chala kvadrati; 3) shu birhadlar ayirmasining kvadrati; 4) ular ayirmasining chala kvadrati bo'la oladigan standart shakldagi ko'phadni yozing.

531. Tushirib qoldirilgan shunday uchhadni topingki, tenglik bajarilsin:

1) $x^3+y^3=(x+y)(...)$; 3) $x^3-y^3=(x-y)(...)$;

2) $(x+y)^3=(x+y)(...)$; 4) $(x-y)^3=(x-y)(...)$.

532. Ko'paytuvchilarga ajrating:

1) x^3-y^3; 2) c^3+d^3; 3) x^3+27; 4) a^3-27.

5) n^3-64; 6) a^3+1; 7) $1-p^3$; 8) $125-b^3$.

533. Ifodani birhadning kubi shaklida ifodalang:

$8a^3$; $27x^3$; $\frac{64}{125}y^6$; $8m^3n^6$.

Ko'paytuvchilarga ajrating **(534–535)**:

534. 1) $27m^3-8$; 2) $64-125y^3$; 3) $125+\frac{1}{8}b^3$; 4) $64y^3+\frac{1}{27}$.

535. 1) $8a^3+1$; 2) $1+27b^3$; 3) $\frac{1}{27}a^3+64b^6$; 4) $\frac{1}{8}a^6+125b^3$

536. 1) a^9-b^3; 2) a^6-b^6; 3) x^6-729; 4) $64-y^6$.

Ifodani qisqa ko'paytirish formulalaridan foydalanib, ikkihad shaklida yozing **(537–538)**:

537. 1) $(z+5)(z^2-5z+25)$; 3) $(2x+3y)(4x^2-6xy+9y^2)$;

2) $(y+2)(y^2-2y+4)$; 4) $(4c-5d)(16c^2+20cd+25d^2)$.

538. 1) $(10a^2-1)(100a^4+10a^2+1)$;

2) $(a^2b^2-5a)(a^4b^4+5a^3b^2+25a^2)$;

3) $(\frac{1}{5}m-n)(\frac{1}{25}m^2+\frac{1}{5}mn+n^2)$;

4) $(\frac{1}{2}x-\frac{1}{3}y)(\frac{1}{4}x^2+\frac{1}{6}xy+\frac{1}{9}y^2)$.

539. Tushirib qoldirilgan yig'indi (yoki ayirma)ning chala kvadratini shunday topingki, natijada birhadlar kublarining ayirmasi (yoki yig'indisi) hosil bo'lsin:

1) $(3a-5b)(...)$; 3) $(\frac{2}{3}x+\frac{1}{2}y)(...)$;

2) $(5x+4y)(...)$; 4) $(0{,}5a-0{,}2b)(...)$.

540. Ko'paytuvchilarga ajrating:

1) $(8a^3-27b^3)-2a(4a^2-9b^2)$; 3) $(a^3+b^3)+(a+b)^2$;

2) $(64a^3+125b^3)+5b(16a^2-25b^2)$; 4) $(a^3-b^3)+(a-b)^2$.

541. Hisoblang:

1) $\frac{258^3-147^3}{258^2+258\cdot147+147^2}$; 2) $\frac{17{,}98^2-17{,}98\cdot32{,}02+32{,}02^2}{17{,}98^3+32{,}02^3}$.

542. Ifodaning qiymatini toping:

1) $(x+2)(x^2-2x+4)-x(x-3)(x+3)$, bunda $x=2$;

2) $(2x-1)(4x^2+2x+1)-4x(2x^2-3)$, bunda $x=0{,}5$;

3) $(4x+1)(16x^2-4x+1)-16x(4x^2-5)$, bunda $x=\frac{1}{5}$;

4) $x(x+2)(x-2)-(x-3)(x^2+3x+9)$, bunda $x=\frac{1}{4}$.

543. Tenglamani yeching:

1) $(x+2)(x^2-2x+4)-x(x-3)(x+3)=26$;
2) $(x-3)(x^2+3x+9)-x(x+4)(x-4)=21$;
3) $(2x-1)(4x^2+2x+1)-4x(2x^2-3)=23$;
4) $(4x+1)(16x^2-4x+1)-16x(4x^2-5)=17$.

Ko'paytuvchilarga ajrating **(544–547):**

544. 1) $3a^3-3$; 2) y^3-y; 3) m^3n-mn^3; 4) $2a^3-2ab^2$.

545. 1) $x^4x^2-x^2x^4$; 3) $8-72x^6y^2$;
2) $7c^2d^2-63c^2b^2$; 4) $32a^4b-2a^2b$.

546. 1) $2a^2+4ab+2b^2$; 4) $8p^2-16p+8$;
2) $2m^2+2n^2-4mn$; 5) $27a^2b^2-18ab+3$;
3) $5x^2+10xy+5y^2$; 6) $12m^5n+24m^4n+12m^3n$.

547. 1) $2c^3+2d^3$; 3) $2cd^3-16c^2$; 5) $7-28x^2y^3$;
2) $54x^3-16$; 4) $\frac{1}{8}a^2-a^5$; 6) $4a^2b+32a^5b$.

548. Hisoblang: $19{,}7^2-8{,}3^2+28\cdot 8{,}6$.

Ko'paytuvchilarga ajrating **(549–551):**

549. 1) $(x^2+1)^2-4x^2$; 3) $4y^2-(y-c)^2$;
2) $(x^2+2x)^2-1$; 4) $81-(y^2+6y)^2$.

550. 1) $(a^2+2ab+b^2)-c^2$; 3) $1-a^2-2ab-b^2$;
2) $1-(x^2-2xy+y^2)$; 4) $4+(-x^2-2xy-y^2)$.

551. 1) a^2-b^2+a+b; 2) a^2-b^2-a-b; 3) $x-y-x^2+y^2$;
4) x^3+x^2-x-1; 5) $m^5-m^3+m^2-1$; 6) x^4+x^3+x+1.

552. 27^2-14^2 soni 13 ga bo'linishini isbotlang.

553. n istagan butun son bo'lganda $(7n-2)^2-(2n-7)^2$ ifodaning qiymati 5 ga bo'linishini, 9 ga bo'linishini isbot qiling.

554. Tenglamani yeching:

1) $(x+3)(x^2+3x+9)-(3x-17)=x^3-12$;

2) $5x-(4-2x+x^2)(x+2)+x(x-1)(x+1)=0$.

555. Mototsiklchi shahardan qishloqqa tomon 60 km/soat tezlik bilan jo'nadi. Oradan yarim soat o'tgandan keyin qishloqdan shaharga tomon 50 km/soat tezlik bilan ikkinchi mototsiklchi yo'lga chiqdi. Agar shahar bilan qishloq orasidagi masofa 162 km bo'lsa, ikkinchi mototsiklchi birinchi mototsiklchi bilan uchrashguncha qancha vaqt yurgan?

556. Motorli qayiqning oqim bo'yicha tezligi 18km/soat, oqimga qarshi tezligi esa 14 km/soat. Daryo oqimining tezligini va qayiqning turg'un suvdagi tezligini toping.

557. (Qadimiy masala.) Bir xizmatchining bir oylik (ya'ni 30 kunlik) ish haqi 10 dinor va bir ko'ylak. U uch kunda bir ko'ylakning narxicha pul ishladi. Ko'ylakning narxini toping.

IV bobga doir mashqlar

Ko'paytuvchilarga ajrating **(558–562):**

558. 1) $6(a+b)+(a+b)^2$; 3) $(a-b)+(b-a)^2$;

2) $4(x-y)+3(x-y)^2$; 4) $(a-b)^2-(b-a)$.

559. 1) $3(x+y)(x-y)(x+y)^2$; 3) $5(a-b)^2-(a+b)(b-a)$;

2) $(x+y)^3-x(x+y)^2$; 4) $a(a-b)^2-(b-a)^2$.

560. 1) $(y+z)(12x^2+6x)+(y-z)(12x^2+6x)$;

2) $(y-z)(12x^2-6x)+(y-z)(12x^2+6x)$;

3) $(6x^2-3)+7x(6x^2-3)-4y(6x^2-3)$;

4) $2x(8x-4y)-3y(8x-4y)-(8x-4y)$.

561. 1) $18a^2-27ab+14ac-21bc$; 3) $35ax+24xy-20ay-42x^2$;

2) $10x^2+10xy+5x+5y$; 4) $48xz^2+32xy^2-15yz^2-10y^3$.

562. 1) $16ab^2-5b^2c-10c^3+32ac^2$; 3) $-28ac+35c^2-10cx+8ax$;

2) $6mnk^2+15m^2k-14n^3k-35mn^2$; 4) $-24bx-15c^2+40bc+9cx$.

563. Ifodani soddalashtiring:

1) $(2x-1)^2-2(2x-3)^2+17$; 3) $24y^2-(7y-2)^2+(5y-3)(5y+1)$;

2) $(3x+2)^2-2(x-1)^2-7x^2$; 4) $(3y+1)(2y-3)+(2y-3)^2-10y^2$.

564*. Ifodani ko'phad shaklida yozing:

1) $(a+(b+c))(a-(b+c))$; 2) $(a^2-(b-c))(a^2+(b-c))$;

3) $(2^m-3^n)(2^m+3^n)$;

4) $(a^m+b^{2n})(a^m-b^{2n})$, (m, n – natural sonlar).

565*. Ikkita ketma-ket natural son kvadratlari ayirmasining moduli toq son bo'lishini isbotlang.

566. Kasrni qisqartiring:

1) $\frac{53^2-27^2}{79^2-51^2}$; 3) $\frac{49^2-2\cdot49\cdot29+29^2}{49^2-19^2}$;

2) $\frac{38^2-17^2}{47^2-19^2}$; 4) $\frac{47^2-3^2}{27^2+2\cdot27\cdot13+13^2}$.

567. x va y ning istagan qiymatlarida $(x+y)(x^2-y^2)=(x-y)(x+y)^2$ tenglik to'g'ri bo'lishini isbotlang.

568. Ifodani soddalashtiring va uning son qiymatini toping:

1) $(4c+\frac{1}{4}x)(4c-\frac{1}{4}x)+(4c-\frac{1}{4}x)^2$, bunda $c=\frac{1}{2}$, $x=2$;

2) $(0{,}1a-0{,}2b)^2+(0{,}1a-0{,}2b)(0{,}1a+0{,}2b)$, bunda $a=-50$, $b=-1\frac{2}{3}$.

24- §. ALGEBRAIK KASR. KASRLARNI QISQARTIRISH

1-masala. Katerning turg'un suvdagi tezligi soatiga a kilometrga teng, daryo oqimining tezligi soatiga b kilometrga teng. Katerning daryo oqimi bo'yicha harakat tezligi uning daryo oqimiga qarshi harakat tezligidan necha marta ortiq?

△ Katerning daryo oqimi bo'yicha tezligi $(a+b)$ kilometrga teng; oqimga qarshi tezligi soatiga $(a-b)$ kilometrga teng. Shuning uchun daryo oqimi bo'yicha harakat tezligi oqimga qarshi harakat tezligidan

$$\frac{a+b}{a-b}$$

marta ortiq bo'ladi. ▲

$\frac{a+b}{a-b}$ ifoda *algebraik kasr* deyiladi. Bu kasrning surati $a+b$, maxraji esa $a-b$. Umuman, surat va maxraji algebraik ifodalar bo'lgan kasr *algebraik kasr* deyiladi.

Algebraik kasrlarga doir yana bir necha misollar keltiramiz:

$$\frac{a}{b};\ \frac{2}{x+y};\ \frac{a-b}{c};\ \frac{x(b+c)}{y(a-c)}.$$

Agar algebraik kasrga kiruvchi harflar o'rniga biror sonlar qo'yilsa, u holda zarur hisoblashlar bajarilgandan keyin shu algebraik kasrning son qiymati hosil bo'ladi.

Masalan, $a=10$, $b=8$ bo'lganda $\frac{a+b}{a-b}$ algebraik kasrning son qiymati $\frac{10+8}{10-8}=\frac{18}{2}=9$ ga teng bo'ladi.

$\frac{a+b}{a-b}$ algebraik kasrda a va b o'rniga o'zaro teng bo'lmagan $(a\neq b)$ istalgan sonlarni qo'yish mumkin, chunki $a=b$ bo'lganda kasrning maxraji nolga aylanadi, nolga bo'lish esa mumkin emas.

Bundan keyin algebraik kasrga kiruvchi harflar yo'l qo'yiladigan

(joiz) qiymatlarnigina, ya'ni shu kasrning maxraji nolga teng bo'lmaydigan qiymatlarnigina qabul qiladi, deb shartlashamiz.

Masalan, $\frac{a}{a(a-1)}$ kasr uchun yo'l qo'yilishi mumkin bo'lgan qiymatlar a ning $a=0$ va $a=1$ dan boshqa qiymatlari bo'ladi.

Kasrning asosiy xossasini bunday yozish mumkin:

$$\frac{a}{b}=\frac{ma}{mb},$$

bu yerda $b\neq 0$, $m\neq 0$.

Bu xossa kasrning surat va maxrajini bir xil algebraik ifodaga ko'paytirilsa yoki bo'linsa, unga teng kasr hosil bo'lishini bildiradi, masalan:

$$\frac{3}{4}=\frac{3\cdot 5}{4\cdot 5}=\frac{15}{20},\quad \frac{a+b}{b}=\frac{(a+b)\cdot c}{bc}$$

Kasrning asosiy xossasidan foydalanib, algebraik kasrni surat va maxrajga bir vaqtda kiruvchi umumiy ko'paytuvchiga qisqartirish mumkin, masalan:

$$\frac{a(b+c)}{a(b-c)}=\frac{(b+c)}{(b-c)},\quad \frac{(a+b)c}{(a+b)d}=\frac{c}{d}.$$

Kasrlarni soddalashtirish uchun avval ularning surat va maxrajining umumiy ko'paytuvchisini ajratib olish kerakligiga doir misollar keltiramiz.

2-masala. Kasrlarni qisqartiring:

1) $\frac{12a^2b}{4ab^2}$; 2) $\frac{m^2-n^2}{m^2+mn}$.

△ 1) $12a^2b$ va $4ab^2$ birhadlar $4ab$ umumiy ko'paytuvchiga ega. Kasrning surat va maxrajini $4ab$ ga bo'lamiz:

$$\frac{12a^2b}{4ab^2}=\frac{4ab\cdot 3a}{4ab\cdot b}=\frac{3a}{b};$$

2) m^2-n^2 va m^2+mn ko'phadlar $m+n$ umumiy ko'paytuvchiga ega, chunki $m^2-n^2=(m+n)(m-n)$, $m^2+mn=m(m+n)$. Kasrning surat va maxrajini $m+n$ ga bo'lamiz:

$$\frac{m^2-n^2}{m^2+mn}=\frac{(m+n)(m-n)}{m(m+n)}=\frac{m-n}{m}.$$ ▲

Shunday qilib, kasrlarni qisqartirish uchun bu kasrlarning surat va maxrajini ularning umumiy ko'paytuvchisiga bo'lish kerak.

Agar $\frac{a}{b}$ kasrning surat yoki maxrajidagi ishorani qarama-qarshisiga o'zgartirilsa, u holda berilgan kasrga qarama-qarshi kasr hosil bo'lishini ta'kidlab o'tamiz:

$$\frac{-a}{b} = -\frac{a}{b}; \quad \frac{a}{-b} = -\frac{a}{b}$$

Masalan, $\frac{-3}{7} = -\frac{3}{7}$; $\frac{-a}{1-a} = -\frac{a}{1-a} = \frac{a}{a-1}$.

3-masala. $\frac{3a(y-x)}{a^2(x-y)}$ kasrni qisqartiring:

△ $\frac{3a(y-x)}{a^2(x-y)} = \frac{-3a(y-x)}{a^2(y-x)} = \frac{-3}{a} = -\frac{3}{a}$. ▲

Mashqlar

569. Surati x va y sonlarning ko'paytmasiga, maxraji esa ularning yig'indisiga teng algebraik kasrni yozing.

570. Surati p va q sonlarning ayirmasiga, maxraji esa ularning ko'paytmasiga teng bo'lgan algebraik kasrni yozing.

571. Surati a va b sonlar kvadratlarining ayirmasiga, maxraji esa shu sonlar ayirmasining kvadratiga teng bo'lgan algebraik kasrni yozing.

572. Surati c va d sonlar kublarining yig'indisiga, maxraji esa shu sonlar ko'paytmasining ikkilanganiga teng bo'lgan algebraik kasrni yozing.

573. (Og'zaki.) Algebraik kasrning son qiymatini toping:

1) $\frac{x}{4}$, bunda $x=2$, $x=-8$, $x=\frac{1}{2}$, $x=4{,}24$;

2) $\frac{a}{5}$, bunda $a=25$, $a=-125$, $a=12{,}5$, $a=0$;

3) $\frac{18}{c-3}$, bunda $c=8$, $c=-13$, $c=5{,}3$;

4) $\frac{3+2b}{b}$, bunda $b=-3$, $b=5$, $b=0{,}3$;

5) $\frac{4-a^2}{3}$, bunda $a=5, a=2, a=-2$;

6) $\frac{b^3-2}{b}$, bunda $b=1, b=-2, b=0{,}1$.

574. (Og'zaki.) 1) b ning qanday qiymatlarida $\frac{3b-21}{5-b^2}$ kasrning son qiymati 0 ga teng bo'ladi?

2) a ning qanday qiymatlarida $\frac{9a+81}{4a+1}$ kasrning son qiymati 0 ga teng bo'ladi?

575. Algebraik kasrning son qiymatini toping:

1) $\frac{1}{a}$, bunda $a=2\frac{3}{5}$;

2) $\frac{b+1}{b-1}$, bunda $b=1{,}5$;

3) $\frac{a^2+1}{2a}$, bunda $a=-3$;

4) $\frac{a-b}{a+2b}$, bunda $a=16, b=-3$;

5) $\frac{5a+b^2}{a^2-5b}$, bunda $a=2, b=8$;

6) $\frac{-7ab}{3b^2-a^3}$, bunda $a=3, b=-4$.

576. Algebraik kasrning son qiymatini toping:

1) $\frac{8a}{7b}$, bunda $a=-2, b=3$;

2) $\frac{5}{d+3}$, bunda $d=\frac{1}{3}$;

3) $\frac{9y^2}{4x^2}$, bunda $x=1, y=-5$;

4) $\frac{2a-3x}{a^2}$, bunda $a=0{,}5, x=-0{,}2$.

577. 1) $S=vt$ formuladan v ni;

2) $p=\frac{m}{V}$ formuladan V ni;

3) $C=2\pi R$ formuladan R ni;

4) $P=2(a+b)$ formuladan a ni toping.

578. Har bir yuk mashinasiga t tonnadan kartoshka yuklash mumkin bo'lsa, har birida p kilogrammdan kartoshka bo'lgan n qop kartoshkani tashib ketish uchun nechta yuk mashinasi (x) kerak bo'ladi? x ni $n=90$, $p=50$, $t=1{,}5$ bo'lganda toping.

579. Mashina soatiga o'rtacha c metr linoleum ishlab chiqaradi. Agar mashina kuniga n soatdan ishlasa, u a metr linoleumni

necha kunda ishlab chiqaradi? Izlanayotgan vaqtni t bilan belgilab, t ni $c=47$, $a=11280$ va $n=16$ bo'lganda toping.

580. 1) a sonni shunday tanlangki, $\frac{a^3}{a^2-1}$ kasr $\frac{27}{8}$ son qiymatga ega bo'lsin;

2) b sonni shunday tanlangki, $\frac{7b^2}{b^3+1}$ kasr $\frac{28}{9}$ son qiymatga ega bo'lsin.

581. Berilgan ikkita kasrning tengligini ko'rsating:

1) $\frac{6}{7}$ va $\frac{18}{21}$; 3) $\frac{2}{3}$ va $\frac{2a}{3a}$; 5) $\frac{m-n}{m+n}$ va $\frac{m^2-n^2}{(m+n)^2}$;

2) $\frac{-3}{5}$ va $\frac{27}{-45}$; 4) $\frac{2a}{7b}$ va $\frac{2a^2b}{7ab^2}$; 6) $\frac{a+3b}{c}$ va $\frac{(a+3b)c}{c^2}$.

582. (Og'zaki.) Kasrni qisqartiring:

1) $\frac{3}{6}$; 2) $\frac{21}{12}$; 3) $\frac{16}{32}$; 4) $\frac{12}{16}$; 5) $\frac{15}{27}$; 6) $\frac{100}{36}$.

Kasrni qisqartiring **(583–585):**

583. 1) $\frac{-48}{-56}$; 2) $\frac{-64}{-80}$; 3) $\frac{-121}{55}$; 4) $\frac{28}{-14}$.

584. 1) $\frac{12a}{20}$; 2) $\frac{2c}{3c}$; 3) $\frac{7b}{21b}$; 4) $\frac{4ab}{8ac}$; 5) $\frac{a^2}{2a}$; 6) $\frac{5x}{x^3y}$.

585. 1) $\frac{a^2}{a^3}$; 2) $\frac{b^3}{b^7}$; 3) $\frac{a^5}{a^4}$; 4) $\frac{b^6}{b^4}$.

586. (Og'zaki.) Kasrni ko'rsatilgan maxrajli (suratli) unga teng kasr bilan almashtiring:

1) $\frac{3a}{9a}=\frac{\ldots}{3}$; 2) $\frac{2y}{x}=\frac{8xy}{\ldots}$; 3) $\frac{2}{a-b}=\frac{\ldots}{b-a}$; 4) $\frac{m-3}{m-2}=\frac{3-m}{\ldots}$.

Quyidagi mashqlarda kasrni qisqartiring **(587–598):**

587. 1) $\frac{6ab}{4a}$; 3) $\frac{a^4b}{ab^3}$; 5) $\frac{12a^4b^2}{18a^3b^3}$;

2) $\frac{14c}{49c}$; 4) $\frac{3a^2b}{9a^3}$; 6) $\frac{25a^3bc^2}{125ac^3}$.

588. 1) $\frac{4(m+n)}{5(m+n)}$; 3) $\frac{2b(m-n)}{8b(m-n)(m-n)}$; 5) $\frac{2(a-b)}{b-a}$;

2) $\frac{7a(a-b)}{5(a-b)}$; 4) $\frac{3a(a+b)}{9a(a+b)(a-b)}$; 6) $\frac{5(x-y)}{15(y-x)}$.

589. 1) $\frac{3m(1-x)^2}{9m^2(x-1)^2}$; 3) $\frac{(a-b)^2}{a-b}$; 5) $\frac{m-n}{(n-m)^2}$;

2) $\frac{8a^2b(a-b)}{4a^3b(b-a)^2}$; 4) $\frac{m+n}{(m+n)^4}$; 6) $\frac{(2x-3y)^2}{3y-2x}$.

590. 1) $\frac{3x+3y}{6c}$; 3) $\frac{2a+2b}{4a-4b}$; 5) $\frac{ac-bc}{ac+bc}$;

2) $\frac{8a}{4m-4n}$; 4) $\frac{12a-3}{6a+9}$; 6) $\frac{a+ab}{a-ab}$.

591. 1) $\frac{a^2}{a^2+ab}$; 3) $\frac{7a+14b}{3a+6b}$; 5) $\frac{3a-6b}{12b-6a}$;

2) $\frac{pq^3}{p^2q-pq^2}$; 4) $\frac{2m^2-mn}{2mn-n^2}$; 6) $\frac{x^2-2xy}{2y^2-xy}$.

592. 1) $\frac{12x^2-30xy}{30x^2-12xy}$; 2) $\frac{36a^2+24ab}{24a^2+36ab}$; 3) $\frac{m^3-3m^2n}{3m^2n-3m^3}$; 4) $\frac{a^3-2a^2b}{2a^3b^2-a^4b}$.

593. 1) $\frac{a^2-b^2}{a+b}$; 3) $\frac{4c^2-9x^2}{2c-3x}$; 5) $\frac{3a(a-b)}{6a^2(b-a)}$;

2) $\frac{a-b}{a^2-b^2}$; 4) $\frac{25-x^2}{5-x}$; 6) $\frac{5a(c^2-4)}{10a^2(2-c)}$.

594. 1) $\frac{8-3c}{9c^2-64}$; 3) $\frac{2y-10}{25-y^2}$; 5) $\frac{b^2-c^2}{b^4n-c^4n}$;

2) $\frac{100-49b^2}{7b+10}$; 4) $\frac{5y-y^2}{25-y^2}$; 6) $\frac{5a^3b+5ab^3}{a^4-b^4}$.

595. 1) $\frac{d^2-6d+9}{d-3}$; 2) $\frac{b+7}{b^2+14b+49}$; 3) $\frac{9-6a+a^2}{3-a}$; 4) $\frac{1-2p}{1-4p+4p^2}$.

596. 1) $\frac{4y^2-4y+1}{4y^2-1}$; 3) $\frac{3a^2-6ab+3b^2}{6a^2-6b^2}$;

2) $\frac{16a^2-1}{16a^2-8a+1}$; 4) $\frac{50m^2+100mn+50n^2}{15m^2-15n^2}$.

597. 1) $\frac{1-a^4}{(a-1)^2}$; 2) $\frac{(m-n)^2}{n-m}$; 3) $\frac{4y^2-4y+1}{2-4y}$; 4) $\frac{5-2x}{4x^2-20x+25}$.

598. 1) $\frac{a+b}{a^3+b^3}$; 3) $\frac{8c^3-1}{4c^2+2c+1}$; 5) $\frac{27a^3+b^3}{3ab+b^2}$;

2) $\frac{a^3-27}{a-3}$; 4) $\frac{2ab-b}{8a^3-1}$; 6) $\frac{b^3+27}{9+6b+b^2}$.

599*. Kasrni qisqartiring:

1) $\frac{9c^2-16}{16-24c+9c^2}$; 2) $\frac{16x^2-24xy+9y^2}{9y^2-16x^2}$; 3) $\frac{4x^2-4xy+y^2}{y^2-4x^2}$;

4) $\frac{36c-c^3}{c^3+12c^2+36c}$; 5) $\frac{25b-49b^3}{49b^3-70b^2+25b}$; 6) $\frac{4b^2-12bc+9c^2}{-2ab+3ac}$.

600*. Kasrni qisqartiring:

1) $\frac{2a^5-128a^2}{(2a^2+8a+32)(a^4-4a^3)}$; 3) $\frac{3a^4+ab-6a^2b-2b^3}{9a^5-ab^4-18a^4b+2b^5}$;

2) $\frac{2a^4+3a^3+2a+3}{(a^2-a+1)(2a+3)}$; 4) $\frac{3ac^2+3bc^2-3ab^2-3b^3}{6ac^2+6bc^2-6ab^2-6b^3}$.

601*. Kasrni qisqartiring:

1) $\frac{a^{2n}}{a^n}$; 2) $\frac{b^n}{b^{n-3}}$, $n>m$; 3) $\frac{a^m b^{m+n}}{a^{n-m}b^m}$, $n>m$;

4) $\frac{30a^{2n-1}b^{2n+2}}{25a^{n+2}b^{3n+2}}$, $n>3$ (m, n – natural sonlar).

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602. Hisoblang: $\frac{25{,}5\cdot 42\cdot 0{,}8}{28\cdot 5\cdot 1{,}7}$.

603. Ko'paytuvchilarga ajrating:

1) $5x^2-10xy+5y^2$; 2) $m^2(a-2)+n^2(2-a)$.

604. Hisoblang:

1) $(15\frac{5}{6}-9\frac{25}{27})-(7\frac{2}{9}-5)$; 3) $22\frac{3}{8}-(10\frac{7}{12}+9\frac{13}{16})$;

2) $(17\frac{13}{48}-7\frac{23}{32})+(4-2\frac{7}{12})$; 4) $19\frac{11}{20}-(16\frac{17}{24}+\frac{23}{60})$.

605. Tenglamani yeching:

1) $2x+\frac{6x-5}{7}=\frac{8x+7}{3}$; 3) $2x+1+\frac{2x-1}{6}=\frac{7x-13}{4}$;

2) $\frac{x+5}{24}-\frac{3x-8}{16}=1$; 4) $\frac{3(2x-2{,}5)}{5}-2x+2{,}5=\frac{2-x}{2}$.

25- §. KASRLARNI UMUMIY MAXRAJGA KELTIRISH

Oddiy kasrlarni qo'shishda avval kasrlarni umumiy maxrajga keltirib olinadi. Masalan, $\frac{1}{4}$, $\frac{3}{25}$, $\frac{7}{10}$ kasrlar uchun umumiy maxraj 100 soni bo'ladi, bu son 4, 25, 10 sonlarining eng kichik umumiy karralisidir.

Algebraik kasrlarni qo'shish va ayirishda ham xuddi shunday almashtirishlarni bajarishga to'g'ri keladi, uni ham *kasrlarni umumiy maxrajga keltirish* deyiladi.

1-masala. $\frac{m}{3a^2b}$, $\frac{n}{6ab^2}$ va $\frac{p}{4ac}$ algebraik kasrlarni umumiy maxrajga keltiring.

△ Berilgan kasrlarning umumiy maxraji har bir kasrning maxrajiga bo'linishi kerak. Demak, u 3 ga, 6 ga, 4 ga, ya'ni 12 ga; a^2 ga, a ga va a ga, ya'ni a^2 ga; b ga va b^2 ga, ya'ni b^2 ga; c ga bo'linishi kerak.

Shunday qilib, kasrlarning umumiy maxraji 12, a^2, b^2 va c ko'paytuvchilarni o'z ichiga olishi kerak. Umumiy maxraj sifatida $12a^2b^2c$ ko'paytmani olish lozim bo'ladi. Bu umumiy maxrajni birinchi kasrning maxrajiga bo'lib, uning surat va maxrajini ko'paytirish kerak bo'lgan birhadni topamiz. Bu birhad berilgan *kasrning qo'shimcha ko'paytuvchisi* deyiladi. Birinchi kasr uchun bunday birhad $4bc$ ga teng. Xuddi shunday yo'l bilan ikkinchi va uchinchi kasrlar uchun qo'shimcha ko'paytuvchilarni topamiz: $2a$ va $3ab^2$.

Birinchi, ikkinchi va uchinchi kasrlarning surati va maxrajini mos ravishda $4bc$, $2ac$ va $3ab^2$ ga ko'paytirib, ularni $12a^2b^2c$ umumiy maxrajga keltiramiz:

$$\frac{m}{3a^2b}=\frac{4mbc}{12a^2b^2c},\quad \frac{n}{6ab^2}=\frac{2nac}{12a^2b^2c},\quad \frac{p}{4ac}=\frac{3pab^2}{12a^2b^2c}.$$ ▲

2-masala. Kasrlarni umumiy maxrajga keltiring:

$$\frac{a}{x^2-y^2},\quad \frac{b}{2x^2-4xy+2y^2},\quad \frac{c}{3x^2+6xy+3y^2}.$$

Kasrlarning maxrajini ko'paytuvchilarga ajratamiz:

$$x^2-y^2=(x-y)(x+y);$$

$$2x^2-4xy+2y^2=2(x^2-2xy+y^2)=2(x-y)^2;$$
$$3x^2+6xy+3y^2=3(x^2+2xy+y^2)=3(x+y)^2.$$

Umumiy maxraj berilgan kasrlarning har birining maxrajiga bo'linishi kerak.

Umumiy maxraj birinchi kasrning maxrajiga bo'linishi uchun uning tarkibida $(x-y)(x+y)$ ko'paytma bo'lishi kerak.

So'ngra, umumiy maxraj ikkinchi kasrning maxrajiga bo'linishi kerak va shuning uchun unda $2(x-y)^2$ ko'paytuvchi bo'lishi kerak. Demak, birinchi kasr maxrajiga $2(x-y)$ ko'paytuvchini yozib qo'yish kerak, ya'ni umumiy maxraj tarkibida

$$2(x-y)^2(x+y)$$

ko'paytma bo'lishi lozim.

Umumiy maxraj uchinchi kasrning $3(x+y)^2$ maxrajiga bo'linishi uchun hosil qilingan ko'paytmaga $3(x+y)$ ko'paytuvchini yozib qo'yish kerak. Demak, uchala kasrning umumiy maxraji

$$6(x-y)^2(x+y)^2$$

ga teng bo'ladi.

Kasrlarni umumiy maxrajga keltirish uchun ularning surat va maxrajini qo'shimcha ko'paytuvchilarga ko'paytirish kerak, ular esa umumiy maxrajni har bir kasrning maxrajiga bo'lish yo'li bilan topiladi; berilgan kasrlar uchun ular mos ravishda quyidagilarga teng:

$$6(x-y)(x+y),\ 3(x+y)^2,\ 2(x-y)^2.$$

Demak, berilgan kasrlarni bunday yozib olish mumkin:

$$\frac{a}{x^2-y^2}=\frac{6a(x-y)(x+y)}{6(x-y)^2(x+y)^2};\quad \frac{b}{2x^2-4xy+2y^2}=\frac{3b(x+y)^2}{6(x-y)^2(x+y)^2};$$

$$\frac{c}{3x^2+6xy+3y^2}=\frac{2c(x-y)^2}{6(x-y)^2(x+y)^2}.\ \blacktriangle$$

Shunday qilib, algebraik kasrlarni umumiy maxrajga keltirish uchun:

1) berilgan kasrlarning umumiy maxrajini topish;

2) har bir kasr uchun qo'shimcha ko'paytuvchini topish;

3) har bir kasrning suratini uning qo'shimcha ko'paytuvchisiga ko'paytirish;

4) har bir kasrni topilgan surat va umumiy maxraj bilan yozish kerak.

Mashqlar

Quyidagi mashqlarda kasrlarni umumiy maxrajga keltiring **(606–614):**

606. 1) $\frac{1}{2}$ va $\frac{2}{3}$; 3) $\frac{5}{7}$ va $\frac{3}{14}$; 5) $\frac{x}{2y}$ va $\frac{x}{3y}$;

2) $\frac{1}{a}$ va $\frac{2}{b}$; 4) $\frac{a}{b}$ va $\frac{a}{2b}$; 6) $\frac{8}{15}$ va $\frac{5}{12}$.

607. 1) $\frac{3}{4a}$, $\frac{1}{5b}$ va $\frac{7}{20ab}$; 3) $\frac{7}{a^2}$ va $\frac{8}{a^3}$;

2) $\frac{3x}{4y}$, $\frac{6}{xy}$ va $\frac{4y}{3x}$; 4) $\frac{a}{2x}$ va $\frac{b}{4x^3}$.

608. 1) a va $\frac{b^2}{a}$; 2) $3b$ va $\frac{a^2}{2b}$; 3) a^2 va $\frac{c}{2ab}$; 4) $\frac{b}{3a}$, $\frac{3c}{2b}$ va ab.

609. 1) $\frac{1}{2p^2}$, $\frac{1}{6pk}$ va $\frac{1}{3k^2}$; 3) $\frac{2a}{b^2}$, $\frac{4}{15a^2b}$ va $\frac{3}{20a^3b^4}$;

2) $\frac{1}{6b^2}$, $\frac{a^2+b^2}{9a^2b^2}$ va $\frac{3-a^2}{18ab^2}$; 4) $\frac{7}{20x^4y}$, $\frac{31}{6xy^3}$ va $\frac{4}{3x^2y^4}$.

610. 1) $\frac{3}{x+y}$ va $\frac{5}{x}$; 3) $\frac{7x}{2(x-1)}$ va $\frac{5x}{x-1}$;

2) $\frac{6}{a-1}$ va $\frac{2}{a}$; 4) $\frac{2a^2}{3(a+1)}$ va $\frac{5a^2}{4(a+1)}$.

611. 1) $\frac{1}{x-y}$ va $\frac{1}{x+y}$; 3) $\frac{5x}{2x-2}$ va $\frac{3}{4x-4}$;

2) $\frac{7a}{3x-y}$ va $\frac{6b}{3x+y}$; 4) $\frac{3x}{4x+4y}$ va $\frac{x}{8x+8y}$.

612. 1) $\frac{3b}{b-2}$ va $\frac{4}{b^2-4}$; 3) $\frac{1}{1-a}$, $\frac{2a}{1+a}$ va $\frac{a^2}{1-a^2}$;

2) $\frac{7a}{x^2-9}$ va $\frac{a}{x+3}$; 4) $\frac{6x}{x-y}$, $\frac{7xy}{x+y}$ va $\frac{3}{x^2-y^2}$.

613. 1) $\frac{m+n}{2m-2n}$ va $\frac{n^2+m^2}{m^2-n^2}$; 4) $\frac{5c}{c^2-4c+4}$ va $\frac{6}{c-2}$.

2) $\frac{a-b}{5a+5b}$ va $\frac{a+b}{a^2-b^2}$; 5) $\frac{2p}{q^2-p^2}$ va $\frac{7c}{p-q}$;

3) $\frac{7}{(x-y)^2}$ va $\frac{5}{x-y}$; 6) $\frac{2}{9x^2-1}$ va $\frac{4x}{1-3x}$.

614. 1) $\frac{m}{2m+2n}$, $\frac{n}{8m-8n}$ va $\frac{mn}{6m^2-6n^2}$;

2) $\frac{2c}{5b-5c}$, $\frac{3a^2}{35b^2-35c^2}$ va $\frac{7b}{14b+14c}$;

3) $\frac{1}{a^2-4b^2}$, $\frac{1}{3a^2+6ab}$ va $\frac{1}{2ab-a^2}$;

4) $\frac{5}{4x-4}$, $\frac{4x}{1-x^2}$ va $\frac{1}{3x^2+3x}$.

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615. Hisoblang:

1) $(18\frac{1}{4}-17\frac{5}{6})+(24-23\frac{13}{24})$; 2) $(36\frac{15}{28}-19\frac{17}{21})-(2-1\frac{5}{24})$;

616. Tenglamani yeching:

1) $5(x+3)^2-5(x-4)(x+8)=3x$;

2) $\frac{(2x+5)(x-3)}{2}-x(x+3)=-1$.

26-§. ALGEBRAIK KASRLARNI QO'SHISH VA AYIRISH

Bir xil maxrajli kasrlarni qo'shish va ayirish qoidasini bunday yozish mumkin:

$$\frac{a}{m}+\frac{b}{m}=\frac{a+b}{m} \qquad \frac{a}{m}-\frac{b}{m}=\frac{a-b}{m}$$

1-masala. $\frac{a-b}{a+b}$, $\frac{2a-b}{a+b}$ va $\frac{a-2b}{a+b}$ kasrlarni qo'shing.

△ $\frac{a-b}{a+b}-\frac{2a-b}{a+b}+\frac{a-2b}{a+b}=\frac{a-b+2a-b+a-2b}{a+b}=\frac{4a-4b}{a+b}=\frac{4(a-b)}{a+b}$ ▲

2-masala. $\frac{a^2}{a+b}$ va $\frac{b^2}{a+b}$ kasrlarning ayirmasini toping.

△ $\frac{a^2}{a+b}-\frac{b^2}{a+b}=\frac{a^2-b^2}{a+b}=\frac{(a-b)(a+b)}{a+b}=a-b$. ▲

Har xil maxrajli kasrlarni qo'shish va ayirish uchun bu kasrlarni umumiy maxrajga keltirish va bir xil maxrajli kasrlarni qo'shish yoki ayirish qoidasidan foydalanish kerak.

3-masala. $\frac{1}{a^3}$, $\frac{1}{2a^2b}$ va $\frac{1}{3ab^2}$ kasrlarni qo'shing.

△ Berilgan kasrlarning umumiy maxraji $6a^3b^2$ ko'paytma bo'ladi. Demak,

$$\frac{1}{a^3}+\frac{1}{2a^2b}+\frac{1}{3ab^2}=\frac{6b^2}{6a^3b^2}+\frac{3ab}{6a^3b^2}+\frac{2a^2}{6a^3b^2}=\frac{6b^2+3ab+2a^2}{6a^3b^2}. \blacktriangle$$

4-masala. $\frac{a}{3b^2c}$ va $\frac{c}{15ab^2}$ kasrlarning ayirmasini toping.

△ $\frac{a}{3b^2c}-\frac{c}{15ab^2}=\frac{5a^2}{15ab^2c}-\frac{c^2}{15ab^2c}=\frac{5a^2-c^2}{15ab^2c}$. ▲

5-masala. $\frac{1}{x^2-x}$ va $\frac{3}{x^2-1}$ kasrlarni qo'shing.

△ Kasrlarning maxrajlarida turgan ko'pxadlarni ko'paytuvchilarga ajratamiz:

$$x^2-x=x(x-1),\ x^2-1=(x-1)(x+1). \blacktriangle$$

Kasrlarning umumiy maxraji $x(x-1)(x+1)$ ko'paytma bo'ladi. Kasrlarni umumiy maxrajga keltirib, topamiz:

$$\frac{1}{x^2-x}+\frac{3}{x^2-1}=\frac{1}{x(x-1)}+\frac{3}{(x-1)(x+1)}=\frac{x+1}{x(x^2-1)}+\frac{3x}{x(x^2-1)}=$$

$$=\frac{x+1+3x}{x(x^2-1)}=\frac{4x+1}{x(x^2-1)}. \blacktriangle$$

Shunday qilib, turli maxrajli kasrlarni qo'shish va ayirishni ushbu tartibda bajarish mumkin:

1) kasrlarning umumiy maxraji topiladi;
2) kasrlarni umumiy maxrajga keltiriladi;
3) hosil bo'lgan kasrlarni qo'shiladi;
4) mumkin bo'lsa, natijani soddalashtiriladi.

6-masala. $\frac{1}{a^2+4a+4}-\frac{4}{a^4+4a^3+4a^2}+\frac{4}{a^3+2a^2}$ ifodaning son qiymatini $a=0,5$ bo'lganda hisoblang.

△ Berilgan ifodani quyidagicha almashtirish mumkin:

$$\frac{1}{(a+2)^2}-\frac{4}{a^2(a^2+4a+4)}+\frac{4}{a^2(a+2)}=\frac{1}{(a+2)^2}-\frac{4}{a^2(a+2)^2}+$$

$$+\frac{4}{a^2(a+2)}=\frac{a^2-4+4(a+2)}{a^2(a+2)^2}=\frac{a^2+4a+4}{a^2(a+2)^2}=\frac{1}{a^2}.$$

Demak, izlanayotgan son qiymat: $\frac{1}{0,5^2}=\frac{1}{0,25}=\frac{100}{25}=4.$ ▲

Kasrlarning yig'indisini (ayirmasini) toping **(617–625)**:

617. (Og'zaki.)

1) $\frac{2}{3}+\frac{1}{3}$; 3) $\frac{5}{9}+\frac{7}{9}$; 5) $\frac{2}{7}-\frac{b}{7}$;

2) $\frac{5}{7}-\frac{2}{7}$; 4) $\frac{a}{6}+\frac{1}{6}$; 6) $\frac{b}{8}+\frac{3a}{8}$.

618. (Og'zaki.)

1) $\frac{5c}{11}+\frac{3c}{11}$; 3) $\frac{7}{c}+\frac{1}{c}$; 5) $\frac{2a}{17}-\frac{5a}{17}+\frac{a}{17}$;

2) $\frac{2a}{13}-\frac{a}{13}$; 4) $\frac{2}{3a}+\frac{7}{3a}$; 6) $\frac{3m}{7}+\frac{2n}{7}-\frac{m}{7}$.

619. 1) $\frac{p}{q^2}+\frac{3p}{q^2}$; 2) $\frac{8a}{b^3}-\frac{3a}{b^3}$; 3) $\frac{a}{a+b}+\frac{c}{a+b}$; 4) $\frac{x}{n+a}-\frac{y}{n+a}$.

620. 1) $\frac{c+d}{2a}+\frac{2c-d}{2a}$; 3) $\frac{a+b}{2c}-\frac{a-b}{2c}$; 5) $\frac{(1+b)^2}{5d}+\frac{(1-b)^2}{5d}$;

2) $\frac{a+2b}{3c^2}+\frac{5a-2b}{3c^2}$; 4) $\frac{10a-b}{a^3}-\frac{3a-b}{a^3}$; 6) $\frac{(2+a)^2}{a^2b}-\frac{(2-a)^2}{a^2b}$.

621. 1) $\frac{2}{5}+\frac{3}{7}$; 3) $\frac{2}{3a}+\frac{1}{a}$; 5) $\frac{c}{15a}+\frac{d}{3}$;

2) $\frac{4}{7}-\frac{5}{28}$; 4) $\frac{1}{b}-\frac{2}{5b}$; 6) $\frac{a}{4}-\frac{b}{12d}$.

622. 1) $\frac{m}{2}-\frac{1}{n}$; 2) $\frac{3}{a}+\frac{b}{5}$; 3) $5-\frac{1}{a}$; 4) $\frac{2}{b}+7$.

623. 1) $5-\frac{2}{b}+\frac{3}{b^2}$; 2) $\frac{2}{c}+4-\frac{3}{c^2}$; 3) $d-\frac{c}{d}+\frac{c^2}{d^2}$; 4) $\frac{m}{n}-k+\frac{m^2}{n^2}$.

624. 1) $\frac{1}{ab}+\frac{1}{bc}$; 3) $\frac{a}{bc}-\frac{a}{bd}$; 5) $\frac{3}{m^2}+\frac{4}{mn}$;

2) $\frac{1}{mn}-\frac{1}{mk}$; 4) $\frac{b}{ac}+\frac{b}{cd}$; 6) $\frac{2}{mn}-\frac{3}{n^3}$.

625. 1) $\frac{3c}{4a^3b}+\frac{5d}{6ab^3}$; 3) $\frac{2}{3y^3}-\frac{1}{6x^2y}+\frac{5}{12xy^2}$; 5) $\frac{a}{b^2}+\frac{b}{c^2}+\frac{c}{a^2}$;

2) $\frac{2a}{9b^4}-\frac{7c}{6a^3b}$; 4) $\frac{5}{7x^2y}-\frac{3}{4xy^2}+\frac{11}{14x^2y^2}$; 6) $\frac{b}{c}+\frac{b}{c^2d}+\frac{b}{cd^2}$

626. Tenglamani yeching:

1) $\frac{4x-3}{2}-\frac{5-2x}{3}-\frac{3x-4}{3}=5$;

2) $2x+\frac{3x-1}{2}-\frac{5x-2}{3}=2$;

3) $\frac{8x+7}{6}-\frac{5x-2}{2}=3-\frac{3-2x}{4}$;

4) $\frac{4z}{3}-17+\frac{3z-17}{4}=\frac{z+5}{2}$.

627. Amallarni bajaring:

1) $\frac{5(2a-b)}{8}-\frac{3(a-4b)}{2}+\frac{7(a-b)}{6}$; 2) $\frac{(x+y)^2}{6}+\frac{(x-y)^2}{12}-\frac{x^2-y^2}{4}$;

3) $\frac{(2x-y)^2}{6x}-\frac{(2x+2y)^2}{9y}+1$;

4) $2x-\frac{2(x-2y)}{5}+\frac{3(x-y)}{2}-3y$;

5) $\frac{2x^2-m^2}{2mx}+m-\frac{2x+m}{x}$.

6) $1+a-\frac{a-1}{a}+\frac{a^2-1}{2a}-\frac{3a}{2}$;

Algebraik kasrlarni qo'shing va ayiring **(628–641)**:

628. 1) $\frac{2x}{3(a-b)}+\frac{x}{a-b}$;

2) $\frac{7x}{2(x-1)}-\frac{5x}{x-1}$;

3) $\frac{2a^2}{3(a+1)}+\frac{5a^2}{4(a+1)}$;

4) $\frac{4y}{5(y-3)}-\frac{5x}{2(y-3)}$.

629. 1) $\frac{5}{2x-2}+\frac{3}{4x-4}$;

2) $\frac{7}{5b+5}-\frac{3}{10b+10}$;

3) $\frac{a}{3a+3b}-\frac{2a}{6a+6b}$;

4) $\frac{3x}{4x+4y}-\frac{x}{8x+8y}$.

630. 1) $\frac{3}{a^2+a}+\frac{5a}{ab+b}$;

2) $\frac{5b}{ax+ay}-\frac{2a}{bx+by}$;

3) $\frac{y+a}{b^2+ba}+\frac{y-b}{ab+a^2}$;

4) $\frac{y-b}{a^2-ab}-\frac{y-a}{ab-b^2}$.

631. 1) $\frac{4}{x-3}-\frac{5}{x+3}$;

2) $\frac{3x}{2x-1}+\frac{5x}{2x+1}$;

3) $\frac{a-2}{a+2}+\frac{a+2}{a-2}$;

4) $\frac{a-y}{a-b}+\frac{b-y}{a+b}$;

5) $\frac{b}{1-a^2}+\frac{b}{a^2+1}$;

6) $\frac{b}{a^3+1}+\frac{b}{a^3-1}$.

632. 1) $\frac{3}{x+y}-\frac{5}{x}$;

2) $\frac{6}{a}-\frac{10}{a-1}$;

3) $\frac{x}{x(x-3)}+\frac{1}{x(x+3)}$;

4) $\frac{4}{5(a-b)}-\frac{7}{8(a+b)}$.

633. 1) $\frac{a}{1-b^2}+\frac{1}{1+b}$;

2) $\frac{2}{x^2-9}+\frac{1}{x+3}$;

3) $\frac{5+p^2}{p^2-36}-\frac{p}{6+p}$;

4) $\frac{2x}{x-4}-\frac{5x-2}{x^2-16}$.

634. 1) $\frac{2x}{x-4}-\frac{5x-2}{16-x^2}$;

2) $\frac{12n-5}{n^2-49}+\frac{6}{7-n}$;

3) $\frac{c^2-8}{2c+3}-\frac{16c-2c^3}{9-4c^2}$;

4) $\frac{21y^2+1}{1-9y^2}-\frac{y}{3y-1}$.

635. 1) $\frac{3}{a+2}+\frac{2a}{(a+2)^2}$;

2) $\frac{a}{(3a+1)^2}+\frac{4}{3a+1}$.

636. 1) $\frac{2y+8}{y^2-4y+4}-\frac{7}{y-2}$;

2) $\frac{4-5x}{1+6x+9x^2}-\frac{2}{3x+1}$;

3) $\frac{7}{(a-b)^2}-\frac{5}{b-a}$;

4) $\frac{4}{(m-n)^2}-\frac{7}{n-m}$;

5) $\frac{2a}{25-10a+a^2}+\frac{10}{a^2-25}$;

6) $\frac{1}{x^2-6x+9}+\frac{1}{(x+3)^2}$.

637. 1) $\frac{7a-1}{2a^2+6a}+\frac{5-3a}{a^2-9}$;

2) $\frac{6}{3x+3y}+\frac{8x}{4x^2-4y^2}$;

3) $\frac{3a-b}{a^2-b^2}-\frac{a}{a^2-ab}$;

4) $\frac{3a}{4a^2-1}-\frac{a+1}{2a^2+a}$;

5) $\frac{b-1}{(b+3)^2}-\frac{b}{b^2-9}$;

6) $\frac{a-3}{a^2-4}-\frac{a}{(a-2)^2}$.

638. 1) $a+\frac{a}{a-1}$; 2) $b-\frac{b}{b-2}$; 3) $c+1-\frac{c^2}{c-1}$; 4) $\frac{a^2}{a+1}-a+1$.

639. 1) $\frac{7}{a+b}+\frac{8}{a-b}-\frac{16b}{a^2-b^2}$;

2) $\frac{6x}{x^2-y^2}-\frac{3}{x-y}-\frac{4}{x+y}$;

3) $\frac{3}{a+3}+\frac{2}{3-a}-\frac{6}{a^2-9}$;

4) $\frac{3}{4a^2-9}-\frac{8}{2a+3}-\frac{7}{3-2a}$.

640. 1) $\frac{a+b}{a}-\frac{a}{a-b}-\frac{b}{a^2-ab}$;

2) $\frac{5b-1}{3b^2-3}+\frac{b+2}{2b+2}-\frac{b+1}{b-1}$;

3) $\frac{6a}{9a^2-1}+\frac{3a+1}{3-9a}+\frac{3a-1}{6a+2}$;;

4) $\frac{7}{m}-\frac{4}{m-2n}-\frac{m-n}{4n^2-m^2}$;

5) $x-\frac{xy}{x+y}-\frac{x^3}{x^2-y^2}$;

6) $a-2+\frac{4a}{2+a}-\frac{a^3+b}{a^2+2a}$.

641. 1) $\frac{a+1}{a^3-1}-\frac{1}{a^2+a+1}$;

2) $\frac{a^2+4}{a^3+8}-\frac{1}{a+2}$;

3) $\frac{a+b}{a^2-ab+b^2}-\frac{1}{a+b}$;

4) $\frac{m^2-3m+9}{m^3-27}-\frac{1}{m-3}$.

642. Ifodani soddalashtirib, so'ngra son qiymatini toping:

1) $\frac{8a^2}{a^3-1}+\frac{a+1}{a^2+a+1}$, bunda $a=2$;

2) $\frac{3c^2-c+3}{c^3-1}-\frac{c-1}{c^2+c+1}+\frac{2}{1-c}$, bunda $c=1\frac{1}{2}$.

643. Ifodani avval ko'paytuvchilarga ajratib, so'ngra son qiymatini toping:

1) $2x^2-2y^2$, bunda $x=21\frac{1}{3}$, $y=\frac{1}{3}$;

2) $5a^2-10ab+5b^2$, bunda $a=5\frac{2}{3}$, $b=3\frac{13}{15}$.

644. Tenglamani yeching:

1) $(2x-5)(2x+5)-(8x^2+5x):2=0$;

2) $(3x+1)^2-(18x^2-12x):2=13$.

645. Ifodaning qiymatini toping:

1) $5\frac{1}{6}:31+(3\frac{1}{4}+2\frac{1}{6}):2\frac{3}{5}$; 2) $5\frac{1}{8}\cdot\frac{16}{41}\cdot5\frac{1}{2}+(\frac{3}{17}+\frac{4}{5})\cdot1\frac{2}{83}$.

646. $1\frac{7}{11}$ va $3\frac{2}{3}$ sonlari ko'paytmasini $4\frac{1}{6}$ ga ko'paytiring.

647. Proportsiyaning noma'lum hadini toping:

1) $x:3\frac{11}{13}=10,5:3\frac{3}{4}$; 2) $\frac{25,6}{2,4}=\frac{5\frac{1}{3}}{x}$.

27- §. ALGEBRAIK KASRLARNI KO'PAYTIRISH VA BO'LISH

Algebraik kasrlarni ko'paytirish va bo'lish ham oddiy kasrlarni ko'paytirish va bo'lish qoidalari bo'yicha bajariladi:

$$\frac{a}{b}\cdot\frac{c}{d}=\frac{ac}{bd} \qquad \frac{a}{b}:\frac{c}{d}=\frac{ad}{bc}$$

1 - m a s a l a . Kasrlarni ko'paytiring:

$$\frac{1}{2xy},\ \frac{4x^2y^3}{5z}\ \text{va}\ \frac{10z^2}{3x^3}.$$

$$\triangle\ \frac{1}{2xy}\cdot\frac{4x^2y^3}{5z}\cdot\frac{10z^2}{3x^3}=\frac{1\cdot4x^2y^3\cdot10z^2}{2xy\cdot5z\cdot3x^3}=\frac{4y^2z}{3x^2}.\ \blacktriangle$$

2-masala. $\frac{a-b}{a^2+ab}$ va $\frac{b^2+ab}{(a-b)^2}$ kasrlarni ko'paytiring.

△ Ko'paytuvchilarga ajratib, topamiz:

$$\frac{a-b}{a^2+ab}\cdot\frac{b^2+ab}{(a-b)^2}=\frac{(a-b)(b^2+ab)}{a(a+b)(a-b)^2}=\frac{b}{a(a-b)}.$$ ▲

3-masala. $\frac{m+n}{9m^2n^3}$ va $\frac{m^2-n^2}{27mn^2}$ kasrlarni bo'ling.

△ $\frac{m+n}{9m^2n^3}\cdot\frac{m^2-n^2}{27mn^2}=\frac{(m+n)27mn^2}{9m^2n^3(m^2-n^2)}=$

$$=\frac{(m+n)27mn^2}{9m^2n^3(m-n)(m+n)}=\frac{3}{mn(m-n)}.$$ ▲

Algebraik kasrni darajaga ko'tarishda ushbu formuladan foydalaniladi:

$$\left(\frac{a}{b}\right)^n=\frac{a^n}{b^n}$$

Masalan:

$$\left(\frac{4a^2}{b}\right)^2=\frac{16a^4}{b^2},\ \left(\frac{a+b^3}{3c}\right)^3=\frac{(a+b)^9}{27c^3}.$$

Mashqlar

(Og'zaki.) Kasrlarni ko'paytiring **(648–649)**:

648. 1) $\frac{1}{2}\cdot\frac{3}{7}$; 3) $\frac{a}{5}\cdot\frac{6}{7}$; 5) $\frac{13}{18}\cdot\frac{c}{26}$;

2) $\frac{5}{11}\cdot\frac{2}{3}$; 4) $\frac{4}{b}\cdot\frac{1}{2}$; 6) $\frac{7}{12}\cdot\frac{36}{a}$.

649. 1) $\frac{7}{16}\cdot\frac{16}{7}$; 3) $\frac{2a}{5c}\cdot\frac{a}{3c}$; 5) $\frac{4c}{d}\cdot\frac{2n}{5p}$;

2) $\frac{x}{y}\cdot\frac{y}{x}$; 4) $\frac{5b}{m}\cdot\frac{m^2}{10b}$; 6) $\frac{8}{3x}\cdot\frac{x^3}{4y^2}$.

Kasrlarni ko'paytiring **(650–651)**:

650. 1) $\frac{85}{24}\cdot\frac{72}{17}$; 2) $\frac{256}{169}\cdot\frac{13}{64}$; 3) $50\cdot\frac{7}{625}$; 4) $\frac{5}{26}\cdot 39$.

651. 1) $\frac{a^3b}{c} \cdot \frac{c^2}{a^4}$; 3) $\frac{6a}{5b} \cdot \frac{15c}{2d}$; 5) $\frac{2a}{3b} \cdot 3c$;

2) $\frac{m^2n^2}{k} \cdot \frac{k^3}{m^3n^3}$; 4) $\frac{4m}{9n} \cdot \frac{27k}{16d}$; 6) $14a^2 \cdot \frac{b^2}{7c^3}$.

652. Kasrlarni bo'ling:

1) $\frac{3}{5} : \frac{3}{7}$; 3) $\frac{a}{8} : \frac{1}{3}$; 5) $\frac{2}{a} : \frac{6}{7}$;

2) $\frac{11}{12} : \frac{2}{5}$; 4) $\frac{6}{c} : \frac{m}{13}$; 6) $\frac{9}{35} : \frac{b}{5}$.

653. Kasrlarni bo'ling:

1) $\frac{8}{17} : \frac{8}{17}$; 3) $\frac{3a}{7b} : \frac{m}{n}$; 5) $\frac{2a}{3b} : \frac{a^2}{bc}$;

2) $\frac{a}{b} : \frac{a}{b}$; 4) $\frac{c}{2d}$; 6) $\frac{5m}{n^2} : \frac{10m^3}{n}$.

654. Kasrlarni bo'ling:

1) $\frac{17}{12} : \frac{34}{39}$; 3) $\frac{4}{13} : 5$; 5) $12 : \frac{8}{9}$;

2) $\frac{54}{25} : \frac{81}{75}$; 4) $\frac{a}{b} : c$; 6) $a : \frac{b}{c}$.

655. Kasrlarni bo'ling:

1) $\frac{a^2b}{c} : \frac{a^4}{c^2}$; 3) $\frac{4a}{5b} : \frac{12c}{25d}$; 5) $\frac{6a}{5b} : (5c)$;

2) $\frac{mn}{k} : \frac{m^2n^2}{k^3}$; 4) $\frac{8m}{9n} : \frac{16k}{27d}$; 6) $12a^2 : \frac{4d}{5c^2}$.

Ko'rsatilgan amallarni bajaring **(655–662):**

656. 1) $(\frac{5a}{7b})^2 \cdot \frac{14b^2}{25a^3}$; 3) $\frac{2a^2}{5b^2} : \frac{12a^2}{15b^2}$; 5) $(\frac{ab}{cd})^2 acd$;

2) $(\frac{3a^2}{2b})^3 \cdot \frac{16b^3}{21a^4}$; 4) $\frac{3a^3}{7b} : \frac{9a^4}{21b}$; 6) $abc^2 (\frac{ab}{cd})^2$.

657. 1) $\frac{8a^2b}{9c} \cdot \frac{36c^3}{5a^3b}$; 3) $\frac{16x^2y}{7z} : \frac{20xy^3}{21z^2}$; 5) $\frac{18m^3n^5}{7k} : (9n^2)$;

2) $\frac{7b^4}{9c^5y} : \frac{35b^4c^2}{18c^4y^2}$; 4) $\frac{46d^3c}{15a} : \frac{23dc^2}{5a^3}$; 6) $24k^2 : \frac{12m^4k^2}{11p^3n}$.

658. 1) $\frac{3x^2y}{4a^2b} \cdot 4a^2b$; 3) $15xy : \frac{30xy}{7a^2b}$;

2) $\frac{5a^2b}{7xy^2} \cdot 14xy^2$; 4) $\frac{7x^2y}{2a^2b} : (14x^2y)$.

659. 1) $\frac{7-x}{a+b}\cdot\frac{a-b}{7-x}$; 3) $\frac{c+d}{c-d}:\frac{c}{c-d}$; 5) $\frac{a^2-ab}{b}\cdot\frac{b}{a}$;

2) $\frac{x-y}{2a}\cdot\frac{4b}{x-y}$; 4) $\frac{a-b}{2b}:\frac{a-b}{6b^2}$; 6) $\frac{ab+b^2}{9}:\frac{b^2}{3a}$.

660. 1) $\frac{a+1}{b}\cdot\frac{4b^2}{a^2-1}$; 3) $\frac{a^2-b^2}{9b^2}:\frac{a+b}{3b}$; 5) $\frac{3(x+y)}{4y^2(x^2+y^2)}\cdot\frac{x^2+y^2}{x^2-y^2}$;

2) $\frac{1-a}{3b^2}\cdot\frac{b^3}{1-a^2}$; 4) $\frac{5m}{m^2-n^2}:\frac{15m^3}{m-n}$; 6) $\frac{5(a-b)}{3(a^2+b^2)}:\frac{(a-b)^2}{a^2+b^2}$.

661. 1) $\frac{a^2-b^2}{3a+3b}\cdot\frac{3a^2}{5b-5a}$; 4) $\frac{3n^2-3m^2}{n^2+np}\cdot\frac{6m-6n}{n+p}$;

2) $\frac{5x^2-5y^2}{x^2+y^2}\cdot\frac{3x^2}{10y-10x}$; 5) $\frac{a^2+b^2}{x^3+x^2y}\cdot\frac{x^2-y^2}{a^4-b^4}$;

3) $\frac{a^2-25}{a^2-3a}:\frac{a+5}{9-a^2}$; 6) $\frac{a^2+b^2}{a^2-ab}:\frac{a^4b-b^5}{a^2b-ab^2}$.

662. 1) $\frac{a-5}{a^2+6a+9}:\frac{(a+3)^2}{a^2-25}$; 3) $\frac{a^2-49}{a^2+2ab+b^2}\cdot\frac{a+b}{a-7}$;

2) $\frac{b^2-8b+16}{b+3}:\frac{(b-4)^2}{b^2-9}$; 4) $\frac{a^2-2a+1}{2a+1}:\frac{a-1}{4a^2-1}$.

663. Hisoblang:

1) $\frac{(23,86-23,56)\cdot\frac{3}{4}}{4\cdot0,9\cdot0,125}$; 2) $(17\frac{1}{3}:19\frac{1}{2}+1\frac{1}{12})\cdot3+3\frac{7}{12}$.

664. Ko'paytuvchilarga ajrating:

1) $(x+1)^2-1$; 2) $x^2-2x+1-x^4$; 3) $4+4x+x^2-(3x^2-12)$.

665. Tenglamani yeching: $a(a^2+a+1)-(a-1)(a+1)a=a^2$.

28- §. ALGEBRAIK KASRLAR USTIDA BIRGALIKDA BAJARILADIGAN AMALLAR

Algebraik kasrlar ustida birgalikda bajariladigan amallarga doir misollar ko'ramiz.

1 - m a s a l a . Ifodani soddalashtiring:

$$\left(\frac{a+1}{2a-2}-\frac{1}{2a^2-2}\right)\cdot\frac{2a+2}{a+2}.$$

△ Qavs ichidagi ifodalarni soddalashtiring:

$$\frac{a+1}{2a-2}-\frac{1}{2a^2-2}=\frac{a+1}{2(a-1)}-\frac{1}{2(a^2-1)}=$$

$$=\frac{(a+1)^2-1}{2(a^2-1)}=\frac{(a+1-1)(a+1+1)}{2(a^2-1)}=\frac{a(a+2)}{2(a+1)(a-1)}.$$

Ko'paytmani topamiz:

$$\frac{a(a+2)}{2(a+1)(a-1)}\cdot\frac{2a+2}{a+2}=\frac{a(a+2)2(a+1)}{2(a+1)(a-1)(a+2)}=\frac{a}{a-1}.$$ ▲

2-masala. Ko'rsatilgan amallarni bajaring:

$$\left(\frac{a+b}{a-b}-\frac{a-b}{a+b}\right):\left(\frac{a+b}{a-b}-1\right);$$

△ Birinchi qavs ichidagi amalni bajaramiz:

$$\frac{a+b}{a-b}-\frac{a-b}{a+b}=\frac{(a+b)^2-(a-b)^2}{(a-b)(a+b)}=\frac{(a+b+a-b)(a+b-a+b)}{a^2-b^2}=$$

$$=\frac{2b\cdot 2a}{a^2-b^2}=\frac{4ab}{a^2-b^2}.$$

Ikkinchi qavs ichidagi amalni bajaramiz:

$$\frac{a+b}{a-b}-1=\frac{a+b-a+b}{a-b}=\frac{2b}{a-b}.$$

Bo'lamiz:

$$4)\ \frac{4ab}{a^2-b^2}:\frac{2b}{a-b}=\frac{4ab(a-b)}{(a^2-b^2)\cdot 2b}=\frac{2a}{a+b}.$$ ▲

3-masala. Hovuz birinchi quvur orqali a soatda, ikkinchisi orqali b soatda to'ladi. Agar bir vaqtda ikkala quvurni ochib qo'yilsa, hovuz necha soatda to'ladi?

△ Hovuzning hajmi V bo'lsin, deylik. Bir soatda birinchi quvur $\frac{V}{a}$ ga teng hajmni, ikkinchisi $\frac{V}{b}$ ga teng hajmni to'ldiradi, ikkala quvur esa bir soatda $\frac{V}{a}+\frac{V}{b}$ ga teng hajmni to'ldiradi. Qidirilayotgan vaqt t bo'lsin. t soatda ikkala quvur hovuzni butunlay to'ldirishi kerak, ya'ni

$$\left(\frac{V}{a}+\frac{V}{b}\right)\cdot t=V.$$

Tenglikning ikkala qismini V ga bo'lib,

$$(\frac{1}{a}+\frac{1}{b})\cdot t=1$$

ni hosil qilamiz. Qavs ichida turgan kasrlarning yig'indisi $\frac{a+b}{ab}$ ga teng. Shuning uchun $\frac{a+b}{ab}\cdot t=1$, bundan $t=\frac{ab}{a+b}$. ▲

Mashqlar

666. Amallarni bajaring:

1) $(5\frac{1}{2}-2\frac{1}{4})\cdot\frac{8}{39}$;
2) $(5{,}5-3\frac{3}{4}):\frac{7}{16}$;
3) $(\frac{3}{4}-\frac{1}{2})\cdot(\frac{5}{7}-\frac{5}{14})$;
4) $(\frac{7}{8}+1)(1-\frac{7}{8})$;
5) $\frac{1}{4}+\frac{4}{5}:\frac{8}{45}$;
6) $\frac{20}{27}:5+25:\frac{5}{8}+\frac{4}{9}:\frac{3}{5}$.

Ko'rsatilgan amallarni bajaring **(667–673):**

667. 1) $(\frac{a}{2}-\frac{a}{3})\cdot\frac{1}{a^2}$; 3) $\frac{a+b}{a-b}(\frac{a}{5}+\frac{b}{5})$; 5) $1:(1\frac{1}{a})$;
2) $\frac{a^2}{3}(\frac{2}{a}+\frac{2}{a^2})$; 4) $\frac{ab}{a-b}(\frac{1}{b}-\frac{1}{a})$; 6) $b:(b+\frac{1}{b})$.

668. 1) $(1+\frac{1}{a}):(1-\frac{1}{a})$; 3) $(\frac{b}{a}+\frac{a}{b}-2):(\frac{1}{b}-\frac{1}{a})$;
2) $(a+\frac{a}{b})(a-\frac{a}{b})$; 4) $(\frac{m}{n}+\frac{n}{m}+2)(1+\frac{m-n}{m+n})$.

669. 1) $(1-\frac{a-b}{a+b})(2+\frac{2b}{a-b})$; 3) $(\frac{6}{a-b}-\frac{5}{a+b})\cdot\frac{a-b}{a+11b}$;
2) $(1+\frac{a+b}{a-b})(2-\frac{2a}{a+b})$; 4) $(\frac{3}{c}+\frac{3}{c+d})\cdot\frac{c}{18(2c+d)}$.

670. 1) $(\frac{2m+1}{2m-1}-\frac{2m-1}{2m+1}):\frac{4m}{10m-5}$; 3) $\frac{y-1}{y}:(\frac{y^2+1}{y^2+2y}-\frac{2}{y+2})$;
2) $(\frac{z+6}{3z+9}-\frac{1}{z+3}):\frac{z+2}{27z}$; 4) $\frac{m-2}{m-5}:(\frac{m^2+24}{m^2-25}-\frac{4}{m-5})$.

671. 1) $\frac{a^2+ab}{a^2+b^2}(\frac{a}{a-b}-\frac{b}{a+b})$; 3) $(\frac{c+d}{c})\cdot\frac{d-c}{c^2+d^2}$;
2) $\frac{ab-b^2}{a^2+b^2}(\frac{a}{a+b}+\frac{b}{a-b})$; 4) $(\frac{2c}{c+d}+\frac{d-c}{c})\cdot\frac{c+d}{c^2+d^2}$.

672. 1) $\left(\frac{a+1}{2a-2}+\frac{6}{2a^2-2}-\frac{a+3}{2a+2}\right)\cdot\frac{4a^2-4}{3}$;

2) $\left(\frac{b}{a^2+ab}+\frac{2}{a+b}+\frac{a}{b^2+ab}\right):\frac{a^2-b^2}{4ab}$;

3) $\frac{a^2-c^2}{a+d}\cdot\frac{a^2-b^2}{ac+c^2}\cdot\left(a+\frac{ac}{a-c}\right)$; 4) $\frac{c^2-ac}{a^2-b^2}\cdot\frac{a-b}{c^2-a^2}:\left(c-\frac{ac}{a+c}\right)$.

673. 1) $\frac{a^2+2a+1}{b^2-4}\cdot\frac{b+2}{a+b}-\frac{a}{b+2}$; 2) $\frac{a^2-2a+1}{b-2}:\frac{a^2-1}{b^2-4}-\frac{2a-b}{a+1}$;

3) $\left(\frac{(a+1)^2}{a^2-1}-1\right)\left(1-\frac{a}{a+1}\right)$;

4) $\left(\frac{x^2}{x+y}-\frac{x^3}{x^2+2xy+y^2}\right):\left(\frac{x}{x+y}-\frac{x^2}{x^2-y^2}\right)$.

674. Hajmi V bo'lgan muz bo'lagining massasi p kilogrammga teng. Hajmi V_1 bo'lgan bo'lakning massasi nimaga teng?

675. Avtomobil soatiga v km tezlik bilan harakat qilib, s kilometr yo'l bosib o'tdi. Agar mototsiklchining tezligi soatiga u kilometr bo'lsa, shu vaqt ichida u qancha yo'l bosib o'tadi?

676. Motorli qayiqning turg'un suvdagi tezligi soatiga v kilometr, daryo oqimining tezligi esa v_1 kilometr. Qayiq oqim bo'yicha harakat qilib, s kilometr o'tdi. Motorli qayiq oqimga qarshi shu vaqt ichida qancha masofa bosib o'tadi?

677. (Qadimiy masala.) Ikki buyumdan birining 10 tasi bir dinor va ikkinchisining 15 tasi bir dinor. Bir dinorga ikkala buyumdan bir xil miqdorda necha donadan sotib olish mumkin?

---

678. Proporsiyaning noma'lum hadini toping:

1) $\frac{x}{36}=\frac{14}{42}$; 3) $\frac{3,5}{a}=\frac{0,01}{4}$; 4) $3,75:10,4=3\frac{11}{13}:p$;

2) $\frac{0,4}{5}=\frac{2,4}{x}$; 5) $\frac{2}{7}=\frac{x}{14}$; 6) $x:2\frac{1}{12}=15:14\frac{1}{2}$.

679. Proroporsiyadan noma'lum x ni toping:

1) $\frac{a}{x}=\frac{2b}{3}$; 2) $\frac{4a}{3b}=\frac{2x}{a}$; 3) $\frac{x}{a+b}=\frac{a}{(a+b)^2}$; 4) $\frac{a+1}{a-1}=\frac{a^2-1}{ax}$.

680. Amallarni bajaring:

1) $(\frac{a}{a-b}-\frac{a^3}{a^3-b^3})(a^2+ab+b^2)$;

2) $(\frac{x^2}{y^2}+\frac{y}{x}):(\frac{x^2}{y^2}-\frac{1}{y}+\frac{1}{x})$; 3) $(1+\frac{a}{b}+\frac{a^2}{b^2})(1-\frac{a}{b})\cdot\frac{b^2}{a^3-b^3}$;

4) $(\frac{a^2+b^2}{a}+b):((\frac{1}{a^2}+\frac{1}{b^2})\cdot\frac{a^3-b^3}{a^2+b^2})$.

681. Tenglamani yeching:

1) $\frac{3(x-11)}{4}=\frac{3(x+1)}{5}-\frac{2(2x-5)}{11}$);

2) $\frac{2(5x+2)}{9}-1=\frac{4(33+2x)}{5}-\frac{5(1-11x)}{9}$;

3) $\frac{8(x+10)}{15}-24\frac{1}{2}=\frac{7x}{10}-\frac{2(11x-5)}{5}$;

4) $\frac{2(x-4)}{3}+\frac{3x+13}{8}=\frac{3(2x-3)}{5}-7$.

V bobga doir mashqlar

Kasrlarni umumiy maxrajga keltiring **(682–683)**:

682. 1) $\frac{5a}{a^3-27}$, $\frac{a-3}{a^2+3a+9}$ va $\frac{1}{a-3}$; 2) $\frac{3}{x+2}$, $\frac{x+1}{x^3+8}$ va $\frac{x+2}{x^2-2x+4}$.

683. 1) $\frac{5x}{x^2-4}$, $\frac{3x+y}{x^2+4x+4}$ va $\frac{y-x}{x^2-4x+4}$;

2) $\frac{3a}{2a-3}$, $\frac{4a}{2a+3}$ va $\frac{5b}{4a^2c-9c}$;

3) $\frac{4b}{b^2-2bc+c^2}$, $\frac{2a}{c-b}$ va $\frac{1}{4ac+4ab}$;

4) $\frac{1}{4x^2-9y^2}$, $\frac{1}{4x^2y+12xy^2+9y^3}$ va $\frac{1}{3y-2x}$;

5) $\frac{c-b}{8bc+16c^2}$, $\frac{c+b}{2bc}$ va $\frac{1}{b^2c+4bc^2+4c^3}$;

6) $\frac{2x}{y^3-x^3}$, $\frac{3}{x^2y-xy^2}$ va $\frac{1}{x^2y+xy^2+y^3}$.

Kasrlarning yig'indisini (ayirmasini) toping **(684–685)**:

684. 1) $\frac{a+3}{5}+\frac{7+a}{10}+\frac{a-3}{2}$; 2) $\frac{b-7}{4}+\frac{5b-2}{3}+\frac{3b-1}{8}$;

3) $\frac{a-2}{45}-\frac{a+5}{15}-\frac{a-9}{9}$; 4) $\frac{b}{12}-\frac{3b+1}{9}-\frac{2b-1}{4}$.

685. 1) $\frac{y}{n-2}+\frac{z}{2-n}$; 3) $\frac{2m}{3-5n}-1+\frac{7n-4}{5n-3}$;

2) $\frac{p+2q}{3p-q}-\frac{5q-2p}{q-3p}$; 4) $4-\frac{3a}{5-2b}+\frac{5(a-10)}{2b-5}$.

Ko'rsatilgan amallarni bajaring **(686–689):**

686. 1) $\frac{a^2-2ab+b^2}{a^2-ab+b^2}:\frac{8a-8b}{a^3+b^3}$; 3) $\frac{n^3-m^3}{n^2-m^2}:\frac{n^2+nm+m^2}{n^2+2nm+m^2}$;

2) $\frac{a^2+2ab+b^2}{a^2+ab+b^2}\cdot\frac{a^3-b^3}{7a+7b}$: 4) $\frac{m^2+2mn+n^2}{p^3+c^3}\cdot\frac{p+c}{2m+2n}$.

687. 1) $\frac{64x^2-1}{x^2-4}\cdot\frac{(x+2)^2}{x^2-4}:\frac{(x-2)^2}{8x+1}$;

2) $\frac{x-6}{x^2+6x+9}\cdot\frac{x^2+4x+4}{(x^2+2)(x-2)}\cdot\frac{x^3-9x}{(x-6)(x+2)}$;

3) $\frac{am^2-an^2}{m^2+2mn+n^2}:\frac{am^2+2amn+an^2}{3m+3n}$;

4) $\frac{ab-4b-2a+8}{2a+8-ab-4b}:\frac{2a-8-ab+4b}{ab+4b-2a-8}$.

688. 1) $(x^2-1)(\frac{1}{x-1}-\frac{1}{1+x}+1)$; 2) $(1+a-\frac{a^2+3}{a+1})(1-a^2)$;

3) $(\frac{x+y}{x-y}-\frac{x-y}{x+y}):(\frac{x-y}{x+y}+\frac{x+y}{x-y})$; 4) $(\frac{2-a}{2+a}-\frac{a+2}{a-2}):(\frac{2+a}{2-a}+\frac{a-2}{a+2})$.

689*. 1) $(\frac{c-d}{c^2+dc}-\frac{c}{d^2+cd}):(\frac{d^2}{c^2-cd^2}+\frac{1}{c+d})$;

2) $(\frac{2n}{k+2n}-\frac{4n^2}{k^2+4nk+4n^2}):(\frac{2n}{k^2-4n^2}+\frac{1}{2n-k})$;

3) $(\frac{b^2}{b+x}-\frac{b^3}{b^2+x^2+2bx}):(\frac{b}{b+x}-\frac{b^2}{b^2-x^2})$;

4) $(\frac{2q}{2q+m}-\frac{4q^2}{4q^2+4mq+m^2}):(\frac{2q}{4q^2-m^2}+\frac{1}{m-2q})$.

CHIZIQLI FUNKSIYA VA UNING GRAFIGI

VII BOB

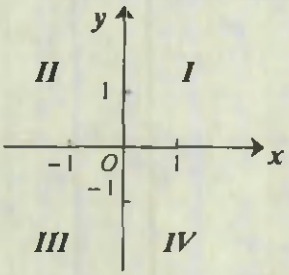
29- §. TEKISLIKDA TO'G'RI BURCHAKLI KOORDINATALAR SISTEMASI

Tekislikda ikkita o'zaro perpendikulyar to'g'ri chiziq o'tkazamiz: biri – gorizontal, ikkinchisi – vertikal (14- rasm). Ularning kesishish nuqtasini O harfi bilan belgilaymiz. Shu to'g'ri chiziqlarda yo'nalishlar tanlaymiz: gorizontalda – o'ngga, vertikalda yuqoriga. Har bir to'g'ri chiziqda bir xil uzunlik birligini ajratamiz.

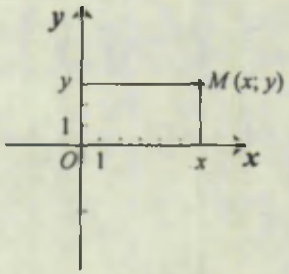
Gorizontal to'g'ri chiziq Ox bilan belgilanadi va *abssissalar o'qi* deyiladi; vertikal to'g'ri chiziq Oy bilan belgilanadi va *ordinatalar o'qi* deyiladi. Abssissalar o'qini va ordinatalar o'qini *koordinatalar o'qlari*, ularning kesishish nuqtasini *koordinatalar boshi* deyiladi. Koordinatalar boshi har bir o'qdagi nol sonini tasvirlaydi.

Abssissalar o'qida musbat sonlar O nuqtadan o'ngda joylashgan nuqtalar bilan, manfiy sonlar esa O nuqtadan chapda joylashgan nuqtalar bilan tasvirlanadi. Ordinatalar o'qida musbat sonlar O nuqtadan yuqorida joylashgan nuqtalar bilan, manfiy sonlar esa O nuqtadan pastda joylashgan nuqtalar bilan tasvirlanadi.

Yo'nalishlar va uzunlik birligi tanlangan ikkita o'zaro perpendikulyar to'g'ri chiziq tekislikda *to'g'ri burchakli koordinatalar sistemasini* hosil qiladi. Koordinatalar sistemasi tanlangan tekislik



14- rasm



15- rasm

XVII asrning taniqli matematigi Rene Dekart (1596-1650). Tekislikda to'gri burchakli koordinatalar sistemasidan foydalanish uning nomi bilan bog'liq

koordinata tekisligi deyiladi. Koordinata o'qlari tashkil qilgan to'g'ri burchaklar *koordinata burchaklari* (kvadrantlar) deyiladi va 14- rasmda ko'rsatilgani kabi nomerlanadi.

Aytaylik, M – koordinata tekisligining ixtiyoriy nuqtasi bo'lsin (15- rasm). M nuqtadan abssissalar o'qiga perpendikulyar tushiramiz.

Shu perpendikulyarning asosi *M nuqtaning abssissasi* deb ataladigan biror x sonni tasvirlaydi.

M nuqtadan ordinatalar o'qiga perpendikulyar tushiramiz. Shu perpendikulyarning asosi *M nuqtaning ordinatasi* deb ataladigan biror y sonni tasvirlaydi.

M nuqtaning abssissasi va ordinatasini *M nuqtaning koordinatalari* deyiladi. $M(x; y)$ yozuvi M nuqta x abssissaga va y ordinataga ega ekanini bildiradi. Bu holda M nuqta $(x; y)$ koordinatalarga ega deb ham aytiladi. Masalan, $M(3; 5)$ yozuvida 3 soni – abssissa, 5 soni – ordinata.

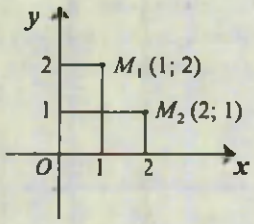
Nuqtalarning koordinatalarini yozishda sonlarning tartibi muhim ahamiyatga molik. Masalan, $M_1(1; 2)$ va $M_2(2; 1)$ tekislikdagi har xil nuqtalardir (16- rasm).

Xususiy hollarni qaraymiz:

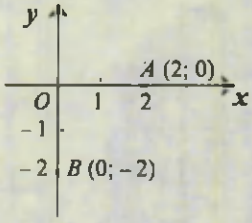
1) Agar nuqta abssissalar o'qida yotsa, u holda uning ordinatasi nolga teng bo'ladi. Masalan, A nuqta (17- rasm) $(2; 0)$ koordinatalarga ega.

2) Agar nuqta ordinatalar o'qida yotsa, u holda uning abssissasi nolga teng bo'ladi. Masalan, B nuqta (17- rasm) $(0; -2)$ koordinatalarga ega.

3) Koordinatalar boshining abssissasi va ordinatasi nolga teng: $O(0; 0)$.



16- rasm

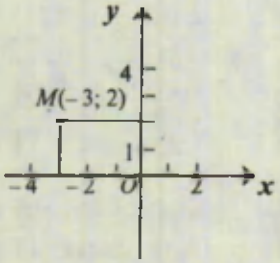


17- rasm

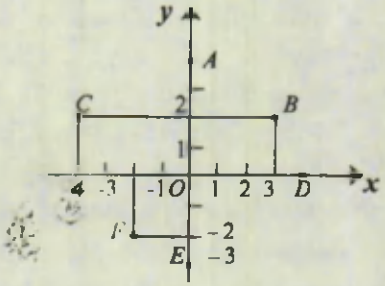
Koordinata tekisligining har bir M nuqtasiga $(x; y)$ sonlar jufti – uning koordinatalari mos keladi va har bir $(x; y)$ sonlar juftiga koordinata tekisligining koordinatalari $(x; y)$ bo'lgan birgina M nuqtasi mos keladi.

M a s a l a . $M(-3; 2)$ nuqtani yasang.

△ Abssissalar o'qida -3 koordinatali nuqtani belgilaymiz va bu nuqta orqali shu o'qqa perpendikulyar o'tkazamiz. Ordinatalar o'qida koordinatasi 2 bo'lgan nuqtani belgilaymiz va u orqali ordinatalar o'qiga perpendikulyar o'tkazamiz. Shu perpendikulyarning kesishish nuqtasi izlanayotgan M nuqta bo'ladi (18- rasm). ▲



18- rasm



19- rasm

Mashqlar

690. Nuqtaning abssissasi va ordinatasini ayting hamda shu nuqtani yasang: $(1; 0)$, $(4; 0)$, $(0; -2)$, $(-6; 0)$, $(0; -7)$, $(0; 0)$.

691. 19- rasm bo'yicha A, B, C, D, E, F nuqtalarning koordinatalarini toping.

692. Nuqtalarni yasang:

1) $A(3; 4)$, $B(2; -5)$, $C(-2; 5)$, $E(-6; -2)$, $F(3; -0{,}5)$,

$K(3; 0)$, $M(0; 1{,}5)$, $N(-3{,}5; 3{,}5)$, $L(\frac{5}{2}; \frac{3}{2})$;

2) $A(-1{,}5; 2{,}5)$, $B(-2{,}5; 1{,}5)$, $C(3\frac{1}{2}; 1)$, $F(2; -2)$, $M(0; 2{,}5)$.

693. Quyidagi nuqtalardan o'tuvchi to'g'ri chiziqni yasang:

1) $A(3; -2)$ va $B(-2; 2)$; 2) $M(2; 0)$ va $N(0; -2)$.

694. Oxirlarining koordinatalari:

1) $A(3; 4)$, $B(-6; 5)$; 2) $M(0; -5)$, $N(4; 0)$ bo'lgan kesmani yasang.

695. Oxirlarining koordinatalari:

1) $A(3; 4)$, $B(-6; 4)$; 2) $P(-5; 2)$, $Q(2; 7)$ bo'lgan kesmani yasang.

696. Uchlarining koordinatalari: 1) $K(-2; 2)$, $M(3; 2)$, $N(-1; 0)$; 2) $A(0; -1)$, $B(0; 5)$, $C(4; 0)$ bo'lgan uchburchakni yasang.

697. Uchlarining koordinatalari: 1) $A(-2; 0)$, $B(-2; 3)$, $C(0; 3)$, $O(0; 0)$ bo'lgan to'g'ri to'rtburchakni yasang.

698. Kvadratning uchta uchi berilgan: $A(1; 2)$, $B(4; 2)$, $C(4; 5)$. $ABCD$ kvadratni yasang. D uchining koordinatalarini toping.

699. Ox o'qida yotuvchi 4 ta nuqta yasang. Bu nuqtalarning koordinatalari qanday umumiylikka ega?

700. $A(0; 5)$, $B(-2; 5)$ nuqtalardan o'tuvchi to'g'ri chiziqni yasang. AB to'g'ri chiziqda yotuvchi nuqtalarning abssissalari nimaga teng?

701. $A(-2; 3)$ va $B(-2; -1)$ nuqtalardan o'tuvchi to'g'ri chiziqni yasang. AB to'g'ri chiziqda yotuvchi nuqtalarning ordinatalari nimaga teng?

702. $A(5; 4)$, $B(2; -1)$, $C(-3; 2)$, $D(-4; -4)$ nuqtalarga Ox o'qiga nisbatan simmetrik bo'lgan nuqtalarni yasang va ularning koordinatalarini aniqlang.

703. $A(2; -2)$, $B(1; 1)$, $C(-3; 2)$, $D(-4; -2\frac{1}{2})$ nuqtalarga Oy o'qiga nisbatan simmetrik bo'lgan nuqtalarni yasang va ularning koordinatalarini aniqlang.

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704. Amallarni bajaring: $\frac{1}{x-2} - \frac{1}{x^2-4} \cdot \left(\frac{1}{x^2-1} - \frac{1}{x-1}\right)$.

705. $\frac{2}{9-12x} - \frac{1}{6x-8x^2}$ ifodani soddalashtiring va uning qiymatini $x = -1\frac{2}{3}$ bo'lganda toping.

30- §. FUNKSIYA TUSHUNCHASI

Ushbu masalani qaraylik.

1-masala. Poyezd Toshkentdan Samarqandga tomon 60 km/soat tezlik bilan harakat qilmoqda. U jo'nagandan t soat keyin Toshkentdan qancha masofada bo'ladi?

△ Agar izlanayotgan masofa s (km hisobida) harfi bilan belgilansa, javobni bunday formula bilan yozish mumkin:

$$s = 60t \quad \blacktriangle \qquad (1)$$

Poyezdning harakati davomida s yo'l va t vaqt o'zgarib boradi. Shuning uchun ularni *o'zgaruvchi kattalik (miqdor)lar* yoki *o'zgaruvchilar* deyiladi. Bunda s va t ixtiyoriy ravishda emas, balki (1) tekis harakat qonuniga bo'ysungan holda o'zgarishi muhim ahamiyatga ega. Bu qonunga muvofiq t vaqtning har bir qiymatiga s yo'lning aniq bir qiymati mos keladi (mos qo'yiladi). Masalan, $t=2$ bo'lganda (1) formula bo'yicha hosil qilamiz:

$$s = 120.$$

Shunday qilib, (1) formula s yo'lni t vaqtning berilgan qiymati bo'yicha hisoblash qoidasini belgilaydi. Bu masalada t musbat va poyezdning Toshkentdan Samarqandgacha harakat vaqtidan katta bo'lishi mumkin emas.

O'zgaruvchi miqdor (kattalik)lar orasidagi bog'lanishning yana bir misolini qaraymiz.

Aytaylik, x kvadrat tomonining uzunligi, y esa uning yuzi bo'lsin. Bu holda

$$y = x^2. \qquad (2)$$

(2) formula y yuzni tomonning oldindan berilgan qiymati bo'yicha hisoblash qoidasini beradi. Masalan, agar $x=2$ bo'lsa, $y=4$ bo'ladi; agar $x=3$ bo'lsa, $y=9$ bo'ladi va hokazo. Bu masalada x musbat sonlar to'plamidan istalgan qiymatni qabul qilishi mumkin.

Qaralgan misollarda bir o'zgaruvchili miqdorning oldindan berilgan qiymati bo'yicha ikkinchisining qiymatini topishga imkon

beruvchi qoidalar ko'rsatildi.

Agar biror sonlar to'plamidan olingan x ning bir qiymatiga biror qoida bo'yicha y son mos qilib qo'yilgan bo'lsa, u holda shu to'plamda *funksiya* aniqlangan deyiladi.

y miqdorning x miqdorga bog'liqligini ta'kidlash uchun ko'pincha $y(x)$ deb yoziladi (o'qilishi: «igrek iksdan»). Bunda x ni *erkli o'zgaruvchi*, $y(x)$ni esa *erksiz o'zgaruvchi* yoki *funksiya* deyiladi.

Masalan, kvadratning yuzi uning x tomoni uzunligining funksiyasi bo'ladi, ya'ni

$$y(x)=x^2.$$

Bunday yozuvda $y(2)$ tomoni 2 ga teng bo'lgan kvadratning yuzini bildiradi, ya'ni $y(2)=2^2=4$. Xuddi shunday, $y(5)=25$, $y(6)=36$.

$y(2)$ soni $y=x^2$ funksiyaning $x=2$ bo'lgandagi qiymati deyiladi. Bu funksiyaning $x=5$ bo'lgandagi qiymati 25 ga, $x=6$ bo'lgandagi qiymati esa 36 ga teng.

Odatda erkli o'zgaruvchi x harfi bilan, erksiz o'zgaruvchi esa y harfi bilan belgilanadi. Lekin bunday belgilash majburiy emas. Masalan, shu paragrafning boshida qaralgan masalada s yo'l t vaqtga bog'liq, ya'ni s yo'l t vaqtning funksiyasi. Bu holda bunday yoziladi:

$$s(t)=60t.$$

Bunday yozishda $s(2)$ ifoda 2 soat ichida o'tilgan yo'lni kilometr hisobida bildiradi, ya'ni

$$s(2)=60\cdot 2=120.$$

Xuddi shu kabi $s(1)=60$ va $s(3)=180$.

Funksiya berilishining ba'zi usullarini qaraymiz.

1) *Funksiya formula bilan berilishi mumkin.*
Masalan,

$$y=2x$$

formula x ning berilgan qiymati bo'yicha y ning qiymatini qanday hisoblash kerakligini ko'rsatadi. Funksiya berilishining bunday usuli *analitik usul* deyiladi.

2-masala. Funksiya $y=x^2+x+1$ formula bilan berilgan. $y(-2)$, $y(0)$, $y(1)$ ni toping.

△ 1) Bu formulaga $x=-2$ ni qo'yib, hosil qilamiz:

$$y(-2)=(-2)^2+(-2)+1=4-2+1=3;$$

2) $y(0)=0^2+0+1=1$;

3) $y(1)=1^2+1+1=3$.

Javob: $y(-2)=3$, $y(0)=1$, $y(1)=3$. ▲

3-masala. Funksiya $y=-3x+5$ formula bilan berilgan. x ning shunday qiymatini topingki, unda $y=-1$ bo'lsin.

△ Formuladagi y ning o'rniga -1 sonini qo'yib, hosil qilamiz:

$$-1=-3x+5.$$

Bu tenglamani yechib, topamiz: $3x=5+1$, $x=2$. ▲

Javob: $x=2$.

2) *Funksiya jadval bilan berilishi mumkin.*

Masalan:

x	1	2	3	4	5	6	7	8
y	1	4	9	16	25	36	49	64

Bu jadvalga muvofiq $x=3$ qiymatga $y=9$ qiymat mos keladi. $x=5$ qiymatga $y=25$ qiymat mos keladi. Funksiyaning bunday berilish usuli *jadval usuli* deyiladi.

Funksiyaning jadval usulida berilishiga doir misollar: natural sonlar kvadratlari jadvali, natural sonlar kublari jadvali, bankka qo'yilgan pul miqdoriga qarab, jamg'armaning ko'payib borish jadvali.

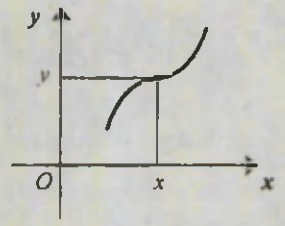
3) Amalda ko'pincha *funksiyani uning grafigi yordamida berilish usuli* qo'llaniladi.

Funksiyaning grafigi – bu koordinata tekisligining abssissalari erkli o'zgaruvchining qiymatlariga, ordinatalari esa funksiyaning mos qiymatlariga teng bo'lgan barcha nuqtalari to'plamidir.

4-masala. $y=x^2+2$ funksiya berilgan. Shu funksiyaning grafigiga koordinatalari: 1) (1; 3); 2) (2; 2) bo'lgan nuqta tegishli yoki tegishli emasligini aniqlang.

△ 1) y ning qiymatini $x=1$ bo'lganda topamiz:

$$y(1)=1^2+2=3.$$



20- rasm

$y(1)=3$ bo'lgani uchun (1; 3) nuqta berilgan funksiya grafigiga tegishli bo'ladi.

2) $y(2)=2^2+2=6$.

Grafikning abssissasi $x=2$ bo'lgan nuqtasi $y=6$ ordinataga ega, shuning uchun (2; 2) nuqta berilgan funksiya grafigiga tegishli emas. ▲

Faraz qilaylik, koordinata tekisligida biror $y(x)$ funksiyaning grafigi tasvirlangan bo'lsin (20- rasm). Berilgan grafik bo'yicha x ning biror aniq qiymatiga $y(x)$ funksiyaning mos qiymatini topish uchun bunday yo'l tutamiz. Abssissalar o'qining x koordinatali nuqtasidan shu o'qqa perpendikulyar o'tkazamiz va uning berilgan funksiya grafigi bilan kesishgan nuqtasi M ni topamiz. Kesishish nuqtasining ordinatasi funksiyaning mos qiymati bo'ladi (20- rasm).

Funksiyani grafik yordamida berilish usuli *grafik usul* deyiladi.

Funksiyaning grafik usulda berilishidan ilmiy-tadqiqot ishlarida va hozirgi zamon ishlab chiqarishida keng foydalaniladi. U yerlarda qo'llaniladigan o'zi yozar asboblar temperatura, tezlik va hokazo kabi har xil kattaliklarning o'zgarish grafiklarini avtomatik tarzda chizadi.

Mashqlar

706. (Og'zaki.) Quyidagi ifodalarni o'qing, erkli va erksiz o'zgaruvchilarni ayting: $s(t)=120t$, $p(x)=17{,}8x$, $y(x)=3x$, $y(t)=4{,}5(t+2)$, $f(x)=\frac{1}{7}x+3$.

707. x ning qiymati $-2; -1; 0; 2$ ga teng bo'lganda:

1) $y=3x$; 2) $y=-2x$; 3) $y=-x-3$; 4) $y=20x+4$

funksiyaning qiymatini hisoblang.

708. Funksiya $s=60t$ formula bilan berilgan, bu yerda s – yo'l (km hisobida), t – vaqt (soat hisobida).

1) $s(2)$, $s(3{,}5)$, $s(5)$ ni aniqlang.

2) Agar $s=240$ bo'lsa, t ni aniqlang.

709. Funksiya $y=2x-1$ formula bilan berilgan.

1) x ning qiymati 10; −4,5; 15; 251; 600 ga teng bo'lganda y ning qiymatini hisoblang;

2) y ning qiymati −19; −57; 205; $-3\frac{1}{2}$ ga teng bo'ladigan x ning qiymatini toping.

710. Funksiya $P(x)=\frac{1}{3}(2x+1)$ formula bilan berilgan:

1) $P(3)$, $P(-12)$, $P(2{,}1)$ ni toping;

2) Agar $P(x)=15$, $P(x)=2{,}4$, $P(x)=-9$ bo'lsa, x ning qiymatini toping.

711. Funksiya $f(x)=2-5x$ formula bilan berilgan. Tengliklar to'g'rimi:

1) $f(-2)=12$; 2) $f(-\frac{1}{5})=3$; 3) $f(4)=20$; 4) $f(\frac{1}{2})=0{,}5$?

712. Funksiya $y(x)=2x+5$ formula bilan berilgan.

1) $y(0)$, $y(-1)$, $y(2)$, $y(\frac{1}{2})$, $y(-\frac{3}{4})$, $y(-2{,}5)$ ni toping;

2) x ning $y(x)=10$, $y(x)=8{,}6$, $y(x)=-14$, $y(x)=-7\frac{1}{2}$ bo'ladigan qiymatini toping;

3) Tengliklar to'g'rimi: $y(-3)=-1$, $y(-\frac{1}{2})=6$, $y(7)=19$, $y(-7)=-10$?

713. (Og'zaki.) Quyidagi jadvallar atmosfera bosimining dengiz sathidan h balandlikka bog'liqligini ifodalaydi:

h, km hisobida	0	0,5	1	2	3	4	5	10	20
p, mm.sim.ust.	760,0	716,0	674,0	596,7	525,7	462,2	404,2	198,1	40,9

1) 1 km, 3 km, 5 km, 10 km balandlikdagi bosimni ayting.

2) Dengiz sathidan qanday balandlikda bosim 760,0 mm.sim.ust.ga, 462,2 mm.sim.ust.ga teng bo'ladi?

714. (Og'zaki.) Temperaturaning bir kecha-kunduz davomida o'zgarish natijalari quyidagi jadvalda berilgan:

Vaqt, soat hisobida	0	2	4	6	8	10	12	14	16	18	20	22	24
Temperatura, °C	−1	1	−3	−4	$2\frac{1}{2}$	5	8	$10\frac{1}{2}$	11	9	6	$3\frac{1}{2}$	$1\frac{1}{2}$

1) Soat 6 dagi, soat 18 dagi, soat 24 dagi temperaturani ayting;

2) Qanday vaqtda temperatura $+1°$ ga, $-4°$ ga, $11°$ ga teng bo'lgan?

3) Nima uchun bu bog'lanishni funksiya deb atash mumkin?

715. $y=x^2-5x+6$ funksiya berilgan. Shu funksiya grafigiga koordinatalari:

1) (1; 2); 2) (−2; 0); 3) (−2; 20); 4) (3; 0) bo'lgan nuqta tegishli bo'lish yoki bo'lmasligini aniqlang.

716. $y=x^2-5x+6$ funksiya berilgan. Shu funksiya grafigiga koordinatalari:

1) (−1; 1); 2) (1; 0); 3) (3; 27); 4) (−2; 7) bo'lgan nuqta tegishli bo'lish yoki bo'lmasligini aniqlang.

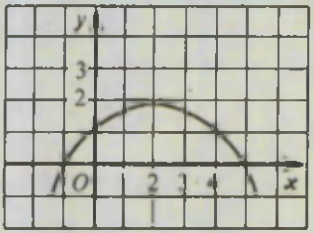
717. $y(x)$ funksiya grafigi bilan berilgan (21- rasm).

1) $y(0)$, $y(2)$, $y(4)$, $y(-1)$ ni toping.

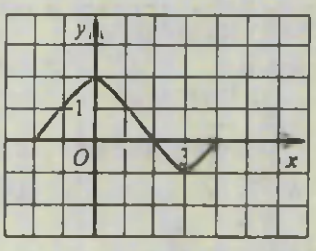
2) x ning qanday qiymatida funksiyaning qiymati 1 ga, 2 ga, 0 ga teng bo'ladi?

3) x ning funksiyaning qiymati musbat bo'ladigan bir nechta qiymatini ayting;

4) x ning funksiyaning qiymati manfiy bo'ladigan bir nechta qiymatini ayting.



21- rasm



22- rasm

718. $y(x)$ funksiya grafigi bilan berilgan (22- rasm).

1) $y(0)$, $y(-2)$, $y(1)$, $y(3)$ ni toping;

2) x ning qanday qiymatida funksiya 2 ga, 0 ga, 1 ga teng bo'ladi ?

3) x ning funksiyaning qiymati musbat bo'ladigan bir nechta

qiymatini ayting;

4) x ning funksiyaning qiymati manfiy bo'ladigan bir nechta qiymatini ayting.

719. Ifodani soddalashtiring:

1) $(x+1+\frac{1}{x-1}):\frac{x^2}{1-2x+x^2}$; 2) $(m-2+\frac{8}{m+2})\cdot\frac{m^2+4}{4+m^2+4m}$.

720. Ikki velosipedchi bir vaqtda A va B qishloqlardan bir-biriga qarab yo'lga chiqdilar va 2 soatdan keyin uchrashdilar. A dan B gacha bo'lgan masofa 42 km ga teng. Agar birinchi velosipedchining tezligi ikkinchisinikidan 3 km/soat ortiqligi ma'lum bo'lsa, har bir velosipedchining tezligini aniqlang.

31- §. $y=kx$ FUNKSIYA VA UNING GRAFIGI

Funksiyaga doir yana bitta misol keltiramiz.

Asosi 3 ga, balandligi esa x ga teng bo'lgan to'g'ri to'rtburchakning yuzini hisoblaymiz. Agar izlanayotgan yuzni y harfi bilan belgilansa, u holda javobni $y=3x$ formula bilan yozish mumkin.

Agar to'g'ri to'rtburchakning asosi k ga teng bo'lsa, u holda x balandlik bilan y yuz orasidagi bog'liqlik $y=kx$ formula bilan ifoda qilinadi. k sonning har bir qiymati biror

$$y=kx$$

funksiyani aniqlaydi.

Endi

$$y=kx \qquad (1)$$

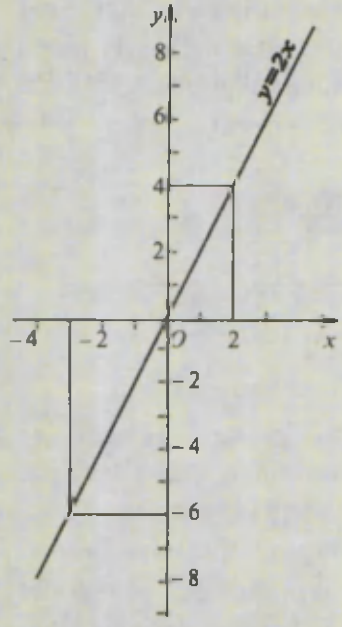
funksiyaning grafigini yasaymiz.

$k=2$ bo'lsin, deylik. U holda funksiya bunday ko'rinishga ega bo'ladi:

$$y=2x. \qquad (2)$$

x ga turli qiymatlar berib, (2) formula bo'yicha y ning mos qiymatlarini hisoblaymiz.

Masalan, $x=2$ ni olib, $y=4$ ni hosil qilamiz. Koordinatalari (2; 4) bo'lgan nuqtani yasaymiz. Agar $x=0$ bo'lsa, u holda $y=2\cdot 0=0$; agar $x=-3$ bo'lsa, u holda $y=2\cdot(-3)=-6$; agar $x=0{,}5$ bo'lsa, u holda $y=2\cdot 0{,}5=1$ bo'ladi va hokazo.



23- rasm

Jadval tuzamiz:

x	2	0	-3	0,5
y	4	0	-6	1

Topilgan koordinatalar bo'yicha nuqtalarni yasaymiz.

Chizg'ichni qo'yib, barcha topilgan nuqtalar koordinatalar boshidan o'tuvchi bir to'g'ri chiziqda yotishiga ishonch hosil qilish mumkin. Shu to'g'ri chiziq $y=2x$ funksiyaning grafigi bo'ladi (23-rasm).

Koordinatalari $(x; y)$ bo'lgan nuqta faqat $y=2x$ tenglik to'g'ri bo'lgan holdagina shu to'g'ri chiziqda yotadi. Masalan, $(-1; -2)$ koordinatali nuqta to'g'ri chiziqda yotadi, chunki $(-2)=2\cdot(-1)$ to'g'ri tenglik.

$y=kx$ funksiyaning grafigi k ning istagan qiymatida koordinatalar boshidan o'tuvchi to'g'ri chiziq bo'ladi.

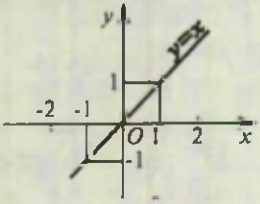
Geometriya kursidan ma'lumki, ikki nuqta orqali birgina to'g'ri chiziq o'tadi, shu sababli *$y=kx$ funksiyaning grafigini yasash uchun grafikning ikkita nuqtasini yasash yetarli*, so'ngra esa shu nuqtalar orqali chizg'ich yordamida to'g'ri chiziq o'tkaziladi.

Koordinatalar boshi $y=kx$ funksiyaning grafigiga tegishli bo'lgani sababli bu grafikni yasash uchun uning yana bir nuqtasini topish yetarli.

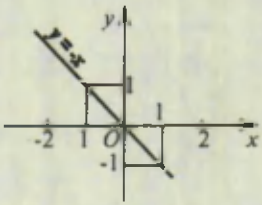
M a s a l a . $y=kx$ funksiyaning: 1) $k=1$; 2) $k=-1$; 3) $k=0$ bo'lgandagi grafigini yasang.

1) $k=1$ bo'lganda funksiya $y=x$ ko'rinishga ega bo'ladi. Agar $x=1$ bo'lsa, u holda $y=1$ bo'ladi. Va shuning uchun (1; 1) nuqta grafikka tegishli bo'ladi. $y=x$ funksiyaning grafigini yasash uchun (0; 0) va (1; 1) nuqtalardan o'tuvchi to'g'ri chiziq chizamiz. Bu to'g'ri chiziq birinchi va uchinchi koordinata burchaklarini teng ikkiga bo'ladi (24- rasm).

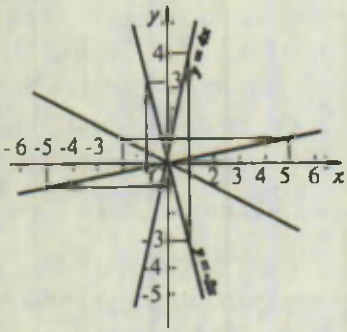
2) $k=-1$ bo'lganda funksiya $y=-x$ ko'rinishga ega bo'ladi. Agar $x=1$ bo'lşa, u holda $y=-1$ bo'ladi, shuning uchun $(1; -1)$ nuqta grafikka tegishli bo'ladi. (0; 0) va (1; 1) nuqtalardan o'tuvchi to'g'ri chiziq $y=-x$ funksiyaning grafigi bo'ladi (25- rasm).



24- rasm



25- rasm



26- rasm

Bu to'g'ri chiziq ikkinchi va to'rtinchi koordinata burchaklarini teng ikkiga bo'ladi (25-rasm).

3) $k=0$ bo'lganda funksiya $y=0\cdot x$, ya'ni $y=0$ ko'rinishga ega bo'ladi. Bu grafikning barcha nuqtalarining ordinatalari nolga tengligini bildiradi. Shuning uchun bu funksiyaning grafigi abssissalar o'qi bilan ustma-ust tushuvchi to'g'ri chiziq bo'ladi. ▲

26- rasmda $y=kx$ funksiyaning k ning turli qiymatlaridagi grafiklari tasvirlangan: $y=4x$, $y=\frac{1}{5}x$, $y=-\frac{1}{2}x$, $y=-3x$.

x bilan y orasidagi $y=kx$ formula bilan ifodalangan (bu yerda $k>0$) bog'lanishni odatda *to'g'ri proporsional (mutanosib) bog'lanish, k sonni esa proporsionallik koeffitsiyenti* deyiladi.

Masalan, jism o'zgarmas tezlik bilan harakat qilganda uning bosib o'tgan yo'li harakat vaqtiga to'g'ri proporsional. Zichligi doimiy bo'lgan gazning massasi uning hajmiga to'g'ri proporsional.

Mashqlar

721. Albom 80 so'm turadi. Shu albomlarning sotib olingan miqdori (n) bilan unga so'mlar hisobida to'langan pul (y)

orasidagi bog'lanishni formula bilan ifoda qiling. $y(6)$, $y(11)$ nimaga teng?

722. "Neksiya" avtomobili katta yo'lda 90 km/soat tezlik bilan harakat qilmoqda. Yo'l uzunligi s (km hisobida)ning harakat vaqti t (soat hisobida)ga bog'liqligini ifodalovchi formulani yozing. $s(3)$, $s(5,4)$ nimaga teng?

723. Funksiyaning grafigini yasang:

1) $y=3x$; 2) $y=5x$; 3) $y=-4x$; 4) $y=-0,8x$.

Funksiyaning grafigini yasang **(723–724)**:

724. 1) $y=1,5x$; 2) $y=-2,5x$; 3) $y=-0,2x$; 4) $y=0,4x$.

725. 1) $y=2\frac{1}{2}x$; 2) $y=\frac{1}{4}x$; 3) $y=0,6x$; 4) $y=-\frac{5}{3}x$.

726. $y=-1,5x$ formula bilan berilgan funksiyaning grafigini yasang. Grafik bo'yicha:

1) x ning 1 ga; 0 ga; 2 ga; 3 ga teng qiymatiga mos keluvchi y ning qiymatini;

2) x ning qanday qiymatida y ning qiymati -3 ga; 4,5 ga; 6 ga teng bo'lishini;

3) x ning y ning qiymati musbat (manfiy) bo'ladigan bir nechta qiymatini toping.

727. $y=0,2x$ formula bilan berilgan funksiyaning grafigini yasang. Grafik bo'yicha:

1) y ning x ning -5 ga; 0 ga teng qiymatiga mos keluvchi qiymatini;

2) x ning qanday qiymatida funksiya -2; 0; 2 ga teng bo'lishini;

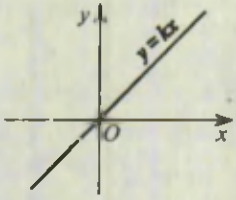
3) x ning y musbat (manfiy) bo'ladigan bir nechta qiymatini toping.

728. Ikkita funksiyaning grafiklarini (bitta chizmada) yasang:

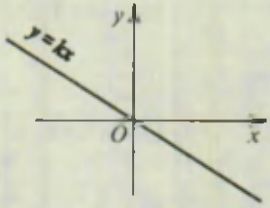
1) $y=\frac{1}{6}x$ va $y=-\frac{1}{6}x$; 2) $y=3x$ va $y=-3x$.

729. $y=kx$ funksiyaning grafigi bo'yicha k ning ishorasini aniqlang:

1) 27- rasm; 2) 28- rasm.



27- rasm



28- rasm

730. Funksiyaning grafigini yasang va shu grafik qaysi koordinata burchaklarida joylashganligini ko'rsating:

1) $y = \frac{1}{3}x$; 2) $y = -\frac{1}{3}x$; 3) $y = 4{,}5x$; 4) $y = -4{,}5x$.

731. Funksiyaning grafigini yasang:

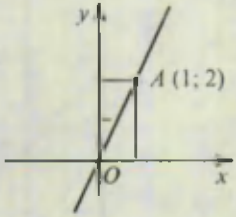
1) $y = 3{,}5x$; 2) $y = -\frac{2}{5}x$.

Har bir holda grafikning abssissalar o'qidan yuqorida (abssissalar o'qidan pastda) yotuvchi ikkita nuqtasi koordinatalarini ko'rsating.

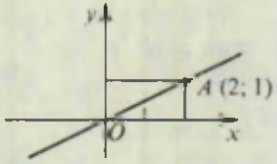
732. $A(5; -3)$, $B(-2; 4)$; $C(0; 0)$; $D(2; 1)$; $E(-5; 2.5)$ nuqtalardan qaysilari $y = \frac{1}{2}x$ formula bilan berilgan funksiyaning grafigiga tegishli?

733. Grafigi rasmdagi to'g'ri chiziq bilan tasvirlangan funksiyani formula bilan yozing:

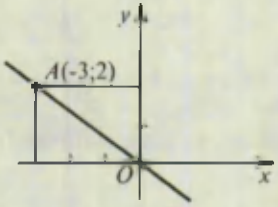
1) 29- rasm; 2) 30- rasm; 3) 31- rasm; 4) 32- rasm.



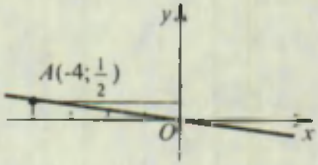
29- rasm



30- rasm



31- rasm



32- rasm

734. OA to'g'ri chiziq koordinatalar boshidan va $A\left(\frac{1}{2}; 7\right)$ nuqtadan o'tadi. Shu to'g'ri chiziq quyidagi funksiyalardan qaysi birining grafigi bo'ladi: $y=7x$, $y=-14x$, $y=14x$?

735. Agar B nuqta $y=kx$ funksiyaning grafigiga tegishli ekanligi ma'lum bo'lsa, shu funksiyaning grafigini yasang:

1) $B(2; -3)$; 2) $B\left(3\frac{1}{3}; -2\right)$. Shu funksiyalardan qaysinisining grafigi $M(-10; 15)$ nuqtadan o'tadi?

736. Sol daryoda 2 km/soat tezlik bilan suzib bormoqda. Solning x soatda bosib o'tgan s yo'lini ifodalang. Solning 1 soatda; 2,5 soatda; 4 soatda bosib o'tgan yo'lini hisoblang. Yo'lning harakat vaqtiga bog'liqligi grafigini yasab, grafik bo'yicha solning 6 km yo'lni bosib o'tish vaqtini toping.

737. Piyoda kishi 3 km/soat tezlik bilan yurib bormoqda. Piyoda kishining t soatda bosib o'tgan (s) yo'li ifodasini topib, yo'lning vaqtga bog'liqligi grafigini yasang. Grafik bo'yicha piyodaning 0,5 soatda; 1 soatda; 1 soat-u 30 minutda bosib o'tgan yo'lini toping.

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738. Amallarni bajaring:

1) $\frac{a-2}{a-3}:\left(\frac{a^2-2}{a^2-9}+\frac{2}{a+3}\right)$; 2) $\frac{m+1}{m}:\left(\frac{m^2-5}{m^2-2m}-\frac{4}{m-2}\right)$.

739. Ekskavatorchi har kuni rejadan 7 m^3 ortiq tuproq qazib, bir oylik rejani topshiriqdagi 26 kun o'rniga 19 kunda bajardi. Kunlik reja necha kubmetr tuproqni tashkil qiladi?

32- §. CHIZIQLI FUNKSIYA VA UNING GRAFIGI

Chiziqli funksiya deb, $y = kx + b$ ko'rinishidagi funksiyaga aytiladi, bu yerda k va b — berilgan sonlar.

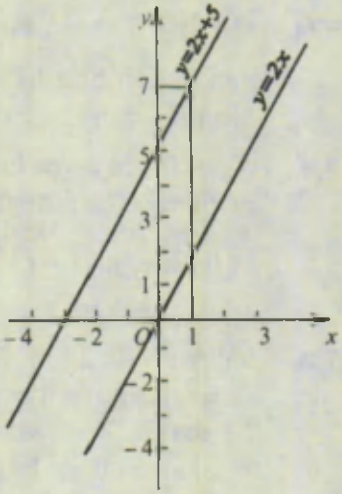
$b=0$ bo'lganda chiziqli funksiya $y=kx$ ko'rinishga ega bo'ladi va uning grafigi koordinatalar boshidan o'tuvchi to'g'ri chiziq bo'ladi. Bu dalilga asoslanib, *$y=kx+b$ chiziqli funksiyaning grafigi to'g'ri chiziq* bo'lishini ko'rsatish mumkin. Ikki nuqta orqali birgina to'g'ri chiziq o'tganligi uchun $y=kx+b$

funksiyaning grafigini yasashda shu grafikning ikki nuqtasini yasash yetarli bo'ladi.

1-masala. $y=2x+5$ funksiya grafigini yasang.

△ $x=0$ bo'lganda $y=2x+5$ funksiyaning qiymati 5 ga teng, ya'ni (0; 5) nuqta grafikka tegishli.

Agar $x=1$ bo'lsa, u holda $y=2\cdot 1+5=7$ bo'ladi, ya'ni (1; 7) nuqta ham grafikka tegishli. (0; 5) va (1; 7) nuqtalarni yasaymiz va ular orqali to'g'ri chiziq o'tkazamiz. Bu to'g'ri chiziq $y=2x+5$ funksiyaning grafigi bo'ladi (33- rasm). ▲



33- rasm

$y=2x+5$ funksiya grafigi har bir nuqtasining ordinatasi $y=2x$ funksiya grafigi o'sha abssissali nuqtasining ordinatasidan 5 birlik katta bo'lishini payqaymiz.

Bu $y=2x+5$ funksiya grafigining har bir nuqtasi $y=2x$ funksiya grafigining mos nuqtasini ordinatalar o'qi bo'ylab yuqoriga 5 birlik siljitish yo'li bilan hosil qilinishini bildiradi.

Umuman, $y=kx+b$ *funksiyaning grafigi* $y=kx$ *funksiya grafigini ordinatalar o'qi bo'ylab b birlik siljitish yo'li bilan hosil qilinadi.* $y=kx$ *va* $y=kx+b$ funksiyalarning grafiklari parallel to'g'ri chiziqlar bo'ladi.

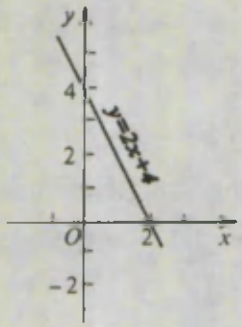
2-masala. $y=-2x+4$ funksiya grafigining koordinata o'qlari bilan kesishish nuqtalarini toping.

△ Grafikning abssissalar o'qi bilan kesishish nuqtasini topamiz. Bu nuqtaning ordinatasi 0 ga teng. Shuning uchun $-2x+4=0$, bundan $x=2$.

Shunday qilib, grafikning abssissalar o'qi bilan kesishish nuqtasi (2; 0) koordinataga ega bo'ladi.

Grafikning ordinatalar o'qi bilan kesishish nuqtasini topamiz. Bu nuqtaning abssissasi 0 ga teng bo'lgani uchun $y=-2\cdot 0+4=4$.

Shunday qilib, grafikning ordinatalar o'qi bilan kesishish nuqtasi



34- rasm

(0; 4) koordinataga ega bo'ladi (34- rasm). ▲

Chiziqli funksiyaning grafigini yasash uchun ba'zan shu grafikning koordinata o'qlari bilan kesishish nuqtalarini topish qulayligini ta'kidlab o'tamiz.

3-masala. $k=0$ va $b=2$ bo'lganda $y=kx+b$ chiziqli funksiyaning grafigini yasang.

△ $k=0$ va $b=2$ bo'lganda funksiya $y=2$ ko'rinishga ega bo'ladi. Grafikning barcha nuqtalarining ordinatalari 2 ga teng.

Bu funksiyaning grafigi Ox o'qiga parallel va (0; 2) nuqtadan o'tuvchi to'g'ri chiziq bo'ladi. ▲

Ko'pgina fizik jarayonlar chiziqli funksiya yordamida tavsiflanadi. Masalan, tekis harakatda jismning bosib o'tgan yo'li vaqtning chiziqli funksiyasi bo'ladi.

Mashqlar

740. (Og'zaki.) Quyidagi formula bilan berilgan funksiya chiziqli bo'la oladimi:

1) $y=-x-2$; 3) $y=\frac{x}{3}$; 5) $y=\frac{3}{x}+8$;

2) $y=2x^2+3$; 4) $y=250$; 6) $y=-\frac{x}{5}+1$.

Chiziqli funksiyalar uchun k va b ning qiymatlarini ayting.

741. $y(x)=3x-1$ chiziqli funksiya berilgan.

1) $y(0)$, $y(1)$, $y(2)$ ni toping;

742. 2) agar $y(x)=-4$, $y(x)=8$, $y(x)=0$ bo'lsa, x ning qiymatini toping.

Idishga qaynatgich solingan paytda suv 6° temperaturaga ega edi. Har minutda uning temperaturasi 2° dan ko'tarilib boradi. Suv temperaturasi T ning uning isish vaqti t ga bog'liq ravishda o'zgarishini ifodalovchi formula toping. Shu funksiya chiziqli bo'ladimi? $T(20)$, $T(31)$ nimaga teng? Suv isiy boshlaganidan necha minut keyin qaynaydi?

743. Funksiyaning grafigini yasang:

1) $y=2x+1$; 3) $y=3x-4$; 5) $y=\frac{1}{4}x-2$;

2) $y=-2x+1$; 4) $y=0{,}5x-1$; 6) $y=\frac{1}{2}x+2$.

744. Grafikning koordinata o'qlari bilan kesishish nuqtalarining koordinatalarini toping:

1) $y=-1{,}5x+3$; 3) $y=-1{,}5x-6$; 5) $y=-\frac{1}{4}x+2$;

2) $y=-2x+4$; 4) $y=0{,}8x-0{,}6$; 6) $y=\frac{2}{3}x-5$.

745. Funksiyaning grafigini uning koordinata o'qlari bilan kesishish nuqtalarini topib, yasang:

1) $y=2x+2$; 3) $y=4x+8$; 5) $y=2{,}5x+5$;

2) $y=-\frac{1}{2}x-1$; 4) $y=-3x+6$; 6) $y=-6x-2$.

746. Funksiyaning grafigini yasang:

1) $y=7$; 2) $y=-3{,}5$; 3) $y=\frac{1}{4}$; 4) $y=0$.

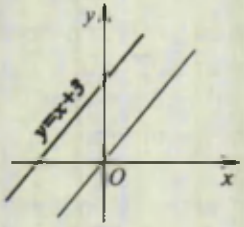
747. (Og'zaki.) $y=-2x$ funksiya grafigidan $y=-2x+3$ va $y=-2x-3$ funksiyalarning grafiklarini qanday qilib hosil qilish mumkin?

748. (Og'zaki.) $y=\frac{1}{3}x$ funksiya grafigidan $y=\frac{1}{3}x+2$ va $y=\frac{1}{3}x-2$ funksiyalarning grafiklarini qanday qilib hosil qilish mumkin?

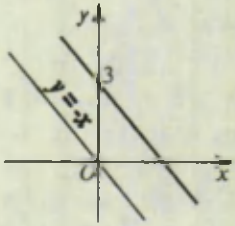
749. 35- va 36- rasmlarda parallel to'g'ri chiziqlar juftlari tasvirlangan. Grafigi to'g'ri chiziq bo'lib:

1) koordinatalar boshidan (35- rasm);

2) (0; 3) koordinatali nuqtadan (36- rasm) o'tuvchi funksiya formulasini yozing.



35- rasm



36- rasm

750. 1) $y=-0,5x-2$ funksiyaning grafigini yasang va grafik bo'yicha x ning funksiya qiymati musbat (manfiy) bo'ladigan bir nechta qiymatini ko'rsating.

2) $y=-4x+3$ funksiyaning grafigini yasang va grafik bo'yicha x ning funksiya qiymati musbat (manfiy) bo'ladigan bir nechta qiymatini ko'rsating.

751. $y=2x+3$ formula bilan berilgan funksiyaning grafigini yasang. Grafik bo'yicha:

1) x ning -1 ga; 2 ga; 3 ga; 5 ga teng qiymatiga mos keluvchi y ning qiymatini;

2) x ning qanday qiymatida y ning qiymati 1 ga; 4 ga; 0 ga; -1 ga teng bo'lishini ko'rsating.

752. $y=-2x-1$ formula bilan berilgan funksiyaning grafigini yasang. Grafik bo'yicha:

1) x ning 2 ga; -2 ga; $-1\frac{1}{2}$ ga teng qiymatiga mos keluvchi y ning qiymatini;

2) x ning qanday qiymatida y ning qiymati -5 ga; 2 ga; 0 ga; 6 ga teng bo'lishini toping.

753. Chiziqli funksiya $y=x+2$ formula bilan berilgan. Shu funksiyaning grafigiga $M(0;2)$, $N(1;3)$, $A(-1;1)$, $B(-4;-2,7)$, $C(-2\frac{1}{2};\frac{1}{2})$ nuqtalar tegishlimi?

754. $y=2x-\frac{1}{3}$ funksiya grafigini yasamasdan, u quyidagi nuqtalardan o'tish yoki o'tmasligini aniqlang:

1) $(0;-\frac{1}{3})$; 2) $(1;-2)$; 3) $(\frac{1}{3};\frac{1}{3})$; 4) $(2;3)$.

755. $y=kx+2$ funksiyaning grafigi: 1) $P(-7;-12)$; 2) $C(3;-7)$ nuqtadan o'tishi ma'lum bo'lsa, k ning qiymatini toping.

756. $y=-3x+b$ funksiyaning grafigi: 1) $M(-2;4)$; 2) $N(5;2)$ nuqtadan o'tishi ma'lum bo'lsa, b ning qiymatini toping.

757. Agar $y=kx+1$ funksiya grafigiga: 1) $M(1;3)$; 2) $M(2;-7)$ nuqta tegishli ekanligi ma'lum bo'lsa, shu funksiyaning grafigini yasang.

758. Ko'p nuqtalar o'rnini to'ldiring:

1) $y = 2x$ funksiya (..., 4) nuqta orqali o'tadi;

2) $y = 3x - 4$ to'g'ri chiziq ordinatalar o'qidan uning boshidan boshlab ... uzunlikdagi kesma ajratadi;

3) $y=2x-6$ to'g'ri chiziq abssissalar o'qidan uning boshidan boshlab ... uzunlikdagi kesma ajratadi;

4) $y=x-7$, $y=5x+2$, $y=3x-7$, $y=x+4$, $y=-x-7$ to'g'ri chiziqlar orasida ... to'g'ri chiziqlar parallel bo'ladi.

759. 1) Ko'mir omborida 400 t ko'mir bor edi. Har kuni omborga yana 50 tonnadan ko'mir tashib keltirildi. Ko'mir miqdori (p) ning vaqt (t) ga bog'liqligini formula bilan ifodalang.

2) Ko'mir omborida 400 t ko'mir bor edi. Undan har kuni 50 t dan ko'mir tashib ketildi. Ko'mir miqdori (p) ning vaqt (t) ga bog'liqligini formula bilan ifodalang.

760. Sayyoh shahardan chiqib avtobusda 10 km yo'l bosdi, so'ngra esa shu yo'nalishda piyoda 5 km/soat tezlik bilan yura boshladi. Sayyoh x soat piyoda yurganidan keyin shahardan qancha (y) masofada bo'lgan?

761*. $y=13-x$ funksiya grafigining koordinata o'qlari bilan kesishish nuqtalarining koordinatalarini aniqlang va shu to'g'ri chiziq hamda koordinata o'qlari bilan chegaralangan to'g'ri burchakli uchburchakning yuzini hisoblang.

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762. Ifodani soddalashtiring: $\left(\frac{a+10}{5a+25}-\frac{1}{a+5}\right)\cdot\frac{5}{a-5}-\frac{5}{25-a^2}$.

763. Tenglamani yeching: $x-\frac{4(x+2)}{5}=2-\frac{2(x+10)}{6}$.

764. Zavod mashina ishlab chiqarishni rejaga binoan 20 kunda bajarishi kerak edi. Lekin zavod har kuni rejadan 1 ta ko'p mashina ishlab chiqarganligi sababli muddatidan bir kun oldin rejani bajaribgina qolmasdan, balki rejadan 4 ta ko'p mashina ishlab chiqardi. Zavod reja asosida nechta mashina ishlab chiqarishi kerak bo'lgan?

765. (Qadimiy masala.) Bir buyumning 10 tasi, ikkinchi buyumning 15 tasi, uchinchi buyumning esa 30 tasi bir dinor turadi. Bir dinor pulga bu buyumlarning har biridan bir xil miqdorda necha donadan sotib olish mumkin?

766*. $A\,(5;\,0)$, $B\,(5;\,-3)$, $C\,(0;\,3)$, $D\,(-3;\,1)$, $E\,(4;\,2)$ nuqtalarga koordinatalar boshiga nisbatan simmetrik bo'lgan nuqtalarni yasang va ularning koordinatalarini aniqlang.

767*. $A\,(5;\,3)$ nuqta berilgan. Shu nuqtaga: 1) Ox o'qiga; 2) Oy o'qiga; 3) koordinatalar boshiga nisbatan simmetrik bo'lgan nuqtani yasang. Hosil bo'lgan nuqtalarning koordinatalarini aniqlang.

768*. Tekislikda $A\,(2;\,7)$, $B\,(3;\,4)$, $C\,(2;\,-7)$, $D\,(-3;\,-4)$, $E\,(-2;\,7)$ nuqtalar joylashgan. Shu nuqtalarning qanday juftlari:
1) abssissalar o'qiga; 2) ordinatalar o'qiga; 3) koordinatalar boshiga nisbatan simmetrik bo'lishini aniqlang.

769*. Tomoni 4 ga teng bo'lgan kvadratning markazi koordinatalar boshida yotadi, tomonlari esa koordinata o'qlariga parallel. Kvadrat uchlarining koordinatalarini aniqlang.

770*. Tekis harakat formulasi $s=vt$ dan harakat vaqtini yo'l bilan tezlikning funksiyasi sifatida ifoda qiling.

771*. Modda zichligining formulasi $p=\frac{m}{V}$ dan:

1) jism massasi m ni zichlik bilan hajmning funksiyasi; 2) jism hajmi V ni massa bilan zichlikning funksiyasi sifatida ifoda qiling.

772. x va y o'zgaruvchilar orasidagi bog'lanish $y=kx$ formula bilan ifoda qilingan. Agar $x=2{,}5$ bo'lganda $y=-5$ bo'lsa, k ni aniqlang.

773. 1) $y=kx$ funksiyaning grafigi $B\,(-30;\,3)$ nuqtadan o'tadi. k ni toping.

2) $y=kx$ funksiyaning grafigi $B\,(4;\,-80)$ nuqtadan o'tadi. k ni toping.

774*. Quyidagi funksiyalar grafiklari kesishish nuqtalarining koordinatalarini toping:

1) $y=-2x+7$ va $y=0{,}5x-5{,}5$; 2) $y=4x$ va $y=-x+10$;

3) $y=1-2x$ va $y=x-5$.

775*. Agar $y=kx+b$ funksiyaning grafigi $(2;\,10)$, $(-7;\,-10)$ nuqtalar orqali o'tishi ma'lum bo'lsa, k va b ning qiymatlarini toping.

IKKI NOMA'LUMLI IKKITA TENGLAMA SISTEMASI

33- §. TENGLAMALAR SISTEMASI

Ushbu masalani qaraylik.

M a s a l a . O'quvchi yig'indisi 10 ga, ayirmasi esa 4 ga teng bo'lgan ikkita son o'yladi. O'quvchi qanday sonlarni o'ylagan?

Izlanayotgan sonlardan birini x bilan, ikkinchisini esa y bilan belgilaymiz. U holda, masala shartiga ko'ra $x+y=10$ va $x-y=4$ bo'ladi.

Bu tenglamalarda noma'lum sonlar bir xil bo'lgani uchun bu tenglamalarni birgalikda qaraladi va ular *ikkita tenglama sistemasini* tashkil qiladi deyiladi:

$$\begin{cases} x+y=10, \\ x-y=4. \end{cases} \qquad (1)$$

Chap tomonda turgan katta qavs har bir tenglamani to'g'ri tenglikka aylantiruvchi $(x;\ y)$ sonlar juftini topish kerakligini bildiradi.

(1) tenglamalar sistemasi – *bu birinchi darajali ikki noma'lumli ikkita tenglama sistemasiga* misoldir.

Ikkita son: $x=7$ va $y=3$ (1) sistemadagi har bir tenglamani to'g'ri tenglikka aylantirishini tekshirib ko'rish oson:

$$\begin{cases} 7+3=10, \\ 7-3=4. \end{cases}$$

Bunday sonlar jufti (1) *sistemaning yechimi* deyiladi.

Birinchi darajali ikki noma'lumli ikkita tenglama sistemasi umumiy ko'rinishda bunday yoziladi:

$$\begin{cases} a_1x+b_1y=c_1, \\ a_2x+b_2y=c_2 \end{cases}$$

bu yerda a_1, a_2, b_1, b_2, c_1, c_2 – berilgan sonlar, x va y –

noma'lum sonlar. Masalan, (1) sistemada: $a_1=1$, $b_1=1$, $c_1=10$, $a_2=1$, $b_2=-1$, $c_2=4$.

(2) tenglamalar sistemasining yechimi deb, shunday x va y sonlar juftiga aytiladiki, ularni shu sistemaga qo'yganda uning har bir tenglamasi to'g'ri tenglikka aylanadi.

Tenglamalar sistemasini yechish – bu uning hamma yechimlarini topish yoki ularning yo'qligini aniqlash demakdir.

Mashqlar

776. (Og'zaki.) $x=40$, $y=20$ sonlari

$$\begin{cases} x+y=60, \\ x-y=20 \end{cases}$$

sistemaning yechimi ekanligini tekshiring.

777. (Og'zaki.) $x=4$, $y=3$ sonlari

$$\begin{cases} 2,5x-3y=1, \\ 5x-6y=2 \end{cases}$$

sistemaning yechimi ekanligini tekshiring.

778. Tenglamalar sistemasi berilgan:

$$\begin{cases} 4x+3y=6, \\ 2x+y=4. \end{cases}$$

Quyidagi sonlar juftlaridan berilgan sistemani qanoatlantiradiganini toping:

1) $x=0$, $y=2$; 2) $x=6$, $y=-6$;
3) $x=3$, $y=-2$; 4) $x=5$, $y=0$.

779. Tenglamalar sistemasi berilgan:

$$\begin{cases} \frac{1}{3}x+\frac{1}{2}y=-1, \\ \frac{1}{2}x-\frac{1}{3}y=5 \end{cases}$$

Quyidagi sonlar juftlaridan berilgan sistemani qanoatlantiradiganini toping:

1) $x=6$, $y=3$; 2) $x=10$, $y=0$;
3) $x=0$, $y=-2$; 4) $x=6$, $y=-6$.

780. Tenglamalar sistemasi berilgan:

$$\begin{cases} x-3y=a, \\ 2x+4y=b, \end{cases}$$

$x=5$ va $y=2$ sonlari jufti uning yechimi ekanligi ma'lum, a va b ni toping.

781. Tenglamalar sistemasi berilgan:

$$\begin{cases} kx-3y=11, \\ 11x+my=29. \end{cases}$$

$x=1$ va $y=-2$ sonlari jufti uning yechimi ekanligi ma'lum. k va m ni qiymatlarini toping.

782*. Tenglamalar sistemasi yechimlarga egami:

1) $\begin{cases} x+y=5, \\ x+y=-1; \end{cases}$ 2) $\begin{cases} 2x-2y=4, \\ x-y=3? \end{cases}$

783*. Tanlash yo'li bilan tenglamalar sistemasining ikkitadan yechimini toping:

1) $\begin{cases} u+v=7, \\ uv=12; \end{cases}$ 2) $\begin{cases} u+v=10, \\ uv=21. \end{cases}$

784. Tenglamani yeching:

1) $(x-0,2)(x+0,2)-(1-5x)^2=-2,04-24x^2$;

2) $\frac{12-x}{3}-4\frac{1}{2}=-\frac{1+3x}{2}$.

785. $y=\frac{1}{2}x+5$ funksiya grafigini yasang va uning koordinata o'qlari bilan kesishish nuqtalarining koordinatalarini toping.

34- §. O'RNIGA QO'YISH USULI

1 - m a s a l a . Tenglamalar sistemasini yeching:

$$\begin{cases} x+2y=5, \\ 2x+y=4. \end{cases} \qquad (1)$$

△ x va y shunday sonlarki, (1) sistemaning ikkala tengligi ham to'g'ri bo'ladi, ya'ni x va y (1) sistemaning yechimi, deb faraz qilamiz.

$2x+y=4$ tenglamaning chap qismidan $2x$ ni uning o'ng qismiga olib o'tamiz; yana to'g'ri tenglik hosil qilamiz:

$$y=4-2x. \qquad (2)$$

Endi (1) sistemaning birinchi tenglamasini qaraymiz:

$$x+2y=5. \qquad (3)$$

x va y shunday sonlarki, (3) tenglik to'g'ri bo'ladi degan farazimizni eslaylik. Bu tenglikdagi y sonni unga teng bo'lgan $4-2x$ son bilan almashtiramiz, ya'ni y ning o'rniga uning $4-2x$ qiymatini qo'yamiz. U holda $x+2(4-2x)=5$ tenglikni hosil qilamiz. Bu tenglikdan topamiz: $x+8-4x=5$, $-3x=-3$, $x=1$.

$x=1$ ni (2) tenglikka qo'yib, $y=4-2\cdot 1=2$ ekanini hosil qilamiz.

Olib borilgan mulohazalarimizga yakun yasaylik. (1) sistema yechimga ega deb faraz qilib, biz $x=1$ va $y=2$ ni hosil qildik va sistemaning boshqa yechimlari yo'qligini aniqladik. Bu sonlar jufti (1) sistemaning yechimi ekanligiga ishonch hosil qilish qoldi, ya'ni $x=1$, $y=2$ bo'lganda sistemaning ikkala tenglamasi ham to'g'ri tenglikka aylanishini ko'rsatish qoldi.

x va y ning topilgan qiymatlarini (1) sistemaning ikkala tenglamasiga qo'yamiz va hisoblashlarni bajaramiz:

$$\begin{cases} 1+2\cdot 2=5, \\ 2\cdot 1+2=4. \end{cases}$$

Ikkala tenglik ham to'g'ri tenglik.

Shunday qilib (1) sistema birgina yechimga ega: $x=1$, $y=2$. ▲

(1) sistemani yechishning ko'rib chiqilgan bu usuli *o'rniga qo'yish usuli* deyiladi. U quyidagilardan iborat:

1) sistemaning bir tenglamasidan (qaysinisidan bo'lsa ham farqi yo'q) bir noma'lumni ikkinchisi orqali, masalan, y ni x orqali ifodalash kerak;

2) hosil qilingan ifodani sistemaning ikkinchi tenglamasiga qo'yish kerak – bir noma'lumli tenglama hosil bo'ladi;

3) bu tenglamani yechib, x ning qiymatini topish kerak;

4) x ning topilgan qiymatini y uchun ifodaga qo'yib, y ning qiymatini topish kerak.

2 - m a s a l a . Tenglamalar sistemasini yeching: $\begin{cases} 3x-2y=16, \\ 5x+3y=-5. \end{cases}$

△ 1) Birinchi tenglamadan topamiz: $-2y=16-3x$, $y=\frac{16-3x}{-2}$, ya'ni $y=-8+\frac{3}{2}x$.

2) $y=-8+\frac{3}{2}x$ ni sistemaning ikkinchi tenglamasiga qo'yamiz:

$$5x+3(-8+\frac{3}{2}x)=-5.$$

3) Bu tenglamani yechamiz: $5x-24+\frac{9}{2}x=-5$, $\frac{19}{2}x=19$, $x=2$.

4) $x=2$ ni $y=-8+\frac{3}{2}x$ tenglikka qo'yib, topamiz:

$$y=-8+\frac{3}{2}\cdot 2=-5.$$

J a v o b : $x=2$, $y=-5$. ▲

3 - m a s a l a . Tenglamalar sistemasini yeching: $\begin{cases} \frac{3x}{2}+\frac{y}{3}=2, \\ \frac{x}{3}-\frac{y}{2}=-3. \end{cases}$

△ Tenglamalar sistemasini almashtiramiz:

$$\begin{cases} 9x+2y=12, \\ 2x-3y=-18. \end{cases}$$

1) $9x+2y=12$, $2y=12-9x$, $y=6-\frac{9}{2}x$;

2) $2x-3(6-\frac{9}{2}x)=-18$, $2x-18+\frac{27}{2}x=-18$; $\frac{31}{2}x=0$, $x=0$.

3) $y=6-\frac{9}{2}\cdot 0=6$.

Javob: $x=0$, $y=6$. ▲

Mashqlar

786. Tenglamalarning har birida bir noma'lumni ikkinchisi orqali ifoda qiling:

1) $x+y=7$; 2) $x-y=10$; 3) $2x-y=5$;

4) $x+3y=11$; 5) $2x+3y=7$; 6) $5y-3x=3$.

Tenglamalar sistemasini yeching (787–790):

787. 1) $\begin{cases} x = 2 + y, \\ 3x - 2y = 9; \end{cases}$ 3) $\begin{cases} y = 11 - 2x, \\ 5x - 4y = 8; \end{cases}$ 5) $\begin{cases} y = 2 - 4x. \\ 8x = 5 - 3y; \end{cases}$

2) $\begin{cases} 5x + y = 4, \\ x = 3 + 2y; \end{cases}$ 4) $\begin{cases} x - 2y = 11, \\ y = 2x - 5; \end{cases}$ 6) $\begin{cases} 3x - 5y = 8, \\ x = -y. \end{cases}$

788. 1) $\begin{cases} x + 5y = 7, \\ 3x - 2y = 4; \end{cases}$ 3) $\begin{cases} x + 12y = 11, \\ 5x - 3y = 3; \end{cases}$ 5) $\begin{cases} 2x - 3y = 0, \\ 3x - 2y = 5; \end{cases}$

2) $\begin{cases} x - 3y = 17, \\ x - 2y = -13; \end{cases}$ 4) $\begin{cases} y - 3x = 5. \\ 2x + 2y = 23; \end{cases}$ 6) $\begin{cases} 3x = 5y, \\ -3x + 8y = -13. \end{cases}$

789. 1) $\begin{cases} \frac{x}{5} + \frac{y}{2} = 5, \\ \frac{x}{4} - \frac{y}{3} = 0{,}5; \end{cases}$ 3) $\begin{cases} \frac{5x}{2} + \frac{y}{5} = -4, \\ \frac{x}{3} + \frac{y}{6} = \frac{1}{6}; \end{cases}$

2) $\begin{cases} \frac{x}{2} + \frac{y}{3} = 3, \\ \frac{x}{3} + \frac{y}{2} = \frac{8}{3}; \end{cases}$ 4) $\begin{cases} \frac{2x}{3} - \frac{5y}{4} = -3, \\ \frac{5x}{6} + \frac{7y}{8} = 6. \end{cases}$

790. 1) $\begin{cases} \frac{x+y}{2} - \frac{x-y}{3} = 8, \\ \frac{x+y}{3} + \frac{x-y}{4} = 11; \end{cases}$ 3) $\begin{cases} \frac{7x-2y}{2} + 2x = 6, \\ \frac{5y-8x}{3} - y = -2; \end{cases}$

2) $\begin{cases} \frac{x+y}{9} - \frac{x-y}{9} = 2, \\ \frac{2x-y}{9} - \frac{3x+2y}{3} = -20; \end{cases}$ 4) $\begin{cases} \frac{1}{2}(2x - y) - 1 = y - 2, \\ \frac{1}{4}(3x - 7) = \frac{1}{5}(2y - 3) = 1. \end{cases}$

791*. Tenglamalar sistemasi yechimlarga ega emasligini ko'rsating:

1) $\begin{cases} 2x + y = 8, \\ 10x + 5y = 10; \end{cases}$ 2) $\begin{cases} 3x + 8y = -1, \\ x + 2\frac{2}{3}y = 5. \end{cases}$

792*. Tenglamalar sistemasi cheksiz ko'p yechimlar to'plamiga ega ekanligini ko'rsating:

1) $\begin{cases} x = 5 - y, \\ y = 5 - x; \end{cases}$ 2) $\begin{cases} 2x + 3y = 13, \\ y = \frac{13-2x}{3}. \end{cases}$

793. Ifodani soddalashtiring va uning son qiymatini toping:

1) $a=-0.2$, bo'lganda $(\frac{1}{a-1}-\frac{1}{a})\cdot a^2-1$;

2) $m=-2$, $n=-1\frac{1}{2}$ bo'lganda $(\frac{m}{n-m}-\frac{m}{n})\cdot n^2-m^2$;

794. Avtomobil 60 km/soat tezlik bilan harakat qilib, A shahardan B shahargacha bo'lgan yo'lni 2 soatda bosib o'tdi. Agar u tezligini 10 km/soatga kamaytirsa, 2 soat-u 30 minutda B dan A ga qaytib kelishga ulguradimi?

795. (Qadimiy masala.) Beshta sondan birinchi va ikkinchisining yig'indisi 10, ikkinchi va uchinchisining yig'indisini 15, uchinchi va to'rtinchisining yig'indisi 18, to'rtinchi va beshinchisining yig'indisi 24, beshinchi va birinchisining yig'indisi 30 ga teng. Bu sonlarni toping.

35- §. QO'SHISH USULI

1 - m a s a l a . Tenglamalar sistemasini yeching:

$$\begin{cases} 7x-2y=27, \\ 5x+2y=33. \end{cases} \qquad (1)$$

△ x va y shunday sonlarki, (1)ning ikkala tengligi ham to'g'ri, ya'ni x, y (1) sistemaning yechimi bo'ladi, deb faraz qilamiz.

Bu tengliklarni hadlab qo'shamiz. Bu holda yana to'g'ri tenglik hosil bo'ladi, chunki teng sonlarga teng sonlar qo'shilayapti:

$$\begin{array}{r} 7x-2y=27, \\ +\ 5x+2y=33 \\ \hline 12x=60, \text{ bundan } x=5. \end{array}$$

Endi $x=5$ ni (1) sistema tenglamalarining biriga, masalan, birinchi tenglamasiga qo'yamiz: $7\cdot 5-2y=27$. Bu tenglikdan topamiz:

$$35-2y=27,\ -2y=-8,\ y=4.$$

Shunday qilib, agar (1) sistema yechimga ega bo'lsa, u holda bu yechim faqat ushbu sonlar jufti bo'lishi mumkin: $x=5$, $y=4$.

Endi $x=5$, $y=4$, haqiqatan ham, (1) sistemaning yechimi ekanligiga ishonch hosil qilish kerak. Buni oddiygina tekshirish bilan bajarish mumkin:

$$7 \cdot 5 - 2 \cdot 4 = 27,$$
$$5 \cdot 5 + 2 \cdot 4 = 33.$$

Ikkala tenglik ham to'g'ri tenglik.

Shunday qilib, (1) sistema birgina yechimga ega: $x = 5$, $y = 4$. ▲

Tenglamalar sistemasini yechishning ko'rib chiqilgan bu usuli *algebraik qo'shish usuli* deyiladi. Noma'lumlardan birini yo'qotish uchun sistema tenglamalarining chap va o'ng qismlarini qo'shish yoki ayirish kerak.

2-masala. Tenglamalar sistemasini yeching: $\begin{cases} 5x + 3y = 29, \\ 5x - 4y = 8. \end{cases}$

△ Birinchi tenglamadan ikkinchisini hadlab ayiramiz:

$$\begin{array}{r} 5x + 3y = 29, \\ \underline{-\ 5x - 4y = 8.} \\ 7y = 21, \text{ bundan } y = 3. \end{array}$$

$y = 3$ ni sistemaning birinchi tenglamasiga qo'yamiz: $5x + 3 \cdot 3 = 29$

Bu tenglamani yechib, topamiz: $5x + 9 = 29$, $5x = 20$, $x = 4$.

Javob: $x = 4$, $y = 3$. ▲

Ko'rib chiqilgan masalalardan ravshanki, sistemani yechishda algebraik qo'shish usuli ikkala tenglamaning ham biror noma'lum oldidagi koeffitsiyentlari bir xil yoki faqat ishoralari bilan farq qilgan holda qulay bo'ladi. Agar bunday bo'lmasa, u holda sistemaning har bir tenglamasining chap va o'ng qismlarini mos keladigan sonlarga ko'paytirish yo'li bilan biror noma'lum oldidagi koeffitsiyentlarning modullarini tenglashtirishga urinib ko'rish kerak.

3-masala. Tenglamalar sistemasini yeching:

$$\begin{cases} 3x + 2y = 10, \\ 5x + 3y = 12. \end{cases}$$

△ Agar sistemaning birinchi tenglamasining ikkala qismini 3 ga, ikkinchisini esa 2 ga ko'paytirib, ikkinchi tenglamadan birinchisini hadlab ayirilsa, u holda birdaniga x ning qiymati topiladi:

$$\begin{cases} 3x + 2y = 10, & \mid 3 \\ 5x + 3y = 12. & \mid 2 \end{cases} \qquad \begin{array}{r} 10x + 6y = 24, \\ \underline{-\ 9x + 6y = 30} \\ x = -6 \end{array}$$

$x=-6$ qiymatni sistemaning birinchi tenglamasiga qo'yib, topamiz: $-18+2y=10$, $2y=28$, $y=14$.

Javob: $x=-6$, $y=14$. ▲

Shunday qilib, tenglamalar sistemasini algebraik qo'shish usuli bilan yechish uchun:

1) noma'lumlardan birining oldida turgan koeffitsiyentlar modullarini tenglashtirish;

2) hosil qilingan tenglamalarni hadlab qo'shib yoki ayirib, bitta noma'lumni topish;

3) topilgan qiymatni berilgan sistemaning tenglamalaridan biriga qo'yib, ikkinchi noma'lumni topish kerak.

4-masala. Tenglamalar sistemasini yeching:

$$\begin{cases} 4x-3y=14, \\ x+2y=-2. \end{cases} \qquad (2)$$

△ 1) Birinchi tenglamani o'zgarishsiz qoldirib, ikkinchi tenglamani 4 ga ko'paytiramiz:

$$\begin{cases} 4x-3y=14, \\ 4x+8y=-8. \end{cases} \qquad (3)$$

2) (3) sistemaning ikkinchi tenglamasidan birinchi tenglamani hadlab ayirib, topamiz: $11y=-22$, bundan $y=-2$.

3) $y=-2$ ni (2) sistemaning ikkinchi tenglamasiga qo'yib, topamiz: $x+2\cdot(-2)=-2$, bundan $x=2$.

Javob: $x=2$, $y=-2$. ▲

Mashqlar

Tenglamalar sistemasini algebraik qo'shish usuli bilan yeching **(796–799):**

796. 1) $\begin{cases} 2x+y=11, \\ 3x-y=9; \end{cases}$

2) $\begin{cases} 5x-2y=6, \\ 7x+2y=6; \end{cases}$

3) $\begin{cases} 4x+7y=40, \\ -4x+9=24; \end{cases}$

4) $\begin{cases} x+3y=17, \\ 2y-x=13. \end{cases}$

797. 1) $\begin{cases} 4x+3y=-15, \\ 5x+3y=-3; \end{cases}$ 3) $\begin{cases} x+5y=3, \\ x+4y=2; \end{cases}$

2) $\begin{cases} 2x-5y=1, \\ 4x-5y=7; \end{cases}$ 4) $\begin{cases} 2y-3x=6, \\ y-3x=9. \end{cases}$

798. 1) $\begin{cases} \frac{x}{2}-\frac{y}{3}=1, \\ \frac{x}{4}+\frac{2y}{3}=8; \end{cases}$ 3) $\begin{cases} 2x+\frac{x-y}{4}=11, \\ 3y-\frac{x-y}{3}=1; \end{cases}$

2) $\begin{cases} \frac{x}{4}+\frac{y}{4}=2, \\ \frac{x}{6}+\frac{y}{3}=2; \end{cases}$ 4) $\begin{cases} 5x-\frac{x-y}{5}=11, \\ 2y-\frac{x+y}{3}=11. \end{cases}$

799. 1) $\begin{cases} \frac{x+3}{2}-\frac{y-2}{3}=2, \\ \frac{x-1}{4}+\frac{y+1}{3}=4; \end{cases}$ 3) $\begin{cases} \frac{x+y}{2}-\frac{2y}{3}=\frac{5}{2}, \\ \frac{3x}{2}+2y=0; \end{cases}$

2) $\begin{cases} \frac{x+y}{2}+\frac{x-y}{3}=6, \\ \frac{x+y}{4}+\frac{x-y}{3}=6; \end{cases}$ 4) $\begin{cases} \frac{2,5x-2y}{2}-2x=3, \\ \frac{3x-2y}{3}+4=3x. \end{cases}$

800*. Tenglamalar sistemasini yeching:

1) $\begin{cases} 16x-27y=20, \\ 5x+18y=41,5; \end{cases}$ 4) $\begin{cases} 3(x-y)=6(y+1), \\ \frac{x}{3}-1\frac{1}{3}=y; \end{cases}$

2) $\begin{cases} 18x-21y=2, \\ 24x-15y=7; \end{cases}$ 5) $\begin{cases} \frac{x-y}{3}-\frac{1}{2}=\frac{x-y}{4}, \\ \frac{x-y}{2}=4,5+\frac{y-1}{3}; \end{cases}$

3) $\begin{cases} \frac{1}{2}(x-4y)=x-y, \\ \frac{x}{2}+y=0; \end{cases}$ 6) $\begin{cases} \frac{x+y}{5}-\frac{y-x}{2}=x+\frac{3}{20}, \\ \frac{x-y}{4}+\frac{x+y}{3}=y-7\frac{1}{24}. \end{cases}$

801. Bitta koordinata sistemasida $y=2x+3$ va $y=0,5x-1,5$ funksiyalarning grafiklarini chizing va ularning kesishish nuqtalari koordinatalarini toping.

802. Bitta koordinata sistemasida:

1) $y=-\frac{1}{3}x+2$ va $y=-x+6$; 2) $y=3x-4$ va $y=3x+1{,}5$

funksiyalarning grafiklarini chizing.

803. Tenglamani yeching:

1) $(2x-3)(x+5)-(3-x)(5-2x)=-30$;

2) $5(x-1)^2-2(x+3)^2=3(x+2)^2$;

3) $(x-3)(3+x)+(12x-6):3=(x-2)(x+2)-7$;

4) $(x+1)^2-(x+2)^2=(x+3)^2-(x+5)^2$.

36- §. TENGLAMALAR SISTEMASINI YECHISHNING GRAFIK USULI

Ushbu sistema berilgan bo'lsin:

$$\begin{cases} x-y=-1, \\ 2x+y=4. \end{cases} \qquad (1)$$

Avval birinchi tenglamani qaraymiz:

$$x-y=-1. \qquad (2)$$

Bu tenglamaning koordinata tekisligidagi geometrik tasviri bo'lib uning grafigi xizmat qiladi.

Ikki noma'lumli birinchi darajali

$$ax+by=c$$

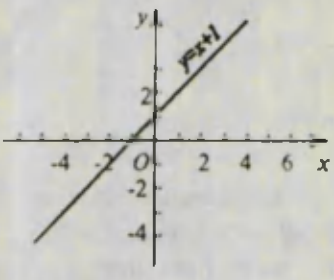
tenglamaning grafigi deb, bu tenglamaga x va y koordinatalarini qo'yganda uni to'g'ri tenglikka aylantiruvchi $M(x; y)$ nuqtalar to'plamiga aytiladi.

(2) tenglamaning grafigini yasash uchun bu tenglamada y ni x orqali ifoda qilamiz:

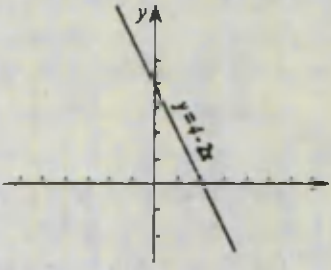
$$y=x+1. \qquad (3)$$

(2) va (3) tenglamalar x va y sonlar orasidagi bir xil bog'lanishni ifoda qiladi: x va y sonlarning istagan jufti uchun yoki (2) va (3) tengliklar to'g'ri, yoki ikkala tenglik ham noto'g'ri bo'ladi. Shuning uchun bu tenglamalarning grafigi bir xil. (3) funksiyaning grafigi to'g'ri chiziq bo'lgani uchun shu to'g'ri chiziqning o'zi (2) tenglamaning ham grafigi bo'ladi.

To'g'ri chiziqni yasash uchun uning ikkita nuqtasini topish yetarli. Masalan, (2) tenglamadan topamiz: agar $x=0$ bo'lsa, u holda $y=1$ bo'ladi; agar $x=-1$ bo'lsa, u holda $y=0$ bo'ladi. Shunday qilib, (2) tenglamaning grafigi (0; 1) va (–1; 0) nuqtalardan o'tuvchi to'g'ri chiziq bo'ladi (37- rasm).



37- rasm



38- rasm

Xuddi shuningdek, birinchi darajali ikki noma'lumli $ax+by=c$ ko'rinishdagi istalgan tenglamaning grafigi, agar a yoki b sonlardan aqalli bittasi nolga teng bo'lmasa, *to'g'ri chiziq* bo'lishini ko'rsatish mumkin.

(1) sistema ikkinchi tenglamasi

$$2x+y=4 \qquad (4)$$

ning grafigini yasaymiz (38- rasm).

Bu tenglamadan topamizki, agar $x=0$ bo'lsa, u holda $y=4$ bo'ladi, agar $y=0$ bo'lsa, u holda $x=2$ bo'ladi.

Demak, (4) tenglamaning grafigi (0; 4) va (2; 0) nuqtalardan o'tuvchi to'g'ri chiziq bo'ladi (38- rasm).

Yasalgan ikkala to'g'ri chiziqning kesishish nuqtasini qaraymiz. 39- rasmdan ko'rinib turibdiki, uning koordinatalari (1; 2) bo'ladi. Bu nuqta ikkala to'g'ri chiziqqa ham tegishli bo'lgani uchun $x=1$ va $y=2$ bo'lganda (2) va (4) tenglamalarning ikkalasi ham to'g'ri tenglikka aylanadi, ya'ni $x=1$ va $y=2$ (1) sistemaning yechimi bo'ladi.

Tenglamalar sistemasini yechishning grafik usuli quyidagidan iborat:

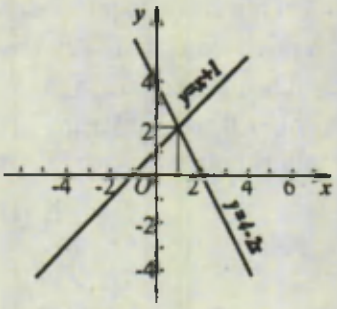
1) sistema har bir tenglamasining grafigi yasaladi;

2) yasalgan to'g'ri chiziqlar kesishish nuqtasining (agar ular kesishsa) 39- rasm koordinatalari topiladi.

Tenglamalar grafiklari kesishish nuqtasining koordinatalari shu tenglamalar sistemasining yechimi bo'ladi.

Grafik usul ko'pgina amaliy masalalarning taqribiy yechimlarini topishda qo'llaniladi.

Tenglamalar sistemasi nechta yechimga ega bo'lishi mumkinligini grafiklar yordamida osongina aniqlash mumkin.



39- rasm

Tekislikda ikki to'g'ri chiziq – tenglamalar sistemasi grafiklarining o'zaro joylashuvida uch hol bo'lishi mumkin:

(1) *To'g'ri chiziqlar kesishadi*, ya'ni bitta umumiy nuqtaga ega bo'ladi. Bu holda tenglamalar sistemasi bitta (yagona) yechimga ega bo'ladi ((1) sistema uchun 39- rasmga qarang).

(2) *To'g'ri chiziqlar parallel*, ya'ni ular umumiy nuqtalarga ega emas. Bu holda tenglamalar sistemasi yechimlarga ega bo'lmaydi.

(3) *To'g'ri chiziqlar ustma-ust tushadi.* Bu holda sistema cheksiz ko'p yechimlar to'plamiga ega bo'ladi.

Oxirgi ikki hol uchun misollar keltiramiz.

1 - m a s a l a . Ushbu

$$\begin{cases} x + 2y = 6, \\ 2x + 4y = 8. \end{cases} \qquad (5)$$

tenglamalar sistemasi yechimlarga ega emasligini ko'rsating.

△ (5) sistemaning birinchi tenglamasini 2 ga ko'paytiramiz va hosil bo'lgan tenglamadan berilgan sistemaning ikkinchi tenglamasini hadlab ayiramiz:

$$\begin{array}{r} 2x+4y=12, \\ \underline{-\ 2x+4y=8} \\ 0=4 \end{array}$$

Noto'g'ri tenglik hosil bo'ldi. Demak, x va y ning (5) sistemasining ikkala tengligi ham to'g'ri bo'la oladigan qiymatlari yo'q, ya'ni (5) sistema yechimlarga ega emas. ▲

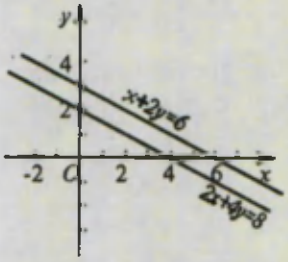
Bu geometrik nuqtai nazardan (5) sistema tenglamalarining

grafiklari parallel to'g'ri chiziqlar bo'lishini anglatadi (40- rasm).

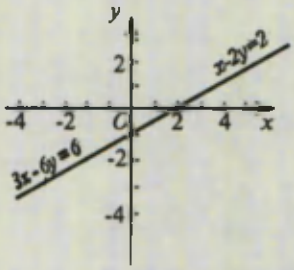
2 - m a s a l a . Ushbu

$$\begin{cases} x - 2y = 2, \\ 3x - 6y = 6 \end{cases} \qquad (6)$$

tenglamalar sistemasi cheksiz ko'p yechimlarga ega ekanligini ko'rsating.



40- rasm



41- rasm

△ (6) sistemaning birinchi tenglamasidan x ni y orqali ifoda qilamiz:

$$x = 2 + 2y.$$

x ning bu qiymatini sistemaning ikkinchi tenglamasiga qo'yib, hosil qilamiz:

$$3(2 + 2y) - 6y = 6,$$
$$6 + 6y - 6y = 6,$$
$$6 = 6.$$

To'g'ri tenglik hosil bo'ldi. Shunday qilib, y ning istagan qiymatida $x = 2 + 2y$ va y sonlar (6) sistemaning ikkala tenglamasini ham to'g'ri tenglikka aylantiradi, ya'ni (6) sistema cheksiz ko'p yechimlar to'plamiga ega bo'ladi. ▲

Bu geometrik nuqtai nazardan (6) sistema ikkala tenglamasining grafiklari ustma-ust tushishini bildiradi (41- rasm).

Mashqlar

804. To'g'ri chiziqlarning koordinata o'qlari bilan kesishish nuqtalarining koordinatalarini toping:

1) $x - y + 5 = 0$; 2) $3x - 2y + 3 = 0$; 3) $2x + y = 1$; 4) $5x + 2y = 12$.

805. Tenglamaning grafigini yasang:

1) $y=3x+5$; 2) $3x+y=1$; 3) $2y+7x=-4$; 4) $4y-7x-12=0$.

806. $y=2x+1$ va $x+y=1$ tenglamalarning grafiklarini yasang. Ularning kesishish nuqtalarining koordinatalari toping. Grafiklar kesishish nuqtalarining koordinatalari tenglamalarning har birini to'g'ri tenglikka aylantirish-aylantirmasligini tekshirib ko'ring.

Quyidagi mashqlarda sistemani grafik usul bilan yeching **(807–808):**

807. 1) $\begin{cases} y=4x, \\ y-3=x; \end{cases}$ 3) $\begin{cases} y=2x, \\ x-y=-3; \end{cases}$

2) $\begin{cases} y=-3x, \\ y-x=-4; \end{cases}$ 4) $\begin{cases} y=3x, \\ 4x-y=3. \end{cases}$

808. 1) $\begin{cases} x+y=5, \\ x-y=1; \end{cases}$ 3) $\begin{cases} x+2y=5, \\ 2x-y=5; \end{cases}$

2) $\begin{cases} 2x+y=1, \\ 2x-y=3; \end{cases}$ 4) $\begin{cases} x+3y=6, \\ 2x+y=7. \end{cases}$

809. Tenglamalar sistemasi yechimlarga ega emasligini ko'rsating:

1) $\begin{cases} y=3x, \\ 6x-2y=3; \end{cases}$ 2) $\begin{cases} x+y=6, \\ 2x=1-2y. \end{cases}$

810. Tenglamalar sistemasi cheksiz ko'p yechimlarga ega ekanligini ko'rsating:

1) $\begin{cases} x+y=0, \\ 2y+2x=0; \end{cases}$ 2) $\begin{cases} x-y=3, \\ 2x-2y=6. \end{cases}$

811. Tenglamalar sistemasi birgina yechimga ega ekanligini grafik usul bilan va o'rniga qo'yish usuli bilan ko'rsating:

1) $\begin{cases} 2x+3y=13, \\ 3x-2y=3; \end{cases}$ 2) $\begin{cases} 2x+y=7, \\ x-y=1. \end{cases}$

812*. Shunday tenglama tuzingki, u $x-y=4$ tenglama bilan birgalikda: 1) birgina yechimga ega bo'lgan sistema; 2) cheksiz

ko'p yechimlarga ega bo'lgan; 3) yechimlarga ega bo'lmagan sistemani tashkil qilsin.

813. Ifodani soddalashtiring va uning son qiymatini toping:

$(\frac{t-1}{t+1}-\frac{t+1}{t-1})(\frac{1}{2}-\frac{t^2+1}{4t})$, bunda $t=-2\frac{1}{2}$.

814. Jamoa xo'jaligi rejaga ko'ra ekinni 8 kunda ekib bo'lishi kerak edi. U kunlik topshiriqni 4 ga ortiqi bilan bajarib, ekishni 6 kunda tamomladi. Xo'jalik har kuni necha gektar ekin ekkan va hammasi bo'lib necha gektar yerga ekin ekilgan?

815. 1) Agar p sonning 30%i 63 ni tashkil qilsa, shu sonni toping;

2) a sonni 25%ga orttirilgandan keyin 87,5 hosil bo'ldi. a ni toping.

37- §. MASALALARNI TENGLAMALAR SISTEMASI YORDAMIDA YECHISH

1-masala. Daryo bo'yidagi ikki qishloq orasidagi masofa 60 km ga teng. Bu masofani kater daryo oqimi bo'yicha 2 soatda, oqimga qarshi esa 1 soatda o'tadi. Katerning va daryo oqimining tezliklari o'zgarmas deb faraz qilib, katerning harakat tezligini va daryo oqimining tezligini toping.

△ Masalani yechishda ikki bosqichni qaraymiz:

1) tenglamalar sistemasini tuzish va

2) sistemani yechish.

1) Belgilashlar kiritamiz:

x km/soat – katerning turg'un suvdagi harakat tezligi;

y km/soat – daryo oqimining tezligi.

U holda:

$(x+y)$ km/soat – katerning daryo oqimi bo'yicha harakat tezligi;

$(x+y)2$ km – katerning daryo oqimi bo'yicha 2 soatda bosib o'tgan yo'li.

Masalaning shartiga ko'ra bu masofa 60 km ga teng:

$$(x+y)\,2=60.$$

So'ngra: $(x-y)$ km/soat – katerning daryo oqimiga qarshi harakat tezligi va

$(x-y)3$ km – kater oqimga qarshi 3 soatda bosib o'tgan yo'li. Shartga ko'ra bu masofa ham 60 km ga teng:

$$(x-y)\,3=60.$$

Hosil qilingan tenglamalarda x va y bir xil sonlarni belgilagani uchun bu tenglamalar sistema tashkil qiladi:

$$\begin{cases}(x+y)2=60,\\(x-y)3=60.\end{cases} \qquad (1)$$

Avval (1) sistemaning har bir tenglamasini, ulardan birinchisini 2 ga, ikkinchisini esa 3 ga bo'lib, soddalashtiramiz:

$$\begin{cases}x+y=30,\\x-y=20.\end{cases} \qquad (2)$$

Bu tenglamalarni hadlab qo'shib, topamiz: $2x=50$, $x=25$.

(2) sistemaning birinchi tenglamasidan ikkinchi tenglamasini ayirib, hosil qilamiz: $2y=10$, $y=5$.

Javob. Katerning harakat tezligi 25 km/soat, daryo oqimining tezligi 5 km/soat. ▲

2-masala. Agar ikki son yig'indisining ikkilangani ularning ayirmasidan 5 ta ortiq, shu sonlar yig'indisining uchlangani esa ular ayirmasidan 8 ta ortiq bo'lsa, bu sonlarni toping.

△1) Tenglamalar sistemasini tuzish.

Aytaylik, x, y – izlanayotgan sonlar bo'lsin. Bu holda masalaning shartiga ko'ra, quyidagiga ega bo'lamiz:

$$\begin{cases}2(x+y)=(x-y)+5,\\3(x-y)=(x-y)+8.\end{cases} \qquad (3)$$

2) Sistemani yechish.

Avval (3) sistemaning tenglamalarini soddalashtiramiz:

$$\begin{cases}2x+2y=x-y+5,\\3x-3y=x-y+8;\end{cases} \qquad (4)$$

$$\begin{cases}x+3y=5,\\2x+4y=8.\end{cases}$$

Ikkinchi tenglamani hadlab 2 ga bo'lamiz va uni birinchi tengla-

madan ayiramiz:

$$\begin{array}{r} x+3y=5, \\ \underline{-\ x+2y=4} \\ y=1 \end{array}$$

$y=1$ ni (4) sistemaning birinchi tenglamasiga qo'yib, topamiz: $x+3\cdot 1=5$, $x=2$.

Javob. Izlanayotgan sonlar 2 va 1. ▲

Shunday qilib, masalalarni tenglamalar sistemasi yordamida yechish ko'pincha quyidagi sxema bo'yicha olib boriladi, ya'ni:

1) noma'lumlarga belgilashlar kiritiladi va tenglamalar sistemasi tuziladi;

2) tenglamalar sistemasi yechiladi;

3) masala shartiga qaytib, javob yoziladi.

Lekin ba'zan, sistemani yechib bo'lingandan keyin yana ba'zi mulohaza va hisoblashlar olib borishga to'g'ri keladi. Shunday masalaga misol keltiramiz.

3-masala. Ikkita qalam va uchta daftar 120 so'm turadi, uchta qalam va ikkita daftar esa 130 so'm turadi. Beshta qalam va oltita daftar qancha turadi?

△ 1) Tenglamalar sistemasini tuzish.

Aytaylik, x so'm qalamning bahosi, y so'm daftarning bahosi bo'lsin. Masala sharti bo'yicha:

$$\begin{cases} 2x+3y=120, \\ 3x+2y=130. \end{cases} \qquad (2)$$

2) Sistemani yechish.

Birinchi tenglamani 3 ga, ikkinchisini 2 ga ko'paytirib, birinchi tenglamadan ikkinchi tenglamani hadlab ayiramiz:

$$\begin{array}{r} 6x+9y=360, \\ \underline{-\ 6x+4y=260} \\ 5y=100, \text{ bundan } y=20. \end{array}$$

$y=20$ ni (5) sistemaning birinchi tenglamasiga qo'yib, topamiz: $2x+3\cdot 20=120$, $2x=60$, $x=30$.

Shunday qilib, $x=30$, $y=20$ – sistemaning yechimi, ya'ni qalam 30 so'm, daftar 20 so'm turadi.

3) Beshta qalam va oltita daftar

$$5 \cdot 30 + 6 \cdot 20 = 270 \text{ so'm}$$

turadi.

Javob. 270 so'm. ▲

Mashqlar

816. Ikki sonning yig'indisi 51 ga teng, ularning ayirmasi esa 21 ga teng. Shu sonlarni toping.

817. O'quvchi 3 ta umumiy daftarga va 2 ta qalamga 660 so'm to'ladi. Ikkinchi o'quvchi xuddi shunday 2 ta umumiy daftar va 2 ta qalamga 460 so'm to'ladi. Umumiy daftar necha so'm va qalam necha so'm turadi?

818. 14 m matodan 4 ta erkaklar va 2 ta bolalar paltosini tikish mumkin. Agar 15 m shu matodan 2 ta erkaklar va 6 ta bolalar paltosini tikish mumkin bo'lsa, bitta erkaklar va bitta bolalar paltosi tikish uchun necha metr mato kerak bo'ladi?

819. To'g'ri to'rtburchakning perimetri 32 sm ga teng. Qo'shni tomonlarning ayirmasi 2 sm ga teng. To'g'ri to'rtburchakning tomonlarini toping.

820. Agar ikki sondan birinchisining ikkilanganidan ikkinchi sonning ayirmasi 7 ga teng, birinchi sondan ikkinchi son ikkilanganining ayirmasi 8 ga teng bo'lsa, shu sonlarni toping.

821. Ikki brigada birgalikda 1456 sr don yig'ib olishdi. Birinchi brigada 46 ga maydondan, ikkinchi brigada esa 35 ga maydondan bug'doy yig'ib oldi. Agar birinchi brigada 1 ga maydondan ikkinchiga qaraganda 7 sr ko'p don yig'ishtirib olgan bo'lsa, har bir brigada o'rtacha har gektardan alohida-alohida necha sentnerdan hosil yig'ib olgan?

822. Vagonga hammasi bo'lib 300 ta dub va qarag'ay yog'och ortishdi. Hamma dub yog'ochlar hamma qarag'ay yog'ochlardan 1 t kamligi ma'lum. Agar har bir dub yog'och 46 kg, har bir qarag'ay yog'och esa 28 kg bo'lsa, dub yog'ochlar va qarag'ay yog'ochlar alohida-alohida nechtadan ekanligini aniqlang.

823. Ikki ishchi birgalikda 1020 ta detal tayyorladi. Birinchi ishchi 15 kun, ikkinchisi esa 14 kun ishladi. Agar birinchi ishchi 3 kunda ikkinchi ishchi 2 kunda tayyorlaganidan 60 ta ko'p detal tayyorlagan bo'lsa, har bir ishchi bir kunda nechta detal tayyorlagan?

824. Ikki traktorchi birgalikda 678 ga yerni ekishga tayyorladi. Birinchi traktorchi 8 kun, ikkinchisi esa 11 kun ishladi. Agar birinchi traktorchi 3 kunda ikkinchi traktorchi 4 kunda bajarganidan 22 ga kam yerni ekishga tayyorlagan bo'lsa, har bir traktorchi bir kunda necha gektar yerni ekishga tayyorlagan?

825. 8 ta ot va 15 ta sigir uchun kuniga 162 kg xashak ajratishdi. Agar 5 ta otga 7 ta sigirga qaraganda 3 kg ortiq xashak berishganligi ma'lum bo'lsa, kuniga har bir otga va har bir sigirga qanchadan xashak berishgan?

826. Ikki usta 1170 ta detal yasashdi. Birinchisi 15 kun, ikkinchisi esa 14 kun ishladi. Agar birinchi usta 4 kunda ikkinchi usta 3 kunda yasaganidan 110 ta ortiq detal yasaganligi ma'lum bo'lsa, ulardan har biri bir kunda qancha detal yasagan?

827. a so'mga 8 kg birinchi nav va 20 kg ikkinchi nav uzum sotib olishdi. Agar 5 kg birinchi nav uzum 7 kg ikkinchi nav uzumdan b so'm qimmat tursa, har bir nav uzumning 1 kilogrami qancha turadi?

828. Agar ikki son yig'indisining uchlangani ular ayirmasining ikkilanganidan 8 ta ortiq, shu sonlar yig'indisining ikkilangani ular ayirmasidan 6 ta ortiq bo'lsa, shu sonlarni toping.

829. Otasi qizidan 26 yosh katta, 4 yildan keyin u qizidan 3 marta katta bo'ladi. Otasi necha yoshda, qizi necha yoshda?

830. Ikkita idishda 140 ℓ suv bor. Birinchi idishdan 26 ℓ suv, ikkinchisidan esa 60 ℓ suv olganlaridan keyin birinchi idishda ikkinchisidagidan ikki marta ko'p suv qoldi. Dastlab har bir idishda necha litrdan suv bo'lgan?

831 Bir bidonda ikkinchisidagidan 5 ℓ ko'p sut bor. Birinchi bidondan ikkinchisiga 8 ℓ sut olib quyishganlaridan keyin

unda birinchi bidonda qolganidan ikki marta ko'p sut bo'ladi. Har bir bidonda necha litrdan sut bor edi?

832. Motorli qayiq daryo oqimi bo'yicha 12 km yurib, qaytishda yo'lga 2,5 soat sarfladi. Ikkinchi marta xuddi shu motorli qayiq 1 soat-u 20 minut ichida daryo oqimi bo'yicha 4 km, oqimga qarshi esa 8 km yo'l bosdi. Motorli qayiqning turg'un suvdagi tezligini va daryo oqimining tezligini toping.

833. Oralaridagi masofa 650 km bo'lgan ikki shahardan bir-birlariga tomon ikki poyezd yo'lga chiqdi. Poyezdlar 10 soatdan keyin uchrashdilar. Agar birinchi poyezd ikkinchisidan 4 soat-u 20 minut oldin yo'lga chiqqanida edi, u holda uchrashuv ikki poyezd jo'naganidan 8 soat keyin sodir bo'lardi. Har bir poyezd bir soatda necha kilometr yo'l bosadi?

834. *A* shahardan mototsiklda yo'lga chiqqan sayyoh *B* shaharga belgilangan vaqtda yetib kelishi kerak. Agar sayyoh 35 km/soat tezlik bilan yursa, 2 soat kechikadi; agarda u 50 km/soat tezlik bilan yursa, u holda muddatidan 1 soat oldin yetib keladi. *A* va *B* shaharlar orasidagi masofani va sayyohning shu masofani o'tish uchun sarf qilgan vaqtni aniqlang.

835. Fermer xo'jaligi ikki ekin maydonidan 460 t beda yig'ishtirib oldi. Ikkinchi yili birinchi maydondagi hosildorlik 15% ga, ikkinchisidagi hosildorlik esa 10% ga ortdi va umumiy hosil 516 t ni tashkil qildi. Birinchi yili har bir gektardan necha tonna beda yig'ishtirib olingan?

836. Yanvar oyida ikki sex 1080 ta detal tayyorladi. Fevral oyida birinchi sex detal tayyorlashni 15% ga, ikkinchisi esa 12% ga oshirdi, shuning uchun ikkinchi sex 1224 ta detal tayyorladi. Fevralda har bir sex nechtadan detal tayyorlagan?

837. Madaniyat uyi uchun *t* so'mga 4 ta dutor va 3 ta rubob sotib olishga qaror qilishdi. Dutorning bahosi 20% ga, rubobniki esa 30% ga kamaytirilganligi uchun o'sha xaridga *s* so'm to'lashdi. Dutor va rubobning yangi bahosini toping.

838. Daraxt ekuvchilarning ikki guruhi mart oyida 900 ta ko'chat ekishdi. Aprelda birinchi guruh martdagiga qaraganda 15%, ikkinchisi esa 12% ortiq ko'chat ekishdi va shuning uchun

ikkala guruh birgalikda shu vaqt ichida 1020 ta ko'chat ekishdi. Har bir guruh aprelda nechtadan ko'chat ekishgan?

839. Ifodani soddalashtiring:

1) $\frac{1}{9-a^2}-\frac{3}{a+3}\cdot\left(\frac{a+4}{3a+3}-\frac{1}{a+1}\right)$; 2) $\frac{a^2+ax}{a^3-x^3}\cdot\left(\frac{a}{a^2-x^2}+\frac{x}{a^2-ax}\right)$.

840. $a=23{,}7$ va $a=-5{,}12$ bo'lganda ushbu ifodalarning qiymatlari teng bo'lishini isbotlang: $\left(\frac{4a^2}{a^2-1}-\frac{a-1}{a+1}+\frac{a+1}{a-1}\right)\cdot\frac{1-a}{a}$.

841. Tenglamani yeching: $(2x-1)(2x+1)-(1-2x)^2=-2$.

VII bobga doir mashqlar

Tenglamalar sistemasini o'rniga qo'yish usuli bilan yeching (**842–845**):

842. 1) $\begin{cases}2x+y-8=0,\\3x+4y-7=0;\end{cases}$ 3) $\begin{cases}\frac{7y-x}{3}=-2,\\\frac{x+14y}{2}=4{,}5;\end{cases}$

2) $\begin{cases}3x-4y-2=0,\\5x-2y-6=0;\end{cases}$ 4) $\begin{cases}\frac{7x-y}{2}=-3,\\\frac{-8x+5y}{2}=3{,}5.\end{cases}$

843. 1) $\begin{cases}3x+2y-9=0,\\4x+5y-8=0;\end{cases}$ 3) $\begin{cases}\frac{6y-x}{4}=2,\\\frac{x+13y}{2}=4;\end{cases}$

2) $\begin{cases}4x-5y-3=0,\\6x-2y-7=0;\end{cases}$ 4) $\begin{cases}\frac{7x-y}{5}=-3,\\\frac{-8x+5y}{-3}=5.\end{cases}$

844. 1) $\begin{cases}x=3+y,\\x-3y=7;\end{cases}$ 3) $\begin{cases}y-2x=13,\\x=2y-5;\end{cases}$

2) $\begin{cases}5y+x=6,\\y=8+2x;\end{cases}$ 4) $\begin{cases}x=3-4y,\\8y=5-3x.\end{cases}$

845. 1) $\begin{cases} \frac{x}{3}+\frac{y}{2}=\frac{1}{6}, \\ \frac{x}{2}+\frac{2y}{3}=0; \end{cases}$ 2) $\begin{cases} \frac{x}{4}-\frac{y}{3}=\frac{1}{5}, \\ \frac{3x}{2}+\frac{y}{3}=1; \end{cases}$

Tenglamalar sistemasini algebraik qo'shish usuli bilan yeching (**846–848**):

846. 1) $\begin{cases} 4x+3y=6, \\ 2x+y=4; \end{cases}$ 3) $\begin{cases} 4x+3y=-4, \\ 6x+5y=-7; \end{cases}$

2) $\begin{cases} 2x+5y=25, \\ 4x+3y=15; \end{cases}$ 4) $\begin{cases} 4x-5y=-22, \\ 3x+2y=18. \end{cases}$

847. 1) $\begin{cases} x+5y-7=0, \\ x-3y=-1; \end{cases}$ 3) $\begin{cases} 36x+33y+3=0, \\ 12x-13y+25=0; \end{cases}$

2) $\begin{cases} x-3y-4=0, \\ 5x+3y+1=0; \end{cases}$ 4) $\begin{cases} 7x-3y+1=0, \\ 4x-5y+17=0. \end{cases}$

848. 1) $\begin{cases} 3x+5y-4=0, \\ 5x-3y=7; \end{cases}$ 3) $\begin{cases} 7x=9y, \\ 5x+3y=66; \end{cases}$

2) $\begin{cases} 7x-3y-2=0, \\ 5x+3y+9=0; \end{cases}$ 4) $\begin{cases} 5x+6y=9, \\ 3x+4y=7. \end{cases}$

849. Sistemani grafik usul bilan yeching:

1) $\begin{cases} 2x+y=8, \\ 2x-y=1; \end{cases}$ 4) $\begin{cases} 4x-y+7=0, \\ x+3y+5=0; \end{cases}$

2) $\begin{cases} 3x+y=2, \\ x+2y=-6; \end{cases}$ 5) $\begin{cases} x+2y=5, \\ 2x-y=5. \end{cases}$

3) $\begin{cases} 2x+y=1, \\ y-x=4; \end{cases}$ 6) $\begin{cases} x+3y-6=0, \\ 2x+y-7=0. \end{cases}$

850. Ikki xonali sonning raqamlari yig'indisi 12 ga teng. Shu raqamlar bilan teskari tartibda yozilgan son berilgan sondan 54 ta ortiq. Shu sonni toping.

851. Ikki xonali sonning raqamlari yig'indisi 12 ga teng, shu sondagi birliklar soni bilan o'nliklar sonining ayirmasi berilgan sondan 12 marta kichik. Bu sonni toping.

852. Bog' to'g'ri to'rtburchak shaklida. Agar bog'ning bo'yini 8 m ga, enini esa 6 m ga orttirilsa, u holda bog'ning yuzi 632 m^2 ga ortadi. Bog'ning bo'yi va enini aniqlang.

853. Agar kitob sahifasidagi satrlar sonini 4 ta, satrdagi harflar sonini esa 5 ta kamaytirilsa, u holda butun sahifadagi harflar soni 360 taga kamayadi. Agarda kitob sahifalaridagi satrlar sonini 3 ta, satrdagi harflar sonini esa 2 ta orttirilsa, u holda bir sahifaga oldingiga qaraganda 228 ta harf ortiq joylashadi. Sahifadagi satrlar sonini va satrdagi harflar sonini aniqlang.

VII SINF ALGEBRA KURSINI TAKRORLASH UCHUN MASHQLAR

854. Sonli ifodaning qiymatini toping:

1) $2\frac{7}{8}+5\frac{5}{6}+7\frac{1}{8}+\frac{5}{6}$; 2) $13\frac{5}{6}\cdot\frac{1}{7}+\frac{1}{6}\cdot\frac{1}{7}$.

855. Sonli ifodaning qiymatini toping:

1) $(-1,5+4-2,5)(-6)$; 2) $(2-3-7+7,9)^2$;

3) $(\frac{1}{5}-\frac{1}{4}):(-1,6-3,3+5)$;

4) $\frac{0,25-1\frac{1}{5}}{-3\frac{4}{5}+1,9}+\frac{10-2,5}{\frac{1}{2}-0,75}$; 5) $\frac{(0,2)^2+0,96}{4,5}+\frac{1}{9}$.

856. Tenglik to'g'rimi:

1) $\frac{2-\frac{3}{5}+0,7}{1\frac{4}{5}-1+0,4}=\frac{7}{4}$; 2) $\frac{(\frac{4}{7}-7-0,2)\cdot 3,5}{2,26}=-10$;

3) $(\frac{4,752}{3,2}+\frac{0,608}{3,8}):(7,5-\frac{3,55}{1,42})=0,0617$.

857. Yozing: 1) a va b sonlarning yig'indisini; 2) ularning ayirmasini; 3) ularning ko'paytmasini; 4) ularning bo'linmasini; 5) ularning yig'indisi bilan ayirmasining ko'paytmasini; 6) ularning yig'indisini ayirmasiga bo'lgandagi bo'linmasini; 7) shu sonlarning yarim yig'indisini; 8) shu sonlarning yarim ayirmasini; 9) shu sonlar ko'paytmasining yarmini.

858. Ikki sondan biri a ga teng, ikkinchisi undan 7 ta ortiq. Shu sonlar ko'paytmasining ikkilanganini toping. Shu ko'paytmaning qiymatini $a=\frac{1}{2}$ bo'lganda hisoblang.

859. Ikki sonning yig'indisi 30 ga teng. Sonlardan biri a. Shu sonlarning ikkilangan ko'paytmasini yozing. Shu ko'paytmaning qiymatini $a=-2$ bo'lganda hisoblang.

860. a ta yuzlik, b ta o'nlik va c ta birlikdan tuzilgan natural sonda nechta birlik borligini ko'rsatuvchi formula tuzing.

Xuddi shu raqamlar yordamida, lekin teskari tartibda yozilgan sonda nechta birlik bor?

861. a kilogramm va c gramm necha grammni tashkil qiladi? Grammlar sonini x harfi bilan belgilab, javobni formula bilan yozing.

862. Algebraik ifodaning son qiymatini toping:

1) $\frac{2a+b}{b-2a}$, bunda $a=-\frac{1}{2}$, $b=-3$;

2) $\frac{1}{8}a^3-27ab^2$, bunda $a=2$, $b=-\frac{1}{3}$;

3) $\frac{2}{3}a^2b-\frac{3}{2}ab^2$, bunda $a=4$, $b=1$;

4) $\frac{abc-4a+3b}{a+b-c}$, bunda $a=-\frac{1}{3}$, $b=-\frac{3}{4}$, $c=-\frac{4}{3}$.

863. Tenglik to'g'rimi:

1) $\frac{5^3 5^4 5}{(5^2)^3}=25$;

2) $\frac{(b^3)^2 b^3 b}{(b^2)^4}-b^2=0$;

3) $\frac{(3b^2)^2 9b^3}{3^4 b^6}+b=2b$;

4) $((\frac{1}{a})^4)^3-(\frac{1}{a})^{11}\cdot\frac{1}{a}=0$?

864. Birhadlarning ko'paytmasini toping:

1) $-12a^2bc^2d\cdot 5ac^3d^4\cdot(-3b^3cd^2)$;

2) $49a^2bc^2\cdot(-\frac{2}{7}ab)\cdot(\frac{1}{14}ac)$;

3) $8a^2b\cdot(-4ab^3)\cdot(-7a^3b^2)$;

4) $(-\frac{2}{3}a^4b^2c)\cdot\frac{15}{2}abc^3$.

865. Birhadni darajaga ko'taring:

1) $(-2ab^2)^3$; 2) $(-0{,}8ac^2)^2$; 3) $(-\frac{3}{5}abc^3)^3$.

866. Ifodani soddalashtiring:

1) $2a^2+2ab+3b^2-a^2-2b^2$;

2) $7a^2+2b^2-(6a^2+b^2)$;

3) $\frac{2}{3}a^2-b^2+\frac{4}{3}a^2-\frac{5}{7}b^2$;

4) $\frac{1}{7}a^2b\cdot 23m-\frac{2}{7}a^2bm$.

867. Ifodaning son qiymatini toping:

$5a^2-2ab+6a-7ab-6a^2-6a$, bunda $a=5$, $b=-\frac{1}{9}$.

868. Ko'phadni birhadga ko'paytiring:

1) $(a^2-ab+b^2)3ab^3$;

2) $(6a^2-4ab^2+1)\cdot\frac{1}{2}ab$.

869. Ko'phadlarni ko'paytiring:

1) $(a^2+3ab+b^2)(7a-5b)$; 3) $(\frac{1}{3}a^2b-\frac{2}{5}ab^2)(15a-30b)$;

2) $(a+3b-4c)(a-3b-4c)$; 4) $(\frac{1}{2}a^2+4a+1)(3a-1)$.

870. Algebraik ifodaning qiymatini toping:

1) $12a^2b^3:(3ab^2)$, bunda $a=\frac{3}{4}$, $b=\frac{1}{9}$;

2) $(4a^3b+6a^2b):(2a^2b)$, bunda $a=-1$.

Tenglamani yeching **(871–879)**:

871. 1) $4(2x-1)+3(1-2x)=7$; 2) $4(x+2)-2(3x-2)=14x-5(x+3)$.

872. 1) $\frac{x}{2}=\frac{4}{3}$; 2) $\frac{1}{2}x=11$; 3) $\frac{x}{2}-7=23$.

873. 1) $\frac{2x+1}{3}=6$; 2) $\frac{x}{3}-\frac{1}{2}=\frac{x}{2}$.

874. 1) $-x-1=x$; 2) $\frac{5x-6}{2}=\frac{4x-5}{2}$.

875. 1) $\frac{x-2}{4}-\frac{1}{2}=\frac{x+7}{6}$; 2) $\frac{2(3x-1)}{5}=4-\frac{x+2}{2}$.

876. 1) $7-\frac{x}{2}=3+\frac{7x}{2}$; 2) $\frac{x+3}{2}=x-4$.

877. 1) $\frac{x}{2}+\frac{x}{3}+\frac{x}{6}=12$; 2) $\frac{2x-1}{5}-\frac{x+1}{5}=\frac{3(1-x)}{10}$.

878. 1) $\frac{6x+7}{7}+\frac{3+5x}{8}=3$; 3) $1+x=\frac{5x-2}{2}$.

2) $5-\frac{2x-5}{3}=\frac{4x+2}{3}$; 4) $\frac{1-x}{9}-1=7x$.

879. 1) $\frac{4x-3}{2}-\frac{5-2x}{3}-\frac{3x-7}{6}=0$; 2) $\frac{x+4}{5}-\frac{x+3}{3}=x-5-\frac{x-2}{2}$.

880. Uchta qutida 119 ta qalam bor. Birinchi qutida ikkinchidagiga qaraganda 4 ta ortiq va uchinchidagiga qaraganda 3 ta kam qalam bor. Har bir qutida nechtadan qalam bor?

881. Yuk poyezdi platforma, sisterna va vagonlardan tuzilgan. Sisternalar platformalarga qaraganda ikki marta ko'p va vagonlar sonidan esa 3 ta ortiq. Agar ularning jami soni 17 ta bo'lsa, sisterna, platforma va vagonlarning har biri nechtadan?

882. Otasi 30 yoshda, o'g'li esa 4 yoshda. Necha yildan keyin otasi o'g'lidan uch marta katta bo'ladi?

883. O'g'li 6 yoshda, otasi esa undan 6 marta katta. Necha yildan keyin o'g'li otasidan 4 marta yosh bo'ladi?

884. Vertolyot ikki qishloq orasidagi masofani shamol yo'nalishida 1,5 soatda, shamol yo'nalishiga qarshi esa 2 soatda uchib o'tadi. Agar shamolning tezligi 10 km/soat bo'lsa, shu qishloqlar orasidagi masofa qancha?

885. Zavod sexi reja bo'yicha bir xil turdagi detallarni 10 kun muddat ichida tayyorlashi kerak edi. Lekin u har kuni rejaga qo'shimcha 2 tadan detal tayyorlab, muddatiga bir kun qolganda faqat topshiriqni bajaribgina qolmasdan, balki rejadan yana 3 ta detal ortiq tayyorladi. Zavod reja bo'yicha nechta detal tayyorlashi kerak edi?

886. Baliq ovlovchilar brigadasi har kuni 60 sr baliq ovlashi kerak edi. Brigada har kuni rejani 5 sr ga oshirib bajarib, reja topshiriqlarini muddatidan 3 kun oldin bajardi va rejaga qo'shimcha 20 sr baliq ovladi. Brigada reja bo'yicha qancha baliq ovlashi kerak edi?

887. Ikki velosipedchi bir vaqtda bitta yo'l ustidagi ikki qishloqdan bir-biriga qarab yo'lga chiqdilar. Birinchisi 15 km/soat, ikkinchisi esa 12 km/soat tezlik bilan harakat qilmoqda. Agar qishloqlar orasidagi masofa 40,5 km bo'lsa, qancha vaqtdan keyin uchrashuv sodir bo'ladi?

888. Ikki velosipedchi bir yo'ldagi ikkita qishloqdan bir vaqtda bir xil yo'nalishda yo'lga chiqdi. Ikkinchi velosipedchi oldinda, birinchisi orqada bormoqda. Birinchi velosipedchining tezligi 15 km/soat, ikkinchisiniki esa 12 km/soat. Agar qishloqlar orasidagi masofa 4,5 km bo'lsa, birinchi velosipedchi ikkinchisini qancha vaqtda quvib yetadi?

889. 1) Traktorchilar 5 kunlik ish vaqtida 500 ga yerga ekin ekdilar. Ikkinchi kuni ular birinchi kundagiga qaraganda 25% ko'p, uchinchi kuni esa ikkinchi kundagiga qaraganda 20% ko'p ekin ekdilar. Oxirgi ikki kunda ular har kuni ikkinchi kundagiga teng maydonga ekin ekdilar. Traktorchilar birinchi kuni necha gektar yerga ekin ekdilar?

2) x son y sonning 80% ini tashkil qiladi. Agar y ni 500 ga orttirilsa, u holda u x dan ortirilgan y ning 25% iga ko'p bo'ladi. Shu sonlarni toping.

3) Zavodni texnik jihatdan qayta jihozlash rejasiga muvofiq birinchi yilda mahsulot qiymatini 4% ga, ikkinchi yilda 25% ga, uchinchi yilda 2% ga va so'nggi ikki yilda 1% dan kamaytirish ko'zda tutilgan. Zavodni texnik jihatdan qayta jihozlash rejasi bajarilsa, mahsulot ishlab chiqarish qanchaga arzonlashadi?

Soddalashtiring: **(890–893).**

890. 1) $(a+1)(a-1)(a^2+1)$; 2) $(\frac{a}{2}-5)(5+\frac{a}{2})+25$.

891. 1) $(a+3)^2+(a-3)^2$; 2) $(4a+b)^2-(4a-b)^2$.

892. 1) $(1-a)(1+a+a^2)+a^3$; 2) $(\frac{1}{2}-c^2)(\frac{1}{4}+\frac{1}{2}c^2+c^4)+c^6$

893. 1) $(1-7b)^2-(1+7b)^2$; 4) $(2+a)(4-2a+a^2)(a^3-8)$;

2) $(2a-b)^2-(2a-b)(2a+b)$; 5) $(1-a)^2(1+a)^2-(1-a^4)$.

3) $(1-2b)(1+2b+4b^2)(1+8b^3)$;

Ko'paytuvchilarga ajrating **(894–897).**

894. 1) $a^4+6a^3+9a^2$; 2) $25-(2-3a)^2$;

895. 1) $(a+1)^2-(4-3a)^2$; 3) $(2a+b)^2-9(a+b)^2$;

2) $(8b-1)^2-(2b+3)^2$; 4) $4(a-2b)^2-25(3a-b)^2$.

896. 1) $a^3b^6c^3-1$; 3) $(a-1)^2+2(a-1)+1$;

2) $8a^3b^3+125c^3$; 4) $(4a-1)^2+2(4a-1)+1$.

897. 1) $4ab^2+15abc-4bcd-15c^2d$; 2) m^3-m^2+m-1;

3) $a^2+b^2-c^2+2ab$; 4) $1+2ab-a^2-b^2$.

898. Kasrni qisqartiring: 1) $\frac{a^2-16}{a^2-8a+16}$; 2) $\frac{4x^2-9}{2x+3x}$.

Amallarni bajaring **(899–904):**

899. 1) $\frac{b+3}{5}+\frac{7+b}{10}+\frac{b-3}{2}$; 2) $\frac{a^2-5a-4}{16-a^2}+\frac{2a}{8a+a^2}$.

900. 1) $1+a-\frac{a-1}{a}+\frac{a^2-1}{2a}-\frac{3a}{2}$;

2) $\frac{m+1}{m^2+m+1}-\frac{2}{1-m}+\frac{3m^2+2m+4}{1-m^3}$;

3) $\frac{m+n}{3}-m+2n$; 4) $m+n-\frac{2m-n}{5}-\frac{m+n}{2}$.

901. 1) $\frac{a}{a^2-1}-\frac{1}{1-a^2}$; 2) $\frac{4x^2}{2x-3y}+\frac{12xy}{3y-2x}+\frac{9y^2}{2x-3y}$.

902. 1) $\frac{a-b}{ab}-\frac{a-c}{ac}$; 2) $\frac{1}{14x^3}-\frac{1}{21x^2y}+\frac{1}{4xy^2}$.

903. 1) $\frac{x^2-y^2}{6xy}\cdot\frac{12x^2y}{x+y}$; 2) $\frac{a^2+4a}{a^2-16}:\frac{4a+16}{a^2-4a}$.

904. 1) $\frac{a^3+2a^2}{a^2-1}\cdot\frac{(a+1)^3(a-1)}{a^2(a+2)}$; 2) $\frac{(a^2+ab)^2}{a^2-b^2}:\frac{(a+b)^2}{(ab-b^2)^2}$.

Amallarni bajaring **(905–908).**

905. 1) $(\frac{a}{a+1}+1):(1-\frac{a}{a+1})$; 2) $\frac{1-a^2}{1+b}\cdot\frac{1-b^2}{a+a^2}\cdot(1+\frac{a}{1-a})$.

906. 1) $1+3a+\frac{9a^2}{1+3a}+\frac{1}{3a-1}+\frac{6a}{1-9a^2}$;

2) $(\frac{a+b}{a-b}+\frac{a-b}{a+b}):(\frac{a^2+b^2}{a^2-b^2}+\frac{a^2-b^2}{a^2+b^2})$.

907. 1) $(\frac{9m^2-3n^2}{4mn}-\frac{m-4n}{5n})(\frac{2m+n}{3m}-\frac{5n^2-3m^2}{16m^2})$;

2) $(\frac{a+4b}{2b}+\frac{6b}{4b-a})(1-\frac{a^2-2ab+4b^2}{a^2-4b^2})$.

908. 1) $\frac{3}{2}(\frac{2a}{3}-\frac{a}{7})-\frac{12(a-5)}{7}+a+\frac{1}{3}(\frac{a}{2}-5a)$;

2) $2-\frac{x-a}{x+a}-\frac{x}{x-a}+(\frac{1}{a^2}-\frac{1}{ax}+\frac{2}{x^2}):(\frac{1}{a^2}-\frac{1}{x^2})$.

909. Jism 4 km/soat tezlik bilan tekis harakat qilmoqda.

1) Shu jismning t soat davomida bosib o'tgan S yo'lini ifoda qiluvchi formulani yozing.

2) t ning 0 ga; 1 ga; 2 ga; 3 ga; 4 ga teng qiymatlari uchun S ning qiymatlari jadvalini tuzing.

3) Jadvaldagi ma'lumotlar bo'yicha mazkur jism bosib o'tgan yo'lning o'zgarishi harakat vaqtining o'zgarishiga bog'liqligi grafigini chizing.

4) Grafik bo'yicha jism 1 soat-u 30 minutda, 3,5 soatda bosib o'tgan yo'lini toping.

5) Grafik bo'yicha jism qancha vaqtda 10 km, 6 km yo'l bosishini toping.

6) Hosil qilingan grafikning istalgan nuqtasi ordinatasining uning abssissasiga nisbati 4 ga tengligini isbotlang.

7) Agar nuqta shu grafikda yotmasa, uning ordinatasining unga mos abssissasiga nisbati 4 ga teng bo'lmasligini isbotlang.

910. Funksiyaning grafigini yasang:

1) $y=-3x+2$; 2) $y=3x-2$; 3) $y=\frac{1}{3}x+2$;

4) $y=-\frac{1}{3}x-2$; 5) $y=-2$; 6) $y=1$.

911. $y=0,4x-8$ funksiyaning grafigini yasang. Grafik bo'yicha:

1) x ning -1; 0; 1; 2,5 qiymatiga mos keluvchi y ning qiymatini;

2) x ning qanday qiymatida y ning qiymati -8; -2; 0; 0,5; 1,5; 4 ga teng bo'lishini toping.

912. Grafikning koordinata o'qlari bilan kesishish nuqtalarining koordinatalarini toping:

1) $y=7x+4$; 2) $y=-7x+4$; 3) $y=3,5x-1$; 4) $y=-3,5x+1$.

913. $y=kx+b$ funksiya berilgan. k va b ning qanday qiymatlarida funksiya grafigi $(-1; 1)$ va $(2; 3)$ nuqtalardan o'tadi?

914. 1) Agar $y=kx-1$ funksiyaning grafigi $(-3; 2)$ nuqta orqali o'tishi ma'lum bo'lsa, k ning qiymatini toping.

2) Agar $y=\frac{1}{3}x+b$ funksiyaning grafigi $(-6; 0)$ nuqta orqali o'tishi ma'lum bo'lsa, b ning qiymatini toping.

915. Tenglamaning grafigini yasang:

1) $x+y-1=0$; 2) $2x+y=3$; 3) $3y-2x=9$; 4) $2x=y-1$.

916. Funksiya grafiklarining kesishish nuqtasini toping:

1) $y=4x-6$ va $y=3x-2$; 2) $y=3x-1$ va $y=-\frac{5}{3}x+\frac{8}{3}$.

Tenglamalar sistemasini yeching **(917–919)**.

917. 1) $\begin{cases} 2x - y = -6, \\ x + 2y = 7; \end{cases}$ 3) $\begin{cases} 3x + 7y = 13, \\ 8x - 3y = 13; \end{cases}$

2) $\begin{cases} x + y = 4, \\ 3x + y = 0; \end{cases}$ 4) $\begin{cases} 3x - 5y = 6, \\ -8y = 3x + 7. \end{cases}$

918. 1) $\begin{cases} \frac{x}{5} + \frac{y}{4} = 5, \\ \frac{x}{4} - \frac{y}{5} = 0{,}5; \end{cases}$ 2) $\begin{cases} \frac{x+y}{3} + y = 9, \\ \frac{x-y}{3} - x = 4. \end{cases}$

919. 1) $\begin{cases} \frac{9x-y}{7} + 2y = 3, \\ \frac{12x+5y}{3} - 3x = 3; \end{cases}$ 2) $\begin{cases} \frac{11x+3y}{9} - 3x = -5, \\ \frac{14x-9y}{11} + 5y = 8. \end{cases}$

920. Tenglamalar sistemasini grafik usulda yeching:

1) $\begin{cases} 2x + 5y = 1, \\ y = 1; \end{cases}$ 3) $\begin{cases} 3x + 2y = 1, \\ 5x - 2y = 7; \end{cases}$

2) $\begin{cases} x + y = 2, \\ 2x + y = 0; \end{cases}$ 4) $\begin{cases} 4x - 5y - 7 = 0, \\ 2x - 8y + 2 = 0. \end{cases}$

921. Birinchi idishda ikkinchisiga qaraganda 4 marta ko'p suyuqlik bor edi. Birinchi idishdan ikkinchisiga 10 ℓ suyuqlik quyishgandan keyin ikkinchi idishda birinchida qolgan suyuqlikning $\frac{3}{2}$ qismicha suyuqlik bo'ldi. Dastlab har bir idishda qanchadan suyuqlik bo'lgan?

922. 2 juft golf va 3 juft paypoq uchun p so'm to'lashdi. Agar 1 juft golf bilan 4 juft paypoq q so'm tursa, bir juft golf qancha va bir juft paypoq qancha turadi?

923. 5 m lavsanli jun gazmol bilan 4 m ipak gazmol uchun n so'm to'lashdi. Lavsanli gazmolning bahosi 25% ga, ipakliniki esa 15% ga arzonlashtirilgandan keyin 6 m lavsanli va 5 m ipakli gazmolga m so'm to'lashdi. Bahosi pasaytirilgunga qadar bir metr jun gazmol qancha va bir metr ipak gazmol qancha turgan?

924. Opasi ukasidan 6 yosh katta, bir yildan keyin esa opasi ukasidan 2 marta katta bo'ladi. Ularning har biri necha yoshda?

925. Agar kasrning suratiga 3 qo'shilsa, u holda 1 hosil bo'ladi; agarda shu kasrning maxrajiga 2 qo'shilsa, u holda $\frac{1}{2}$ ga teng kasr hosil bo'ladi. Shu kasrni toping.

926. $12 \cdot (-5)$ ko'paytmaning har bir ko'paytuvchisi bir xil songa orttirilganda shu sonning kvadrati hosil bo'ladi. Bu sonni toping.

927. 8 ga bo'lganda 3 qoldiq, 9 ga bo'lganda esa 7 qoldiq hosil bo'ladigan va ikkinchi bo'linma birinchi bo'linmadan 1 ta kam bo'ladigan natural sonni toping.

928. 4 ga bo'lganda 3 qoldiq, 7 ga bo'lganda esa 5 qoldiq hosil bo'ladigan natural sonni toping. Sonni 4 ga bo'lgandagi bo'linma uni 7 ga bo'lgandagi bo'linmadan 2 ta ortiq.

929. Teploxod daryo bo'ylab ikki bekat orasidagi masofani oqim bo'yicha 3 soat-u 20 minutda va oqimga qarshi 5 soatda bosib o'tdi. Agar bekatlar orasidagi masofa 80 km bo'lsa, daryo oqimining tezligini va teploxodning turg'un suvdagi tezligini toping.

930. Poyezd ikki stansiya orasidagi 63 km masofani 1 soat-u 15 minutda bosib o'tdi. U yo'lning bir qismini qiyalik bo'lganligi uchun 42 km/soat tezlik bilan, qolgan qismini esa 56 km/soat tezlik bilan bosib o'tdi. Yo'lning qiya qismi necha kilometr va gorizontal qismi necha kilometr?

931. $(x^2-9)^2-(x+3)^2$ ifoda berilgan.

1) Bu ifodani ko'paytuvchilarga ajrating.

2) x ning qanday qiymatlarida berilgan ifodaning qiymati nolga teng?

3) Bu ifodani standart shakldagi ko'phad ko'rinishida yozing.

4) $x=-3$ bo'lganda $(x^2-9)^2-(x+3)^2+6x$ ifodaning son qiymatini toping.

5) Kasrni qisqartiring: $\frac{(x^2-9)^2-(x+3)^2}{(x+3)^2}$.

932. 1) Ifodalarning har birini ko'paytuvchilarga ajrating:

$A=(2x-3)^2-(x+2)^2$, $B=(2x^2-2x)-10x+10$.

2) x ning qanday qiymatlarida yuqoridagi ifodalarning har biri nolga teng bo'ladi?

3) $\frac{A}{B}$ kasrni qisqartiring. $x=-\frac{1}{3}$, $x=-1$ bo'lganda bu kasrning qiymatini hisoblang.

4) x ning qanday qiymatlarida shu kasrning qiymati nolga teng bo'ladi?

933. 1) k va b ning qanday qiymatlarida $y=kx+b$ funksiyaning grafigi $(-1; 1)$, $(2; -3)$ nuqtalardan o'tadi?

2) $y=-2x-1$ funksiyaning grafigi $(-3; 5)$, $(-1; 2)$ nuqtalardan o'tadimi?

3) $y=-2x-1$ funksiyaning grafigini chizing. Grafikning koordinata o'qlari bilan kesishish nuqtalarining koordinatlarini toping.

4) x ning qanday qiymatida $y=-2x-1$ funksiyaning qiymati nolga teng bo'ladi?

5) x ning shunday bir nechta qiymatini ko'rsatingki, unda $y=-2x-1$ funksiyaning qiymati musbat (manfiy) bo'lsin.

6) $y=-2x-1$ funksiya grafigini $y=5$ funksiya grafigi bilan kesishish nuqtasining koordinatalarini toping.

SINFDAN TASHQARI ISHLAR UCHUN MASALALAR

934. Agar uch xonali sondan undagi raqamlarni teskari tartibda yozishdan hosil bo'lgan uch xonali son ayirilsa, hosil bo'lgan ayirmaning moduli 9 ga va 11 ga bo'linishini isbotlang.

935. Ikkita ketma-ket toq natural son kvadratlari ayirmasining moduli shu sonlar yig'indisining ikkilanganiga teng bo'lishini isbotlang.

936. Agar ikki xonali x son raqamlari orasiga shu sonning o'zini yozilsa, u holda hosil bo'lgan to'rt xonali son dastlabki ikki xonali sondan 66 marta katta bo'ladi. x ni toping.

937. 16^5+2^{15} ifodaning qiymati 33 ga bo'linishini isbotlang.

938. $333^{555}+555^{333}$ sonli ifodaning qiymati 37 ga bo'linishini isbotlang.

939. $11^{11}+12^{12}+13^{13}$ ifodaning qiymati 10 ga bo'linishini isbotlang.

940. n ixtiyoriy natural son bo'lganda n^3+3n^2+5n+3 ifodaning qiymati 3 ga bo'linishini isbotlang.

941. 2003^{2003} soni qanday raqam bilan tugaydi?

942. Besh xonali sonni 9 ga ko'paytirganda yana besh xonali son hosil bo'ladi. Ammo bu sonda avvalgi son raqamlari teskari tartibda joylashgan. Avvalgi sonni toping.

943. Isbot qiling: 1) $\frac{171717}{252525}=\frac{1717}{2525}=\frac{17}{25}$; 2) $\frac{313131}{757575}=\frac{3131}{7575}=\frac{31}{75}$.

944. Tenglik to'g'rimi:

$2b^5+(a^4+a^3b+a^2b^2+ab^3+b^4)(a-b)=(a^4-a^3b-a^2b^2-$
$-ab^3+b^4)(a+b)$?

945. Tenglikning to'g'riligini isbotlang:

1) $(n-2)(n-1)n(n+1)+1=(n^2-n-1)^2$;

2) $(n+1)(n+2)(n+3)+1=(n^2+3n+1)^2$.

946. $2000\cdot 2001\cdot 2002\cdot 2003+1$ soni biror x sonning kvadrati bo'lishini isbot qiling va x ni toping.

947. Ko'paytuvchilarga ajrating:

1) a^2-2a-3; 2) $b^2-7b+12$; 3) a^3+a^2-12;

4) x^3-7x+6; 5) m^2-7m+6; 6) m^2-m-2.

948. Kasrni qisqartiring:

1) $\frac{a^4+a^3+4a^2+3a+3}{a^3-1}$; 2) $\frac{2a^2-5ab+3b^2}{2a^2-ab-3b^2}$;

3) $\frac{a^2+b^3+c^2+2ab+2bc+2ca}{a^2-b^2-c^2-2bc}$.

949. Ifodani soddalashtiring va uning bu ifodaga kiruvchi harflarning berilgan qiymatlarida son qiymatini toping:

1) $x^2-\frac{x^3-4xy^2}{x(x-2y)+y^2}\cdot\frac{x^2-2xy+y^2}{x-2y}$, bunda $x=-\frac{1}{2}$, $y=-5$;

2) $(\frac{mn}{m^2-n^2}+\frac{n}{2n-2m})\frac{m^2-n^2}{2n}$, bunda $m=6\frac{1}{2}$, $n=-1{,}5$;

3) $\frac{5m+5n}{m-n}\cdot(\frac{m}{m+n}+\frac{m}{n-m}-\frac{2mn}{m^2-n^2})$, bunda $m=3\frac{1}{2}$, $n=-\frac{1}{2}$.

Amallarni bajaring **(950–955):**

950. 1) $(\frac{a-1}{3a+(a-1)^2}-\frac{1-3a+a^2}{a^3-1}-\frac{1}{a-1}):\frac{a^2+1}{1-a}$;

2) $(\frac{2p}{2p+q}-\frac{4p^2}{4p^2+4pq+q^2}):(\frac{2p}{q^2-4p^2}+\frac{1}{2p-q})$.

951. 1) $(\frac{2a}{2a+b}-\frac{4a}{4a^2+4ab+b^2}):(\frac{2a}{4a^2-b^2}+\frac{1}{b-2a})$;

2) $(\frac{1}{1-a}-1):(a-\frac{1-2a^2}{1-a}-1)$.

952. 1) $\frac{a+b}{a^2-2ab+b^2}+\frac{a-b}{a^2+2ab+b^2}+\frac{2a}{b^2-a^2}$;

2) $\frac{a-5}{a^2-18a+81}+\frac{5-3a}{18a-81-a^2}+\frac{131+2a}{(9-a)^2}$.

953. 1) $\frac{8y^2+14}{y^3-1}-\frac{y+7}{y^2+y+1}$; 2) $\frac{2y-1}{y^2-2y+4}+\frac{7}{y+2}-\frac{9y^2-11y+26}{y^3+8}$;

3) $\frac{1}{3x-2}+\frac{3x-2}{9x^2+6x+4}+\frac{18x}{8-27x^3}$.

954. 1) $\frac{1}{x}+\frac{1}{x-1}-\frac{2}{x+1}$; 2) $\frac{2}{x+1}-\frac{3}{x+2}+\frac{1}{x-3}$;

3) $\frac{x}{x^2+1}-\frac{1}{x}+\frac{2x}{(x^2+1)^2}$; 4) $\frac{1}{x^2}-\frac{1}{1+x^2}-\frac{1}{(1+x^2)^2}$.

955. 1) $\frac{4}{1+x^4}+\frac{2}{1+x^2}+\frac{1}{1+x}+\frac{1}{1-x}$;

2) $\frac{a^2-bc}{(a+b)(a+c)}+\frac{b^2-ac}{(b+c)(a+b)}+\frac{c^2-ab}{(a+c)(b+c)}$.

956. Aytaylik, $ABCD$ – kvadrat bo'lsin. Agar:
1) A (0; 1), B (0; –2); 2) B (3; –3), C (6; –3);
3) C (5; 0), D (5; –5); 4) A (–4; 0), D (1; 0)
bo'lsa, kvadratning qolgan ikkita uchining koordinatalarini aniqlang.

957. A (3; 4) nuqta orqali koordinatalar boshidan o'tuvchi to'g'ri chiziq va markazi koordinatalar boshida bo'lgan aylana o't-kazilgan. To'g'ri chiziq bilan aylananing ikkinchi kesishish nuqtasining koordinatalarini aniqlang.

958. Agar A (–5; 2), B (7; 2), C (1; –6), D (1; 5) bo'lsa, AB va CD to'g'ri chiziqlar kesishish nuqtasining koordinatalarini toping.

959. Agar (3; 10) koordinatali nuqtadan ushbu formula bilan berilgan funksiyaning grafigi o'tsa, b ning qiymatini aniqlang:

1) $y=x+b$; 2) $y=3x+b$; 3) $y=-\frac{1}{3}x+b$; 4) $y=-\frac{1}{2}x+b$.

960. Grafigi A va B nuqtalardan o'tuvchi to'g'ri chiziq bo'ladigan funksiyani formula bilan bering:
1) A (–6; –3), B (2; –3); 2) A(–4; –4), B (3; 3);
3) A (2; 2), B (0; 4); 4) A(3; –8), B (–5; 32).

961. Diametri 5 mm bo'lgan po'lat simdan balandligi 122 mm bo'lgan burama silindrik prujina tayyorlash kerak. Agar prujina o'ramlari orasidagi bo'shliq yuk tushmagan vaqtda 88 mm ga teng bo'lishi lozim bo'lsa, prujina o'ramlari soni topilsin.

962. Temiryo'l stansiyasiga yaqin joydagi dala hovlisida yashovchi bir kishi odatda dala hovlidan stansiyaga poyezd jo'nashiga taqab 18 minutda kelardi. Bir kuni u kishi yo'lga chiqishdan oldin hovlida bir necha minut ushlanib qoldi. Shundan keyin u tezligini odatdagidan 1,2 marta oshirgani bilan baribir poyezdga 2 minut kechikdi. U yo'lga chiqishdan oldin uyida necha minut ushlanib qolgan?

963. Hovuzni ertaga soat 16 gacha to'ldirish uchun bugun soat 13 da bitta quvurni ochishdi. Lekin hovuzni soat 12 gacha to'ldirish kerak bo'lib qolgani uchun biror vaqtdan so'ng xuddi shunday ikkinchi quvur ochib qo'yildi. Ikkinchi quvurni soat nechada ochishgan?

964. Elektropoyezd svetofor yonidan 5 sekundda, uzunligi 150 m bo'lgan platforma yonidan esa 15 sekundda o'tdi. Elektropoyezdning uzunligi va uning tezligi qancha?

965. Fermer xo'jaligidan shaharga boradigan yo'l avval tekis bo'lib, so'ngra esa tepalikka ko'tariladi. Fermer xizmatchisi velosipedda yo'lning tekis qismini 12 km/soat tezlik bilan bosib o'tdi. Tepalikka esa 3 km/soat tezlik bilan piyoda ko'tarildi va yo'lga chiqqanidan 1 soat-u 40 minutdan keyin shaharga yetib keldi. Qaytishda tepalik yo'lni 15 km/soat tezlik bilan, tekis yo'lni esa 12 km/soat tezlik bilan bosib o'tdi va shahardan chiqqanidan 58 minut o'tganidan keyin qishloqqa yetib keldi. Xo'jalikdan shahargacha necha kilometr?

966. A qishloqdan B bekatga qarab piyoda kishi yo'lga chiqdi. Oradan 1 soat-u 24 minut o'tgandan keyin xuddi shu yo'nalishda A dan velosipedchi yo'lga chiqdi va 1 soat o'tgandan keyin velosipedchining piyoda kishiga yetishiga 1 km bor edi. Oradan yana bir soat o'tganidan keyin esa velosipedchi B ga yetib borishi uchun piyoda kishiga qaraganda ikki marta kam masofa qoldi. Agar AB masofa 27 km ga teng ekanligi ma'lum bo'lsa, piyoda kishining va velosipedchining tezliklarini toping.

967. Velosipedchi ma'lum tezlik bilan harakat qilib, A bekatdan B bekatga belgilangan vaqtda yetib keldi. Agar u shu tezligini 3 km/soat ga oshirganda edi, belgilangan joyga muddatidan bir soat oldin yetib kelardi, agar u tezligini 2 km kamay-

tirganida edi, u holda manzilga bir soat kechikkan bo'lar edi. A va B bekatlar orasidagi masofani, velosipedchining tezligini va uning harakat vaqtini aniqlang.

968. Otlarni boqish uchun ma'lum vaqtga pichan g'amlashdi. Agar otlar ikkita kam bo'lganida edi, u holda bu pichan yana 10 kunga yetgan bo'lar edi; agar otlar ikkita ko'p bo'lganida edi, u holda pichan belgilangan muddatga 6 kun qolganida tugar edi. Otlar nechta bo'lgan va pichan necha kunga mo'ljallangan?

969. Birinchi quvur hovuzni ikkinchi quvur uning $\frac{2}{3}$ qismini to'ldirishiga ketgan vaqtning yarmida to'ldiradi. Ikkinchi quvurning o'zi hovuzni birinchisiga qaraganda 6 soat kech to'ldiradi. Har bir quvur hovuzni alohida-alohida qancha vaqtda to'ldiradi?

970. Mis bilan rux qotishmasida mis ruxdan 640 g ortiq. Qotishmadan undagi misning $\frac{6}{7}$ qismini va 60% ruxni ajratib olishganidan keyin qotishmaning massasi 200 g ga teng bo'lib qoldi. Dastlab qotishmaning massasi qancha bo'lgan?

971. A qishloqdan piyoda kishi, shu vaqtning o'zida B qishloqdan unga qarab velosipedchi yo'lga chiqdi. Ular uchrashganlaridan keyin piyoda B ga qarab yo'lini davom ettirdi, velosipedchi esa orqasiga qaytib, u ham B ga qarab jo'nadi. Piyoda B ga velosipedchidan 2 soat kech yetib kelganligini, piyodaning tezligi esa velosipedchinikidan 3 marta kam ekanligi ma'lum. Harakat boshlanganidan to piyoda bilan velosipedchi uchrashguncha qancha vaqt o'tgan?

972. Suzuvchi daryo oqimiga qarshi suzib borayotib, daryoda oqib kelayotgan bo'sh qayiqni ko'rib qoldi. U qayiq bilan uchrashganidan keyin yana oqimga qarshi suzishni t minut davom ettirdi va orqasiga qayrilib, uchrashuv joyidan s metr masofada qayiqni quvib yetdi. Daryo oqimining tezligini toping.

973. A qishloqdan B qishloqqacha bo'lgan 11,5 km uzunlikdagi yo'l avval tepalikka ko'tariladi, keyin tekislik bo'ylab, va, nihoyat, pastlikka qarab boradi. Piyoda kishi A dan B gacha

bo'lgan yo'lga 2 soat-u 54 minut, qaytishidagi yo'lga esa 3 soat-u 6 minut vaqt sarf qildi. U tepalikka 3 km/soat tezlik bilan ko'tarildi, tekis yo'lda 4 km/soat tezlik bilan yurdi, pastga esa 5 km/soat tezlik bilan tushdi. Yo'lning tekislik bo'ylab o'tadigan qismi necha kilometrni tashkil qiladi?

TARIXIY MASALALAR

974. Ota o'g'liga yechish uchun 30 ta masalani taklif etdi va u bilan bunday kelishdi: har bir to'g'ri yechilgan masala uchun otasi o'g'liga 7 tanga to'laydi; har bir noto'g'ri yechilgan masala uchun o'g'li otasiga 12 tanga to'laydi. Pirovardida kelishuvga muvofiq otasi o'g'liga 77 tanga to'ladi. Nechta masala to'g'ri yechilgan?

975. 56 ta ko'zguni tashish uchun kirachi aravakashni bunday shart bilan yollashdi: aravakash butun yetkazib kelingan har bir ko'zgu uchun 1 tangadan oladi, yo'lda sinib qolgan har bir ko'zgu uchun 6 tanga to'laydi. Hisob-kitobda aravakash hech narsa olmasligi ma'lum bo'ldi. U nechta ko'zguni butun etkazib kelgan?

976. Turli qishloqlarda yashovchi ikki o'rtoq ko'rishishni istab, bir kunnig o'zida yo'lga chiqish va kuniga 28 chaqirimdan yurishga kelishib olishdi. Ulardan biri betobligi sabab kelishilgandan 3 kun kechikib yo'lga chiqdi va kechikilgan vaqtni yetkazib olish maqsadida kuniga 49 chaqirimdan yura boshladi. Shunday qilib bu o'rtoqlar o'zlari mo'ljallagan kuni uchrashishdi. Bu qishloqlar orasidagi yo'lning uzunligini hisoblang.

977. 5 ta lagan va 7 ta kosa sotib olindi va hammasiga 560 so'm to'landi. Boshqa gal shu narxlarda 10 ta lagan va 3 ta kosa sotib olindi va 790 so'm to'landi. Har bir lagan necha so'mdan va har bir kosa necha so'mdan sotib olingan?

978. Ona qizi bilan gilam to'qishmoqda. Agar ular doimo birga ishlashadigan bo'lishsa, gilam 15 haftada tayyor bo'lishini hisoblashdi. Aslida esa ular faqat birinchi 8 hafta davomida

birgalikda ishlashdi, shundan so'ng faqat qizi ishlay boshladi va u 28 haftadan so'ng gilamni to'qib bo'ldi. Ona-bola alohida-alohida ishlaganlarida ularning har biri gilamni necha haftada to'qib bo'lishlari mumkin?

979 Xattot bir kunda 14 sahifa, uning o'q'li esa faqat 8 sahifa matnni ko'chirib yozishi mumkin. Birinchi 6 kun davomida matnni o'g'lining yolg'iz o'zi ko'chirdi. Shundan so'ng ishni belgilangan muddatda tugatish maqsadida otasi ham yordam qildi. Ish tugatilganidan so'ng ularning har biri bir hil miqdordagi sahifani ko'chirganliklari ma'lum bo'ldi. Ular jami necha sahifa matn ko'chirganlar?

VII SINF ALGEBRA KURSINING QISQACHA MAZMUNI

1. Algebraik ifodalar

Sonli ifoda – sonlardan tuzilib, amallar belgilari bilan birlashtirilgan yozuv.

Masalan, $1{,}2 \cdot (-3) - 9 : 0{,}5$ – sonli ifoda.

Algebrada harflardan har xil sonlarni belgilash uchun foydalaniladi.

Masalan, agar $2(n+m)$ tomonlari n va m bo'lgan to'g'ri to'rtburchakning perimetri bo'lsa, u holda n va m harflari o'rnida istalgan musbat sonlar tushuniladi.

Algebraik ifoda – bu sonlar va harflardan tuzilib, amallar belgilari bilan birlashtirilgan ifodalar.

Algebraik ifodalarga misollar:

$$2(m+n);\ 3a+2ab-1;\ (a-b)^2;\ \frac{2x+y}{z}.$$

Algebraik ifodaning son qiymati – berilgan ifodadagi harflarni sonlar bilan almashtirilgandan keyin hisoblash natijasida hosil bo'lgan son.

Masalan, $3a+2ab-1$ ifodaning son qiymati $a=2$ va $b=3$ bo'lganda $3 \cdot 2 + 2 \cdot 2 \cdot 3 - 1 = 17$ ga teng bo'ladi.

a sonning n natural ko'rsatkichli darajasi – bu har biri a ga teng bo'lgan n ta ko'paytuvchi ko'paytmasidir, ya'ni

$$a^n = \underbrace{a \cdot a \cdot \ldots \cdot a}_{n \text{ marta}}.$$

Masalan,

$$2^3 = 2 \cdot 2 \cdot 2,\ m^5 = \underbrace{m \cdot m \cdot m \cdot m \cdot m}_{5 \text{ marta}}.$$

a^n darajaning yozuvida a soni – *daraja asosi*, n son– *daraja ko'rsatkichi*.

Masalan, 2^2 yozuvida 2 soni – darajaning asosi, 3 soni – daraja ko'rsatkichi.

Sonning birinchi darajasi sonning o'zidir: $a^1 = a$.

Masalan, $3^1 = 3, (\frac{1}{13})^1 = \frac{1}{13}$.

Sonning kvadrati – bu shu sonning 2 ko'rsatkichli darajasidir. Masalan, 5^2 – bu 5 sonining kvadrati.

Sonning kubi – shu sonning 3 ko'rsatkichli darajasidir. Masalan, 4^3 – bu 4 sonining kubidir.

Darajaning asosiy xossalari.

1) Bir xil asosli darajalarni ko'paytirishda asos o'zgarishsiz qoladi, daraja ko'rsatkichlar esa qo'shiladi:

$$a^n \cdot a^m = a^{n+m}.$$

2) Bir xil asosli darajalarni bo'lishda asos o'zgarishsiz qoladi, daraja ko'rsatkichlar esa ayiriladi:

$$a^n : a^m = a^{n-m}.$$

3) Darajani darajaga ko'tarishda asos o'zgarishsiz qoladi, daraja ko'rsatkichlar esa o'zaro ko'paytiriladi:

$$(a^n)^m = a^{nm}.$$

4) Ko'paytmani darajaga ko'tarishda har bir ko'paytuvchi shu darajaga ko'tariladi:

$$(a \cdot b)^n = a^n \cdot b^n.$$

5) Kasrni darajaga ko'tarishda uning surat va maxraji shu darajaga ko'tariladi:

$$(\frac{a}{b})^n = \frac{a^n}{b^n}.$$

Amallarni bajarish tartibi.

Birinchi bosqich amallar – qo'shish va ayirish.

Ikkinchi bosqich amallar – ko'paytirish va bo'lish.

Uchinchi bosqich amallar – darajaga ko'tarish.

1) Agar ifoda qavslarni o'z ichiga olmagan bo'lsa, u holda avval uchinchi bosqich amallar, so'ngra ikkinchi bosqich amallar va nihoyat, birinchi bosqich amallar bajariladi; bunda bir xil bosqich

amallar ular qanday tartibda yozilgan bo'lsa, xuddi shunday tartibda bajariladi.

2) Agar ifoda qavslarni o'z ichiga olgan bo'lsa, u holda avval qavslar ichidagi sonlar ustidagi barcha amallar, keyin esa qolgan barcha amallar bajariladi: bunda qavs ichidagi sonlar ustidagi amallarni va qavsdan tashqaridagi amallarni 1- bandda ko'rsatilgan tartibda olib boriladi.

3) Agar kasr ifodaning qiymati hisoblanayotgan bo'lsa, u holda kasrning suratidagi amallar va maxrajidagi amallar bajariladi va birinchi natija ikkinchisiga bo'linadi.

4) Agar ifoda boshqa qavslar ichida joylashgan qavslarni o'z ichiga olgan bo'lsa, u holda avval ichkaridagi qavslar ichidagi amallar bajariladi.

Algebraik yig'indi – bir necha algebraik ifodalardan tuzilib, «+» yoki «–» ishoralari bilan birlashtirilgan yozuvlardir.

Qavslarni ochish qoidalari.

1) Agar algebraik ifodaga qavs ichida turgan algebraik yig'indi qo'shilgan bo'lsa, u holda shu algebraik yig'indining har bir qo'shiluvchisi oldida turgan ishoralarni saqlagan holda qavslarni tushirib qoldirish mumkin, masalan:

$$14+(7-23+21)=14+7-23+21.$$

$$a+(b-c-d)=a+b-c-d.$$

2) Agar algebraik ifodadan qavs ichida turgan algebraik ifodani ayiriladigan bo'lsa, u holda shu algebraik yig'indining har bir qo'shiluvchisi oldida turgan ishoralarni qarama-qarshisiga o'zgartirilgan holda qavslarni tushirib qoldirish mumkin, masalan:

$$14-(7-23+21)=14-7+23-21.$$

$$a-(b-c-d)=a-b+c+d.$$

2. Birhadlar va ko'phadlar

Birhad – son va harfiy ko'paytuvchilar ko'paytmasidan iborat algebraik ifoda.

Birhadlarga misollar: $3ab$, $-2ab^2c^3$, a^2, a, $0{,}6xy5y^2$, $-t^4$.

Masalan, ushbu

$$3a^2\cdot(0{,}4)\cdot b(-5)\,c^2$$

birhadning sonli ko'paytuvchilari 3; 0,4; –5, harfiy ko'paytuvchilari esa a^2, b, c^3 bo'ladi.

Standart shakldagi birhad birinchi o'rinda turuvchi faqat bitta sonli ko'paytuvchidan va turli harfiy asosli darajalardan tuzilgan birhad.

Birhadni standart shaklda yozish uchun uning barcha son ko'paytuvchilarini o'zaro ko'paytirish va ularning ko'paytmasini birinchi o'ringa qo'yish, so'ngra barcha bir xil harfiy ko'paytuvchilarni daraja shaklida yozish kerak.

Birhadning koeffitsienti standart shaklida yozilgan birhadning sonli ko'paytuvchisi. Masalan, $\frac{3}{4}abc^2$ birhadning koeffitsienti $\frac{3}{4}$ ga teng, $-7a^2b$ birhadning koeffitsienti –7 ga teng, a^2bc birhadning koeffitsienti 1 ga teng, $-ab^2$ birhadning koeffitsienti –1 ga teng.

Ko'phad bir nechta birhadning algebraik yig'indisi.

Ko'phadlarga misollar: $4ab^2c$ – birhad,

$2ab-3bc$ – ikkihad,

$4ab+3ac-bc$ – uchhad.

Ko'phadning hadlari ko'phadni tashkil qiluvchi birhadlardir. Masalan, $2ab^2-3a^2b+7ac-4bc$ ko'padning hadlari $2ab^2$, $-3a^2b$, $7ac$, $-4bc$ bo'ladi.

O'xshash hadlar – faqat koeffitsientlari bilan farq qiluvchi birhadlar yoki bir xil birhadlar.

O'xshash hadlarni ixchamlash ko'phadni soddalashtirish bo'lib, bunda o'xshash birhadlarning yig'indisini bitta birhad bilan almashtiriladi. Masalan,

$$2ab-4bc+ac+3ab+bc=5ab-3bc+ac.$$

Ko'phadning standart shakli – barcha hadlari standart shaklda yozilgan va ularning orasida o'xshashlari bo'lmagan ko'phadning yozuvi.

Birhadlar va ko'phadlar ustida amallar.

1) Bir nechta ko'phadlar algebraik yig'indisini ko'phadning standart shaklida yozish uchun qavslarni ochish va o'xshash hadlarni ixchamlash kerak, masalan:

$(2a^2b-3bc)+(a^2b+5bc)-(3a^2b-bc)=2a^2b-3bc+a^2b+5bc-$
$-3a^2b+bc.$

2) Ko'phadni birhadga ko'paytirish uchun ko'phadning har bir hadini shu birhadga ko'paytirish va hosil bo'lgan ko'paytmalarni qo'shish kerak, masalan:

$$(2ab-3bc)\cdot(4ac)=(2ab)\cdot(4ac)+(-3bc)\cdot(4ac)=8a^2bc-12abc^2.$$

3) Ko'phadni ko'phadga ko'paytirish uchun birinchi ko'phadning har bir hadini ikkinchi ko'phadning har bir hadiga ko'paytirish va hosil bo'lgan ko'paytmalarni qo'shish kerak, masalan:

$$(5a-2b)\cdot(3a+4b)=(5a)\cdot(3a)+(5a)\cdot(4b)+(-2b)\cdot(3a)+$$
$$+(-2b)\cdot(4b)=15a^2+14ab-8b^2.$$

4) Ko'phadni birhadga bo'lish uchun ko'phadning har bir hadini shu birhadga bo'lish va hosil bo'lgan natijalarni qo'shish kerak, masalan:

$$(4a^3b^2-12a^2b^3):(2ab)=(4a^3b^2):(2ab)+(-12a^2b^3):(2ab)=$$
$$=2a^2b-6ab^2.$$

3. Birinchi darajali bir noma'lumli tenglama

Tenglama harf bilan belgilangan noma'lum son qatnashgan tenglik.

Tenglamaga misol: $2x+3=3x+2$, bu yerda x – topilishi kerak bo'lgan noma'lum son.

Tenglamaning ildizi – noma'lumning tenglamani to'g'ri tenglikka aylantiradigan qiymati.

Masalan, 3 soni $x+1=7-x$ tenglamaning ildizi bo'ladi, chunki $3+1=7-3$.

Tenglamani yechish uning barcha ildizlarini topish yoki ularning yo'qligini aniqlash demakdir.

Tenglamaning asosiy xossalari:

1. Tenglamaning istagan hadini uning bir qismidan ikkinchi qismiga ishorasini qarama-qarshisiga o'zgartirib olib o'tish mumkin.

2. Tenglamaning ikkala qismini nolga teng bo'lmagan bir xil songa ko'paytirish yoki bo'lish mumkin.

4. Qisqa ko'paytirish formulalari

$$(a+b)^2=a^2+2ab+b^2,\quad a^3+b^3=(a+b)(a^2-ab+b^2),$$
$$(a-b)^2=a^2-2ab+b^2,\quad a^3-b^3=(a-b)(a^2+ab+b^2),$$
$$a^2-b^2=(a+b)(a-b).$$

5. Ko'phadni ko'paytuvchilarga ajratish

Ko'phadni ko'paytuvchilarga ajratish – ko'phadni ikki yoki undan ortiq ko'phadlar ko'paytmasi shaklida ifodalashdir, masalan:

$$4x^2 - 9y^2 = (2x+3y)(2x-3y).$$

Ko'phadni ko'paytuvchilarga ajratishda quyidagi usullardan foydalaniladi:

1) Umumiy ko'paytuvchini qavsdan tashqariga chiqarish, masalan:

$$3ax + 6ay = 3a(x+2y).$$

2) Guruhlash usuli, masalan:

$$a^3-2a^2-2a+4 = (a^3-2a^2) - (2a-4) = a^2(a-2) - 2(a-2) = (a-2)(a^2-2)$$

yoki

$$a^3-2a^2-2a+4 = (a^3-2a) - (2a^2-4) = a(a^2-2) - 2(a^2-2) = (a^2-2)(a-2).$$

3) Qisqa ko'paytirish formulalarini qo'llash, masalan:

1) $9x^2 - \frac{1}{16}y^2 = (3x + \frac{1}{4}y)(3x - \frac{1}{4}y)$;

2) $27x^3 + 8y^6 = (3x + 2y^2)(9x^2 - 6xy^2 + 9y^4)$;

3) $z^2 - 14z + 49 = (z-7)^2$.

6. Algebraik kasrlar

Algebraik kasr – surat va maxraji algebraik ifodalar bo'lgan kasr.

Algebraik kasrlarga misollar: $\frac{a^2+b}{c}$, $\frac{3x-2y}{a+1}$.

Algebraik kasr yozuvida harflar faqat shu kasrning maxraji nolga teng bo'lmaydigan qiymatlarni qabul qilishi mumkin, deb faraz qilinadi.

Kasrlarning asosiy xossasi: kasrning surat va maxrajini bir xil algebraik ifodaga ko'paytirish natijasida unga teng kasr hosil bo'ladi.

Masalan: $\frac{a-b}{a+b} = \frac{(a-b)(a-b)}{(a+b)(a-b)} = \frac{(a-b)^2}{a^2-b^2}$.

Kasrning asosiy xossasidan foydalanib, algebraik kasrning surat va maxrajini umumiy ko'paytuvchiga qisqartirish mumkin.

Masalan: $\frac{x^2-1}{x^3-1}=\frac{(x-1)(x+1)}{(x-1)(x^2+x+1)}=\frac{x+1}{x^2+x+1}$.

Algebraik kasrlarni qo'shish va ayirish sonli kasrlar uchun qo'llaniladigan qoidalar bo'yicha olib boriladi.

Ikki yoki bir necha kasrlarning algebraik yig'indisini topish uchun bu kasrlar umumiy maxrajga keltiriladi va bir xil maxrajli kasrlarni qo'shish qoidalaridan foydalaniladi.

Masalan, $\frac{1}{a^2b}$ va $\frac{1}{ab^2}$ kasrlarning umumiy maxraji a^2b^2 ga teng, shuning uchun $\frac{1}{a^2b}+\frac{1}{ab^2}=\frac{b+a}{a^2b^2}$.

Algebraik kasrlarni ko'paytirish va bo'lish sonli kasrlar uchun qo'llaniladigan qoidalar bo'yicha olib boriladi, masalan:

$$\frac{2a}{3b}\cdot\frac{b^2}{4a}=\frac{2ab^2}{3b\cdot 4a}=\frac{1}{6}b. \qquad \frac{x^2-y^2}{2xy}:\frac{x+y}{4x}=\frac{(x^2-y^2)\cdot 4x}{2xy(x+y)}=\frac{2(x-y)}{y}.$$

7. Chiziqli funksiya va uning grafigi

Agar x ning biror sonlar to'plamidagi har bir qiymatiga biror qoida bo'yicha y son mos qo'yilsa, u holda shu to'plamda *funksiya aniqlangan* deb aytiladi.

Bunda x *erkli o'zgaruvchi,* $y(x)$ esa *erksiz o'zgaruvchi* yoki *funksiya* deyiladi.

Chiziqli funksiya

$$y=kx+b$$

ko'rinishdagi funksiyadir, bu yerda k va b – berilgan sonlar.

Funksiyani ko'rsatmali tasvirlash uchun uning to'g'ri burchakli koordinatalar sistemasidagi grafigidan foydalaniladi.

Tekislikda to'g'ri burchakli koordinatalar sistemasi – tanlangan yo'nalishlar va uzunlik birligiga ega bo'lgan ikkita o'zaro perpendikulyar to'g'ri chiziq.

Bu to'g'ri chiziqlarni *koordinata o'qlari* deyiladi: gorizontal tasvirlangan to'g'ri chiziq – abssissalar o'qi, vertikal tasvirlangan to'g'ri chiziq esa *ordinatalar o'qi.*

Koordinata o'qlarining kesishish nuqtasi *koordinatalar boshi* deyiladi. Koordinatalar boshini O harfi bilan, abssissalar o'qini Ox harfi bilan, ordinatalar o'qini Oy bilan belgilanadi.

Koordinata tekisligi koordinatalar sistemasi tanlangan tekislikdir.

$y(x)$ funksiyaning *grafigi* koordinata tekisligining $(x; y(x))$ koordinatali barcha nuqtalari to'plamidir.

Masalan, $y(x)=2x+1$ funksiyaning grafigi koordinata tekisligining $(x, 2x+1)$ koordinatali barcha nuqtalari to'plamidir.

$y=kx+b$ chiziqli funksiyaning grafigi to'g'ri chiziqdir. $b=0$ bo'lganda funksiya $y=kx$ ko'rinishini oladi, uning grafigi koordinatalar boshidan o'tadi.

8. Birinchi darajali ikki noma'lumli ikki tenglama sistemasi

Birinchi darajali ikki noma'lumli ikki tenglama sistemasining umumiy ko'rinishi quyidagicha:

$$\begin{cases} a_1x + b_1y = c_1 \\ a_2x + b_2y = c_2 \end{cases}$$

bu yerda a_1, b_1, c_1, a_2, b_2, c_2 – berilgan sonlar, x, y – noma'lum sonlar.

Sistemaning yechimi – shu sistemaga qo'yganda uning har bir tenglamasini to'g'ri tenglikka aylantiruvchi x, y sonlar jufti.

$$\begin{cases} 4x - y = 2, \\ 5x + y = 7 \end{cases}$$

sistemaning yechimi $x=1$, $y=2$ sonlar jufti bo'ladi.

Sistemani yechish uning barcha yechimlarini topish yoki ularning yo'qligini ko'rsatish demakdir.

Tenglamalar sistemasini yechishda bunday usullar qo'llaniladi.

1) O'rniga qo'yish usuli.

Tenglamalarning biridan noma'lumlarning birini ikkinchi noma'lum orqali ifodalanadi va uni sistemaning ikkinchi tenglamasiga qo'yiladi.

2) Algebraik qo'shish usuli.

Noma'lumlardan birining oldida turgan koeffitsientlarning modullarini tenglab, sistema tenglamalarini hadlab qo'shish va ayirish orqali shu noma'lum yo'qotiladi.

3) Grafik usul.

Sistema tenglamalarning grafiklari yasaladi va ularning kesishish nuqtasining koordinatalari topiladi.

MASHQLARGA JAVOBLAR

1. 2) 7; 4) 5,86. **2.** 2) $\frac{9}{56}$; 4) 0,5. **4.** 2) Noto'g'ri; 4) to'g'ri. **5.** 2) Noto'g'ri; 4) noto'g'ri. **6.** $40 \cdot 0{,}03 = 6 : 5$. **7.** 2) $3 \cdot (2+6) = 2 \cdot (2 \cdot 6)$. **10.** 2) $\frac{9}{56}$; 4) $4\frac{6}{7}$; 6) 0,03. **11.** 2) $-0{,}02$; 4) 3. **12.** 2 dirham. **13.** 2) 0; 4) 5. **14.** 2) -2; 4) 0. **15.** $(7m)$ t; 168 t. **16.** 1) $(60m)$ min; 2) $\frac{p}{60}$ min; 3) $(60m + l + \frac{p}{60})$ min. **17.** $3(x-y)$; 2) 4,5; 4) 2,5. **18.** $(x+y)(x-y)$; 2) $-\frac{11}{64}$; 4) 0,104. **19.** 2) $-1\frac{2}{3}$. **20.** 2) 4. **21.** 1, 3, 15, 21. **22.** 2) $(m-1)m$; 4) $(2p+1)(2p+3)(2p+5)$. **23.** 2) $p = (m+n) \cdot 2$; $S = mn - xy$; 4) $p = 2(a+m+n+x)$, $S = mn - ab - xy$. **24.** $(p-q)$ t; 1) 5 t; 2) q p dan katta bo'la olmaydi; q p ga teng bo'lishi mumkin. **25.** $400n + 500m$; 155000; 155000. **27.** 187200 m^3, $(37440m)$ m^3. **28.** $s = 3\frac{1}{6}c + 1\frac{2}{3}a + 2\frac{1}{2}b$, 53 km. **30.** 2) 0,2; 4) 0. **31.** 2) $a-b$; 4) $2mn$; 6) $(a+b)(a-b)$. **32.** 2) $5mn$; 4) $\frac{m+n}{17}$. **35.** 5000; 150000. **36.** $3a$; $8a$; $\frac{a}{2}$. 5000; 100; $\frac{sa}{1000}$. **37.** 2) 30kg. **38.** 2) $(5k)$ km. **39.** $(50a)$ kg. **40.** $(15a)$ ga. **41.** $(x \cdot 6 + y \cdot 3)$ s'om. **42.** $(a \cdot 15 + b \cdot 20)$ kg. **43.** $(am + cn)$ kg. **44.** $S = a(a-b)$. **45.** 810 o'rin. **46.** 4 soat 35 min. **48.** 2) $2(2a+4)$ m; 3) $(a+8)(a-4)$ m^2. **49.** $\frac{S}{t-1}$ km/soat. **51.** $\frac{a-1500}{20}$ m^2. **53.** $50(100+p)$ so'm. **55.** $t = \frac{s-3}{v}$, ulgurmaydi. **56.** 160 ta olma. **57.** 2) 1; 4) $20\frac{11}{18}$. **58.** 2) 40; 4) -41. **59.** 2) $3y - 2x$; 4) $8{,}7 - 2\frac{1}{3}m + 1\frac{2}{3}n$. **60.** 2) $3 - 2{,}7b$; 4) $\frac{2}{3}y + \frac{1}{3}b - 3$ 6) $5p$. **61.** 2) $x+5$; 4) $58c + 14d$. **62.** 2) 67,048; 4) $-11{,}221$. **63.** 2) 0,28; 4) $7\frac{37}{112}$. **64.** 2) $-4 - -9 + 11$; 4) $2a - 3b - 4c$. **66.** 3) $2 + b + (-c)$; 4) $3 + a + (-b) + (-c)$. **68.** 2) $a -$

$-2b+3c$; 4) $-a+2b-3c$. **69.** 2) $a-b+c-d$; 4) $a-b-c+d-k$. **70.** 2) $8x-2y$; 4) $3a-2$. **71.** 2) $a-2b+(m+c)$; 4) $a+(-m+3b^2-2a^3)$. **72.** 2) $2a+b-(-m-3c)$; 4) $a-(m-3b^2+2a^3)$. **73.** 2) $a-(b-1)$; 4) $(a-2b)+8$. **74.** 2) $2x^2+5x^2y+(-4xy^2-y^3)$; 4) $-(-2x^2-5x^2y)-4xy^2-y^3$. **75.** 2) $c+(-a+b)$; 4) $n+(-d+l)$. **76.** 2) $4a-4b$; 4) $5x-3y$. **77.** 2) $x=1$; 4) $x=5$. **78.** 2) $-1{,}16$; 4) -3. **79.** 2) -17; 4) $15{,}79$. **80.** 2) $-0{,}00009$. **82.** 2) -1; 4) 9; 6) 9; 8) 3,9. **83.** 2) 0,027; 4) $\frac{1}{3}$. **84.** 2) 147; 4) 144. **85.** 2) -132; 4) 7. **86.** 2) 1,08; 4) 6,12. **87.** 2) 42; 4) -1. **88.** 2) $-\frac{6}{5}$; 4) $\frac{3}{64}$. **89.** 2) $7\frac{1}{4}$. **90.** 2) $(-2)^2+(-2)^3>(-2)^{2+3}$; 4) $\frac{m^2}{3}>(\frac{m}{3})^2$. **91.** 2) $(a+b+c)^3>27abc$ **94.** 6 dirham. **95.** 2) 220. **97.** 2) 3. 103. $-\frac{49}{128}$. **106.** 2) $x=-27$; 4) $x=1{,}009$. **107.** 2) $x=\frac{5}{7}$; 4) $x=\frac{2}{3}$. **108.** 2) $x=-1{,}3$; 4) $x=0{,}05$. **109.** 2) $x=64$; 4) $x=1$. **110.** 2) $x=-\frac{4}{25}$; 4) $x=-\frac{1000}{3}$. **111.** 2) $x=\frac{3}{7}$; 4) $x=\frac{1}{3}$. **112.** 2) $x=17$; 4) $y=-1$. **113.** 2) $x=7\frac{1}{2}$; 4) $y=24$. **114.** 2) $z=6$; 4) $x=0{,}6$. **115.** 2) $y=13$; 4) $x=1$. **116.** 2) $y=319$; 4) $x=5$. **117.** 2) $x=37$; 4) $x=1{,}1$. **120.** 2) $x=1$; 4) $x=1$. **121.** 2) $x=0{,}2$; 4) $x=4$. **122.** 2) $(m^2-2n^3)(m^2+2n^3)$. **123.** 2) $0{,}3xy^2z+0{,}49xyz^2$; 4) $\frac{4}{49}m^2-n^2$. **124.** 1. **125.** 2) 10. **126.** 2) 16, 20, 24. **127.** 2) 158, 474, 237. **128.** 2) 8, 8, 6. **129.** 2) 20, 40. **130.** 2, 12, 84. **131.** 25, 27, 29. **132.** 4, 6, 8 va 10. **133.** 2) 12. **134.** 2) 8 yildan keyin. **135.** 2) 2200 t; 4) 1100 t. **136.** 2) 108 km. **137.** 2) 40 kg. **138.** 2) 150 ta mashina. **139.** 36 ta g'oz. **141.** $-\frac{1}{2}$. **144.** 2) $y=0$; 4) $x=0{,}8$. **145.** 2) $x=13$; 4) $x=-153$. **146.** 83,6 kg, 508, 8 kg, 1327 kg. **147.** 2) 8 km/soat. **148.** 2) 37,8 km. **149.** 4 soatdan keyin. **150.** 2) 32 kundan so'ng. **151.** 2) 40 km/soat, 30 km/soat yoki $46\frac{2}{3}$ km/soat, $36\frac{2}{3}$ km/soat. **155.** 2) $(\frac{1}{3})^5$; 4) $(-2{,}7)^4$. **156.** 2) m^5; 4) $(-3b)^4$. **157.** 2) $(a+b)^2$; 4) $(\frac{m}{n})^5$. **158.** 2) $4^4\cdot 21$; 4) $6^2\cdot 7^2\cdot 3^3$. **159.** 2) $(0{,}5)^3\cdot 2^2\cdot 4^2$. 4) $(\frac{2}{3})^3\cdot(2{,}3)^2$. **160.** 2) $x^4\cdot 3^2$; 4)

$(\frac{a}{b})^2(8a-b)^3$. **162.** 2) a^2+b^4; 4) $2x^3$. **163.** 2) $3a+a^4$; 4) $a^2b^2+x^3y^3$. **164.** 2) na^3; 4) 5^k+a^{17}. **168.** 2) 9; 4) 125. **169.** 2) -1; 4) 0. **170.** 2) $\frac{9}{25}$; 4) $12\frac{19}{27}$. **171.** 2) 2,89; 4) $\frac{1}{625}$. **172.** 2) -125; 4) $-5\frac{1}{16}$. **173.** 2) 270; 4) 4. **174.** 2) 40; 4) -6. **175.** 2) 18; 4) 72. **176.** $-2\frac{1}{4}$, $2\frac{1}{4}$, $-3\frac{3}{8}$; -25, 25, 125. **179.** $a\cdot 10^3+b\cdot 10^2+c\cdot 10+d$. **181.** 2) 3532037; 4) 101001. **182.** Daraxt shoxida 5 ta va ostida 3 ta. **183.** 2) 40,5. **184.** 2) $\frac{7}{1800}$. **185.** 2) 7^6; 4) 5^6. **186.** 2) a^7; 4) $(3b)^7$. **187.** 2) $(-3)^4$; 4) $(-1,2)^7$. **188.** 2) 3^{10}; 4) $(-6)^{12}$. **189.** 2) $(\frac{2}{3})^8$; 4) b^{15}. **190.** 2) $(\frac{-5x}{6})^{12}$; 4) $(n+m)^{20}$. **191.** 2) 3^{8+n}; 4) a^{n+13}. **192.** 2) b^{n+k}; 4) 3^{3n+3m}. **194.** 2) 2^2; 4) 2^7. **195.** 2) 2^6; 4) 2^{10}. **196.** 2) 2^{14}; 4) 2^9. **197.** 2) 2^{23}; 4) 2^{4+n}. **198.** 2) 3^1; 4) 3^4. **199.** 2) 3^5; 4) 3^7. **200.** 2) 3^{18}; 4) 3^6. **201.** 2) 3^{n+1}; 4) 3^{3+n}. **202.** 2) 0; 1; 1; 16; $\frac{16}{81}$; 0,0016. **203.** 2) 4^2; 4) 10^8. **204.** 2) $\frac{1}{17}$; 4) d^{12}. **205.** 2) $(2a)^2$; 4) $(m+n)^5$. **206.** 2) 5^{2n}; 4) x^{2n-1}. **207.** 2) 2^2; 4) 2^2. **208.** 2) 2^3; 4) 2^9. **209.** 2) 2^n; 4) 2^{3n+3}. **210.** 2) 3^3; 4) 3. **211.** 2) 3^2; 4) 3^4. **212.** 2) 3^{4n}; 4) 3^4. **213.** 2) 6; 4) 25. **214.** 2) 44; 4) 9. **215.** 2) -6; 4) 12. **216.** 2) To'g'ri; 4) noto'g'ri. **217.** 2) 1; -1; 0,001; $-\frac{1}{8}$; 4) 169; 121; 1,44; $\frac{9}{25}$. **218.** 2) $x=64$; 4) $x=27$. **219.** 2) $x=16$; 4) $x=4$. **220.** 2) $x=243$; 4) $x=9$. **221.** 2) 5^{12}; 4) 5^{36}. **222.** 2) 5^{3n}; 4) 5^{5n}. **223.** 2) 7^{10}; 4) 7^7. **224.** 2) 7^2; 4) 7^{21}. **225.** 2) a^{56}; 4) a^{21}. **226.** 2) a^{15}; 4) a^{23}. **227.** 2) a^9; 4) a^{12}. **228.** 2) a^{2n}; 4) a^{6n}. **229.** 2) $25\frac{1}{16}$; 100; 4) $-0,027$; $\frac{8}{125}$. **230.** 2) $(2^4)^5$; 4) $(2^{10})^2$. **231.** 2) $n=7$; 4) $n=2$. **232.** 2) $(\frac{5}{6})^2$; 4) $(0,02)^2$. **233.** 2) $(7^3)^2$; 4) $((-\frac{2}{3})^{12})^2$. **234.** 2) $(b^3)^2$; 4) $(x^{10})^2$. **235.** 2) $7^5\cdot 6^5$; 4) $4^3\cdot(\frac{1}{7})^3$. **236.** 2) $81x^4$; 4) $64b^2$. **237.** 2) 6^6y^6; 4) $27n^3m^3$. **238.** 2) $x^7y^7z^7$; 4) $2^9\cdot 4^9\cdot 9^9$. **239.** 2) a^6b^3; 4) $0,01c^6$. **240.** 2) $512a^{12}b^{21}$; 4) $16n^4m^{12}$. **243.** 2) $(2a)^3$; 4) $(2\cdot 3)^5$. **244.** 2) $(3,4\cdot b)^4$; 4) $(-\frac{2}{3}a)^2$. **245.** 2) $(9\cdot r)^2$; 4) $(15\cdot a\cdot b)^3$. **246.** 2) $(a^2b^3)^2$; 4) $(9m)^2$. **247.** 2) (xy^2z^4); 4)

$(10c^4x^3)^2$. **248.** 2) $(0{,}7nm^5)^2$; 4) $(\frac{4}{25}a^5b^8)^2$. **249.** 2) $(b^3)^3$; 4) $(4^2)^3$. **250.** 2) $((-\frac{2}{3})^5)^3$; 4) $(-0{,}1)^3$. **251.** 2) $(a^2b)^3$; 4) $(x^4y^3z^2)^3$. **252.** 2) $(-10b^2)^3$; 4) $(-0{,}2xy^3)^3$. **253.** 2) 1; 4) -1. **254.** 2) 1; 4) $\frac{1}{32}$. **255.** 2) 144; 4) 14. **256.** 2) 1; 4) 4. **257.** 2) 14; 4) 16. **258.** 2) $\frac{25}{49}$; 4) $\frac{b^3}{8^2}$. **259.** 2) $\frac{169}{n^2}$; 4) $-\frac{64}{c^3}$. **260.** 2) $\frac{81b^4}{625c^4}$; 4) $\frac{5^6}{7^{12}}$. **261.** 2) $\frac{49}{(2+c)^2}$; 4) $\frac{(a+b)^7}{(a-b)^7}$. **262.** 2) $(\frac{2}{5})^5$; 4) $(\frac{5}{a})^7$. **263.** 2) $(\frac{a}{b})^3$; 4) $(\frac{7}{10})^2$. **264.** 2) $(\frac{4x}{3y})^4$; 4) $(-\frac{1}{3})^3$. **265.** 2) $\frac{1}{35}$; 4) $\frac{16}{9}$. **266.** 2) $\frac{2}{5}$; 4) $\frac{7}{3}$. **267.** 1) $\cong 3{,}3\cdot10^5$ marta; 2) $\cong 9$ yil. **268.** 2) 0,00064; 15625; $\frac{729}{64}$; $\frac{1000000}{729}$. **269.** 2) $\frac{3}{10}$. **270.** 2) 6^{6n+2}; 4) a^{5n+5}. **271.** 2) 3^{5n+2}; 4) b^{4n}. **272.** 2) 7; 4) 5. **273.** 2) $81x^8y^6z^{14}$; 4) $-2{,}48832a^{15}b^{10}c^{20}$. **274.** 2) a^2; 4) a^4. **275.** $(\frac{3^5a^4}{5^2b})^3$; 4) $(\frac{6^3a^4}{7^4b^6})^3$. **276.** 2) $10^{20}>20^{10}$; 4) $3^{40}>6^{20}$. **277.** 2) 4; 4) $\frac{1}{7}$. **278.** 2) 9; 4) 13,2. **279.** 2) $8{,}647\cdot10^6$. **281.** 2) $3bc$; 4) ab^2. **282.** 2) $3a^2b$. **283.** 2) $100n$ (sm). **284.** b) $4a^2$, $4a^2$, $2a^2$, $6a^2$. **285.** 2) 8; 4) 1; 6) 18. **286.** 2) z^{11}; 4) m^4; 6) $72p^3q^2$. **287.** 2) 2. **288.** $\frac{12}{25}$ kun. **289.** 2) $\frac{7}{4}$. **290.** $8{,}88\cdot10^6$; $3{,}2\cdot10^6$; $2{,}8416\cdot10^{13}$. **291.** 2) $-\frac{4}{3}$; 4) -75. **292.** 2) $6ab$; 4) $-2a^3$. **293.** 2) $35m^2n$; 4) $-4b^5$. **294.** 2) $-2m^3n$; 4) $\frac{5}{14}b^3c^2$. **295.** 2) $28x^3y^3$; 4) $2a^2b^2c^2$. **296.** 2) $-21a^6b^6c^2$; 4) $-\frac{9}{8}a^4x^3y^4$. **297.** 2) $-7{,}5m^7r^7n^5$; 4) $-7{,}5a^5b^7c^7$. **298.** 2) $-15m^3n^2$; 4) $-26a^4b^4c^5$. **299.** 2) $30a^4b^3$; 4) $4a^3b^2c^3$. **300.** 2) $25b^2$; 4) $4a^6$. **301.** 2) $16a^2b^2$; 4) $-8x^3y^3z^3$. **302.** 2) $-a^{10}b^5c^5$; 4) $16x^8y^{12}$. **303.** 2) $\frac{1}{81}m^8n^8$. **304.** 2) $-2a^4$; 4) $a^2b^5c^2y^2$. **305.** 2) x^5y^5; 4) $-4a^{10}b^{11}$. **306.** 2) $(4x^2)^2$; 4) $(9x^3y)^2$. **307.** 2) $(2b^2)^3$; 4) $(2a^3b^2)^3$. **308.** 2) 204,8; 4) 1,008. **309.** $7\frac{1}{5}$ qarich. **310.** $6\frac{3}{4}$. **315.** 2) $6a^2b^3-24a^4b$; 4) $-bc^5+5x^2y^4$. **316.** 2) $-6xy^4z-20m^3n^2k^3$; 4) $\frac{1}{3}a^2b^2-2a^2b^3$. **317.** 2) 2; 4) 0. **318.** 2) $-7{,}6$;

4) -252. **319.** 2) $-4{,}85$. **320.** 2) 1,4; 4) 0,28. **324.** 2) $\frac{1}{3}y$; 4) $\frac{13}{16}a^2b$. **325.** 2) $2a+b$; 4) $2a^2-3b^2$. **326.** 2) $-y$; 4) $3{,}8a^2$. **327.** 2) a^2; 4) $2xy-2{,}2y^2$. **328.** 2) $-\frac{7}{8}ab^2-\frac{3}{8}a^2b$; 4) $4x-2{,}46y$. **329.** 2) x^3-6x^2y. 4) ab^2-2ab. **330.** 2) $8b^2-19bc-15c^2$; 4) $2x^2y$. **331.** 2) $-\frac{1}{3}a^2bc-4a^2c$. **332.** 2) $x=\frac{5}{7}$. **333.** 2) 3,9. **334.** 2) 3,675 tiyin. **335.** 2) $3x+3y$; 4) $3x+1$. **336.** 2) $5a^2-b^2$; 4) $-\frac{1}{2}b^2+1\frac{1}{4}$. **337.** 2) $0{,}1c^2$; 4) $6a+22b$. 338. 2) $-2a^2-$ $-6ab+6b^2$; 4) $25z+30az^2$. **339.** 2) $-2b$; 4) $9x^3$. **340.** 2) $3x^2$; 4) $8a^2-$ $-b^2-ab$. **341.** 2) $-x^2-5x^3$; 4) $-\frac{3}{4}a^4+2a^3+\frac{3}{4}a^2+8a$. **342.** 2) $-0{,}07x^2+0{,}06y^2$; $0{,}27x^2-0{,}1y^2$; 4) $0{,}61a^3+1{,}12b^3$; $1{,}39a^3-0{,}88b^3$. **343.** 2) $3x^2+3x^2y^2-x^3$. **344.** 2) $-5b^2+3b$. **345.** 2) q^3; 4) $-5ab+8b^2$. **347.** Mumkin. **348.** $k+2m-n$. **349.** 27 va 33 dinor. **350.** 2) $0{,}6ab+$ $3a^3-0{,}6ab^2$. **353.** 2) $1-\frac{1}{2}x$; 4) $20m-30n$; 6) $-\frac{1}{3}m+\frac{1}{3}n-\frac{1}{3}p$; 8) $-15x^3-35x^2+5x$. **354.** 2) $-10xz+8yz$; 4) x^3-x^2+x. **355.** 2) $75a^2b^2+$ $15a^2b$; 4) $3x^2y^3-6x^4y^2$. **356.** 2) $16ab^2-24a^2bc+8abc^2$; 4) x^3yz+ $2xy^3z+3xyz^3$. **357.** 2) $a^3b^7+\frac{3}{4}a^4b^4$. **358.** 2) $-3a+7b$; 4) $-14p-9$. **359.** 2) $-a^2b+6b^2$; 4) $19x-12$. **360.** 2) $2x-3{,}5$; 4) $0{,}5y-1{,}7$. **361.** 2) 5; 4) 204. **362.** 2) $\frac{8}{15}$. **363.** 2) 96 km. **364.** 2) z^2+3z-4; 4) $bc+4c+$ $+5b+20$. **365.** 2) $-a^2+8a+20$; 4) $p-q+pq-q^2$. **366.** 2) $10a^2+7a-12$; 4) $20p^2-17pq+3q^2$. **367.** 2) $0{,}09-m^2$; 4) $0{,}04a^2-0{,}25x^2$. **368.** 2) $30x^4+30y^4-61x^2y^2$; 4) x^3+5x^2+7x+3. **369.** 2) $27a^3-8b^3$; 4) $27a^3+8b^3$. **370.** 2) $-20b^2+17bc-3c^2-16by+4cy$; 4) $9a^2-24ab+12ac+15b^2-20bc$. **371.** 2) $0{,}3x^2+xz-0{,}3y^2+yz$; 4) $0{,}3a^4-0{,}9a^3+2a^2+3a-10$. **372.** 2) a^3- $-ab^2+3a^2b-3b^3$; 4) $12x^3-29x^2+7x+6$. **373.** 2) 24; 4) 12,08. **375.** 2) $12\frac{2}{3}$. **377.** Soat 2 dan 15 minut o'tgan. **378.** 2) 1. **379.** 2) Noto'g'ri. **382.** 2) y^4; 4) 1. **383.** 2) $-3a$; 4) $-5c$. **384.** 2) $\frac{2}{15}a$; 4) $-9c$. **385.** 2) $9m$; 4) $\frac{4}{5}b$. **386.** 2) 8; 4) 7. **387.** 2) 3; 4) -3. **388.** 2) $-\frac{5}{3}$; 4) $-1{,}3$. **389.** 2) $-\frac{5}{3}p$; 4) $0{,}4c$. **390.** 2) $7m^6$; 4) $\frac{7}{6}$. **391.** 2) $\frac{9}{4}ab^2$; 4) $3ab$. **392.** 2)

$-\frac{1}{13}axy^2$; 4) $\frac{1}{2}a^3b$. **393.** 2) $81x^4y$; 4) $x^7y^{11}z^3$. **394.** 2) $2b-1$; 4) $2-x$. **395.** 2) $4a-3b$; 4) $-c+1$. **396.** 2) $-\frac{2}{3}cb-1$; 4) $-\frac{1}{4}ab+\frac{3}{4}a^2$. **397.** 2) $-2x-3y+4$; 4) $a+3a^2b-2$. **398.** 2) 1; 4) $-3a$. **399.** 2) 24; 4) 0. **400.** 2) $9x^3$; 4) $-9x^2-2-x$. **401.** 7,808 mln. so'm. **402.** 2) 453,6. **403.** 2) Teng; 4) $(\frac{4}{3})^2$. **404.** 2) $(-\frac{1}{2})^2$; 4) $(0,2)^2$. **405.** 2) a^3; 4) c^2+3^2. **406.** 2) n^2-m^2; 4) $(\frac{1}{2})^3-b^3$. **407.** $4c$ sm, c^2 m^2. **408.** $6k^2$ sm^2, k^3 sm^3. **409.** $3x^2$ yoki $\frac{1}{3}x^2$. **410.** 10 km. **411.** 108000. **412.** Yo'q. **413.** 2) $3{,}08\cdot10^{13}$; 3) 10^3. **414.** $5{,}1\cdot10^8$; 10^{12}. **415.** 10 kg. **416.** 2) $(-7)^3$, $(-0{,}4)^3$, $(\frac{1}{7})^3$, $(-1{,}5)^2$. **417.** 2) xy; 4) $10mn^2k$. **418.** 2) $13\frac{3}{4}$. **419.** 2) $3x^2$; 4) $8a^2+b^2-ab$. **420.** 2) $-x^2-5x^3$; 4) $-\frac{3}{4}a^4+2a^3+\frac{3}{4}a^2+8a$. **421.** 2) $0{,}3x^2+xz-0{,}3y^2+yz$; 4) $0{,}3a^4-0{,}9a^3+2a^2+3a-10$. **422.** 2) $a^3-ab^2+3a^2b-3b^3$; 4) $12x^3-29x^2+7x+6$. **423.** 2) $-ab^2-2ab+3$; 4) $\frac{1}{9}x^3-\frac{1}{8}x^2y+\frac{2}{15}xy^2$. **424.** 2) $5x^3+8x^2+9x-1$; 4) $1\frac{1}{4}a^5+2a^2x-1\frac{1}{2}x^2$. **429.** 2) 180,7; 4) 12,5. **430.** 2) $2x^2-2x$; 4) $a^3+ab-a^2b^2-b^3$. **431.** 240 km. **432.** 2) 150000; 4) 4. **433.** 2) $3(a-x)$; 4) $6(a+2)$. **434.** 2) $2(4a-2b-1)$; 4) $3(3x-y+4z)$. **435.** 2) $c(d+b)$; 4) $x(3-y)$. **436.** 2) $3b(d-a)$; 4) $3p(2k-1)$. **437.** 2) $x(y-x+z)$; 4) $4b(b+2a-3a^2)$. **438.** 2) $a^3(a-3)$; 4) $x^2y^2(y-x)$. **439.** 2) $6x^2(x^2-4)$; 4) $3a^2(2a^3+1)$. **440.** 2) $4x^2y(5xy+1)$; 4) $3xyz(3z-4y)$. **441.** 2) $5a^3(4a-1+3a^2)$; 4) $2x^2y^2(y^2-x^2+3xy)$. **442.** 2) 18700; 4) $-1{,}62$. **443.** 2) $(a+5)(b-c)$; 4) $(y-3)\times(1+b)$. **444.** 2) $(m-3)(3n+5m)$; 4) $(c-d)(7a-2b)$. **445.** 2) $(x+y)(a^2-b^2)$; 4) $(a^2-2b^2)(x+y)$. **446.** 2) $(p-q)(c-a+d)$; 4) $(x^2+1)(m-n-l)$. **447.** $(x-y+z)(a-b+c)$; 4) $(m-n+k)(2a-b+1)$. **448.** 2) $(b-c)(a+c)$; 4) $(x-y)(2b+1)$. **449.** 2) $(a-2)(6-a)$; 4) $(m-2)(a^2-b)$. **450.** 2) $(x-y)(x-y-3)$; 4) $(3-b)(-a+1-b)$. **452.** 2) $x=0$, $x=3$; 4) $x=6$, $x=-10$. **453.** 2) $x=1$; 4) $x=0{,}49$. **454.** Ulguradi. **455.** 2) $(m-n)(1+p)$; 4) $(x-y)(1+2a)$. **456.** 2) $(a-b)(a-b+1)$; 4) $(p-1)(4q+p-1)$. **457.** 2) $(p-1)(4q+1)$; 4) $(p-1)\times(4q-1)$. **458.** 2) $(b+c)(a+d)$; 4) $2(x-1)(3x-4y)$. **459.** 2) $(c+d)(a-3b)$; 4) $(a-3b)(x+5y)$. **460.** 2) $(b+c-a)(y-x^2)$; **461.** 2) 12500; 4) 28. **462.**

2) $-0{,}625$; 4) $-0{,}33$. **463.** 2) 906. **464.** 2) $t=-7$, $t=4$. 465. 2) $-2\frac{2}{3}$; 4) 0,019. **466.** 160 km. **467.** 2) $x^2-2xy+y^2$; 4) x^2+2x+1; 6) $49+14m+m^2$. **468.** 2) x^2-6x+9; 4) $y^2-12y+36$; 6) $b^2+b+\frac{1}{4}$. **469.** 2) $9x^2+12xy+4y^2$; 4) $25z^2-10zt+t^2$. **470.** 2) a^4+2a^2+1; 4) $x^4+2x^2y^2+y^4$. **471.** 2) $a^2-\frac{2}{3}a+\frac{1}{9}$; 4) $\frac{x^2}{9}+\frac{xy}{6}+\frac{y^2}{16}$. **472.** 2) $0{,}16b^2-0{,}4bc+0{,}25c^2$; 4) $\frac{1}{16}a^6-\frac{2}{5}a^3+\frac{16}{25}$. **473.** 2) $\frac{1}{9}x^4+\frac{1}{3}x^3+\frac{1}{4}x^2$; 4) $100x^4-60x^3y^3+9x^2y^6$. **474.** 2) $9b^4+12ab^3+4a^2b^2$; 4) $16x^2y^2+4xy^3+0{,}25y^4$. **475.** 2) 1681; 4) 9604. **476.** 2) 1006009; 4) 1521. **477.** 2) 3249; 4) 1002001. **478.** 2) $4xy$; 4) $8a^2+2b^2$. **479.** 2) $7a^2-52a+112$; 4) $4x^2-16x-4$. **480.** 2) $x=2$; 4) $x=-0{,}5$. **481.** 2) $y=3$; 4) $y=\frac{2}{3}$. **482.** 2) -11; 4) -17. **484.** 2) $(\frac{2}{9}xy^2)^2$; 4) $(\frac{8}{11}m^3n^2)^2$. **486.** 2) $(5+x)^2$; 4) $(p-0{,}8)^2$. **490.** 2) $x=\frac{1}{8}$. **491.** 240 km. **492.** 2) p^2-q^2; 4) m^2-n^2; 6) m^2-4. **493.** 2) a^2-9; 4) x^2-49; 6) b^2-1. **494.** 2) c^2-9d^2; 4) $9m^2-4n^2$. **495.** 2) $\frac{25}{36}a^2-b^2$; 4) $\frac{4}{9}m^2-\frac{9}{16}n^2$. **496.** 2) a^4-b^6; 4) m^6-n^6. **499.** 2) $25a^2b^4-4a^4b^2$; 4) $a^2b^6-16x^2y^2$. **500.** 2) x^4-1; 4) $81a^4-16b^4$. **501.** 2) 4896; 4) 2491. **502.** 2) 1584; 4) 39999. **503.** 2) $2a^2+4a$; 4) $24ab+32b^2$. **505.** 2) $x=\frac{4}{3}$; 4) $x=2$. **506.** 64 sm^2 ga kamaydi. **507.** 2) 37^2 soni $36\cdot38$ dan 1 ga ortiq; 4) $(2n-3)(2n+3)$ son $(2n+5)(2n-5)$ dan 16 ga ortiq. **508.** 2) $x=\frac{17}{4}$; 4) $x=4$. **509.** 96 m^2. **510.** -10. **511.** 2) 980; 4) 5,87. **514.** 2) $(2a-3)(2a+3)$; 4) $(9a-4b)(9a+4b)$. **515.** 2) $(ab-4)(ab+4)$; 4) $(4x-5y)(4x+5y)$. **516.** 2) $(\frac{2}{3}a-\frac{1}{4}b)(\frac{2}{3}a+\frac{1}{4}b)$; 4) $(0{,}3x-0{,}4y)(0{,}3x+0{,}4y)$. **517.** 2) $(xy^2-4)(xy^2+4)$; 4) $(5a-3b^3)(5a+3b^3)$. **518.** 2) $(a^2-b^4)(a^2+b^4)$; 4) $(b^2-9)(b^2+9)$. **519.** 2) $(m-n-k)(m-n+k)$; 4) $3(x-y)(3x+y)$. **520.** 2) $(a+2b+c)(a-c)$; 4) $4(2a-b)(-a-2b)$. **521.** 2) $(1+c)^2$; 4) $(9-x)^2$. **522.** 2) $(10-3a)^2$; 4) $(a+5b)^2$. **523.** 2) $(p^2-q)^2$; 4) $(5a^3+3b)^2$. **524.** 2) $(b^2-9)^2$; 4) $(4-a^2b^2)^2$. **525.** 2) $-(3-b)^2$; 4) $-3(a+2b)^2$. **526.** 2) 60000; 4) 216. **527.** 2) $x=\frac{1}{2}$, $x=-\frac{1}{2}$; 4) $x=5$. **528.** 2) 10000; 4) $\frac{2}{3}$ **529.** 2) $125a^3+343b^3$; 4)

$125a^3-343b^3$. **530.** 2) $a^2+3ab+9b^2$; 4) $a^2-3ab+9b^2$. **531.** 2) $x^2+2xy+y^2$; 4) $x^2-2xy+y^2$. **532.** 2) $(c+d)(c^2-cd+d^2)$; 4) $(a-3)(a^2+3a+9)$; 6) $(a+1)\times$ $\times(a^2-a+1)$; 8) $(5-b)(25+5b+b^2)$. **533.** $(2a)^3$, $(3x)^3(\frac{4}{5}y^2)^3$, $(2mn^2)^3$. **534.** 2) $(4-5y)(16+20y+25y^2)$; 4) $(4y+\frac{1}{3})(16y^2-\frac{4}{3}y+\frac{1}{9})$. **535.** 2) $(1+3b)\times$ $\times(1-3b+9b^2)$; 4) $(\frac{1}{2}a^2+5b)(\frac{1}{4}a^4-\frac{5}{2}a^2b+25b^2)$. **536.** 2) $(a+b)(a-b)\times$ $\times(a^4+a^2b^2+b^4)$; 4) $(2+y)(2-y)(16+4y^2+y^4)$. **537.** 2) y^3+8; 4) $64c^3-125d^3$. **538.** 2) $a^6b^6-125a^3$; 4) $\frac{1}{8}x^3-\frac{1}{27}y^3$. **540.** 2) $16a^2(4a+5b)$; 4) $(a-b)\times$ $\times(a^2+ab+b^2+a-b)$. **541.** 2) 0,02. **542.** 2) 5; 4) 26. **543.** 2) $x=3$; 4) $x=0{,}2$. **554.** 2) $x=2$. **555.** 1,2 soat. **556.** 2 km/soat, 16 km/soat. **557.** $1\frac{1}{9}$ dinor. **558.** 2) $(x-y)(4+3x-3y)$; 4) $(b-a)(b-a-1)$. **559.** 2) $y(x+y)^2$; 4) $(b-a)^2(a-1)$. **560.** 2) $24x^2(y-z)$; 4) $4(2x-y)(2x-3y-1)$. **561.** 2) $5(x+y)(2x+1)$; 4) $(3z^2+2y^2)(16x-5y)$. **562.** 2) $(2nk+5m)(3mk-7n^2)$; 4) $(5c-3x)(8b-3c)$. **563.** 2) $16x+2$; 4) $-19y+6$. **564.** 2) $a^4+2bc-b^2-c^2$; 4) $a^{2m}-b^{4n}$. **566.** 2) $\frac{5}{8}$; 4) $\frac{11}{8}$. **568.** 2) $46\frac{2}{3}$. **571.** $\frac{a^2-b^2}{(a-b)^2}$. **575.** 2) 5; 4) 1,9; 6) 4. **576.** 2) $\frac{3}{2}$; 4) 6,4. **577.** 2) $v=\frac{m}{p}$; 4) $a=\frac{p}{2}-b$. **578.** $x=\frac{np}{1000r}$, $x=3$. **579.** $t=\frac{a}{cn}$, $t=15$. **580.** $b=2$. **583.** 2) $\frac{4}{5}$; 4) -2. **584.** 2) $\frac{2}{3}$; 4) $\frac{b}{2c}$. **585.** 2) $\frac{1}{b^4}$; 4) b^2. 587. 2) $\frac{2}{3}$; 4) $\frac{b}{3a}$; 6) $\frac{a^2b}{5c}$. **588.** 2) $\frac{7a}{5}$; 4) $\frac{1}{3(a-b)}$; 6) $-\frac{1}{3}$. **589.** 2) $\frac{2}{a(a-b)}$; 4) $\frac{1}{(m+n)^3}$; 6) $3y-2x$. **590.** 2) $\frac{2a}{m-n}$; 4) $\frac{4a-1}{2a+3}$; 6) $\frac{1+b}{1-b}$. **591.** 2) $\frac{q^2}{p-q}$; 4) $\frac{m}{n}$; 6) $-\frac{x}{y}$. **592.** 2) $\frac{3a+2b}{2a+3b}$; 4) $-\frac{1}{ab}$. **593.** 2) $\frac{1}{a+b}$; 4) $5+x$; 6) $-\frac{c+2}{2a}$. **594.** 2) $10-7b$; 4) $\frac{y}{5+y}$; 6) $\frac{5ab}{a^2-b^2}$. **595.** 2) $\frac{1}{b+7}$; 4) $\frac{1}{1-2p}$. **596.** 2) $\frac{4a+1}{4a-1}$; 4) $\frac{10(m+n)}{3(m-n)}$. **597.** 2) $n-m$; 4) $\frac{1}{5-2x}$. **598.** 2) a^2+3a+9; 4) $\frac{b}{4a^2+2a+1}$; 6) $\frac{b^2-3b+9}{b+3}$. **599.** 2) $\frac{3y-4x}{3y+4x}$; 4) $\frac{6-c}{6+c}$; 6) $\frac{3c-2b}{a}$. **600.** 2) $a+1$; 4) $\frac{1}{2}$. **601.** 2) b^3; 4) $\frac{6a^{n-3}}{5b^n}$. **602.** 3,6. **603.** 2)

$(a-2)(m-n)(m+n)$. **604.** 2) $10\frac{31}{32}$; 4) $2\frac{11}{24}$. **605.** 2) $x=-2$; 4) $x=0$.

606. 2) $\frac{b}{ab}$ va $\frac{2a}{ab}$; 4) $\frac{2a}{2b}$ va $\frac{a}{2b}$; 6) $\frac{32}{60}$ va $\frac{25}{60}$. **607.** 2) $\frac{9x^2}{12xy}$, $\frac{72}{12xy}$ va $\frac{16y^2}{12xy}$; 4) $\frac{2ax^2}{4x^3}$ va $\frac{b}{4x^3}$. **608.** 2) $\frac{6b^2}{2b}$ va $\frac{a^2}{2b}$; 4) $\frac{2b^2}{6ab}$, $\frac{9ac}{6ab}$, $\frac{6a^2b^2}{6ab}$.

609. 2) $\frac{3a^2}{18a^2b^2}$, $\frac{2(a^2+b^2)}{18a^2b^2}$ va $\frac{a(3-a^2)}{18a^2b^2}$; 4) $\frac{21y^3}{60x^4y^4}$, $\frac{310x^3y}{60x^4y^4}$ va $\frac{80x^2}{60x^4y^4}$.

610. 2) $\frac{6a}{(a-1)a}$ va $\frac{2(a-1)}{(a-1)a}$; 4) $\frac{8a^2}{12(a+1)}$ va $\frac{15a^2}{12(a+1)}$. **611.** 2) $\frac{7a(3x+y)}{9x^2-y^2}$ va $\frac{6b(3-y)}{9x^2-y^2}$; 4) $\frac{6x}{8x+8y}$ va $\frac{x}{8x+8y}$. **612.** 2) $\frac{7a}{x^2-9}$ va $\frac{a(x-3)}{x^2-9}$; 4) $\frac{6x(x+y)}{x^2-y^2}$, $\frac{7xy(x-y)}{x^2-y^2}$ va $\frac{3}{x^2-y^2}$. **613.** 2) $\frac{(a-b)^2}{5(a^2-b^2)}$ va $\frac{5(a+b)}{5(a^2-b^2)}$; 4) $\frac{5c}{c^2-4c+4}$ va $\frac{6(c-2)}{c^2-4c+4}$; 6) $\frac{2}{9x^2-1}$ va $\frac{-4x(3x+1)}{9x^2-1}$. **614.** 2) $\frac{28c(b+c)}{70(b^2-c^2)}$, $\frac{6a^2}{70(b^2-c^2)}$ va $\frac{35b(b-c)}{70(b^2-c^2)}$; 4) $\frac{15x(x+1)}{12x(x^2-1)}$; $\frac{-48x^2}{12x(x^2-1)}$ va $\frac{4(x-1)}{12x(x^2-1)}$. **615.** 2) $15\frac{157}{168}$.

616. 2) $x=-1\frac{6}{7}$. **619.** 2) $\frac{5a}{b^3}$; 4) $\frac{x-y}{n+a}$. **620.** 2) $\frac{6a}{3c^2}$; 4) $\frac{7}{a^2}$; 6) $\frac{8}{ab}$.

621. 2) $\frac{11}{28}$; 4) $\frac{3}{5b}$; 6) $\frac{3ad-b}{12d}$. **622.** 2) $\frac{15+ab}{5a}$; 4) $\frac{2+7b}{b}$. **623.** 2) $\frac{2c+4c^2-3}{c^2}$; 4) $\frac{mn-kn^2+m^2}{n^2}$. **624.** 2) $\frac{k-n}{mnk}$; 4) $\frac{bd+ba}{acd}$; 6) $\frac{2n^2-3m}{mn^3}$.

625. 2) $\frac{4a^4-21cb^3}{18a^3b^4}$; 4) $\frac{20y-21x+22}{28x^2y^2}$; 6) $\frac{b(cd+d+c)}{cb^2}$; **626.** 2) $x=1$; 4) $z=15$. **627.** 2) $\frac{3y^2-xy}{6}$; 4) $\frac{31x-37y}{10}$; 6) $\frac{1}{2a}$. **628.** 2) $\frac{3x}{2(1-x)}$; 4) $\frac{8y-25x}{10(y-3)}$. **629.** 2) $\frac{11}{10(b+1)}$; 4) $\frac{5x}{8(x+y)}$. **630.** 2) $\frac{5b^2-2a^2}{ab(x+y)}$; 4) $\frac{a+b-y}{ab}$.

631. 2) $\frac{2x(8x-1)}{4x^2-1}$; 4) $\frac{a^2-2ay+2ab-b^2}{a^2-b^2}$; 6) $\frac{2a^3b}{a^2-1}$. **632.** 2) $\frac{2(2a+3)}{a(1-a)}$; 4) $\frac{67b-3a}{40(a^2-b^2)}$. **633.** 2) $\frac{x-1}{x^2-9}$; 4) $\frac{2x^2+3x+2}{x^2-16}$. **634.** 2) $\frac{6n-47}{n^2-49}$; 4) $\frac{24y^2+y+1}{1-9y^2}$.

635. 2) $\frac{13a+4}{(3a+1)^2}$. **636.** 2) $\frac{2-11x}{(3x+1)^2}$; 4) $\frac{4-7n+7m}{(n-m)^2}$; 6) $\frac{2x^2+18}{(x^2-9)^2}$. **637.** 2)

$\frac{2(2x-y)}{x^2-y^2}$; 4) $\frac{a^2-a+1}{a(4a^2-1)}$; 6) $\frac{6-7a}{(a-2)^2(a+2)}$. **638.** 2) $\frac{b^2-3b}{b-2}$; 4) $\frac{1}{a+1}$.

639. 2) $-\frac{1}{x+y}$; 4) $\frac{2(24-a)}{4a^2-9}$. **640.** 2) $\frac{b-3b^2-14}{6(b^2-1)}$; 4) $\frac{28n^2-4m^2+9mn}{m(4n^2-m^2)}$; 6)

$\frac{4a^2-4a-b}{a^2+2a}$. **641.** 2) $\frac{2a}{a^2+8}$; 4) $-\frac{6m}{m^3-27}$. **642.** 2) $-\frac{12}{19}$. 643. 1) 910; 4) 16,2.

644. 2) $x = 1$. **645.** 2) 12. **647.** 2) $x = \frac{1}{2}$. **650.** 2) $\frac{4}{13}$; 4) $\frac{15}{2}$. **651.** 2) $\frac{k^2}{mn}$;

4) $\frac{3mk}{4nd}$; 6) $\frac{2a^2b^2}{c^3}$. **654.** 2) 2; 4) $\frac{a}{bc}$; 6) $\frac{ac}{b}$. **655.** 2) $\frac{k^2}{mn}$; 4) $\frac{3md}{2nk}$; 6)

$\frac{15a^2c^2}{a}$. **656.** 2) $\frac{18a^2}{7}$; 4) $\frac{1}{a}$; 6) $\frac{a^3b^3}{d^2}$. **657.** 2) $\frac{2y}{5c^3}$; 4) $\frac{2d^2a^2}{3c}$; 6) $\frac{22p^3n}{m^4}$.

658. 2) $10a^2b$; 4) $\frac{1}{4a^2b}$. **659.** 2) $\frac{2b}{a}$; 4) $3b$; 6) $\frac{(a+b)a}{3b}$. **660.** 2) $\frac{b}{3(1+a)}$;

4) $\frac{1}{3m^2(m+n)}$; 6) $\frac{5}{3(a-b)}$. **661.** 2) $-\frac{3x^2(x+y)}{2(x^2+y^2)}$; 4) $\frac{-18(n-m)^2(n+m)}{n(n+p)^2}$;

6) $\frac{1}{a^2-b^2}$. **662.** 2) $b-3$; 4) $(a-1)(2a-1)$. **663.** 2) $9\frac{1}{2}$. **664.** 2) $(x-1-x^2)\times$

$\times(x-1+x^2)$. **666.** 2) 4; 4) $\frac{15}{64}$; 6) $40\frac{8}{9}$. **667.** 2) $\frac{2(a+1)}{3}$; 4) 1; 6)

$\frac{b^2}{b^2+1}$. **668.** 2) $\frac{a^2(b^2-1)}{b^2}$; 4) $\frac{2(m+n)}{n}\cdot 6(c+d)$. **669.** 2) $\frac{4ab}{a^2-b^2}$; 4) $\frac{1}{6(c+d)}$.

670. 2) $\frac{9z}{z+2}$; 4) $\frac{m+5}{m-2}$. **671.** 2) $\frac{b}{a+b}$; 4) $\frac{1}{c}$. **672.** 2) $\frac{4}{a-b}$; 4) $\frac{1}{c(a+b)}$.

673. 2) $\frac{ab-2}{a+1}$; 4) $\frac{x(y-x)}{y+x}$. **676.** $\frac{v-v_1}{v+v_1}$. S km. **677.** 6 donadan. **678.** 2)

$x = 30$; 4) $p = 10\frac{2}{3}$. **679.** 2) $\frac{2a^2}{3b}$; 4) $\frac{(a-1)^2}{a}$. **680.** 2) $x + y$; 4) $\frac{ab^2}{a-b}$.

681. 2) $x = -4$; 4) $x = 49$. **682.** 2) $\frac{3(x^2-2x+4)}{x^3+8}$, $\frac{x+1}{x^3+8}$ va $\frac{(x+2)^2}{x^3+8}$. **683.**

2) $\frac{3ac(2a+3)}{c(4a^2-9)}$, $\frac{4ac(2a-3)}{c(4a^2-9)}$ va $\frac{5b}{c(4a^2-9)}$; 4) $\frac{y(2x+3y)}{y(2x+3y)^2(2x-3y)}$,

$\frac{(2x-3y)}{y(2x+3y)^2(2x-3y)}$ va $\frac{-y(2x+3y)^2}{y(2x+3y)^2(2x-3y)}$; 6) $\frac{2x^2y}{xy(y^3-x^3)}$, $\frac{-3(y^2+xy+x^2)}{xy(y^3-x^3)}$

va $\frac{x(x-y)}{xy(y^3-x^3)}$. **684.** 2) $\frac{55b-61}{24}$; 4) $\frac{5-27b}{36}$. **685.** 2) $\frac{7q-p}{3p-q}$; 4) $\frac{8a+8b-70}{2b-5}$.

686. 2) $\frac{a^2-b^2}{7}$; 4) $\frac{m+n}{2(p^2-pc+c^2)}$. **687.** 2) $\frac{x(x+2)(x-3)}{(x-2)(x+3)(x^2+2)}$; 4) 1. **688.** 2) $-2(a-1)^2$; 4) $\frac{a^2+4}{4a}$. **689.** 2) $\frac{2n(n-k)}{2n+k}$; 4) $\frac{2q(m-2q)}{m+2q}$. **704.** $\frac{x^3+2x^2-2}{(x^2-4)(x^2-1)}$. **705.** $-\frac{1}{6x}$, 0,1. **707.** 2) 4; 2; 0; -2; -4; 4) -36; -16; 4; 24; 44. **708.** 2) 4 soat. **709.** 2) -9; -28; 103; $-1{,}25$. **710.** 2) 22; 3,1; -14. **711.** 2) To'g'ri; 4) noto'g'ri. **712.** 2) 2,5; 1,8; $-9{,}5$; $-6{,}25$. **719.** 2) $\frac{(m^2+4)^2}{(m+2)^3}$. **720.** 9 km/soat, 12 km/soat. **721.** $y=80n$; 480; 880. **722.** $s=90t$; 270; 486. **732.** C, D. **734.** $y=14x$. **736.** $S=2x$; 2km; 5 km; 8 km. **737.** $S=3t$. **738.** 2) $\frac{m-2}{m-5}$. **739.** $19m^3$. **741.** 2) -1; 3; $\frac{1}{3}$. **742.** $6+2t$; 46; 68; 47 min. **744.** 2) (0; 4), (2; 0); 4) (0; $-0{,}6$), (0,75; 0); 6) (0; -5), (7,5; 0). **753.** M, N, A, B nuqtalar tegishli. **754.** 2) Yo'q; 4) yo'q. **755.** 2) $k=-3$. **756.** 2) $b=17$. **759.** 2) $400-50t$. **760.** $y=10+5x$. **761.** 84,5 kv. birlik. **762.** $\frac{a+10}{a^2-25}$. **763.** $x=\frac{1}{2}$. **764.** 300 ta mashina. **765.** 5 donadan. **770.** $t=\frac{s}{v}$. **771.** 2) $V=\frac{m}{p}$. **772.** $k=-2$. **773.** 2) $k=-20$. **774.** 2) (2; 8). **775.** $k=\frac{20}{9}$, $b=\frac{50}{9}$. **778.** $x=3$, $y=-2$. **779.** $x=6$, $y=-6$. **780.** $a=-1$, $b=18$. **781.** $k=5$, $m=-9$. **782.** 1), 2) ega emas. **783.** 1) $u=4$, $v=3$; $u=4$, $v=3$; 2) $u=3$, $v=7$; $u=7$, $v=3$. **784.** 2) $x=0$. **786.** 2) $x=10+y$, $y=x-10$; 4) $x=11-3y$, $y=\frac{11-x}{3}$; 6) $x=\frac{5y-3}{3}$, $y=\frac{3+3x}{5}$. **787.** 2) $x=1$, $y=-1$; 4) $x=-\frac{1}{3}$, $y=-5\frac{2}{3}$; 6) $x=-1$; $y=1$. **788.** 2) $x=-73$, $y=-30$; 4) $x=1\frac{2}{11}$; $y=8\frac{6}{11}$; 6) $x=-7\frac{2}{9}$, $y=-4\frac{1}{3}$. **793.** 2) $\frac{m^3}{n-m}$; -16. **794.** Ulguradi. **795.** 9,5; 0,5; 14,5; 3,5; 20,5. **796.** 2) $x=1$, $y=-0{,}5$; 4) $x=-1$; $y=6$. **797.** 2) $x=3$, $y=1$; 4) $x=-4$; $y=-3$. **798.** 2) $x=4$, $y=4$; 4) $x=2$, $y=7$. **799.** 2) $x=5$, $y=11$; 4) $x=4$, $y=-6$. **800.** 2) $x=\frac{1}{2}$; $y=\frac{1}{3}$; 4) echimlarga ega emas. 6) $x=-5$; $y=4{,}5$. **803.** 2) $x=-\frac{25}{34}$; 4) $x=-6{,}5$. **804.** 2) (0; 1,5); (-1,0); 4) (0; 6), (2,1; 0). **813.** 2) $\frac{7}{3}$. **814.** 16 ga, 96 ga

815. 2) $a=70$. **816.** 36 va 15. **817.** 200 so'm va 30 so'm. **818.** 2,7 m, 1,6 m. **819.** 7 sm, 9 sm. **820.** 2 va -3. **821.** 21 sr, 14 sr. **822.** 100 tup dub, 200 tup qarag'ay. **823.** 40 ta detal, 30 ta detal. **824.** 38 ga, 34 ga. **825.** 9 kg, 6 kg. **826.** 50 ta, 30 ta. **827.** $\frac{14a+40b}{312}$, $\frac{5a-8b}{156}$. **828.** 3 va 1. **829.** 35 yosh, 9 yosh. **830.** 62 ℓ, 78 ℓ. **831.** 19 ℓ, 14 ℓ. **832.** 10 km/soat, 2 km/soat. **833.** 30 km/soat, 35 km/soat. **834.** 350 km/soat, 8 soat. **835.** 200 t, 260 t. **836.** 552, 675. **838.** 460 ta, 560 ta. **839.** 2) $\frac{1}{(a-x)^2}$. **841.** $x=0$. **846.** 2) $x=0$, $y=5$; 4) $x=2$, $y=6$. **847.** 2) $x=\frac{1}{2}$, $y=-\frac{7}{6}$; 4) $x=2$; $y=5$. **850.** 39. **851.** 48. **852.** 52 m, 34 m. **853.** 36 qator, 50 harf. **855.** 2) 0,01; 5) $\frac{1}{3}$. **856.** 2) Noto'g'ri; 3) noto'g'ri. **857.** 2) $a-b$; 4) $\frac{a}{b}$; 6) $\frac{a+b}{a-b}$; 8) $\frac{a-b}{2}$. **858.** $7\frac{1}{2}$. **859.** $2a(30-a)-128$. **860.** $a\cdot 100+b\cdot 10+c$, $c\cdot 100+b\cdot 10+a$. **861.** $x=1000a+c$. **862.** 3) $4\frac{2}{3}$. **863.** To'g'ri; 4) to'g'ri. **864.** 2) $-a^4b^2c^3$. **865.** 2) $0{,}64a^2c^4$. **866.** 4) $3a^2bm$. **869.** 4) $1{,}5a^3+11{,}5a^2-a-1$. **870.** 2) 1. **871.** 2) $x=2\frac{5}{11}$. **872.** 2) $x=22$. **878.** 4) $x=-\frac{1}{8}$. **880.** 40, 36, 43. **881.** 8, 4, 5. **882.** 9 yildan so'ng. **883.** 4 yildan so'ng. **884.** 120 km. **885.** 150 ta detal. **886.** 2580 sr. **887.** 1,5 soat. **888.** 1,5 soatdan keyin. **889.** 1) 80 ga; 2) 6000 va 7500; 3) 31%ga. **890.** 2) $\frac{a^2}{4}$ **891.** 2) $16ab$. **893.** 2) $-4ab+2b^2$; 4) a^6-64; 5) $2a^4-2a^2$. **894.** 2) $3(1+a)(7-3a)$. **895.** 2) $4(3b-2)(5b+1)$; 4) $(17a-9b)(b-13a)$. **896.** 2) $(2ab+5c)(4a^2b^2-10abc+25c^2)$; 4) $16a^2$. **897.** 2) $(m-1)(m^2+1)$; 4) $(1+a-b)(1-a+b)$. **900.** 4) $\frac{m+7n}{10}$. **908.** 2) 1. **912.** 2) (0; 4), $(\frac{4}{7}; 0)$; 4) (0; 1), $(\frac{2}{7}; 0)$. **913.** $k=\frac{2}{3}$, $b=\frac{5}{3}$. **914.** 2) $b=2$. **917.** 4) $(\frac{1}{3}; -1)$. **921.** 20 litr va 5 litr. **922.** $\frac{4p-3q}{5}$, $\frac{2q-p}{5}$. **923.** $\frac{85n-80m}{65}$, $\frac{20m-18n}{13}$. **924.** 11 yosh va 5 yosh. **925.** $\frac{5}{8}$. **926.** $8\frac{4}{7}$, 43. **929.** 19,4 km/soat va 20 km/soat. **930.** 21 km va 42 km. **931.** 1) $(x+3)^2(x-2)(x-4)$; 2) $x=-3$, $x=2$, $x=4$; 4) -18; 5) x^2-6x+8. **932.** 1) $A=(x-5)(3x-1)$, $B=2(x-1)\times$

$\times(x-1)(x-5)$; 2) $x=5$ va $x=\frac{1}{3}$ bo'lganda $A=0$; $x=1$ va $x=5$ bo'lganda $B=0$; 4) $x=\frac{1}{3}$ bo'lganda. **933.** 2) Ha, yo'q; 4) $x=-\frac{1}{2}$ bo'lganda. **941.** 3 raqami bilan. **942.** 10989. **944.** To'g'ri. **947.** 2) $(b-3)(b-4)$; 4) $(x-1)(x-2)(x+3)$; 6) $(m+1)(m-2)$. **948.** 2) $\frac{a-b}{a+b}$. **949.** 2) 2;4) 8,75. **950.** 2) $\frac{2p(2p-q)}{2p+q}$. **953.** 2) 0. **955.** 1) $\frac{8}{1-x^8}$; 2) 0. **956.** 2) $A(3;0)$, $D(6;0)$ yoki $A(3;-6)$, $D(6;-6)$; 4) $B(-4,5)$, $C(1,5)$ yoki $B(-4;-5)$, $C(1;-5)$. **958.** (1; 2). **959.** 2) $b=1$; 4) $b=11,5$. **960.** 2) $y=x$; 4) $y=-5x+7$. **961.** 10 bog'lam. **962.** 5 minutga. **963.** Ertalab soat 8 da. **964.** 75 m, 15 km. **965.** 12 km. **966.** 5 km/soat, 11 km/soat. **967.** 60 km/soat, 5 soat. **968.** 8 ta ot, 30 kunda. **969.** 3 soat, 9 soat. **970.** 1040. **971.** 1 soat. **972.** $\frac{s}{2t}$. **973.** 4 km.

TUSHUNCHLAR KO'RSATKICHI

ISMLAR KO'RSATKICHI

MUNDARIJA

ALIMOV SHAVKAT ORIFJONOVICH,
XOLMUHAMEDOV OLIMJON RAHIMOVICH,
KOLYAGIN YURIY MIXAYLOVICH,
SIDOROV YURIY VIKTOROVICH, SHABUNIN MIXAIL IVANOVICH

ALGEBRA

7-sinf uchun o'quv qo'llanma

Beshinchi nashri

Maxsus muharrir *M.A.Mirzaahmedov*
Muharrir *H.Mahmudova*
Rasmlar muharriri *A.Bobrov*
Texnik muharrir *T.Smirnova*
Musahhih *M.Nasriddinova*
Kompyuterda sahifalovchi *B.Ashurov*

IB № 4206

Diapozitivdan 18.02.2004-y.da bosishga ruxsat etildi. Bichimi 60x90 $^{1}/_{16}$. Kegli 11 shponli. Tayms garnitura. Ofset bosma usulida bosildi. 14,0 shartli b.t. 10,13 nashr t. 20000 nusxada bosildi. 34-2004 raqamli shartnoma. 43 raqamli buyurtma.

O'zbekiston matbuot va axborot agentligining G'afur G'ulom nomidagi nashriyot-matbaa ijodiy uyi. 700129. Toshkent. Navoiy ko'chasi, 30. // 700128. Toshkent. Usmon Yusupov ko'chasi, 86.

A36

Algebra: 7-sinf uchun o'quv qo'llanma
/Sh.O.Alimov, O.R.Xolmuhamedov, Yu.M.Kolyagin va boshq. 5-nashri
– T.: G'.G'ulom nomidagi nashriyot-matbaa ijodiy uyi. 2004. – 224 b.

I. Sh.O.Alimov va boshq.

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