Variant - 1

1. $1abcde \cdot 3 = abcde1$

$\times \begin{array}{r} 1abcde \\ \hline 3 \\ \hline abcde1 \end{array}$

$e=1 \quad d=5 \quad c=8 \quad b=2 \quad a=4$

142857 (B)

2. Ifodaning qiymati 40dan qancha kam?

$$\left(2^{-3}+\left(\frac{3}{4}\right)^{-4}\cdot\left(\frac{1}{2}\right)^{2}\right):\left(\left(\frac{1}{6}\right)^{0}-12\cdot 3^{-3}\right)$$

$18-9\frac{3}{20}$

1) $\frac{81}{1}+\frac{2}{256}{}_{81}\cdot\frac{1}{4}=\frac{81+512}{81\cdot 8}=\frac{593}{648}$

2) $1-12\cdot\frac{1}{27}=\frac{15}{27}$

3) $\frac{593}{648}:\frac{15}{27}=\frac{593}{648}\cdot\frac{27}{15}=\frac{593}{360}$

4) $\frac{593}{360}\cdot 18=\frac{593}{20}$

5) $\frac{593}{20}-\frac{183}{20}=\frac{410}{20}=20,5$

$40-20,5=19,5$ (C)

3. $\frac{b^2-a^2+2b+1}{1+b-a}-b=\frac{(b+1)^2-a^2}{1+b-a}-b=$

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

$=1+a$ (B)

4. $abc=5$.

$$\left(\frac{2}{a}-bc\right)\left(\frac{3}{b}-ac\right)\left(\frac{4}{c}-ab\right)=$$

$$=\frac{(2-abc)(3-abc)(4-abc)}{abc}=$$

$$=\frac{(2-5)(3-5)(4-5)}{5}=\frac{-6}{5}$$ (A)

5. $\sqrt{2^{20}+2^{11}+1}-\sqrt{2^{20}-2^{12}+4}=$

$=\sqrt{(2^{10}+1)^2}-\sqrt{(2^{10}-2)^2}=$

$=2^{10}+1-2^{10}+2=3$ (C)

6. $\frac{210}{210+40}\cdot 100\%=84\%$.

7. $\frac{1}{x-2}+\frac{1}{x+7}=\frac{1}{x-1}+\frac{1}{x+1}$

$\frac{1}{x-2}-\frac{1}{x-1}=\frac{1}{x+1}-\frac{1}{x+7}$

$\frac{1}{(x-2)(x-1)}=\frac{6}{(x+1)(x+7)}$

$x^2+8x+7=6(x^2-3x+2)$

$x^2+8x+7=6x^2-18x+12$

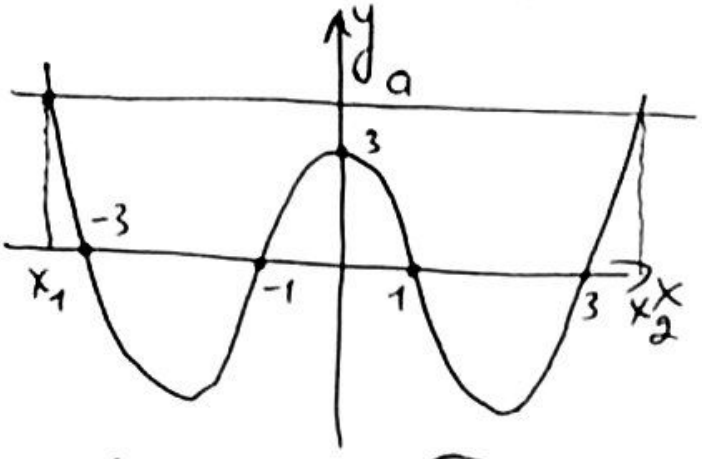
$5x^2-26x+5=0$

$x_1=5 \quad x_2=0,2$ (D)

8. $x^2-4|x|-a+3=0 \quad a\geq 3$

$x^2-4|x|+3=a$.

$x^2-4|x|+3$ juft funksiya



$x_1+x_2=0$. (D)

9. $2-3x+x^2 \geq 2(x^2-4x+4)$

$2-3x+x^2 \geq 2x^2-8x+8$

$x^2-5x+6\leq 0$

2 3

$[2;3]$ (B)

10. $\begin{cases} 2\leq x\leq 3 \\ -2\leq y\leq 3 \end{cases}$

$\frac{x}{y} \to min \to \frac{min}{max}=\frac{2}{3}$

$\left[\frac{2}{3};\infty\right)$.

$\frac{x}{y} \to max \to \frac{min}{-min}=\frac{2}{-2}=-1$

$(-\infty;-1]$ (D)

11. $1\cdot 4+2\cdot 7+3\cdot 10+\ldots+n\cdot(3n+1)=$

$=n\cdot(n+1)^2$

$1\cdot 4+2\cdot 7+3\cdot 10+\ldots+825=$

$=8\cdot(8+1)^2=648$

(C)

12. $a_3=5$

$S_{10}=175$

$a_4^2+a_{12}^2=?$

$\frac{a_1+a_{10}}{2}\cdot 10=175$

$a_1+a_{10}=35$

$a_3=5$

$\begin{cases} a_1+a_{10}=35 \\ a_1+2d=5 \end{cases}$ (-).

$a_{10}-2d=30$

$\begin{cases} a_8=30 \\ a_3=5 \end{cases}$

$d=\frac{30-5}{5}=5$

$a_4=a_3+d=5+5=10$

$a_{12}=a_3+9d=5+9\cdot 5=50$

$10^2+50^2=2600$ (C)

13. $\frac{3\pi}{2}<\alpha<2\pi$

$\sin\alpha\cdot|\cos\alpha|-\cos\alpha\cdot|\sin\alpha|=$

$=\sin\alpha\cdot\cos\alpha-\cos\alpha\cdot(-\sin\alpha)=$

$=\sin\alpha\cdot\cos\alpha+\sin\alpha\cos\alpha=$

$=\sin 2\alpha$.

(D)

14. $\frac{\sin 10^\circ}{\cos 50^\circ - \operatorname{tg} 30^\circ \sin 50^\circ} =$

$= \frac{\sin 10^\circ}{\cos 50^\circ - \frac{\sqrt{3}}{3}\sin 50^\circ} =$

$= \frac{\sqrt{3}\sin 10^\circ}{\sqrt{3}\cos 50^\circ - \sin 50^\circ} =$

$= \frac{\sqrt{3}\sin 10^\circ}{2\cdot \sin(60^\circ - 50^\circ)} = \frac{\sqrt{3}}{2}$ (A)

15. $\cos^2 2x + \cos^2 3x + \cos^2 4x = \frac{3}{2}$

$\frac{1+\cos 4x}{2} + \frac{1+\cos 6x}{2} + \frac{1+\cos 8x}{2} = \frac{3}{2}$

$\cos 4x + \cos 6x + \cos 8x = 0$

$2\cos 6x \cos 2x + \cos 6x = 0$

$\cos 6x (2\cos 2x + 1) = 0$

$\cos 6x = 0 \quad \cos 2x = -\frac{1}{2}$

$6x = \frac{\pi}{2} + \pi n$

$x = \frac{\pi}{12} + \frac{\pi n}{6}; n \in Z$ (B)

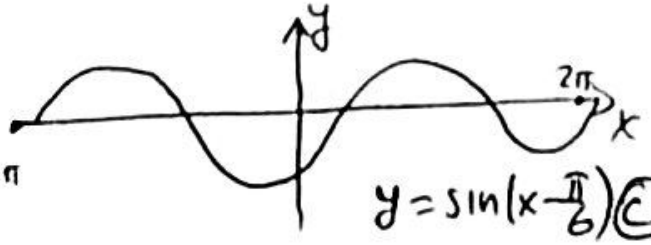
$2x = \pm \frac{2\pi}{3} + 2\pi n$

$x = \pm \frac{\pi}{3} + \pi n; n \in Z$

16. $y = x - 2 \quad \begin{cases} x - 2 \geq 4 & x \geq 6 \\ 0{,}5x + 1 \geq 4 & x \geq 6. \end{cases}$

$y = 0{,}5x + 1.$

$[6; \infty)$ (A)

17. 

$y = \sin(x - \frac{\pi}{6})$ (C)

18. $x \neq 0.$

$5 + 5^{2x+y} - 5^{x+1} - 5^{x+y} = 0$

$5^{x+y}(5^x - 1) - 5(5^x - 1) = 0$

$(5^x - 1)(5^{x+y} - 5) = 0$

$5^x = 1 \quad 5^{x+y} = 5$ (B)

$x = 0 \quad x + y = 1 \quad x = 1 - y$

19. $\left(2^{\frac{\log_2 5}{\log_2 2}} - 5^{\frac{1}{\log_5 2}} + 5^{\log_5 25}\right)^{0,5} =$

$\left(2^{\log_2 5 \cdot \log_2 5} - 5^{\log_2 5} + 25\right)^{0,5} =$

$\left(5^{\log_2 5} - 5^{\log_2 5} + 25\right)^{0,5} = 25^{0,5} = 5$

(B)

20. $x > 0 \quad x \neq 1.$

$\log_x 3 + \log_3 x = \log_{\sqrt{x}} 3 + \log_3 \sqrt{x+6} + 0,5$

$\log_x 3 + \log_9 x^2 = \log_x 9 + \log_9 x + 0,5$

$\log_9 x^2 - \log_9 x = \log_x 9 - \log_x 3 + 0,5$

$\log_9 x = \log_x 3 + 0,5$

$\log_3 x = a.$

$\frac{1}{2}a = \frac{1}{a} + 0,5.$

$a^2 = 2 + a \quad a^2 - a - 2 = 0$

$-1 \quad 2$

$\log_3 x = -1 \quad \log_3 x = 2.$

$x = \frac{1}{3} \quad x = 9.$ (D)

$\frac{1}{3} \cdot 9 = 3$

21. $y = \frac{3x^4}{6} - \frac{3x^2}{2} + 2x$

$x_0 = 2$

$y' = 2x^3 - 3x + 2$

$y' = 2 \cdot 2^3 - 3 \cdot 2 + 2 = 12$ (C)

22. $\int_{-1}^{0} (bx+a)\,dx = 10$

$\frac{bx^2}{2} + ax \Big|_{-1}^{0} = 10.$

$-\frac{b}{2} + a = 10.$

$2a - b = 20.$ (C)

23. 1) 4) 5) (C)

24. $4 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 96$

(D)

25. $r = 3$

$\begin{cases} a = 10 \\ \frac{a+b-c}{2} = 3. \end{cases}$

$b - c = -4$

$c - b = 4.$

$a^2 + b^2 = c^2.$

$100 + (c-4)^2 = c^2$

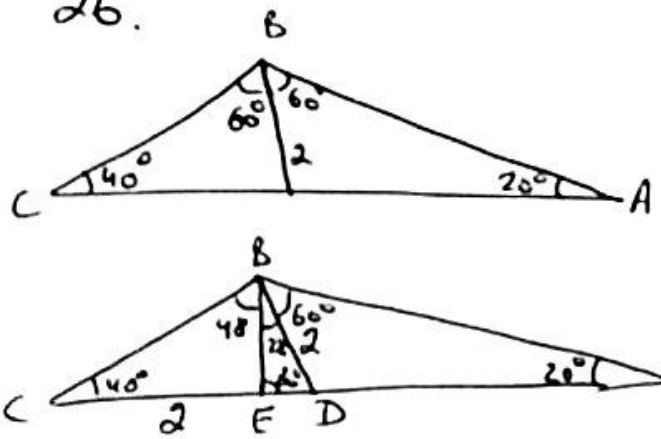
$100 + c^2 - 8c + 16 = c^2$

$8c = 116$

$c = 14,5$

$P = 7,25.$ (B)

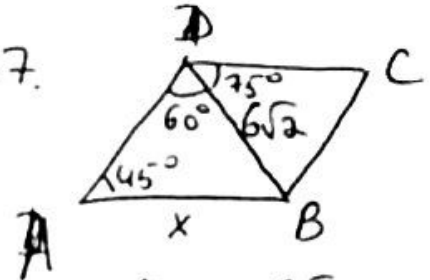
26.



$CE = BD = BC = BE = 2$ $BA = EA.$

$AC - AB = 2 + EA - AB = 2.$ (C)

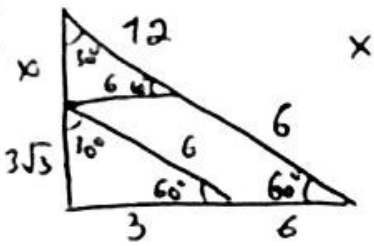
27.



$\frac{x}{\sin 60^\circ} = \frac{6\sqrt{2}}{\sin 45^\circ}$ (A)

$\frac{x}{\frac{\sqrt{3}}{2}} = \frac{6\sqrt{2}}{\frac{\sqrt{2}}{2}}$ $x = 6\sqrt{3}.$

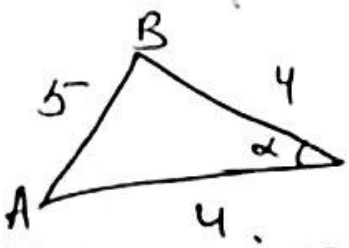
28.



$x = 6 \operatorname{tg} 60^\circ = 6\sqrt{3}.$

$P = 9\sqrt{3} + 27$ (B)

29.



$\overline{CA} \cdot \overline{CB} = |\overline{CA}| \cdot |\overline{CB}| \cdot \cos\alpha =$

$= 4 \cdot 4 \cdot \cos\alpha = 3,5$

$25 = 4^2 + 4^2 - 2 \cdot 4 \cdot 4 \cdot \cos\alpha.$

$4 \cdot 4 \cdot \cos\alpha = 3,5$ (D)

30. $40 \times 40 \times 5$ cm

$400 \times 400 \times 50 = 8 \cdot 10^{6}\ mm^2$

$8 \cdot 10^{6} \cdot 10^{-6} = 8\ m^2$

Variant-2

1. $\overline{abc} + \overline{bca} + \overline{cab} = 777$ $\quad a+b+c=7$ (A)

2. $\frac{(\sqrt{5}-\sqrt{11})(\sqrt{33}+\sqrt{15}-\sqrt{22}-\sqrt{10})}{\sqrt{76}-\sqrt{50}} =$

$= \frac{(\sqrt{5}-\sqrt{11})(\sqrt{3}(\sqrt{11}+\sqrt{5})-\sqrt{2}(\sqrt{11}+\sqrt{5}))}{5(\sqrt{3}-\sqrt{2})} =$

$= \frac{(\sqrt{5}-\sqrt{11})(\sqrt{3}-\sqrt{2})(\sqrt{11}+\sqrt{5})}{5\cdot(\sqrt{3}-\sqrt{2})} = \frac{11-5}{5} = \frac{6}{5}$

$= 1,2$ A

3. $\left(\frac{4a^{0,25}+b\cdot c^{1,5}}{(c^{1,5}+4)(a^{0,25}-b)} + \frac{a^{\frac{1}{4}}\cdot c^{\frac{3}{2}}-4b}{(4-c^{1,5})(\sqrt[4]{a}-b)}\right)\cdot\frac{1}{16+c^2}$

$\frac{(4a^{0,25}+b\cdot c^{1,5})\cdot(4-c^{1,5})+(a^{\frac{1}{4}}c^{\frac{3}{2}}-4b)(c^{1,5}+4)}{(16-c^3)(\sqrt[4]{a}-b)}\cdot\frac{1}{16+c^2} =$

$= \frac{16a^{0,25}+4bc^{1,5}-4a^{0,25}\cdot c^{1,5}-b\cdot c^3+a^{\frac{1}{4}}\cdot c^{\frac{3}{2}}+4a^{\frac{1}{4}}c^{\frac{3}{2}}-}{(16-c^3)(\sqrt[4]{a}-b)}$

$\frac{-4bc^{1,5}-16b}{} \cdot \frac{1}{16+c^2} = \frac{16(a^{0,25}-b)+c^3(a^{\frac{1}{4}}-b)}{(16-c^3)(\sqrt[4]{a}-b)}\cdot\frac{1}{16+c^2} =$

$= \frac{(16+c^3)(a^{\frac{1}{4}}-b)}{(16-c^3)(\sqrt[4]{a}-b)}\cdot\frac{1}{16+c^2} = \frac{1}{16-c^3}$ (D)

4. $\frac{x+y}{\sqrt[3]{x}+\sqrt[3]{y}} = \frac{(\sqrt[3]{x}+\sqrt[3]{y})(\sqrt[3]{x^2}-\sqrt[3]{xy}+\sqrt[3]{y^2})}{\sqrt[3]{x}+\sqrt[3]{y}} =$

$= \sqrt[3]{x^2}-\sqrt[3]{xy}+\sqrt[3]{y^2}$ (C)

5. $\frac{a^{-1}-x^{-1}}{a^{-3}+x^{-3}}\cdot\left(\frac{x\,a^{-2}+a\cdot x^{-2}}{x-a}\right)^{-1} = \frac{\frac{1}{a}-\frac{1}{x}}{\frac{1}{a^3}+\frac{1}{x^3}}\cdot\frac{\frac{x}{a^2}+\frac{a}{x^2}}{x-a} =$

$= \frac{\frac{1}{a}-\frac{1}{x}}{\frac{1}{a^3}+\frac{1}{x^3}}\cdot\frac{\frac{x^3+a^3}{x^2a^2}}{x-a} = \frac{x-a}{\frac{x^3+a^3}{x^3a^3}}\cdot\frac{\frac{x^3+a^3}{x^2a^2}}{x-a} = 1$ (C)

6. $\sqrt{4x+y-13}+\sqrt{5x-2y-13}=0$.

$\begin{cases} 4x+y-13=0 \\ 5x-2y-13=0 \end{cases}$ $\quad y=13-4x$

$5x-26+8x-13=0$

$13x=39$

$x=3$ $\quad y=1$.

$x\cdot y = 3\cdot 1 = 3$ (A)

7. $\frac{1}{10-\sqrt{72}}+\frac{1}{10+6\sqrt{2}} = -p$. $\quad p=-\frac{20}{28}$

$\frac{1}{10-\sqrt{72}}\cdot\frac{1}{10+6\sqrt{2}} = q$ $\quad q=\frac{1}{28}$

$x^2-\frac{20}{28}x+\frac{1}{28}=0$ (D)

8. $(x-4)^3+(x-4)^2+(x-4)(x-3)+$
$(x-3)^2+(x-3)^3=6$

$(x-4)^2(x-4+1)+(x-4)(x-3)+$
$+(x-3)^2+(x-3)^3=6$

$(x-3)((x-4)^2+x-4)+$
$(x-3)^2+(x-3)^3=6$

$(x-3)(x-4)(x-3)+$
$(x-3)^2+(x-3)^3=6$

$(x-3)^2(x-4+1)+(x-3)^3=6$

$(x-3)^3+(x-3)^3=6$

$(x-3)^3=3$

$x=\sqrt[3]{3}+3$ (D)

9. $2x^3+mx^2-13x+n=0$

$x^3+\frac{m}{2}x^2-\frac{13}{2}x+\frac{n}{2}=0$

$x_1=2 \quad x_2=3.$

$x_1x_2+x_1x_3+x_2x_3=-\frac{13}{2}$

$6+2x_3+3x_3=-\frac{13}{2}$

$5x_3=-12,5$

$x_3=-2,5$ (B)

10. $\sqrt{\frac{\sqrt{2}+\sqrt{3}-3}{x-5}}>\sqrt{3}-4.$

$\frac{\sqrt{2}+\sqrt{3}-3}{x-5}\geq 0.$

$x>5$ (C)

11. $|x^2+3x+4|+|x^2-1|>|2x^2+3x+3|$

$|a|+|b|>|a+b|$

$a\cdot b<0.$

$(x^2+3x+4)(x^2-1)<0.$

$(-1;1)$ (D)

12. $14;9;4;\dots;$

$a_1=14 \quad d=-5.$

$a_{21}=a_1+20d=14-100=-386.$

(A)

13. $\left(4\frac{1}{\sin\alpha}+\frac{4}{tg\alpha}\right)\cdot tg\frac{\alpha}{2}=$

$\frac{4+4\cos\alpha}{\sin\alpha}\cdot tg\frac{\alpha}{2}=\frac{4(1+\cos\alpha)}{\sin\alpha}\cdot tg\frac{\alpha}{2}=$

$=4\cdot ctg\frac{\alpha}{2}\cdot tg\frac{\alpha}{2}=4.$ (D)

14. $\sin1^\circ+\sin2^\circ+\sin3^\circ+\dots+\sin359^\circ=0$

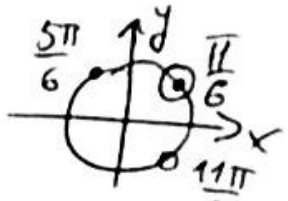
$\sin x+\sin y=0 \quad x+y=360^\circ$

$\sin1^\circ+\sin359^\circ=0$

$\sin2^\circ+\sin358^\circ=0$ (D)

15. $\frac{\sin x-\frac{1}{2}}{\cos x-\frac{\sqrt{3}}{2}}=0 \quad [-2\pi;0]$

$\begin{cases}\sin x=\frac{1}{2}\\ \cos x\neq\frac{\sqrt{3}}{2}\end{cases}$



$x=\frac{5\pi}{6}+2\pi n.$ (B)

$n=-1 \quad x=\frac{5\pi}{6}-2\pi=-\frac{7\pi}{6}.$

16. $y=x^2$

$y=(x-2)^2+3=x^2-4x+7$ (B)

17. $y=\sqrt{6-\frac{1}{3}\left|x-\frac{2}{117}\right|}$

ДЗ $6-\frac{1}{3}\left|x-\frac{2}{117}\right|\geq 0.$ | ОЗ $0\leq y\leq\sqrt{6}$

$\left|x-\frac{2}{117}\right|\leq 18$ | $0+1+2=3$

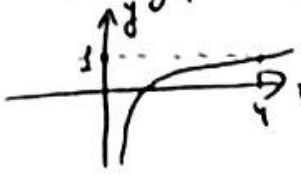
$-18\leq x-\frac{2}{117}\leq 18$ (C)

$-18+\frac{2}{117}\leq x\leq 18+\frac{2}{117}.$

$-17\frac{115}{117}\leq x\leq 18\frac{2}{117}$

$-17+(-16)+\dots+17+18=18.$

18. $y=\log_4 x \quad (4;1).$



(B)

19. $2^{\sqrt{x+1}} - 6 \geq 2^{4-\sqrt{x+1}}$ $\quad x \geq -1$

$2^{\sqrt{x+1}} = a$

$a - 6 \geq \frac{16}{a}$

$a^2 - 6a - 16 \geq 0$

$(a+2)(a-8) \geq 0$

$a \geq 8$

$2^{\sqrt{x+1}} \geq 2^3$

$\sqrt{x+1} \geq 3$

$x+1 \geq 9$

$x \geq 8$ $\quad \boxed{x < 8}$ $\quad \boxed{x \geq -1}$

$1+2+3+\ldots+7 = 28$ (D)

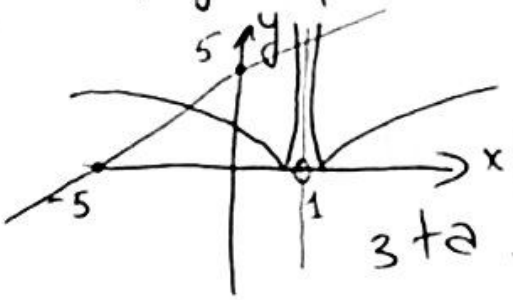
20. $\log_{30} 3 = a$ $\quad \log_{30} 5 = b$

$\log_{30} 4 = 2\log_{30} 2 = 2\log_{30} \frac{30}{15} =$

$= 2(1 - \log_{30} 15) = 2(1-a-b)$

(B)

21. $2\,|\lg|x-1|| = x+5$



(B)

22. $s(t) = \frac{t^3}{3} - 4t^2 + 7t + 2$

$v(t) = s'(t) = t^2 - 8t + 7 = 0$

$1 \quad 7$ (B)

23. $\int \frac{3\,dx}{x \cdot \ln 2x} = \left[\begin{matrix} \ln 2x = t \\ \frac{1}{x}dx = dt \end{matrix}\right] =$

$= \int \frac{3\,dt}{t} = 3\ln t + C = 3\ln \ln 2x + C$

(D)

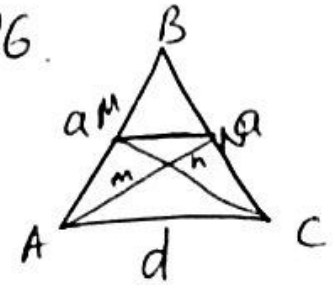
24. 1) 2) (C)

25. (A) $\lg(x^2+1) = -4$

$x^2 + 1 = 10^{-4}$

$x^2 = -1 + \frac{1}{10^4}$ $\quad \emptyset$

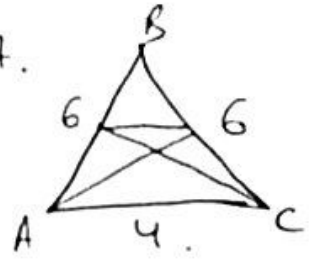
26.



$\frac{m}{n} = \frac{a+d}{a} = \frac{d}{MN}$

$MN = \frac{a \cdot d}{a+d}$ (D)

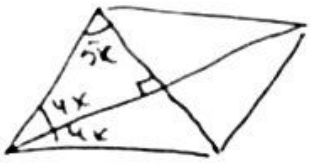
27.



$MN = \frac{6 \cdot 4}{6+4} = \frac{24}{10}$

(D)

28.

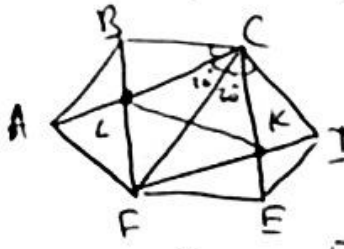


$4x + 5x = 90^\circ$

$x = 10^\circ$

$80^\circ; 100^\circ$ (C)

29.



$a = 2\sqrt{3}$

$S_{LFKC} = ?$

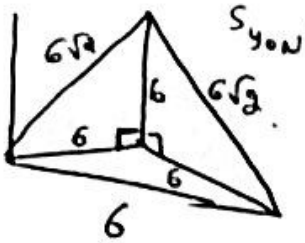
$FC = 2a = 4\sqrt{3}$

$S_{LCK} = \frac{\sqrt{3}}{3} \cdot a^2 = \frac{\sqrt{3}}{3} \cdot 4 \cdot 3 = 4\sqrt{3}$

$S_{LFKC} = 2 \cdot 4\sqrt{3} = 8\sqrt{3}$

(B)

30.



$S_{yoN} = \frac{6 \cdot 6}{2} + \frac{6 \cdot 6}{2} + \frac{6 \cdot 3\sqrt{7}}{2}$

$S_{yoN} = 36 + 9\sqrt{7}$

(D)

Variant-3

1. $x = 3a+2 = 5b+4 = 7c+6$

$x+1 = 3a+3 = 5b+5 = 7c+7$

$x+1 = 3(a+1) = 5(b+1) = 7(c+1)$

$x+1 = n \cdot EKUK(3;5;7)$

$x+1 = 105n$

$x = 105n-1$

$n=9 \quad x = 945-1 = 944$ (B)

2. $\frac{5}{2^2 \cdot 3^2} + \frac{7}{3^2 \cdot 4^2} + \frac{9}{4^2 \cdot 5^2} + \dots + \frac{39}{19^2 \cdot 20^2} =$

$= \frac{3^2-2^2}{2^2 \cdot 3^2} + \frac{4^2-3^2}{3^2 \cdot 4^2} + \frac{5^2-4^2}{5^2 \cdot 4^2} + \dots + \frac{20^2-19^2}{19^2 \cdot 20^2} =$

$= \frac{1}{2^2} - \frac{1}{3^2} + \frac{1}{3^2} - \frac{1}{4^2} + \frac{1}{4^2} - \frac{1}{5^2} + \dots + \frac{1}{19^2} - \frac{1}{20^2} =$

$= \frac{1}{4} - \frac{1}{400} = \frac{99}{400} = 0,2475$ (C)

3. $\frac{a}{6} = 7 - \sqrt{40} = 7 - 2\sqrt{10} = (\sqrt{5}-\sqrt{2})^2$

$\frac{\sqrt{a}-\sqrt{56}}{\sqrt{6}} = \sqrt{\frac{a}{6}} - \sqrt{5} = \sqrt{5}-\sqrt{2}-\sqrt{5} = -\sqrt{2}$ (C)

4. $\left(a^{\frac{1}{3}} + b + \frac{4b^2 - a^{\frac{2}{3}}}{\sqrt[3]{a}-b}\right) : \left(\frac{a^{\frac{1}{3}}}{\sqrt[3]{a^2}-b^2} - \frac{2}{\sqrt[3]{a}+b} + \frac{1}{\sqrt[3]{a}-b}\right) \cdot \frac{2}{a^{\frac{1}{3}}+b}$ $\quad \sqrt[3]{a} = x$

1) $\left(x + b + \frac{4b^2-x^2}{x-b}\right) = \frac{x^2-b^2+4b^2-x^2}{x-b} = \frac{3b^2}{x-b}$

2) $\frac{x}{x^2-b^2} - \frac{x-b}{x+b} + \frac{x+b}{x-b} = \frac{x-2x+2b+x+b}{x^2-b^2}$

$= \frac{3b}{x^2-b^2}$

3) $\frac{3b^2}{x-b} \cdot \frac{x^2-b^2}{3b} \cdot \frac{2}{x+b} = 2b$ (D)

5. $\begin{cases} x+y+z = 85,6 \\ y = 0,8x \\ z = 0,425y \end{cases} \quad x = ?$

$z = 0,425 \cdot 0,8x = 0,34x$

$x + 0,8x + 0,34x = 85,6$

$2,14x = 85,6$

$x = 40$ (C)

6. $\left(x - \frac{2}{x}\right)\left(\frac{x}{3x+2}\right) = \frac{x^2+2}{x}$

$\left(x - \frac{2}{x}\right)\left(\cancel{x+\frac{2}{x}}\right) \cdot \frac{x}{3x+2} = \cancel{x+\frac{2}{x}}$

1) $x + \frac{2}{x} = 0 \quad \frac{x^2+2}{x} = 0$ ∅

$\frac{x^2-2}{x} \cdot \frac{x}{3x+2} = 1$

$x^2 - 2 = 3x + 2 \quad x^2 - 3x - 4 = 0$

$-1 + 4 = 3$ (D)

7. $x^4 - 29x^2 + 100 = 0$

$25 \quad 4$

$x^2 = 25 \quad x^2 = 4$

$x = \pm 5 \quad x = \pm 2$ (A)

8. $\begin{cases} \frac{3b+2a}{ab} = \frac{5}{3} \\ \frac{6b+2a}{ab} = \frac{5}{2} \end{cases} \ominus \begin{cases} \frac{3}{a} + \frac{2}{b} = \frac{5}{3} \\ \frac{6}{a} + \frac{2}{b} = \frac{5}{2} \end{cases}$

$\begin{cases} \frac{6}{a} + \frac{4}{b} = \frac{10}{3} \\ \frac{6}{a} + \frac{2}{b} = \frac{5}{2} \end{cases} \ominus$

$\frac{3}{a} = \frac{5}{2} - \frac{2}{3}$

$\frac{3}{a} = \frac{5}{6} \quad a = \frac{18}{5}$

$\frac{2}{b} = \frac{10}{3} - \frac{5}{2} \quad \frac{2}{b} = \frac{5}{6} \quad b = \frac{12}{5}$ (B)

9. $5\sqrt{1 - \frac{1}{x}} > \frac{7x-1}{x} \quad 5\sqrt{1-\frac{1}{x}} > 6 + 1 - \frac{1}{x}$

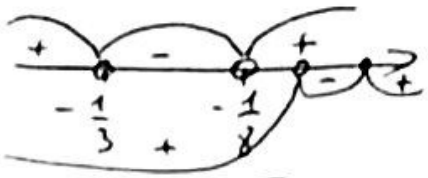
$\sqrt{1-\frac{1}{x}} = a \quad 5a > 6 + a^2$

$a^2 - 5a + 6 < 0 \quad a = 2 \quad a = 3$

$\sqrt{1-\frac{1}{x}} = 2 \quad \sqrt{1-\frac{1}{x}} = 3$

$x = -\frac{1}{3} \quad x = -\frac{1}{8}$

$1-\frac{1}{x}\geq 0 \quad \frac{x-1}{x}\geq 0$



$\left(-\frac{1}{3};-\frac{1}{8}\right)$ (C)

10. $4x^2-8x-1>a$

$4x^2-8x-1-a>0$

$D<0$

$64+4\cdot 4(1+a)<0$

$4+1+a<0$

$a<-5 \quad a=-6$ (D)

11. $1;2;2;3;3;3;4;4;4;4;\dots$

$\frac{1+n}{2}\cdot n=2017 \quad n^2+n-4034=0$

$D=1+4\cdot 4034=16137$

$n=\frac{-1+\sqrt{16137}}{2}>63 \quad n\in\mathbb{N} \quad n=64$ (D)

12. $-7,2;-6,9;\dots$

$a_2-a_1=-6,9+7,2=0,3$

$a_n<0$

$-7,2+0,3(n-1)<0$

$n-1<24 \quad n<25 \quad n\in\mathbb{N}$

$n=24$ (A)

$S_{24}=\frac{2\cdot(-7,2)+23\cdot 0,3}{2}\cdot 24=-90$

13. $\frac{1}{\sin 70^\circ}-tg\,170^\circ\cdot tg\,160^\circ=$

$=\frac{1}{\sin 70^\circ}-tg\,10^\circ\cdot tg\,20^\circ=$

$=\frac{1}{\sin 70^\circ}-\frac{\sin 10^\circ\cdot\sin 20^\circ}{\cos 10^\circ\cdot\cos 20^\circ}=$

$[\sin 70^\circ=\cos 20^\circ]$

$=\frac{\cos 10^\circ-\sin 10^\circ\cdot\sin 20^\circ}{\cos 10^\circ\cdot\cos 20^\circ}=$

$=\frac{\cos 10^\circ-\frac{1}{2}(\cos 10^\circ-\cos 30^\circ)}{\cos 10^\circ\cdot\cos 20^\circ}=\frac{\frac{1}{2}\cos 10^\circ+\frac{1}{2}\cos 30^\circ}{\cos 10^\circ\cdot\cos 20^\circ}=$

$=\frac{\frac{1}{2}(\cos 10^\circ+\cos 30^\circ)}{\frac{1}{2}(\cos 10^\circ+\cos 30^\circ)}=1$ (A)

14. $8\cdot\sin 3^\circ\cdot\cos 3^\circ\cdot 8056^\circ=m \quad ctg\,78^\circ=?$

$ctg\,78^\circ=tg\,12^\circ=\frac{\sin 12^\circ}{\cos 12^\circ}=\frac{m}{\sqrt{4-m^2}}$ (B)

$2\cdot 2\cdot 2\cdot\sin 3^\circ\cdot\cos 3^\circ\cdot\cos 6^\circ=m$

$2\cdot\sin 12^\circ=m \quad \sin 12^\circ=\frac{m}{2} \quad \cos 12^\circ=\sqrt{1-\frac{m^2}{4}}$

15. $x\in(0^\circ;720^\circ)$

$\cos 2x\cdot\cos 3x=-1$

$x=\pi+2\pi n,\ n\in\mathbb{Z}$

$n=0 \quad x=\pi \quad n=1 \quad x=3\pi$

$\pi+3\pi=4\pi=720^\circ$ (D)

16. $f(x)=6^x \quad \left(f(-2)\cdot f\left(\frac{1}{2}\right)\right)^2$

$f(-2)=6^{-2} \quad f\left(\frac{1}{2}\right)=6^{\frac{1}{2}}$

$\left(6^{-2}\cdot 6^{\frac{1}{2}}\right)^2=6^{-4}\cdot 6=6^{-3}$ (D)

17. $4^x>19-1,5^x$

$x=3 \quad 4^3>19-4,5$ (D)

18. $a^2+b^2=14ab$

$\frac{4\lg\frac{a+b}{4}}{\lg\frac{1}{a}+\lg\frac{1}{b}}=\frac{4\lg\frac{a+b}{4}}{\lg\frac{1}{ab}}=\frac{2\lg\frac{a^2+b^2+2ab}{16}}{\lg\frac{1}{ab}}=$

$=\frac{2\lg\frac{14ab+2ab}{16}}{\lg\frac{1}{ab}}=\frac{2\lg 4ab}{-\lg ab}=-2$ (B)

19. $\lg(2^x+x+4)=x-x\lg 5=\lg 10^x-\lg 5^x$

$\lg(2^x+x+4)=\lg 2^x \quad x+4=0 \quad x=-4$

$-4+4=0$ (A)

20. $\log_2 \operatorname{arctg} x > 1$

$\operatorname{arctg} x > 2$ $\varnothing$

$-\frac{\pi}{2} < \operatorname{arctg} x < \frac{\pi}{2}$ (B)

21. $M(2;-50)$ $f(x) = 7x^2 - 7x - 1$

$x_0;\ y_0 = 7x_0^2 - 7x_0 - 1$ $k = 14x_0 - 7$

$y = k(x - x_0) + y_0$

$y = (14x_0 - 7)(x - x_0) + 7x_0^2 - 7x_0 - 1$

$-50 = (14x_0 - 7)(2 - x_0) + 7x_0^2 - 7x_0 - 1$

$-50 = 28x_0 - 14x_0^2 - 14 + 7x_0 + 7x_0^2 - 7x_0 - 1$

$7x_0^2 - 28x_0 - 35 = 0$.

$x_0^2 - 4x_0 - 5 = 0$.

$x_{0_1} + x_{0_2} = 4$ (D)

22. $f(x) = \sin^2 x = \frac{1 - \cos 2x}{2} = \frac{1}{2} - \frac{\cos 2x}{2}$

$F(x) = \frac{1}{2}x - \frac{1}{4}\sin 2x + C = \frac{2x - \sin 2x}{4} + C$

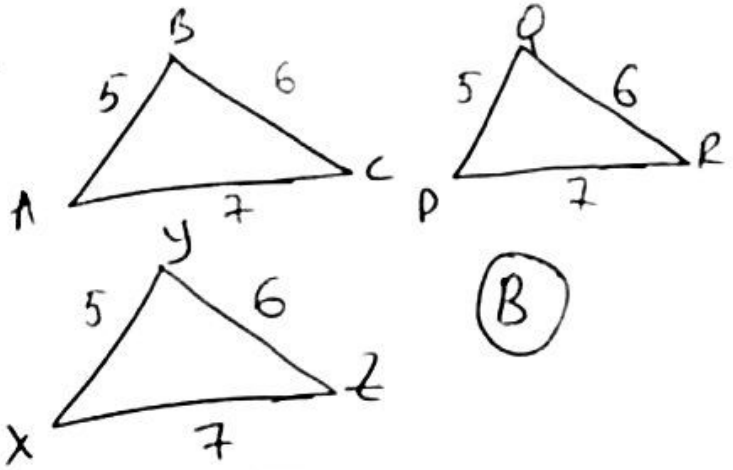
(D)

23. 2) 3) 5) (A)

24. $A = \{1; 3; 5; 6; 8; 10\}$ $B = \{5; 6; 7; 8; 10\}$

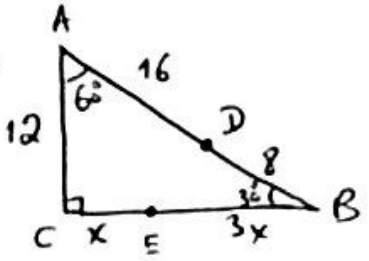
$A \cup B = \{1; 3; 5; 6; 7; 8; 10\}$ $n = 7$ (B)

25.



(B)

26.



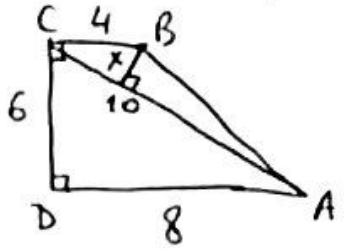
$S_{BDE} = ?$

$AB = \frac{AC}{\sin 30^\circ}$ $AB = 24$

$BC = 4x = 12\sqrt{3}$ $x = 3\sqrt{3}$ (C)

$S_{BDE} = \frac{8 \cdot 3x}{2} \cdot \frac{1}{2} = 6x = 18\sqrt{3}$

27.



$\frac{10 \cdot x}{2} + \frac{6 \cdot 8}{2} = \frac{4+8}{2} \cdot 6$.

$x = 2,4$ (B)

28. $A(2;0)$ $B(-2;6)$

$O\left(\frac{2-2}{2}; \frac{0+6}{2}\right) = O(0;3)$

$(x-0)^2 + (y-3)^2 = 13$ (C)

$AB = \sqrt{(2+2)^2 + 6^2} = \sqrt{16+36} = \sqrt{52}$

$\frac{AB}{2} = \frac{2\sqrt{13}}{2} = \sqrt{13}$

29. $\bar{a}(-3;2)$ $\bar{b}(2;-1)$

$\bar{a} - \bar{b} = (-3-2; 2+1)$

$\bar{a} - \bar{b}(-5;3)$ (B)

30. $\alpha = 120^\circ$

$h_1 = 14$ $h_2 = 16$ $a = 20$.

$h_3^2 = h_1^2 + h_2^2 - 2 \cdot h_1 \cdot h_2 \cdot \cos 120^\circ$.

$h_3^2 = 14^2 + 16^2 + 2 \cdot 14 \cdot 16 \cdot \frac{1}{2}$

$h_3 = 26$.

$S_{yoN} = a \cdot (h_1 + h_2 + h_3) = 20 \cdot 56$

$S_{yoN} = 1120$ (D)

Variant-4

1. $2016\cdot(2017\cdot2018+1)$

$2017=a$ (D)

$(a-1)(a(a+1)+1)=$

$=(a-1)(a^2+a+1)=a^3-1=2017^3-1$

2. $\frac{4}{13}=0,(\underbrace{307692}_{6ta})$ $2016 | 6$, 2016, 336, 0, $r=0$

(2) (A)

3. $(2a-6)^2-8(2a-6)+16-16=$

$(2a-6+4)^2-16$ (A)

4. $a=22$

$\left(\frac{\overset{3-a}{1}}{a+3}-\frac{6}{9-a^2}\right):\left(\frac{a^2-6a-27}{(a^2-9)(a-3)^2}+\right.$

$\left.+\frac{12}{a^3-9a^2+27a-27}\right)$

$\frac{-3-a}{9-a^2}:\left(\frac{(a+3)(a-9)}{(a-3)^3(a+3)}+\frac{12}{(a-3)^3}\right)=$ (A)

$=\frac{a+3}{a^2-9}:\left(\frac{a-9}{(a-3)^3}+\frac{12}{(a-3)^3}\right)=$

$=\frac{a+3}{(a-3)(a+3)}\cdot\frac{(a-3)^3}{a+3}=\frac{(a-3)^2}{a+3}=\frac{19^2}{25}=14,44$

5. $a^2-b^2+a+7b-12=a^2+a-(b^2-7b+12)$

$b-3 \wedge 4-b$

$(a-b+3)(a+b-4)$ (C)

6. $\begin{cases}4x-y=153\\x+y+z=50\end{cases}$ $z=?$ $x;y;z\in N$

$x+4x-153+z=50$

$x=\frac{203-z}{5}$ $z=3;8$ (A)

7. $\frac{1}{x+y-14}-\frac{1}{x-y-6}=1$ $a\neq0$

$x-y-6=a$ $x+y-14=a+2y-8$

$\frac{1}{a+2y-8}-\frac{1}{a}=1$

$a-a-2y+8=a^2+2ay-8a$

$-2y=\frac{a^2-8a-8}{a+1}=a-9+\frac{1}{a+1}$

$a+1=1$ $a+1=-1$

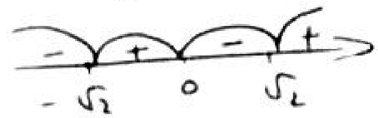
$a=0$ $a=-2$

$a\neq0$ $x-y-6=-2$

$x-y=4$ (D)

8. $(x^2-6)\cdot x=a$ $x^3-6x=a$

$(x^3-6x)'=0$ $3x^2-6=0$ $x=\pm\sqrt2$



$y(\sqrt2)=-4\sqrt2$ $y(-\sqrt2)=4\sqrt2$

$a>4\sqrt2$ $a<-4\sqrt2$ (D)

9. $\frac14<\frac3b<\frac12$ $\frac{3}{12}<\frac3b<\frac36$

$6<b<12$

$\frac16<\frac2a<\frac13$ $\frac{2}{12}<\frac2a<\frac26$

$6<a<12$

(D)

$12<a+b<24$

$a+b\to23$

10. $(x^2-3x-2)(x^2-3x+1)>10$

$x^2-3x=a$

$(a-2)(a+1)>10$

$a^2-a-12>0$

$(a+3)(a-4)>0$

$(x^2-3x+3)(x^2-3x-4)>0$

$(-\infty;-1)\cup(4;\infty)$

$[-1;4]$ $-1+4=3$ (B)

11. $a = 1\cdot2+2\cdot3+3\cdot4+\ldots+42\cdot43$

$b = 5\cdot4+10\cdot6+15\cdot8+\ldots+210\cdot86.$

$b = 5\cdot2\,(1\cdot2+2\cdot3+3\cdot4+\ldots+42\cdot43) = 10a$

$\frac{b}{a} = \frac{10a}{a} = 10$ (A)

12. $a_8 = 24 \quad a_3 = 15 \quad a_1+a_{10} = a_3+a_8 = 39$

(C)

13. $\frac{1}{\sin 200^\circ} + \frac{\sqrt{3}}{3\cos 20^\circ} = \frac{1}{\sqrt{3}\cos 20^\circ} - \frac{1}{\sin 20^\circ} =$

$= \frac{\sin 20^\circ - \sqrt{3}\cos 20^\circ}{\sqrt{3}\cos 20^\circ \cdot \sin 20^\circ} = \frac{2\left(\frac{1}{2}\sin 20^\circ - \frac{\sqrt{3}}{2}\cos 20^\circ\right)}{\sqrt{3}\cdot \sin 20^\circ \cdot \cos 20^\circ} =$

$= \frac{2\sin(20^\circ-60^\circ)}{\sqrt{3}\cdot\frac{1}{2}\sin 40^\circ} = -\frac{4}{\sqrt{3}}$ (B)

14. $m = a\cos x + b\sin x \quad n = -\sqrt{a^2+b^2}$

$-\sqrt{a^2+b^2} \le m \le \sqrt{a^2+b^2} \quad m \ge n.$ (B)

15. $\sin(\pi - x) - \cos\left(\frac{\pi}{2}+x\right) = \sqrt{3} \quad [-2\pi; 2\pi]$

$\sin x + \sin x = \sqrt{3} \quad \sin x = \frac{\sqrt{3}}{2}$

$x = (-1)^n\frac{\pi}{3} + \pi n; \; n \in \mathbb{Z}$

$n=0$ и $n=1$ и $n=-1$ и $n=-2$ и

(D)

16. $\begin{cases} y = 3x-3 & x>0 \\ y = -0{,}5x-a & y<0. \end{cases}$

$3x-3 = -0{,}5x-a.$

$3{,}5x = 3-a.$

$x = \frac{2}{7}(3-a) \quad y = -\frac{1}{7}(3-a)-a$

$\begin{cases} \frac{2}{7}(3-a)>0 \\ -\frac{1}{7}(3-a)-a<0 \end{cases} \begin{cases} a<3 \\ -3+a-7a<0 \end{cases} \begin{cases} a<3 \\ a>-\frac{1}{2} \end{cases}$

$\left(-\frac{1}{2}; 3\right)$ (B)

17. $f(2x-3) = 3x+5.$

$f(f(1)) = ?$

$f(1) \quad x=2 \quad f(1) = 3\cdot2+5$

$f(1) = 11$

$f(11) = 3\cdot7+5 = 26$ (C)

$x = 7$

18. $\frac{13^{x^2+3x+2} - 11^{x^2+3x+2}}{x+1} = 0$

$\begin{cases} 13^{x^2+3x+2} = 11^{x^2+3x+2} \\ x+1 \neq 0. \end{cases}$

$\begin{cases} x^2+3x+2 = 0 \\ x \neq -1 \end{cases}$ $\boxed{x=-2.}$

$8-(-2) = 10$ (D)

19. $y = \log_x 7 + \log_7 x \quad x>1$

$\log_x 7 + \log_7 x \ge 2\sqrt{\log_7 x \cdot \log_x 7}$

$[2; \infty)$ (B)

20. $\lg(x^2-3x+1)\cdot\lg(x-1) = 0$

$x^2-3x+1 = 1 \quad x-1 = 1$

$x^2-3x = 0 \quad x = 2$

$x = 0$ $\boxed{x=3}$ $x = 2$

$x^2-3x+1 > 0 \quad x-1 > 0$

(A)

21. $y = x^2 - |2x-4|$

$x = 3 \quad x_0 = -3$

$y = x^2-2x+4 \quad y = x^2+2x-4$

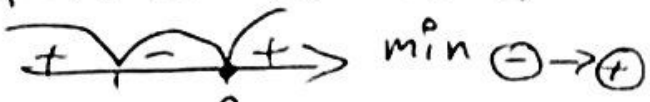
$k_1 = 2x_0 - 2 = 4 \quad k_2 = 2x_0+2 = -4$

$\operatorname{arctg}\left|\frac{4-(-4)}{1+4\cdot(-4)}\right| = \operatorname{arctg}\frac{8}{15}$

(A)

22. $\int f'(x)dx = 2x^3 - 6x^2 + C$

$f'(x) = 6x^2 - 12x = 6x(x-2) = 0$



$x = 2$. (C)

23. 1) 4) (D)

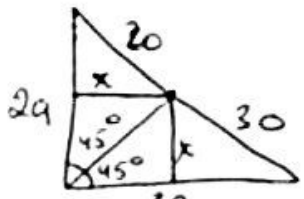
24. $A = \{1; 3; 5; 6; 8; 10\}$

$B = \{5; 6; 7; 8; 10\}$

$A \cap B = \{5; 6; 8; 10\}$

$n = 4$ (B)

25.



$(2a)^2 + (3a)^2 = 50^2$

$4a^2 + 9a^2 = 50^2$ (B)

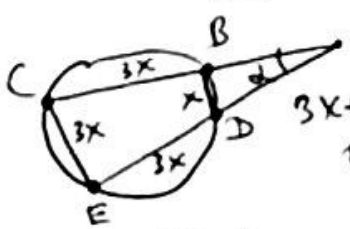
$13a^2 = 50^2$

$a = \frac{50}{\sqrt{13}}$ $3a = \frac{150}{\sqrt{13}}$

26. $\begin{cases} 2(a+b) = 32 \\ a - b = 8 \end{cases}$ $\begin{cases} a+b = 16 \\ a-b = 8 \end{cases}$

(C) $a = 12$ $b = 4$

27.



$3x + 3x + 3x + x = 360^\circ$

$10x = 360^\circ$

$x = 36^\circ$

$\alpha = \frac{3x - x}{2} = x = 36^\circ$ (C)

28. $A(0;1)$ $B(5;-3)$

$C(x;y)$.

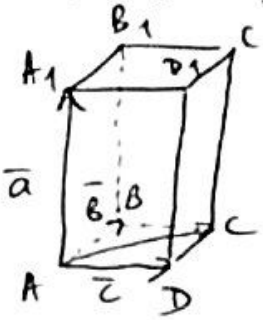
$\frac{0+x}{2} = 5$ $\frac{1+y}{2} = -3$ (C)

$x = 10$ $y = -7$.

$x + y = 10 + (-7) = 3$.

29. $\overline{AA_1} = \bar{a}$ $\overline{AB} = \bar{b}$

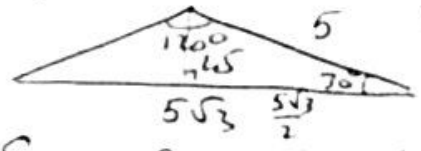
$\overline{AD} = \bar{c}$ $\overline{AC_1} = ?$



$\overline{AC} = \bar{b} + \bar{c}$

$\overline{AC_1} = \bar{a} + \bar{b} + \bar{c}$ (A)

30.



$l = 5$

$R = \frac{5}{2}$

$S_T = 2 \cdot S_{yon} = 2\pi R l$

$S_T = 2\pi \cdot \frac{5}{2} \cdot 5 = 25\pi$. (A)

Variant - 5

1. $47{,}8\cdot 10^n = 0{,}0000478$

$47{,}8\cdot 10^n = 47{,}8\cdot 10^{-6}$

$n=-6$ (A)

2. $\sqrt[3]{\frac{400\sqrt{23^2-17^2}}{\sqrt{0{,}6}}} = \sqrt[3]{400\cdot\sqrt{\frac{6\cdot 40}{0{,}6}}} =$

$= \sqrt[3]{400\cdot 20} = 20$ (D)

3. $\frac{a^{\frac{1}{3}}\cdot c^2 - 3b^{\frac{1}{2}}}{(c^2+3)(a^{\frac{1}{3}}+\sqrt{b})} + \frac{3a^{\frac{1}{3}}+b^{\frac{1}{2}}\cdot c^2}{(c^2-3)(a^{\frac{1}{3}}+\sqrt{b})} - 1$

$\frac{a^{\frac{1}{3}}c^4 - 3c^2b^{\frac{1}{2}} - 3a^{\frac{1}{3}}c^2 + 9b^{\frac{1}{2}} + 3a^{\frac{1}{3}}c^2 + bc^4 + 9a^{\frac{1}{3}} + 3b^{\frac{1}{2}}c^2}{(c^4-9)(a^{\frac{1}{3}}+\sqrt{b})} - 1$ (C)

$= \frac{a^{\frac{1}{3}}(c^4+9) + b^{\frac{1}{2}}(9+c^4)}{(c^4-9)(a^{\frac{1}{3}}+\sqrt{b})} - 1 = \frac{c^4+9}{c^4-9} - 1 = \frac{18}{c^4-9}$

4. $a<0 \quad b<0 \quad c>0$

$\sqrt{b^2} + |b-c| + |c-a| + b = -b - b + c + c - a + b =$

$= 2c - a - b$ (C)

5. $x<-2$

$\sqrt{x^2+5x+2+\sqrt{4-4x+x^2}} = \sqrt{x^2+5x+2+\sqrt{(x-2)^2}} =$

$= \sqrt{x^2+5x+2+|x-2|} = \sqrt{x^2+5x+2-x+2} = \sqrt{x^2+4x+4}$

$= |x+2| = -x-2$ (D)

6. $3500\cdot 6\cdot 0{,}06 = 1260$ (B)

7. $3(2-x) - 8 = 10 \quad 3(2-x) = 18$

$2-x=6 \quad x=-4.$ (A)

8. $\begin{cases} x+y+z=10 \\ y+z+u=6 \\ z+u+x=8 \\ u+x+y=9 \end{cases}$ $x+2y+3z+4u$

$3x+3y+3z+3u = 33$

$x+y+z+u = 11$

$u=1 \quad x=5 \quad y=3 \quad z=2$

$5+2\cdot 3+3\cdot 2+4\cdot 1 = 21$

(B)

9. $x<-1 \quad y>1$

$y^3 > x^3$ (B)

10. $\left|\frac{10-2x}{1+2x}\right| > 0.$

$10-2x \neq 0. \quad x \neq 5.$

$1+2x \neq 0. \quad x \neq -\frac{1}{2}.$

(A)

11. $\{a-\sqrt{a}\} + \{a+\sqrt{a}\}$

a - biror natural sonning kvadrati bo'lmasa, ushbu yig'indi 1 ga teng

a - biror natural sonning kvadrati bo'lsa, ushbu yig'indi 0 ga teng.

$\{2-\sqrt{2}\} + \{2+\sqrt{2}\} + \{3-\sqrt{3}\} +$

$\{3+\sqrt{3}\} + \ldots + \{2017-\sqrt{2017}\} +$

$\{2017+\sqrt{2017}\} = 1973$ (C)

12. $10; 14; 18; \ldots$

$a_1 = 10 \quad d = 4$.

$a_n = a_1 + (n-1)d$

$110 = 10 + (n-1)\cdot 4$

$100 = (n-1)\cdot 4$

$25 = n-1 \quad n = 26$ (A)

13. $\frac{1}{\sin 200^\circ} - \frac{\sqrt{3}}{\cos 200^\circ} =$

$= \frac{\sqrt{3}\cos 200^\circ - \sin 200^\circ}{\sqrt{3}\sin 200^\circ \cdot \cos 200^\circ} =$

$= \frac{2\left(\frac{\sqrt{3}}{2}\cos 200^\circ - \frac{1}{2}\sin 200^\circ\right)}{\sqrt{3}\sin 200^\circ \cdot \cos 200^\circ} =$ (D)

$= \frac{2\sin(60^\circ - 200^\circ)}{\frac{\sqrt{3}}{2}\cdot \sin 400^\circ} = \frac{-2\sin 140^\circ}{\frac{\sqrt{3}}{2}\sin 40^\circ} = -\frac{4}{\sqrt{3}}$

14. $\arcsin(\sin 1) = 1$ (A)

15. $\sin x + \cos x = \sqrt{2}$

$\sqrt{2}\sin(x+45^\circ) = \sqrt{2}$

$\sin(x+45^\circ) = 1$

$x + 45^\circ = 90^\circ + 360^\circ n$

$x = 45^\circ + 360^\circ n$ (A)

16. $x = (0,6+0,0\dot{6})\cdot(0,6-0,06) +$
$(0,8+0,08)(0,8-0,08) =$

$x = 0,6^2 - 0,06^2 + 0,8^2 - 0,08^2 =$

$= 1 - (0,06^2 + 0,08^2) =$

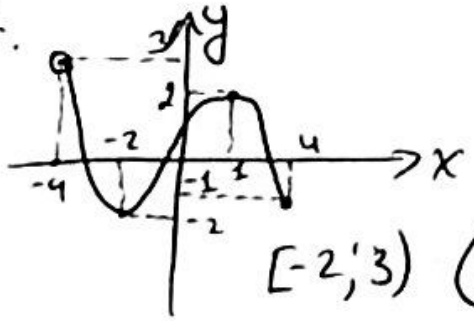
$= 1 - 0,1 = 0,9$.

$\sqrt[3]{0,9}$ - Bu eng kattasi°

$0,9^3$ - Bu eng kichigi°

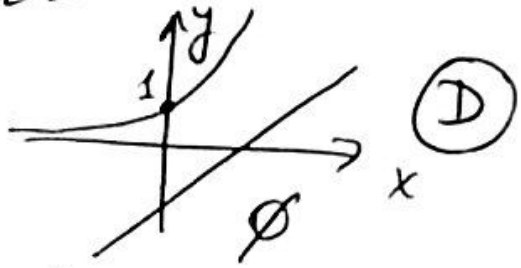
(D).

17.



$[-2; 3)$ (B)

18. $2^x = x - 2$



(D)

19. $\log_a b = x \quad \log_b a = \frac{1}{x} \quad \log_{ab}\frac{a}{b} = 1 - x$

$\frac{64 - (4x)^3}{(x + \frac{1}{x} + 1)(1-x)} \cdot \frac{1}{4x} =$

$= \frac{64(1-x^3)}{\frac{(x^2+x+1)}{x}(1-x)} \cdot \frac{1}{4x} = 16$ (D).

20. $\frac{3x^2 - 16x + 21}{\log_{0,3}(x^2+6)} < 0$

$\log_{0,3}(x^2+6) < 0$.

$3x^2 - 16x + 21 > 0$.

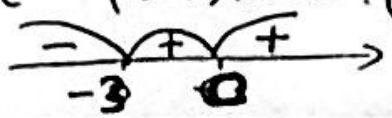
$(3x-7)(x-3) > 0$

$(-\infty; \frac{7}{3}) \cup (3; \infty)$ (B)

21. $f(x) = x^3 \cdot e^{x+7}$

$f'(x) = 0 \quad 3x^2 \cdot e^{x+7} + x^3 \cdot e^{x+7} = 0$.

$e^{x+7}(3+x)x^2 = 0$. (-3) (B)



22. $y = \cos 3x \cdot \cos 12x$

$y = \frac{1}{2}(\cos 15x + \cos 9x)$

$y = \frac{1}{2}\cos 15x + \frac{1}{2}\cos 9x$

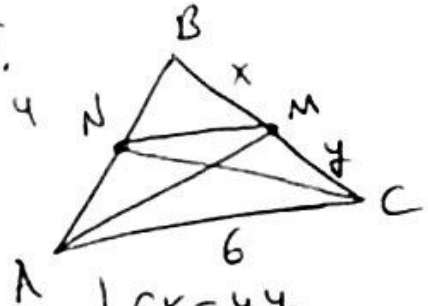
$Y = \frac{1}{30}\sin 15x + \frac{1}{18}\sin 9x + C$

(D)

23. 2) 3) 5) (D)

24. $C_9^6 = \frac{9!}{6!3!} = \frac{7 \cdot 8 \cdot 9}{6} = 84$ (B)

25.



$\begin{cases} 6x = 4y \\ x + y = 4 \end{cases}$

$6 \cdot \frac{8}{5} = 4y$

$x + 1{,}5x = 4$

$2{,}5x = 4$

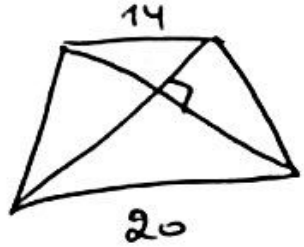
$x = \frac{8}{5}$

$y = \frac{12}{5}$

$\frac{MN}{6} = \frac{x}{x+y}$

$MN = \frac{8}{20} \cdot 6 = \frac{48}{20} = 2{,}4$ (B)

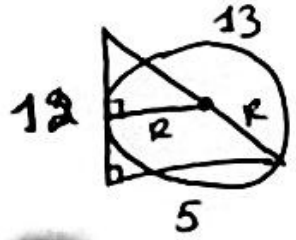
26.



$S = \left(\frac{20+14}{2}\right)^2$

$S = 289$ (B)

27.



$\frac{13-R}{13} = \frac{R}{5}$

$R = \frac{65}{18}$ (D)

28. $3x + 2y = 1$ $\quad M(-4; 0)$

$2x + 3y = 2$

$\begin{cases} 3x + 2y = 1 \ (\times 3) \\ 2x + 3y = 2 \ (\times 2) \end{cases}$

$\ominus \begin{cases} 9x + 6y = 3 \\ 4x + 6y = 4 \end{cases}$

$5x = -1$

$x = -\frac{1}{5}$

$\begin{cases} 3x + 2y = 1 \ (\times 2) \\ 2x + 3y = 2 \ (\times 3) \end{cases}$

$\ominus \begin{cases} 6x + 4y = 2 \\ 6x + 9y = 6 \end{cases}$

$5y = 4$

$y = \frac{4}{5}$.

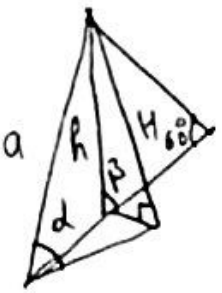
$\frac{x - x_1}{x_1 - x_2} = \frac{y - y_1}{y_1 - y_2}$ $\quad \frac{x + \frac{1}{5}}{-\frac{1}{5} + 4} = \frac{y - \frac{4}{5}}{\frac{4}{5} - 0}$

$\frac{5x+1}{19} = \frac{5y-4}{4}$

$20x + 4 = 95y - 76$

$4x - 19y + 16 = 0$ (A)

29.



$\sin\alpha = \frac{\sqrt{3}}{4}$ $\quad h = \frac{\sqrt{3}}{2}a$

$\frac{H}{a} = \sin\alpha$

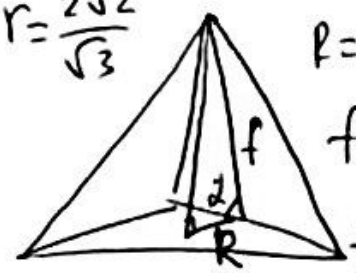
$\frac{H}{h} = \sin\beta$

$H = a\sin\alpha = h\sin\beta$

$a \cdot \frac{\sqrt{3}}{4} = \frac{\sqrt{3}}{2} a \sin\beta$

$\sin\beta = \frac{1}{2}$ $\quad \beta = 30^\circ$

30. $r = \frac{2\sqrt{2}}{\sqrt{3}}$



$h = \frac{\sqrt{3}}{6}a$

$f = \frac{\sqrt{3}}{2}a$

$\frac{R}{f} = \frac{\frac{\sqrt{3}}{6}a}{\frac{\sqrt{3}}{2}a} = \frac{1}{3}$

$r = \frac{\sin\alpha}{1+\cos\alpha} \cdot R$ $\quad \cos\alpha = \frac{1}{3}$

$\frac{2\sqrt{2}}{\sqrt{3}} = \frac{\frac{2\sqrt{2}}{3}}{1+\frac{1}{3}} \cdot \frac{\sqrt{3}}{6}a$ $\quad a = 8$. (A)

Variant - 6

1. $\overline{x853y}$ $\quad 55$

$5\ 11$

$y=0 \quad x=6;$

$y=5 \quad x=1;$

$6+1=7$ (A)

2. $\frac{8}{7}\cdot\frac{9}{8}\cdot\frac{10}{9}\cdot\ldots\cdot\frac{63}{62}=\frac{63}{7}=9$ (A)

3. $(x+a-3)^{2018}+x-4$

$P(0)=0$

$(a-3)^{2018}-4=0$

$a-3=\pm\sqrt[2018]{4}$

$a_{1;2}=3\pm\sqrt[2018]{4}$

$a_1+a_2=6$ (D)

4. $x+\frac{1}{x}=6 \qquad x^3+\frac{1}{x^3}=\left(x+\frac{1}{x}\right)^3-3\cdot x\cdot\frac{1}{x}\left(x+\frac{1}{x}\right)$

(C) $\qquad x^3+\frac{1}{x^3}=6^3-3\cdot 6=216-18=198$

6. $\frac{100-4c^2-4cd-d^2}{20c+10d-4c^2-4cd-d^2}=\frac{10^2-(2c+d)^2}{10(2c+d)-(2c+d)^2}=$

$=\frac{(10-2c-d)(10+2c+d)}{(2c+d)(10-2c-d)}=\frac{10+2c+d}{2c+d}$ (A)

6. $(\vartheta_m+\vartheta_0)\cdot 3=\vartheta_0\cdot 12$

$\vartheta_m=3\vartheta_0$

$(\vartheta_m-\vartheta_0)\cdot t=\vartheta_0\cdot 12$

$2\vartheta_0\cdot t=\vartheta_0\cdot 12$

$t=6$ (A)

7. $\frac{x^7-4x^5+4x^2-7x-2}{x^7-4x^5+3x^2-4x-4}=1$

$x^7-4x^5+4x^2-7x-2=x^7-4x^5+3x^2-4x-4$

$x^2-3x+2=0 \quad x\neq 2 \quad x=1$ (B)

8. $(x^2+14x+14)(x^2+x+14)=14x^2$

$x^2+14=a$

$(a+14x)(a+x)=14x^2$

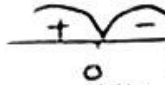
$a^2+15ax+14x^2=14x^2$

$a(a+15x)=0$

$(x^2+14)(x^2+15x+14)=0$

$x=-1 \quad x=-14$ (B)

9. $a^2<a \qquad a^2-a<0 \qquad a(a-1)<0$



$(0;1)$

$x=a^{1947} \qquad y=a^{1960} \qquad z=a^{2019}$

$z<y<x$ (C)

10. $(2x-7)^6+\sqrt{x+1}\geq 1$

$x+1\geq 0 \qquad x\geq -1$ (A)

11. $|a|<1, \quad |b|<1$

$a+ab+ab^2+ab^3+\ldots=\frac{3}{4}$

$\begin{cases}\frac{a}{1-b}=\frac{3}{4} \\ \frac{b}{1-a}=\frac{2}{3}\end{cases}\begin{cases}4a=3-3b \\ 3b=2-2a\end{cases}\begin{matrix}a=\frac{1}{2} \\ b=\frac{1}{3}\end{matrix}$

$b+ba+ba^2+ba^3+\ldots=\frac{2}{3}$

$12ab=12\cdot\frac{1}{2}\cdot\frac{1}{3}=2$ (D)

12. $S_2=3 \qquad S_3-S_2=b_3$

$S_3=7 \qquad b_3=4$

$S_7=?$

$\begin{cases}\frac{b_1(q^2-1)}{q-1}=3 \\ b_1q^2=4\end{cases}\begin{cases}b_1(q+1)=3 \\ b_1q^2=4\end{cases}$

$\frac{q+1}{q^2}=\frac{3}{4} \qquad q=2 \qquad b_1=1$

$S_7=\frac{1\cdot(2^7-1)}{2-1}=127$ (A)

13. $\sqrt{\sin\lambda-\sqrt{\sin\lambda-\sqrt{\sin\lambda-\ldots}}}=\frac{1}{2}$

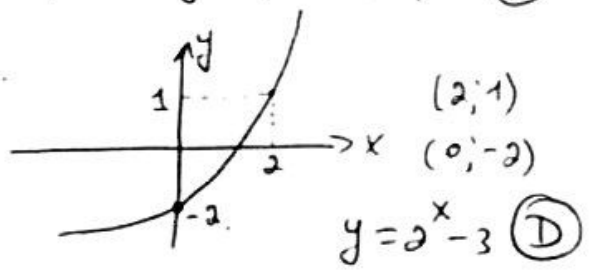
$\sqrt{\sin\lambda-\frac{1}{2}}=\frac{1}{2} \qquad \sin\lambda=\frac{1}{4}+\frac{1}{2}$

$\sin\lambda=\frac{3}{4}$ (A)

14. $(\sin 161^\circ + \sin 41^\circ)(\sin 139^\circ + \sin 49^\circ) -$
$- (\sin 49^\circ - \sin 109^\circ)(\sin 131^\circ - \sin 71^\circ) =$
$[\sin x = \sin y \quad x+y = 180^\circ]$
$= (\sin 49^\circ + \sin 41^\circ)^2 - (\sin 71^\circ - \sin 49^\circ)^2 =$
$= (2\sin 30^\circ \cos 11^\circ)^2 - (2\cos 60^\circ \sin 11^\circ)^2 =$
$\cos^2 11^\circ - \sin^2 11^\circ = \cos 22^\circ$ (B)

15. $\sin^{100} x + \cos^{100} x = 1$
$\sin x = \pm 1 \iff \cos x = 0$
$\cos x = \pm 1 \iff \sin x = 0$
$x = \frac{\pi}{2} n, \; n \in Z$ (A)

16. $f(x) = 0{,}7^x \quad g(x) = 0{,}8^x \quad h(x) = 0{,}9^x$
$f(44) = 0{,}7^{44} \quad g(33) = 0{,}8^{33} \quad h(21) = 0{,}9^{22}$
$f(44) = 0{,}2401^{11} \quad g(33) = 0{,}512^{11} \quad h(22) = 0{,}81^{11}$
$f(44) < g(33) < h(22)$ (A)

17.


$(2;1)$
$(0;-2)$
$y = 2^x - 3$ (D)

18. $(e+1)^x > \sqrt{x}$
$x \geq 0 \quad [0;\infty)$ (B)

19. $y = \ln(x^2 - 2x - 2) > 0$.
$x^2 - 2x - 2 > 1$
$x^2 - 2x - 3 > 0$
$(-\infty;-1) \cup (3;\infty)$ (A)

20. $3^{\log_2(2x-3)} = (2x^2 - 10x + 13)^{\log_2 3}$
$(2x-3) = (2x^2 - 10x + 13) \quad 2+4=6$
$2x^2 - 12x + 16 = 0$
$x^2 - 6x + 8 = 0 \quad x=2 \quad x=4$ (C)

21. $\log_{x-2}(2x-7) > 1$
$\begin{cases} x-2 > 1 \\ 2x-7 > 0 \cdot x-2 \\ 2x-7 > 0 \end{cases} \quad \begin{cases} x > 3 \\ x > 5 \\ x > 3{,}5 \end{cases} \Rightarrow \boxed{x > 5}$ (C)

$\begin{cases} 0 < x-2 < 1 \\ 2x-7 < x-2 \\ 2x-7 > 0 \end{cases} \quad \begin{cases} 2 < x < 3 \\ x < 5 \\ x > 3{,}5 \end{cases} \quad \emptyset$

22. $y = x^2 - |2x-4|$

$x = 3$	$x = -3$
$y = 7$	$y = -1$
$k = 2x - 2 = 4$	$k = 2x + 2 = -4$
$y = 4(x-3) + 7$	$y = -4(x+3) - 1$
$y = 4x - 5$	$y = -4x - 13$

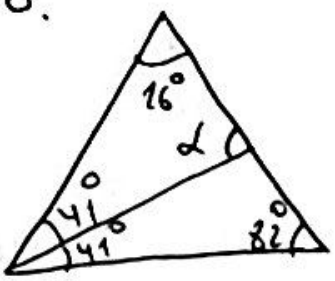
$\begin{cases} y = 4x - 5 \\ y = -4x - 13 \end{cases}$ (+)
$2y = -18$
$y = -9$
$-9 = 4x - 5$
$-4 = 4x$
$x = -1$ (D)

23. $\int x^2 \cdot \sin x \, dx =$
$[\sin x \, dx = d\vartheta \quad x^2 = u \quad -\cos x = \vartheta \quad 2x\,dx = du]$
$= \int -x^2 \cos x + 2\int x \cos x \, dx =$
$[u = x \quad \cos x \, dx = d\vartheta \quad du = dx \quad \sin x = \vartheta]$
$= -x^2 \cdot \cos x + 2 \cdot (x \cdot \sin x - \int \sin x \, dx) =$
$= -x^2 \cdot \cos x + 2x \sin x + 2\cos x + C$ (B)

24. $m_a = \frac{1}{2}\sqrt{2b^2 + 2c^2 - a^2}$ (D)

25. $A \cap B = \{b; c; d\}$
$A \cap C = \{b; d\}$
$A \cap (B \cup C) = (A \cap B) \cup (A \cap C) =$
$\{b; c; d\}$ (D).

26.



$\alpha = 82^\circ + 41^\circ = 123^\circ$ (D)

27. $\begin{cases} a - b = 8 \\ h_b - h_a = 4 \\ a \cdot h_a = b \cdot h_b \end{cases}$

$a = 8 + b$

$h_b = 4 + h_a$

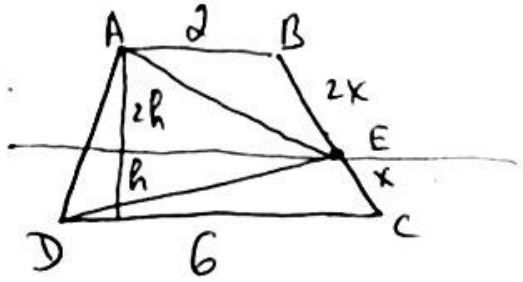
$(8+b)h_a = b(4+h_a)$

$8h_a + b \cdot h_a = 4b + bh_a$

(B)

$\sin\alpha = \frac{h_a}{b} = \frac{1}{2} \quad \alpha = 30^\circ$

28.



$\frac{6+2}{2} \cdot 3h = 36 \quad h = 3$

$S_{ADE} = 36 - \frac{2 \cdot 2h}{2} - \frac{6 \cdot h}{2} =$

$= 36 - 6 - 9 = 21$ (B)

29. $\frac{1}{3} < \frac{3}{8} < \frac{1}{2}$ (B)

30. $R = 11\sqrt{2} \quad r = 2\sqrt{2} \quad R_s = ?$

$\frac{1}{3}\pi H(R^2 + r^2 + Rr) = \pi R_s^2 H$

$\frac{1}{3}(121 \cdot 2 + 8 + 22 \cdot 2) = R_s^2$ (A)

$R_s = 7\sqrt{2}$

7-Variant

ALPHERGANUS

① $2^2+6^2+10^2+14^2+18^2-$
$-1-5^2-9^2-13^2-17^2=$
$=2+6^2-5^2+10^2-9^2+14^2-13^2+$
$+18^2-17^2=3+11+19+27$
$+35=\frac{3+35}{2}\cdot 5=95$ (B)

② $\frac{(-)}{\frac{1}{2\cdot 2\cdot 2}(-)}=\frac{1}{8}$ (A)

③ $(a^2-b^2-c^2+2bc)$
$\frac{a+b-c}{a+b+c}$
$a^2-(b^2-2bc+c^2)$
$\frac{a+b-c}{a+b+c}$
$a^2-(b-c)^2\cdot\frac{a+b+c}{a+b-c}$
$(a-b+c)(a+b-c)\frac{a+b+c}{a+b-c}$
$=(a-b+c)(a+b+c)$
$=(3-\sqrt{3}-1)(3+\sqrt{3}-1)$
$=(2-\sqrt{3})(2+\sqrt{3})$
$=1$ (A)

④ $(a+b)^3-(a-b)^3-8b^3$
$=(a+b-a+b)((a+b)^2+$
$+a^2-b^2+(a-b)^2)-$
$-8b^3=6b(a-b)(a+b)$ (D)

⑤ $132\leftarrow\begin{cases}\text{nok}=x\\ \text{okmo}=4x\\ \text{okrözi}\cdot x-18\end{cases}$
$6x-18=132$
$6x=150$; $x=25$
(C) $4\cdot x=100$

⑥ $\frac{5x+11}{(x+2)(x-1)}=\frac{a(x-2)+b(x-1)}{(x-1)(x+2)}$
$5x+11=ax-2a+bx-b$ 1)
$5x+11=(a+b)x-2a-b$ 2)
$+\begin{cases}a+b=5 & a=-16\\ -2a-b=11 & b=21\end{cases}$ 3) 4)
$21-16=5$ (D)

⑦ $x(x+3)+(x+3)\sqrt{\frac{x}{x+3}}-2=$
$x(x+3)+\sqrt{x(x+3)}-2=$
$a^2+a-2=0$
$a=-2$ $\quad a=1$
$x^2+3x=4$ $\quad x^2+3x=1$
$x=-4$; $x=1$ $\quad -\frac{3\pm\sqrt{13}}{2}$
$-4;\ \frac{\sqrt{13}-3}{2}$ (B) $\frac{\sqrt{13}-3}{2}$

⑧ $x^2-2(m+1)x+1=0$
$D>0$; $m+1>0$
$m^2+2m>0$
$m(m+2)>0$
$m>-1$
$(0;\infty)$ (A)

⑨ $\frac{(x-1)(x-4)}{\sqrt{3+5x-2x^2}}<0$
$(x-1)(x-4)<0$
$2x^2-5x-3<0$
$(-\frac{1}{2};3)$
(A) $(1;3)$

⑩ $|x+4|(|x-2|+|x-4|)>$
$2|x+4||x-3|$
$|x-2|+|x-4|>2|x-3|$
$2\quad 3\quad 4$
1) $6-2x>6-2x$
2) $2>6-2x$; $x>2$
3) $2>2x-6$; $x<4$
4) $-6>-6$
$2+1=3$ (C)

(11) 3, 9, 15 ...
$d = 6$ (C)

(12) n - toq
$n^2 - (n-2)^2 = 152$
$n^2 - n^2 + 4n - 4 = 152$
$4n = 156$
$n = 39$; $39 - 2 = 37$ (A)

(13) $-\operatorname{tg}\alpha \cdot \operatorname{tg}\beta +$
$+ (\operatorname{tg}\alpha - \operatorname{tg}\beta) \cdot$
$\cdot \operatorname{ctg}(\alpha - \beta)$
$-\operatorname{tg}\alpha \cdot \operatorname{tg}\beta + (\operatorname{tg}\alpha - \operatorname{tg}\beta) \cdot$
$\cdot \frac{1 + \operatorname{tg}\alpha \cdot \operatorname{tg}\beta}{(\operatorname{tg}\alpha - \operatorname{tg}\beta)}$
$-\operatorname{tg}\alpha \cdot \operatorname{tg}\beta + 1 + \operatorname{tg}\alpha \operatorname{tg}\beta$
$= 1$ (B)

(14) $m = a\cos x + b \cdot \sin x$
$n = \sqrt{a^2 + b^2}$
$-\sqrt{a^2+b^2} \le m \le \sqrt{a^2+b^2}$
$m \ge n$
$m - n \ge 0$.
$n \to m$ ning eng kichik qiymati
$-2\sqrt{a^2+b^2} \le m+n \le 0$ (A)

(15) $\sin x + \cos x = \sqrt{2}$
$\sqrt{2}\left(\frac{1}{\sqrt{2}}\sin x + \frac{1}{\sqrt{2}}\cos x\right) = \sqrt{2}$
$\cos 45^\circ \sin x + \sin 45^\circ \cos x = 1$
$\sin\left(x + \frac{\pi}{4}\right) = 1$.
$x + \frac{\pi}{4} = \frac{\pi}{2} + 2\pi n$
$x = \frac{\pi}{4} + 2\pi n$ (A)

(16) $y_1 = 3x - 3$.
$y_2 = -0{,}5x - a$
Kesishsa $y_1 = y_2$
$x > 0$
$y > 0$.
$3x - 3 = -0{,}5x - a$
$3x + 0{,}5x = 3 - a$
$3{,}5x = 3 - a$.
$x = \frac{3-a}{3{,}5}$
$3 - a > 0$ $(a < 3)$
$y = \frac{3(3-a) - 3 \cdot 3{,}5}{3{,}5}$
$y = \frac{9 - 3a - 10{,}5}{3{,}5}$
$y = \frac{-3a - 1{,}5}{3{,}5}$
$-3a - 1{,}5 > 0$
$-3a > 1{,}5$ (D)
$a < -\frac{1}{2}$

(17) x ni ozgarish oraliqi $[-4; 4)$ kesmu (D)

(18) $3 \cdot 9^{x+1} + 2 \cdot 3^{x+1} - 1 = 0$
$3 \cdot 9^x \cdot 9 + 2 \cdot 3^x \cdot 3 - 1 = 0$
$27 \cdot 9^x + 6 \cdot 3^x - 1 = 0$
$3^x = R \;/\; 27 \cdot R^2 + 6R - 1 = 0$
$R_{1,2} = \frac{-6 \pm 12}{2 \cdot 27}$
$R_1 = -\frac{1}{3}$? $R_2 = \frac{3}{27} = \frac{1}{9}$.
$3^x = 3^{-2}$ $(x = -2)$ (A)

(19) $\frac{\lg(1 + \frac{1}{2} + \frac{1}{4} + \dots)}{\lg(2 + \frac{2}{3} + \frac{2}{9} + \dots)}$.
$\left(\log_2 3 + \frac{1}{2}\log_2 3 + \frac{1}{4}\log_2 3 + \dots\right)$
1) $1 + \frac{\frac{1}{2}}{1 - \frac{1}{2}} = 2$
2) $2 + \frac{2}{3} \cdot \frac{3}{2} = 3$. (A)
$\frac{\lg 2}{\lg 3} \cdot \log_2 3 \left(1 + \frac{1}{2} + \frac{1}{4} + \dots\right)$
$\log_3 x \cdot \log_2 3 \cdot (1+1) = 2$

(20) $\log_4(x-7) \le \log_4(20$
$1 \le \log_4 \left(\frac{20-x}{x-7}\right)$
$(7; 20)$
$\frac{20-x}{x-7} \ge 4$
$\frac{48 - 5x}{x-7} \ge 0$
$\frac{5x - 48}{x-7} \le 0$
$(7; 9{,}6]$ $8 + 9 = 17$

(21) $f(\sin^2 x) = \cos^2 x$
$f((\sin^2 x) = ?$
$f(\sin^2 x) = 1 - \sin^2 x$
$\sin^2 x = t$.
$f(t) = 1 - t$.
$f'(t) = -1$. (B)

@ALPHRAGANUS

22

$f(x)=A\cdot 2^x+B$

$f'(1)=(\ln 2)^2$

$\int_0^2 f(x)dx=\frac{1}{2}$

$f'(x)=A\cdot 2^x\cdot \ln 2$

$f'(1)=2\ln 2\cdot A$

$\int_0^2 (A\cdot 2^x+B)dx=$

$=\frac{A\cdot 2^x}{\ln 2}+Bx\Big|_0^2$

$2A\cdot \ln 2=(\ln 2)^2$

$A=\frac{\ln 2}{2}$

$\frac{4A}{\ln 2}+2B-\frac{A}{\ln 2}=\frac{1}{2}$

$\frac{3A}{\ln 2}+2B=\frac{1}{2}$

$\frac{3\ln 2}{2\cdot \ln 2}+2B=\frac{1}{2}$

(B) $2B=-1$; $B=-\frac{1}{2}$

23 D 1004

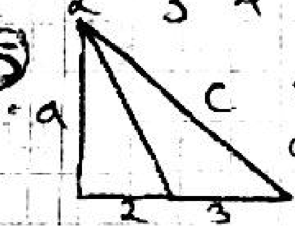
24 $A=\{x:|x-2|<3, x\in N\}$

(B) $-3<x-2<3$

$-1<x<5$

1 2 3 4 4ta

25



$3a=2c$

$a^2+5^2=c^2$

$a^2+5^2=c^2$

$a^2+25=\frac{9}{4}a^2$

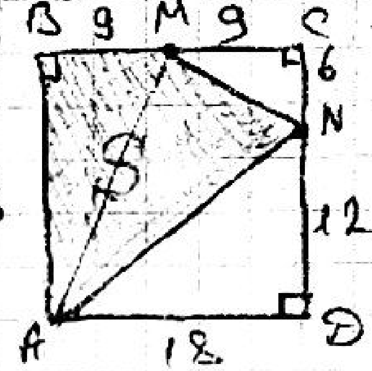
$25\cdot 4=5a^2$

$a^2=5\cdot 4$

$a=2\sqrt{5}$

$S=\frac{2\sqrt{5}\cdot 5}{2}=5\sqrt{5}$

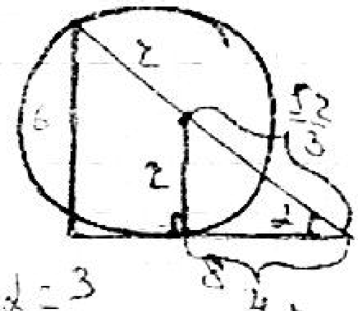
26



$S_{ABMN}=S_{ABCD}-(S_{ADN}+S_{MNC})=$

$=18^2-(27+108)=189$ (B)

27



$tg\,\alpha=\frac{3}{4}$

$r+\frac{5r}{3}=10$

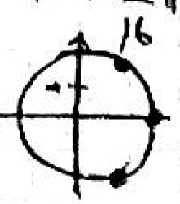
$r=\frac{3}{8}\cdot 10=\frac{15}{4}$

(B) $S_{doira}=r^2\pi=14\frac{1}{16}\pi$

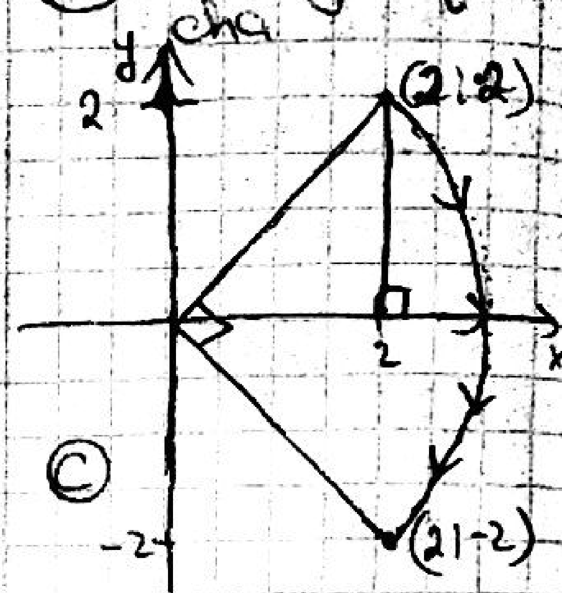
28 (2; 2)

$y<0; x>0$

(C) (2; −2)



28 28-ga qo'shimcha



(C)

29 $\vec{b}(2;3;-1)$

$\vec{a}(x;y;z)$

$\vec{a}=\lambda\cdot\vec{b}$ → kolliniarlik sharti

$x\cdot 2+y\cdot 3+z(-1)=\vec{a}\vec{b}=28$

$\lambda\cdot 2\cdot 2+3\lambda\cdot 3+(-1)\lambda(-1)=28$

$4\lambda+9\lambda+\lambda=28$

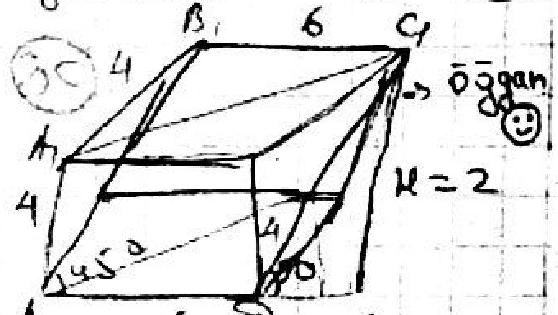
$14\lambda=28$

$\lambda=2$

$\vec{a}=2\vec{b}=(4;6;-2)$

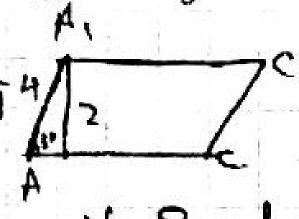
$x+y+z=4+6-2=8$ (D)

30



→ o'rgan 🙂

$h=2$



$A_1H=AA_1\cdot\sin 30°=2$

$V=S_{as}\cdot h=4\cdot 6\cdot\sin 45°\cdot 2=24\sqrt{2}$ (B)

Variant – 8

1. $a = 64 \cdot n + n^3$

$64 > n^3$

$n = 3$

$a = 64 \cdot 3 + 3^3$

$a = 219$ (A)

2. $\frac{a+b}{3a-2b} = \frac{32}{26} = \frac{16}{13}$

$\begin{cases} a+b=16 \\ 3a-2b=13 \end{cases}$ $a=9$, $b=7$ (A)

3. $(x+2)(x+4)(x+6)(x+8)+16 =$

$= (x^2+10x+16)(x^2+10x+24)+16 =$

$= a \cdot (a+8) + 16 = a^2 + 8a + 16 =$

$= (a+4)^2 = (x^2+10x+20)^2 \to 0$

(A)

4. $\frac{5ab+7bc-2ac}{ab+3bc} = 2$ $\quad \frac{b}{a} \cdot \frac{a+c}{b+c}$

$5ab+7bc-2ac = 2ab+6bc$

$3ab-2ac+bc=0$

$2ab-2ac+ab+bc=0$

$2a(b-c)+b(a+c)=0$

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

$-2 = \frac{b}{a} \cdot \frac{a+c}{b-c}$ (C)

5. $\frac{4x^2-4x+1}{4} = (x+a)^2$

$\left(x-\frac{1}{2}\right)^2 = (x+a)^2$

$a = -\frac{1}{2}$ (A)

6. $|4\sqrt{3}-7| - |5\sqrt{2}-7| =$

$7 - 4\sqrt{3} - 5\sqrt{2} + 7 = 14 - 4\sqrt{3} - 5\sqrt{2}$ (D)

7. $\begin{cases} x+y=36 \\ x=y+6 \end{cases}$

$y+y+6=36$

$y=15$

$x=21$ (B)

8. $x^2-2x-2=0$

$x_1^4 + x_2^4 = (x_1^2+x_2^2)^2 - 2x_1^2x_2^2$

$(-2)^4 + 4 \cdot (-2)^2 \cdot (-2) + 2 \cdot (-2)^2 =$

$= 16 + 32 + 8 = 56$ (B)

9. $\begin{cases} 2x+y=7 \\ |x-y|=2 \end{cases}$

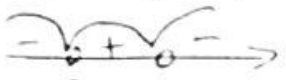
1) $\begin{cases} 2x+y=7 \\ x-y=2 \end{cases}$ $x=3$, $y=1$

2) $\begin{cases} 2x+y=7 \\ x-y=-2 \end{cases}$ $x=\frac{5}{3}$, $y=\frac{11}{3}$

$3+1+\frac{5}{3}+\frac{11}{3} = 4+\frac{16}{3} =$

$= 9\frac{1}{3}$ (D)

10. $(3-x)(x+2) > 0$



(B)

$(-2;3)$

$-1+0+1+2=2$

11. $\begin{cases} 1 \le x \le 25 \\ \frac{5}{2} \le y \le 7 \end{cases}$ $\frac{x}{y} = ?$

$\frac{1}{7} \le \frac{x}{y} \le 10$ (B)

12. $d=2$

$a_1^2 + a_3^2 + a_5^2 + a_7^2 = a_2^2 + a_4^2 + a_6^2 + 57$

$a_7 = ?$

$a_7^2 = a_2^2 - a_1^2 + a_4^2 - a_3^2 + a_6^2 - a_5^2 + 57$

$a_7^2 = 2(a_2 + a_1 + a_4 + a_3 + a_6 + a_5) + 57$

$(a_1+12)^2 = 2(6a_1+30)+57$

$a_1^2 + 24a_1 + 144 = 12a_1 + 60 + 57$

$a_1^2 + 12a_1 + 27 = 0$

$-9 \quad -3$

$a_1 < -5$

$a_1 = -9$

$a_7 = a_1 + 6d = 3$ (C)

13. $\frac{-tg\left(\frac{\pi}{4}-\frac{\alpha}{2}\right)(1+\sin\alpha)}{\sin\alpha} =$

$= \frac{\frac{1-tg\frac{\alpha}{2}}{1+tg\frac{\alpha}{2}}(1+\sin\alpha)}{\sin\alpha} =$

$= \frac{\frac{\cos\frac{\alpha}{2}-\sin\frac{\alpha}{2}}{\cos\frac{\alpha}{2}+\sin\frac{\alpha}{2}}\left(\cos\frac{\alpha}{2}+\sin\frac{\alpha}{2}\right)^2}{\sin\alpha}$

$= \frac{\left(\cos\frac{\alpha}{2}-\sin\frac{\alpha}{2}\right)\left(\cos\frac{\alpha}{2}+\sin\frac{\alpha}{2}\right)}{\sin\alpha}$

$= \frac{\cos^2\frac{\alpha}{2}-\sin^2\frac{\alpha}{2}}{\sin\alpha} = \frac{\cos\alpha}{\sin\alpha}$

$= ctg\alpha$ (C)

14. $\frac{2018}{\pi} \cdot \operatorname{arctg}(\cos 2019\pi) =$

$= \frac{2018}{\pi} \cdot \operatorname{arctg}(-1) = \frac{2018}{\pi} \cdot \frac{3\pi}{4} =$

$= 1513{,}5$ (A)

15. $\operatorname{tg} 3x \le -\sqrt{3} \quad \left[-\frac{\pi}{2}; \frac{\pi}{2}\right]$

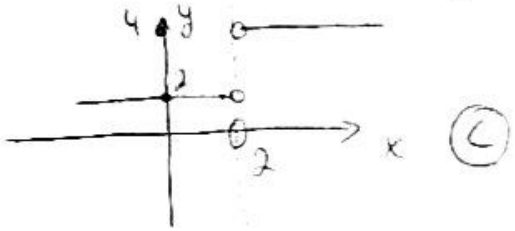
$-\frac{\pi}{2} + \pi n < 3x \le -\frac{\pi}{3} + \pi n; \quad n \in \mathbb{Z}$

$-\frac{\pi}{6} + \frac{\pi n}{3} < x \le -\frac{\pi}{9} + \frac{\pi n}{3}; \quad n \in \mathbb{Z}$

$\left(-\frac{\pi}{6}; -\frac{\pi}{9}\right] \left(\frac{\pi}{6}; \frac{2\pi}{9}\right] \left[-\frac{\pi}{2}; -\frac{4\pi}{9}\right]$

(B)

16. $y = \frac{|x-2|}{x-2} + 3$ $\quad x > 2 \quad y = 4$ $\quad x < 2 \quad y = 2$



(C)

17. (D)

18. $2^x > \sqrt{x} \quad x \ge 0$ (A)

19. $\log_3 7 + \log_7 3 < 3$ (B)

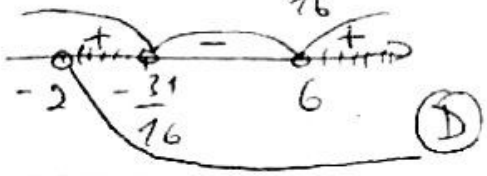
$\log_3 7 > 1{,}7 \quad \log_7 3 > 0{,}5$

20. $(\log_2(x+2) - 3)(\log_2(x+2) + 4) > 0$

$\log_2(x+2) = 3 \quad \log_2(x+2) = -4$

$x+2 = 8 \quad x+2 = \frac{1}{16}$

$x = 6 \quad x = -\frac{31}{16} \quad x+2 > 0$



(D)

21. $y = x^4 - 4\ln x \quad x > 0$

$y' = 4x^3 - \frac{4}{x} = 0$

$\frac{4(x-1)(x+1)(x^2+1)}{x} = 0$

maks (+) → (−).

M.E. (C)

22. $\int x \cdot f^{-1}(x+2)\,dx = 2x^2 - 3x + C$

$x f^{-1}(x+2) = 4x - 3$

$f^{-1}(x+2) = \frac{4x-3}{x}$

$x+2 = a \quad x = a-2$

$f^{-1}(a) = \frac{4a-8-3}{a-2} = \frac{4a-11}{a-2} = y$

$4a - 11 = ay - 2y$

$4a - ay = 11 - 2y$

$a = \frac{11-2y}{4-y}$

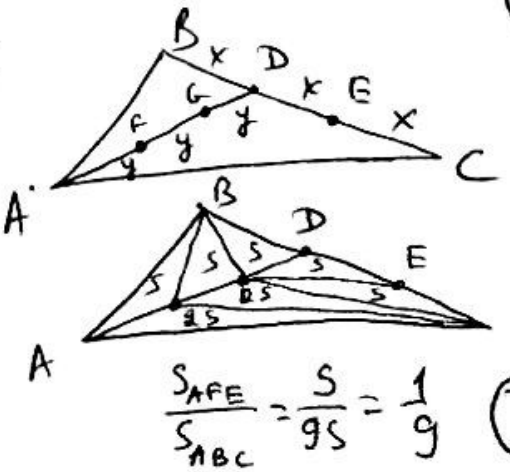
$f(x) = \frac{2x-11}{x-4}$ (C)

23. 1) 2) (D)

24. $\frac{1}{(n+4)!} - \frac{1}{(n+5)!} = \frac{n+5-1}{(n+5)!} = \frac{n+4}{(n+5)!}$

(B)

25.



$\frac{S_{AFE}}{S_{ABC}} = \frac{S}{9S} = \frac{1}{9}$ (D)

26.

$r = \frac{a+a-\sqrt{2}a}{2} = \frac{2-\sqrt{2}}{2}a$

$R = \frac{\sqrt{2}a}{2}$ (C)

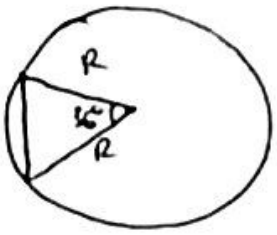
$\frac{r}{R} = \frac{2-\sqrt{2}}{\sqrt{2}} = \sqrt{2}-1$

30. $a=12 \quad b=20 \quad c=16$

$\alpha = 30° \quad p = \frac{12+20+16}{2} = 24$

$V = \frac{1}{3} \cdot 12 \cdot 4 \cdot 8 \cdot \frac{\sqrt{3}}{2} = \frac{128\sqrt{3}}{3}$ (A)

27.



$\frac{360°}{36°} = 10$ (B)

28. $M(-4;1)$

$y = -\frac{5}{6}x + b$

$1 = -\frac{5}{6}\cdot(-4) + b$

$1 - \frac{20}{6} = b$

$-\frac{14}{6} = b$

$y = -\frac{5}{6}x - \frac{14}{6}$

$5x + 6y + 14 = 0$ (D)

$\frac{x}{5} - \frac{y}{6} = 1$

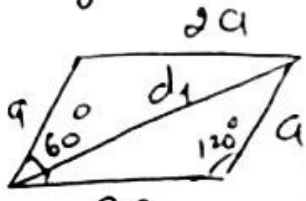
$y = \frac{6}{5}x - 1$

$k_1 \cdot k_2 = -1$

$\frac{6}{5} \cdot k_2 = -1$

$k_2 = -\frac{5}{6}$

29.



$\cos\alpha = \sqrt{\frac{67}{112}} \qquad \sin\alpha = \frac{3\sqrt{35}}{28}$

$\sin\beta = \frac{d_1 \sin\alpha}{d_2}$ $\begin{cases} \frac{H}{d_1} = \sin\alpha \\ \frac{H}{d_2} = \sin\beta \end{cases}$

$d_1^2 = a^2 + 4a^2 + 2\cdot a \cdot 2a \cdot \frac{1}{2}$

$d_1 = \sqrt{7}a$

$d_2^2 = a^2 + 4a^2 - 2a \cdot 2a \cdot \frac{1}{2}$ (C)

$d_2 = \sqrt{3}a$

$\sin\beta = \frac{\sqrt{7} \cdot \frac{3\sqrt{35}}{28}}{\sqrt{3}} = \frac{\sqrt{15}}{4} \qquad \cos\beta = \frac{1}{4}$

Variant-9

1. $a\ (a>1)$

$a = 2017\cdot b + 1$

$a = 2018\cdot c + 1$

$a-1 = 2017\cdot b = 2018\cdot c$

$a-1 = n\cdot EKUK(2017;2018)$

$n = 1$

$a = 2017\cdot 2018 + 1$

$a = 15\cdot d + 12$ (D)

2 $3{,}2 = x + \frac{y}{5}$ $\quad 3\frac{1}{5} = x + \frac{y}{5}$

(A) $\quad x = 3 \quad y = 1$

3. $\dfrac{\frac{1}{a}+\frac{1}{b+c}}{\frac{1}{a}-\frac{1}{b+c}}\left(1+\dfrac{b^2+c^2-a^2}{2bc}\right)\cdot\dfrac{(a+b+c)^2}{bc}$

$\dfrac{a+b+c}{b+c-a}\cdot\dfrac{(b+c-a)(b+c+a)}{2bc}\cdot\dfrac{bc}{(a+b+c)^2}$

$= \frac{1}{2}$ (B)

4 $a-b = |3x|^{-1} \quad a-b>0 \quad a>b$ (C)

5. $\begin{cases} x\cdot 1 + y\cdot 2 = \frac{3}{8} \\ 3\cdot x + 2\cdot y = \frac{5}{8} \end{cases}$ (-) $\quad 2x = \frac{2}{8} \quad x = \frac{1}{8}$

$t = 8$ (C)

6. $5\cdot\sqrt{1-\frac{1}{x}} = \frac{7x-1}{x} = 7 - \frac{1}{x} = 6+1-\frac{1}{x}$

$5a = 6 + a^2 \quad a^2 - 5a + 6 = 0$

$a = 2 \quad a = 3 \quad \sqrt{1-\frac{1}{x}} = 3$

$\sqrt{1-\frac{1}{x}} = 2 \quad x = -\frac{1}{3} \quad x = -\frac{1}{8}$ (B)

7. $|x+2| + \frac{1}{2}|x-4| = 6$

1) $4 \geq x \geq -2$

$x+2+\frac{1}{2}(4-x) = 6$ $\quad \boxed{x=4}$ (4)

2) $x \leq -2$

$-x-2+\frac{1}{2}(4-x) = 6$ $\quad \boxed{x=-4}$

3) $x \geq 4 \quad x+2+\frac{1}{2}(x-4) = 6$ (D)

8. $\begin{cases} (x+xy^2+y^2)(x+y^2)^2 = 225 \\ (x-xy^2+y^2)(x+y^2)^2 = 25 \end{cases}$ (+)

$(x+y^2)^2\cdot 2(x+y^2) = 250$ (C)

$\begin{cases} x+y^2 = 5 & (1;2)\ (4;1) \\ xy^2 = 4 & (1;-2)\ (4;-1) \end{cases}$

9 $\frac{1}{a} > \frac{1}{b} > \frac{1}{c} \quad a<b<c<0$

$|a+b| - |b-c| + |a-c| =$ (A)

$= -a-b+b-c-a+c = -2a$

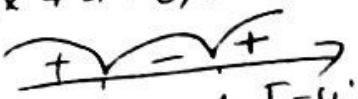
10. $(x^2+3x+1)(x^2+3x+3) \leq 35$

$a(a+2) \leq 35$

$a^2+2a-35 \leq 0$

$(a+7)(a-5) \leq 0$

$(x^2+3x+8)(x^2+3x-4) \leq 0$

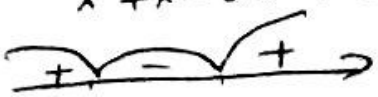


$[-4;1]$

$1-(-4) = 5$ (C)

11. $\frac{1+x}{2}\cdot x > 465$

$x^2+x-930 > 0$



$(30;\infty)$

$x = 31; 32; \ldots$ (B)

12. $b_1=4$ $b_2; b_3; b_4; b_5=324$ (A)

$q^4=\frac{b_5}{b_1}=\frac{324}{4}=81$ $b_1=4$

$q=3$ 12; 36; 108 (A)

13. $\sin^2(30^\circ-\alpha)+\sin 15^\circ\cdot\cos(15^\circ+2\alpha)-$
$-\sin^2(45^\circ+\alpha)=$

$=\frac{1-\cos(60^\circ-2\alpha)}{2}+\frac{\sin(30^\circ+2\alpha)+\sin 2\alpha}{2}$

$-\frac{1-\cos(90^\circ+2\alpha)}{2}=\frac{1-\sin 2\alpha}{2}-\frac{1+\sin 2\alpha}{2}=$

$=-\sin 2\alpha$ (A)

14. $0<\sin 14^\circ<1$ (C)

15. $6\sin^2 x+5\sin x\cos x+3\cos^2 x=2$ $[-\pi,\pi]$

$6\operatorname{tg}^2 x+5\operatorname{tg}x+3=\frac{2}{\cos^2 x}=2(1+\operatorname{tg}^2 x)$

$6a^2+5a+3=2+2a^2$

$4a^2+5a+1=0$ $a=-1$ $a=-\frac{1}{4}$

$\operatorname{tg}x=-1$ $x=-\frac{\pi}{4}+\pi n$ $-\frac{\pi}{4};\frac{3\pi}{4}$ 2 ta

$\operatorname{tg}x=-\frac{1}{4}$ $x=-\operatorname{arctg}\frac{1}{4}+\pi n$ 2 ta

(C)

16. $A(0;2)$ $y=\sqrt{x^2+4x+18}+2$

$AB=\sqrt{(x-0)^2+(\sqrt{x^2+4x+18}+2-2)^2}=$ (B)

$=\sqrt{2x^2+4x+18}$

$\min=\sqrt{y_0}=\sqrt{-\frac{D}{4a}}=\sqrt{\frac{16-4\cdot 2\cdot 18}{4\cdot 2}}=4$

17. $y=\sin^2\left(\frac{x}{3}-\frac{\pi}{4}\right)+2\operatorname{tg}x$

$T_1=\frac{\pi}{\frac{1}{3}}=3\pi$ $T_2=\pi$.

$\text{EKUK}(T_1;T_2)=3\pi$ (B)

18. $\frac{3n-4+5+6n-1-3n}{2}=2^{6n}=4^{3n}$ (B)

19. $\log_a b=29$ $\log_a\sqrt[6]{ab}=$ (D)

$=\frac{1}{6}(1+\log_a b)=\frac{1}{6}\cdot(1+29)=5$

20. $\frac{\arccos\left(-\frac{3}{\pi}\right)\log_{\frac{3}{\pi}}\frac{\pi}{4}}{1-2\log_{\log_2 x}2}\geq 0$

$\arccos\left(-\frac{3}{\pi}\right)>0$ $\log_{\frac{3}{\pi}}\frac{\pi}{4}>0$

$1-2\log_{\log_2 x}2>0$.

$1>\log_{\log_2 x}4$ $\log_2 x>4$

$x>16$

$0<\log_2 x<1$ $1<x<2$

$\log_2 x<4$ $x<16$ (C)

21. $f(x)=0{,}5x^4-x$

$y=-\frac{3}{4}x-\frac{3}{32}$

$f'(x)=k$ $2x^3-1=-\frac{3}{4}$

(A) $2x^3=\frac{1}{4}$ $x=\frac{1}{2}$.

22. $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}}\frac{\sin^3 x+1}{\sin^2 x}dx=$

$=\int_{\frac{\pi}{6}}^{\frac{\pi}{3}}\left(\sin x+\frac{1}{\sin^2 x}\right)dx=$

$=-\cos x-\operatorname{ctg}x\Big|_{\frac{\pi}{6}}^{\frac{\pi}{3}}=$

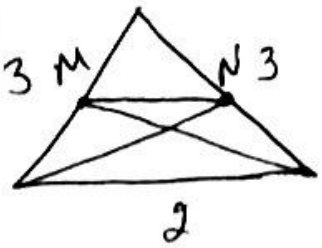
$=-\cos\frac{\pi}{3}-\operatorname{ctg}\frac{\pi}{3}+\cos\frac{\pi}{6}+\operatorname{ctg}\frac{\pi}{6}$

$=\frac{\sqrt{3}-3}{6}$ (D)

23. 2) 3) (C)

24. $A \cap B = \{b; c; d\}$ $A \cap C = \{a; b\}$ (C)
$A \cap (B \cup C) = (A \cap B) \cup (A \cap C) = \{a; b; c; d\}$

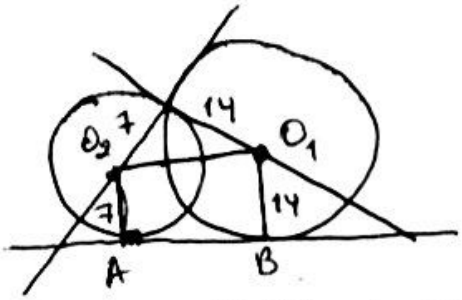
25.



$MN = \frac{ab}{a+b} = \frac{2 \cdot 3}{2+3} = 1,2$

(B)

26.



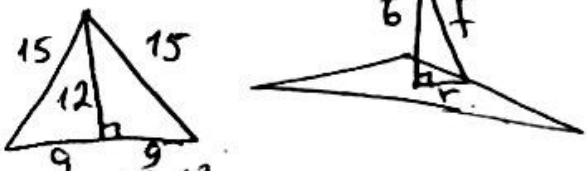
(B)

$S_{ABO_1O_2} = \frac{7+14}{2} \cdot 14 = 147$

27) $r + R = 4$ $c = 6$ $R = 3$
$r = 1$
$\frac{a+b-c}{2} = 1$ $c = 6$
$a + b = 8$ $P = 14$ (D)

28 $A(-2; 3)$ $B(3; 1)$ $C(a; 2)$
$\overline{AB}(5; -2)$ $\overline{BC}(a-3; 1)$
$5(a-3) - 2 \cdot 1 = 0$
$5a - 15 - 2 = 0$
$a = \frac{17}{5} = 3,4$ (B)

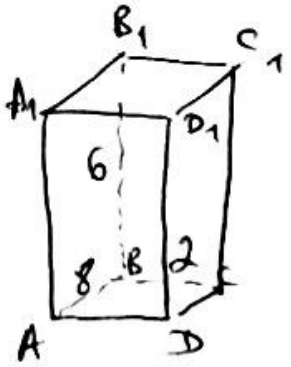
29.



$r = \frac{2 \cdot \frac{12 \cdot 18}{2}}{15+15+18} = 4,5$

$6^2 + 4,5^2 = f^2$ $f = 7,5$ (D)

30. $AB = 8$ $BC = 2$ $BB_1 = 6$



$S_T = S_{ABCD} + S_{CC_1D} + S_{ABB_1} + S_{BB_1CC_1} + S_{ADB_1C_1}$ (B)

$S_T = 8 \cdot 2 + 8 \cdot 6 + 6 \cdot 2 + 2 \cdot 10 = 96$

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Variant-10

1. $n+5$ juft son
n toq son (B)

2. $a;b;c;d>0$

$\left(\frac{1}{a}+\frac{1}{b}+\frac{1}{c}+\frac{1}{d}\right)\cdot(a+b+c+d)$

$1+\frac{a}{b}+\frac{a}{c}+\frac{a}{d}+1+\frac{b}{a}+\frac{b}{c}+\frac{b}{d}+$

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

$=4+\frac{a}{b}+\frac{a}{c}+\frac{a}{d}+\frac{b}{a}+\frac{b}{c}+\frac{b}{d}+\frac{c}{a}+\frac{c}{b}+$

$+\frac{c}{d}+\frac{d}{a}+\frac{d}{b}+\frac{d}{c}\geq 4+12\sqrt[12]{\frac{a}{b}\cdot\frac{a}{c}\cdot\frac{a}{d}\cdot\frac{b}{a}\cdot\frac{b}{c}\cdot\frac{b}{d}\cdot\frac{c}{a}\cdot\frac{c}{b}\cdot\frac{c}{d}\cdot\frac{d}{a}\cdot\frac{d}{b}\cdot\frac{d}{c}}=16.$ (C)

3. $\frac{4ab+7bc-ac}{ab+2bc}=4$

$4ab+7bc-ac=4ab+8bc$

$bc+ac=0$

$c(a+b)=0 \quad a=-b \quad c=0$

$\frac{4ab+7bc-ac}{3ab+5bc-ac}=\frac{4}{3}$ (A)

4. $\frac{x^3+27}{2x-2}\cdot\frac{x^2-1}{x^2+4x+3}\cdot\frac{6x+12}{3x^2-9x+27}+1$

$\frac{(x+3)(x^2-3x+9)}{2(x-1)}\cdot\frac{(x-1)(x+1)}{(x+1)(x+3)}\cdot\frac{6(x+2)}{3(x^2-3x+9)}+1=$

$=x+3$ (A)

5. $\sqrt{4^{10}+6^{11}+9^{11}}+\sqrt{4^{10}-6^{11}+9^{11}}=\sqrt{(2^{10}+3^{11})^2}+\sqrt{(3^{11}-2^{10})^2}=$

$=2\cdot 3^{11}$ (C)

6. $x+x+1+x+3+x+5>70$

$4x>61$

$x>15,25$

$x=17$ (A)

7. $\sqrt{1-\sqrt{1+x}}=x \quad x>0$

$1-\sqrt{1+x}=x^2$ $\varnothing$ (A)

8. $4(x-3)(x+3)-(x-3)(x^2+3x+9)=0$

$(x-3)(4x+12-x^2-3x-9)=0$

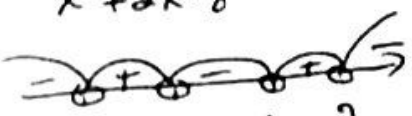
$(x-3)(-x^2+x+3)=0$

$x=3 \quad x^2-x-3=0$

$3\cdot(-3)=-9$ (B)

9. $\frac{2x-7}{x^2+2x-8}>1 \quad \frac{2x-7}{x^2+2x-8}-1>0$

$\frac{2x-7-x^2-2x+8}{x^2+2x-8}>0 \quad \frac{(1-x)(1+x)}{(x+4)(x-2)}>0$



$-4 \quad -1 \quad 1 \quad 2$

$(-4;-1)\cup(1;2)$

$-3-2=-5$ (C)

10. $x^2-6ax-(2-3a)(2+3a)<0$

$(x-3a-2)(x-3a+2)<0$

$x=3a+2 \quad x=3a-2$

$(3a-2;3a+2)$ (D)

11. $(x^2+x)+(x^2+2x)+\ldots+(x^2+19x)=1425$

$\frac{x^2+x+x^2+19x}{2}\cdot 19=1425$

$(x^2+10x)=75$ (C)

$x^2+10x-75=0$

$x=-15 \quad x=5$

12. $1;8;27;64;125;1000$ (D)

13. $\sin 2\alpha-\sin 3\alpha-\sin 4\alpha+\sin 5\alpha=$

$=2\sin\frac{7}{2}\alpha\cos\frac{3}{2}\alpha-2\sin\frac{7}{2}\alpha\cos\frac{1}{2}\alpha$

$=-4\sin\frac{7}{2}\alpha\sin\alpha\sin\frac{\alpha}{2}$ (B)

14. $tg200^\circ - 4\cos250^\circ =$

$= tg20^\circ + 4\sin20^\circ =$

$= \frac{\sin20^\circ}{\cos20^\circ} + 4\sin20^\circ =$

$= \frac{\sin20^\circ + 2\sin40^\circ}{\cos20^\circ} =$

$= \frac{\sin20^\circ + \sin40^\circ + \sin40^\circ}{\cos20^\circ} =$

$= \frac{2\sin30^\circ\cos10^\circ + \sin40^\circ}{\cos20^\circ} =$

$= \frac{\cos10^\circ + \cos50^\circ}{\cos20^\circ} = \frac{2\cos30^\circ\cos20^\circ}{\cos20^\circ} = \sqrt{3}$ (B)

15 $\sin200x\cdot\cos199x - \cos200x\cdot\sin199x = 0$

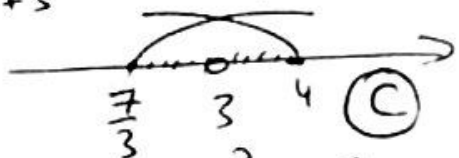
$\sin x = 0 \quad x = \pi n \quad [0; 4\pi]$

$0; \pi; 2\pi; 3\pi; 4\pi$ (B)

16. $y = \sqrt{3x-7} + \frac{\sqrt{4-x}}{x-3}$ $\begin{cases} 3x-7 \geq 0 \\ 4-x \geq 0 \\ x-3 \neq 0 \end{cases}$

$x \geq \frac{7}{3} \quad x \neq 3$

$x \leq 4$



(C)

17. $f(x) = (a+b-4)x^3 + 2x^2 + (b-2)x$

$\begin{cases} a+b-4=0 \\ b-2=0 \end{cases} \quad a=2 \quad b=2$ (A)

$f(x) = 2x^2$

$f(2) = 2\cdot2^2 = 8$

18. $\sqrt[n+1]{\sqrt[n-1]{81}} = \sqrt[4]{9} \quad 9^{\frac{2}{n^2-1}} = 9^{\frac{1}{4}}$ (D)

$\frac{2}{n^2-1} = \frac{1}{4} \quad n=3 \quad 3^2+1=10$

19. $64^x - 15\cdot8^x - 16 = 0 \quad 8^x = -1 \ \emptyset$

$-1 \quad 16 \quad 8^x = 16 \quad x = \frac{4}{3}$ (D)

20. $a=2 \quad \left(25^{\frac{1}{2\log_{49}25}} + 2\log_2\log_2\log_2 a^{2\log_a 4}\right) =$

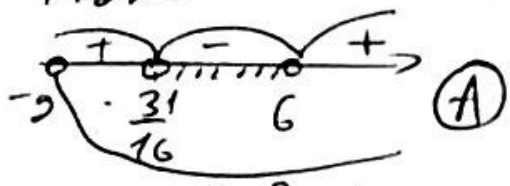
$= 49^{\frac{1}{2}\log_{25}25} + 2\log_2\log_2\log_2 4^{2\log_a 9} = 3+2=5.$

21. $(\log_3(x+2)-3)(\log_3(x+2)+4) < 0$

$\log_3(x+2) = 3 \quad \log_3(x+2) = -4$

$x = 6 \quad x = -2 + \frac{1}{16} = -\frac{31}{16}$

$x+2 > 0$



(A)

22. $S(t) = t^3 - t^2 + 5t + 1$

$S'(t) = 3t^2 - 2t + 5$

$v(3) = 27 - 6 + 5 = 26$ (B)

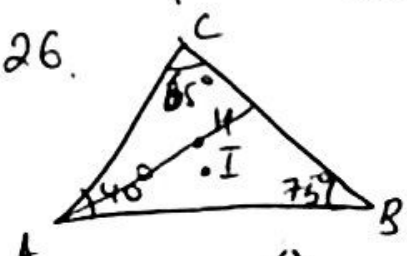
23. $\int_{-5}^{3} |x-1|\,dx = \int_{-5}^{1} (1-x)\,dx + \int_{1}^{3} (x-1)\,dx$

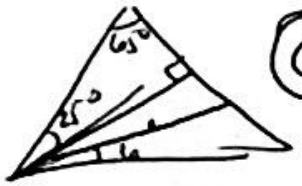
$= x - \frac{x^2}{2}\Big|_{-5}^{1} + \frac{x^2}{2} - x\Big|_{1}^{3} = 20$ (B)

24. 1) 3) A

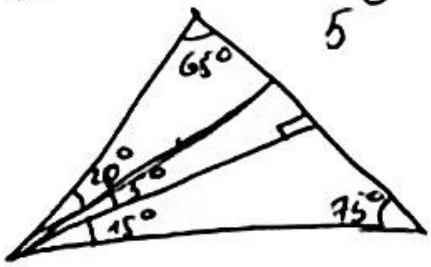
25. $5! = 120$ (B)

26.





(C)



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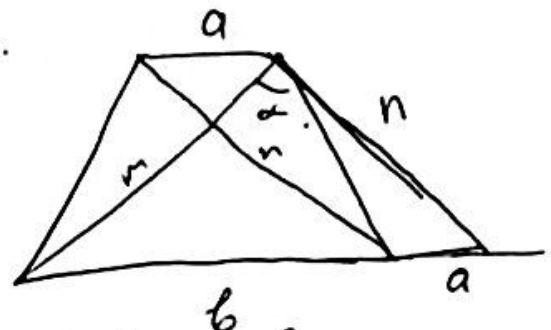


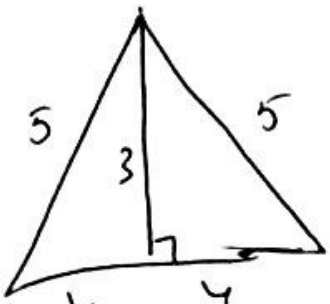
$m^2+n^2=(a+b)^2$

$m^2+n^2-2mn\cos\alpha=(a+b)^2$

$-2mn\cos\alpha=0$

$\cos\alpha=0 \quad \alpha=90^\circ$.

28.



(D)

$R=\frac{a\cdot b\cdot b}{4\cdot\frac{ah}{2}}=\frac{b^2}{2h}=\frac{25}{2\cdot3}=\frac{25}{6}$

29. $A(-4;2)\quad B(6;5)\quad C(1;-4)$

$y=kx+b$

$\begin{cases}2=-4k+b\\5=6k+b\end{cases}\ominus$

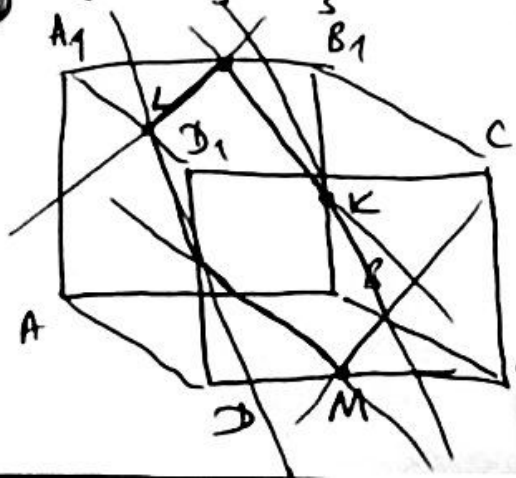
$3=10k \quad k=\frac{3}{10}$

$y=-\frac{10}{3}x+l$.

$-4=-\frac{10}{3}+l \quad l=-\frac{2}{3}$ (B)

$y=-\frac{10}{3}x-\frac{2}{3} \quad 10x+3y+2=0$

30.



(A)

6 burchak.

Variant-11

1. $12+99=111$ (B)

2. $\frac{7}{1+\frac{3}{x-2}} = \frac{7(x-2)}{x+1}$ $x\neq 2$ $x\neq -1$
$2+(-1)=-1$ (B)

3. $xy^2-2y+2y^2-xy = y^2(x+2)-$
$-y(x+2) = (x+2)(y^2-y) = y(y-1)(x+2)$
(B)

4. $\frac{\left(\sqrt[3]{(a^2+4)\cdot\sqrt{1+\frac{4}{a^2}}}-\sqrt[3]{(a^2-4)\sqrt{1-\frac{4}{a^2}}}\right)^2 - \frac{\sqrt[3]{a}}{a}}{\left(\sqrt[3]{\frac{(\sqrt{a^2+4})^3}{a}}-\sqrt[3]{\frac{(\sqrt{a^2-4})^3}{a}}\right)^2 - \frac{\sqrt[3]{a}}{a}} \cdot \frac{\sqrt{a^4-16}-a^2}{\sqrt{a^4-16}-a^2} =$

$= \frac{\left(\frac{\sqrt{a^2+4}-\sqrt{a^2-4}}{\sqrt[3]{a^2}}\right)^2 - \frac{\sqrt[3]{a}}{a}}{\sqrt{a^4-16}-a^2} = \frac{2}{\sqrt[3]{a^2}}\cdot\frac{\sqrt[3]{a}}{a} =$

$= \frac{2\sqrt[3]{a}}{a} - \frac{\sqrt[3]{a}}{a} = \frac{\sqrt[3]{a}}{a}$ (A)

5. $\sqrt{6+\sqrt{6+\sqrt{6+\dots}}} = a$ $\sqrt{6+a}=a$
$6+a=a^2$ $a^2-a-6=0$ $\boxed{a=3}$

$\sqrt{3\cdot\sqrt{3\cdot\sqrt{3\cdot}}} = x$ $\sqrt{3\cdot x}=x$
$3\cdot x = x^2$ $3=x$ (A)

6. $x\cdot\frac{t}{2}=1$ $y\cdot t=1$ $x=2y$
$(x+y)\cdot 18=1$
$3y\cdot 18=1$ $y=\frac{1}{54}$ $x=\frac{1}{27}$
$y\cdot t_1=\frac{2}{3}$ $\frac{1}{54}\cdot t_1=\frac{2}{3}$
$t_1=36$ (A)

7. $x^4-2x^3+x^2-9=0$
$(x^2-x)^2=9$ $x^2-x=3$ $x^2-x=-3$
$x^2-x-3=0$ $x^2-x+3=0$
$a=1$ $b=2$ $\emptyset$
$1+2=3$ (B)

8. $x^2+(k+2)^2x+2k-4=0$
$x_1<2$ $x_2<2$
$(x_1-2)<0$ $(x_2-2)<0$
$(x_1-2)(x_2-2)>0$
$x_1x_2-2(x_1+x_2)+4>0$
$4+2k-4+2(k+2)^2>0$
$4+2k-4+2k^2+8k+8>0$
$2k^2+10k+8>0$
$k^2+5k+4>0$
$(-\infty;-4)\cup(-1;\infty)$
$\boxed{k=1}$ (D)

9. x^7 $|x^2+8x+7|<0$
$\begin{cases} x<0 \\ x\neq -7 \\ x\neq -1 \end{cases}$ $[-8;1]$
$-8;-6;-5;$
$-4;-3;-2$ (A)

10. $\begin{cases} 2\le x\le 18 \\ -2\le y\le 3 \end{cases}$ $\frac{x}{y}$
$\min \to \frac{2}{3}$ $\max \to \frac{2}{-2}=-1$
$(-\infty;-1]\cup[\frac{2}{3};\infty)$ (D)

11. $1;4;7;\dots;46$
$1;7;13;19;25;\dots$ (D)
$S_{16}=\frac{2\cdot 1+15\cdot 6}{2}\cdot 16=736$

12. $800;775;750;\dots;$
$S_n=\frac{2\cdot 800+(n-1)\cdot(-25)}{2}\cdot n=6300$
$n=9$ (B)

13. $\frac{1}{\cos 20^\circ} - 4\cos 40^\circ = \frac{1-4\cos 40^\circ \cdot \cos 20^\circ}{\cos 20^\circ} =$

$= \frac{1-4\cdot\frac{1}{2}(\cos 60^\circ + \cos 20^\circ)}{\cos 20^\circ} = \frac{1-2\left(\frac{1}{2}+\cos 20^\circ\right)}{\cos 20^\circ} =$

$= \frac{1-1-2\cos 20^\circ}{\cos 20^\circ} = -2$ (D)

14. $\operatorname{tg} 20^\circ + \operatorname{tg} 40^\circ + \operatorname{tg} 60^\circ + \ldots + \operatorname{tg} 160^\circ = 0$

$\operatorname{tg} x = -\operatorname{tg} y \quad x+y = 180^\circ$ (A)

15. $\cos\left(x-\frac{\pi}{2}\right)=0 \quad \sin x = 0 \quad x = \pi n$ (C)

16. $f(4x) = 4x+7 \quad f(f(1)) = ?$

$f(x) = x+7 \quad f(1) = 8$

$f(8) = 8+7 = 15$ (A)

17. $5^x - 5^y = 3 \quad x+y = 3$

$5^{2x} + 5^{2y} + 25^x \cdot 5^y - 5^x \cdot 25^y =$

$\left(5^x - 5^y\right)^2 + 2\cdot 5^{x+y} + 5^{x+y}\left(5^x - 5^y\right)$

$3^2 + 2\cdot 5^3 + 5^3 \cdot 3 = 634$ (D)

18. $\lg 2019{,}9 - \lg 0{,}00020199 =$

$= \lg \frac{2019{,}9}{0{,}00020199} = \lg 10^7 = 7$ (D)

19. $4^{\log_4^2(x+2)} + 2(x+2)^{\log_4\sqrt{x+2}} = 8.$

$(x+2)^{\log_4(x+2)} + 2(x+2)^{\log_4\sqrt{x+2}} = 8.$

$a^2 + 2a - 8 = 0 \quad a = -4 \quad a = 2.$

$(x+2)^{\log_4\sqrt{x+2}} = 2.$

$\log_4\sqrt{x+2}\cdot\log_4(x+2) = \log_4 2$

$\frac{1}{2}b^2 = \frac{1}{2} \quad b = \pm 1.$

$\log_4(x+2) = 1 \quad x = 2.$

$\log_4(x+2) = -1 \quad x = -2+\frac{1}{4}$

$-\frac{7}{4}$

$2+\left(-\frac{7}{4}\right) = \frac{1}{4}$ (C)

20. $y = \sqrt{\sin\sqrt{x}} - 6x + \ln 2$

$y'\left(\frac{\pi^2}{4}\right) = ?$

$y' = \frac{1}{2}\sin^{-1}\sqrt{x}\cdot\frac{1}{2\sqrt{x}}\cos\sqrt{x} - 6$

$y'\left(\frac{\pi^2}{4}\right) = -6$ (A)

21. (A)

22. $\int\left(6 - x^2 f(x)\right)dx = x^2 - 5mx + C$

$6 - x^2 f(x) = 2x - 5m.$

$x = -2 \quad f(-2) = 4.$

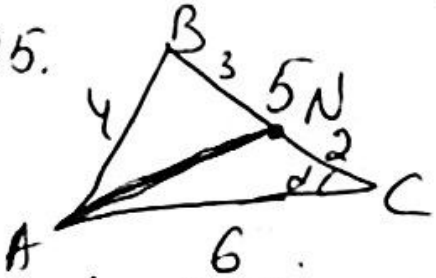
$6 - 4\cdot 4 = -4 - 5m$

$m = 1{,}2$ (C)

23. 2; 3; (A)

24. $6\cdot 5\cdot 4 = 120$ (B)

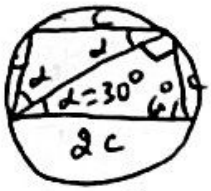
25.



$\begin{cases} AN^2 = 6^2 + 2^2 - 2\cdot 6\cdot 2\cdot\cos\angle \\ 4^2 = 6^2 + 5^2 - 2\cdot 6\cdot 5\cdot\cos\angle \end{cases}$

$AN = \sqrt{22}$ (D)

26.

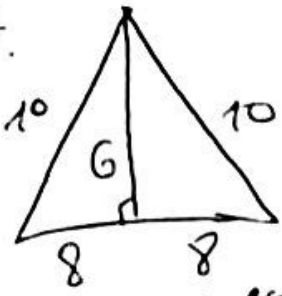


$H = \frac{\sqrt{3}}{2}c$

$2c = 2R \quad c = R.$ (C)

$S = \frac{2c+c}{2} \cdot \frac{\sqrt{3}}{2}c = \frac{3\sqrt{3}}{4}R^2$

27.



$R = \frac{10 \cdot 10 \cdot 16}{2 \cdot 16 \cdot 6} = \frac{25}{3}$ (B)

28. $(2;0)$ $(0;-6)$

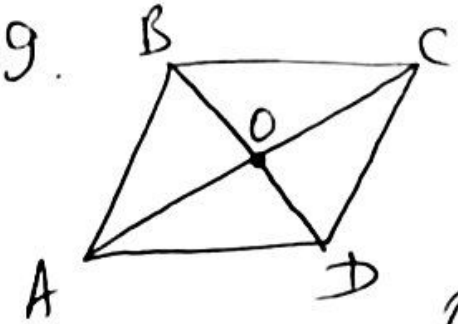
$y = kx + b$ $\quad k_1 \cdot k_2 = -1$

$0 = 2k + b$

$-6 = b \quad k_1 = 3 \quad k_2 = -\frac{1}{3}$

$y = -\frac{1}{3}x \quad x + 3y = 0$ (C)

29.



$\overline{AC} = k \cdot \overline{AO}$ (C)

$\overline{AC} = 2 \cdot \overline{AO} \quad k = 2$

30. $f = 2 \quad \alpha = 60°$. (C)

$r = 1$. $S_{4oN} = \frac{6 \cdot \frac{2\sqrt{3}}{3} \cdot 2}{2} = 4\sqrt{3}$.

$a = 2 \cdot 1 \cdot \operatorname{tg} 30° = \frac{2\sqrt{3}}{3}$.

$S_6 = 6 \cdot 1^2 \cdot \operatorname{tg} 30° = 2\sqrt{3} \quad S_1 = 2\sqrt{3} + 4\sqrt{3} = 6\sqrt{3}$.

Variant-12

1. $\begin{cases} 4a = 3b \\ \text{EKUB}(a;b) = 6 \end{cases}$ $\frac{a}{b} = \frac{3}{4}$ $a = 18$ $b = 24$ (A)

$18 + 24 = 42$

2. $\frac{2}{3x} = -\frac{3}{4y} = \frac{4}{5z}$ $y < 0$

(C) $10z = 12x$ $z > x > y$

3. $a^2 - b^2 + 8a - 2b + 15 =$

$a^2 + 8a - (b^2 + 2b - 15) =$

$(b+5)(b-3)$

$= (a - b - 5)(a + b - 3)$ (C)

4. $\sqrt{5}a - 3b = 2a - \sqrt{5}b - 15$

$a = -b$ (A)

$-3b = -2b - 15$

$b = 15$ $a = -15$

5. $a^2 - 1 = 8^{17}(2^{49} + 1)$

$a^2 - 1 = 2^{51}(2^{49} + 1)$

$a^2 - 1 = 2^{100} + 2^{51}$

$a^2 = 2^{100} + 2^{51} + 1$

$a = 2^{50} + 1$

$\frac{2^{50} + 1 - 1}{2^{48}} = 2^2$ (B)

6. $v = \frac{s}{t}$ $v_1 = \frac{5}{15} = \frac{1}{3}$

$v_2 = \frac{3}{55}$;

$\frac{\frac{3}{55}}{\frac{1}{3}} \cdot 100\% = \frac{9}{55} \cdot 100 = \frac{180}{11}$ (A)

(7) $x\sqrt{x} - 8\sqrt{x} = 7 \quad x - \sqrt{x}$

$x\sqrt{x} - \sqrt{x} = 7 + 7\sqrt{x}$

$\sqrt{x}(\sqrt{x} - 1)(\sqrt{x} + 1) = 7(1 + \sqrt{x})$

$x - \sqrt{x} = 7$ (C)

8. $n \cdot |13x - 1| = 17n - n^2$

$13x - 1 = 17 - n$

$x = \frac{18 - n}{13} > 0$

$n < 18$ (B)

9. $||x| - 2| \le 1$

$-1 \le |x| - 2 \le 1$

$1 \le |x| \le 3$ (D)

$[-3; -1] \cup [1; 3]$

10. $S_5 = 100$

$x + x + 1 + x + 2 + x + 3 + x + 4 = 100$

$x = 18$ (C)

11. $\frac{(\sin^2\alpha + \operatorname{tg}^2\alpha + 1)(\cos^2\alpha + 1 - \operatorname{ctg}^2\alpha)}{(\cos^2\alpha + \operatorname{ctg}^2\alpha + 1)(\sin^2\alpha + \operatorname{tg}^2\alpha - 1)} =$

$\frac{\left(\sin^2\alpha + \frac{1}{\cos^2\alpha}\right)\left(\cos^2\alpha + \frac{\sin^2\alpha - \cos^2\alpha}{\sin^2\alpha}\right)}{\left(\cos^2\alpha + \frac{1}{\sin^2\alpha}\right)\left(\sin^2\alpha + \frac{\sin^2\alpha - \cos^2\alpha}{\cos^2\alpha}\right)} =$

$= \frac{\sin^2\alpha}{\cos^2\alpha} \cdot \frac{\cos^2\alpha}{\sin^2\alpha} = 1$ (B)

12. $\sin x + \cos x = 1{,}04$

$\sin x > 0 \quad \cos x > 0$ (B)

13. $\sin 2x + 2\sin x = \cos x + 1$

$2\sin x(\cos x + 1) = \cos x + 1$

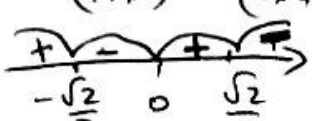
$\sin x = 0 \quad \cos x = -1$

$x = \pi n; \; n \in \mathbb{Z}$

$-\pi; 0; \pi$ (C)

14. $y = \frac{3x^2}{(1+x^2)(4x^2+1)} = \frac{1}{1+x^2} - \frac{1}{4x^2+1}$

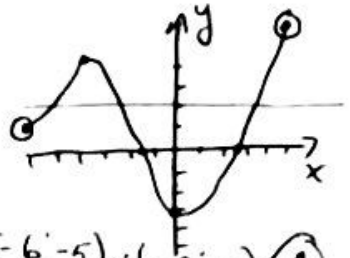
$y' = \frac{-2x}{(1+x^2)^2} + \frac{8x}{(4x^2+1)^2} = 0 \quad x = \pm\frac{\sqrt{2}}{2} \quad x = 0$



$y\left(\frac{\sqrt{2}}{2}\right) = \frac{1}{3}$ (C)

15. $[-6; 5]$

$f(x) < 2$



$[-6; -5) \cup (-2; 4)$ (A)

16. $3^{-x} = a \quad 2^x = b$

$216^{-x} = 6^{-3x} =$

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

$(3^{-x})^3 (6^x)^{-3} =$

$= a^3 b^{-3}$ (D)

17. $\sqrt{(\log_{16}24 - \log_{16}6)\cdot\log_{16}4} =$

$= \sqrt{\log_{16}4 \cdot \log_{16}4} = \log_{16}4 = \frac{1}{2}$ (D)

18. $y = \ln(x^2-2x-3) < 0$

$x^2-2x-3 < 1$

$\begin{cases} x^2-2x-4<0 \\ x^2-2x-3>0 \end{cases}$ (C)

19. $\ln(x+1) \geq 2 \quad x+1 \geq e^2$

(C) $x \geq e^2-1$

$x = 7$

20. $y = e^{-x} - 2x^7$

$y' = -e^{-x} - 14x^6$ (A)

21. $f(x) = \frac{2}{3}x^3 - ax^2 + 7ax + 5$

$f'(x) = 2x^2 - 2ax + 7a > 0$

$D < 0 \quad 4a^2 - 4\cdot 7a < 0$

$4a(a-14) < 0$

$(0;14)$ (D)

22. $\int_1^a (2x+1)\,dx = 4$

$x^2 + x \Big|_1^a = 4$

$a^2 + a - 1 - 1 = 4$

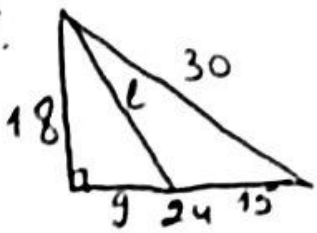
$a^2 + a - 6 = 0$ (C)

$-3 \quad 2 \quad a > 0$

23. g) 3) (C)

24. $C_{22}^3 = \frac{22!}{3!\,19!} = \frac{20\cdot 21\cdot 22}{6} = 1540$ (A)

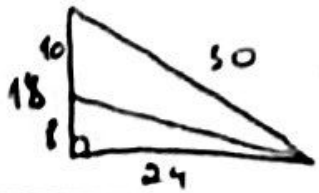
25.



$l^2 = 18\,30 - 9\cdot 15$

$l = \sqrt{405} = 9\sqrt{5}$

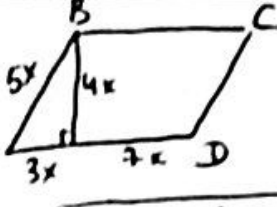
(D)



$l^2 = 30\cdot 24 - 8\,10$

$l = \sqrt{640} = 8\sqrt{10}$

26.



$\frac{AC}{BD} = ?$

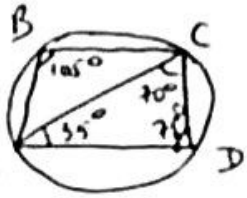
$\cos\alpha = \frac{3}{5}$

$AC = \sqrt{100x^2 + 25x^2 + 2\cdot 10x\cdot 5x\cdot\frac{3}{5}} = \sqrt{185}\,x$

$BD = \sqrt{100x^2 + 25x^2 - 2\cdot 10\cdot 5x\cdot\frac{3}{5}} = \sqrt{65}\,x$

$\frac{AC}{BD} = \frac{\sqrt{37}}{\sqrt{13}}$ (D)

27.



$\angle ABD = \angle ACD = 70^\circ$

(C)

28. $A(8;-4) \quad y = x-4$

$B(0;-4) \quad 8+x = 0+8 \quad x = 0$

$C(8;4) \quad -4+y = -4+4 \quad y = 4$

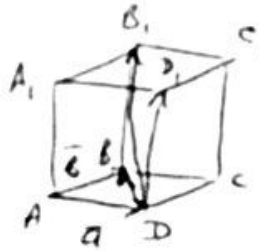
$D(x;y)$

(A)

29 $ABCDA_1B_1C_1D_1 \quad \vec{AD} = \vec{a} \quad \vec{AB} = \vec{b}$

$\vec{AA_1} = \vec{c} \quad \vec{DB_1} = \vec{DB} + \vec{DD_1}$

$\vec{AC} = \vec{AD} + \vec{AB} = \vec{a} + \vec{b}$ (C)



$\vec{DB} = \vec{b} - \vec{a}$

$\vec{DD_1} = \vec{AA_1} = \vec{c}$

$\vec{DB_1} = \vec{b} - \vec{a} + \vec{c}$

30. $\frac{\sqrt{3}}{2}a = 12 \quad a = \frac{24}{\sqrt{3}}$

$S = 3\cdot a\cdot H = 3\cdot\frac{24}{\sqrt{3}}\cdot 4 = 96\sqrt{3}$

(B)

Variant-13

1. 93mo7n :8 :6
$n=2$
93mo72
$m=0;3;6;9$ 18 (C)

2. $3<a<7$ $3<b<10$
$\frac{1+\frac{a}{b}}{1+\frac{b}{a}} : \frac{\frac{b+a}{b}}{\frac{a+b}{a}} = \frac{a}{b} = \frac{6}{4} = \frac{3}{2}$ (A)

3. $x^2+\frac{2}{x}=3$ $x\neq 1$ $x^2+x=?$
$x^3+2=3x$ $x^3-3x+2=0$

x^3-3x+2	$x-1$
x^3-3x+2	x^2+x-2
0	

(C)
$(x-1)(x^2+x-2)=0$ $x^2+x=2$

4. $|a|\neq|b|\neq|c|$
$\frac{a}{b+c}+\frac{b}{a+c}+\frac{c}{a+b}=-2$ $(\times a)(\times b)(\times c)$

$\begin{cases} \frac{a^2}{b+c}+\frac{ab}{a+c}+\frac{ac}{a+b}=-2a \\ \frac{ab}{b+c}+\frac{b^2}{a+c}+\frac{bc}{a+b}=-2b \\ \frac{ac}{b+c}+\frac{bc}{a+c}+\frac{c^2}{a+b}=-2c \end{cases}$ (+)

$\frac{a^2}{b+c}+\frac{b^2}{a+c}+\frac{c^2}{a+b}+a+b+c=-2a-2b-2c$
$\frac{a^2}{b+c}+\frac{b^2}{a+c}+\frac{c^2}{a+b}=-3(a+b+c)$ (B)
$-3(a+b+c):(a+b+c)=-3$

5. $\sqrt{30+\sqrt{30+\sqrt{30+\dots}}}=a$
$\sqrt{30+a}=a$ $30+a=a^2$ $a=6$.
$\sqrt{6+\sqrt{6+\sqrt{6+\dots}}}=x$ $\sqrt{6+x}=x$ (A)
$6+x=x^2$ $x^2-x-6=0$ $x=3$

6. $x+y+z=42,8$
$y=0,8x$
$z=0,425y=0,8\cdot0,425x$
$x+0,8x+0,425\cdot0,8x=42,8$
$x=20$
$z=0,8\cdot0,425\cdot20$
$z=6,8$

7. $\sqrt{x+16}-\sqrt{x+8}=2$
$\sqrt{x+16}=2+\sqrt{x+8}$
$x+16=4+4\sqrt{x+8}+x+8$ (B)
$4=4\sqrt{x+8}$
$x+8=1$ $x=-7$

8. $x^2-6x+3=0$
$\frac{a^3b^2-a^2b^3}{a^2-b^2}=\frac{a^2b^2(a-b)}{(a-b)(a+b)}=$
$=\frac{a^2b^2}{a+b}=\frac{9}{6}$ (B)

9. $\begin{cases} (x-3)^4\cdot(y-5)=1 \\ (x-3)^5\cdot(y-5)^4=1 \end{cases}$
$\frac{y-5}{y-3}=?$
$(x-3)^{11}=1$
$x=4$
$\frac{4-5}{6-3}=-\frac{1}{3}$ (A)

$y-5=\frac{1}{(x-3)^4}$
$(x-3)^5\cdot\frac{1}{(x-3)^{16}}=1$
$\frac{1}{(x-3)^{11}}=1$
$y-5=1$ $y=6$.

10. $\left|\frac{4-2x}{1+3x}\right|>0$
$4-2x\neq0$ $x\neq2$
$1+3x\neq0$ $x\neq-\frac{1}{3}$
(C)

11. $a_1=-3,1$ $a_{n+1}=a_n+0,9$ $S_{19}=?$
$a_2=a_1+0,9=-2,2$ $d=0,9$.
$S_{19}=\frac{a_1+a_{19}}{2}\cdot19=(a_1+9d)\cdot19=$
$=(-3,1+9\cdot0,9)\cdot19=95$ (B)

12. $tg3x - tg2x - tgx =$

$= \frac{\sin 3x}{\cos 3x} - \frac{\sin x}{\cos x} - \frac{\sin 2x}{\cos 2x} =$

$= \frac{\sin 2x}{\cos x \cos 3x} - \frac{\sin 2x}{\cos 2x} =$

$= \frac{\sin 2x\,(\cos 2x - \cos x \cdot \cos 3x)}{\cos x \cos 2x \cos 3x} =$

$= \frac{\sin 2x\,(\cos 2x - \frac{1}{2}(\cos 4x + \cos 2x))}{\cos x \cos 2x \cos 3x} =$

$= \frac{\sin 2x \cdot \frac{1}{2}(\cos 2x - \cos 4x)}{\cos x \cos 2x \cos 3x} =$ (A)

$= \frac{\sin 2x \cdot \sin 3x \sin x}{\cos x \cos 2x \cos 3x} = tgx\,tg2x\,tg3x$

13. $\left((\cos\alpha - \cos\beta)^2 + (\sin\alpha - \sin\beta)^2\right) : \left(4\sin^2\frac{\alpha-\beta}{2}\right) - 3$

$\left(2 - 2(\cos\alpha\cos\beta + \sin\alpha\sin\beta)\right) : \left(2(1-\cos(\alpha-\beta))\right) - 3 =$

(C) $= \left(2(1-\cos(\alpha-\beta))\right) : \left(2(1-\cos(\alpha-\beta))\right) - 3 = 1 - 3 = -2$

14. $2\arcsin\left(-\frac{\sqrt{3}}{2}\right) + \operatorname{arcctg}(-1) + \arccos\frac{1}{\sqrt{2}} + \frac{1}{2}\arccos(-1)$

$2\cdot\left(-\frac{\pi}{3}\right) + \frac{3\pi}{4} + \frac{\pi}{4} + \frac{1}{2}\cdot\pi = \frac{5\pi}{6}$ (C)

15. $\sqrt{4-x^2}\,(\sin^7 x - \cos^7 x) = 0$

$4 - x^2 \geq 0 \quad [-2;2] \qquad \sin^7 x = \cos^7 x$

$x = \frac{\pi}{4} + \pi n\,;\ n \in \mathbb{Z} \qquad tgx = 1$

$n = 0 \quad \frac{\pi}{4}$ (A)

16. $f(\varphi(x)) = \frac{x+2}{x-3} \qquad \varphi(x) = 2x - 1$

$y = \frac{\varphi(x)+1}{2} \qquad f(\varphi(y)) = \frac{\frac{\varphi(x)+1}{2} + 2}{\frac{\varphi(x)+1}{2} - 3}$

$f(\varphi(x)) = \frac{\varphi(x)+5}{\varphi(x)-5} \qquad f(x) = \frac{x+5}{x-5}$ (C)

17. $2^x = 152 \qquad |x-8| + |x-6| = 8 - x + x - 6 = 2$

$128 < 2^x < 256$ (A)

$2^7 < 2^x < 2^8$

$7 < x < 8.$

(A)

18. $\log_{30} 3 = a \qquad \log_{30} 5 = b \qquad \log_{30} 64 =$

$= \log_{30} 2^6 = 6\log_{30} 2 = 6\log_{30}\frac{30}{15} =$

$= 6(1 - \log_{30} 15) = 6(1 - a - b)$ (C)

19. $\log_{0,5}(2x-7) \leq \log_{0,5}(10-x) + 1$

$\log_{0,5}(2x-7) \leq \log_{0,5} 0{,}5(10-x)$

$\begin{cases} 2x - 7 \geq 0{,}5(10-x) \\ 10 - x > 0. \end{cases} \qquad \begin{cases} x \geq 4{,}8 \\ x < 10. \end{cases}$

$5; 6; 7; 8; 9$ (C)

20. $f(3x+2) = 2x^2 - 5x + 8.$

$3x + 2 = a \qquad x = \frac{a-2}{3}.$

$f(a) = 2\left(\frac{a-2}{3}\right)^2 - 5\cdot\left(\frac{a-2}{3}\right) + 8$

$f(x) = \frac{2}{9}x^2 - \frac{23}{9}x + \frac{110}{9}.$

$f'(x) = \frac{4}{9}x - \frac{23}{9}$ (C)

21. $g(x) = 2x - 3$

$f(g(x)) = 3x^2 - 8x + 13$

$x = \frac{g(x)+3}{2}$

$f(g(x)) = 3\cdot\left(\frac{g(x)+3}{2}\right)^2 - 8\,\frac{g(x)+3}{2} + \dots$

$f(g(x)) = \frac{3}{4}(g(x))^2 + \frac{1}{2}g(x) + \frac{31}{4}$

$f'(g(x)) = \frac{3}{2}(g(x)) + \frac{1}{2} =$

$= \frac{3}{2}(2x-3) + \frac{1}{2} = 3x - \frac{9}{2} + \frac{1}{2}$

$= 3x - 4$ (B)

22. $\left(\int (x^2 - 5x) f(x)\,dx\right)' = (x^2 - 10x + c)'$

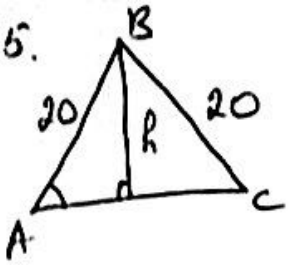
$(x^2 - 5x)\cdot f(x) = 2x - 10$

$f(x) = \frac{2(x-5)}{x(x-5)} = \frac{2}{x}$ (B)

23. 1) 3) (A)

24. $A = \{1; 3; 5; 6; 8; 9; 10; 11\}$

$B = \{5; 6; 7; 8; 10; 11\} \qquad A \cup B = \{1; 3; 5; 6; 7; 8; 9; 10; 11\}$

25. 

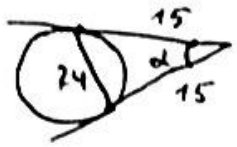
$\cos A = \frac{2\sqrt{6}}{5}$

$\sin A = \frac{1}{5} = \frac{h}{20}$ $h = 4$

(B)

26. $2(a+b) = 40$ $\begin{cases} a+b=20 \\ a-b=10 \end{cases}$ (C)

$a = 15$ $b = 5$

27. 

$24^2 = 15^2 + 15^2 - 2 \cdot 15^2 \cos\alpha$

$\cos\alpha = -\frac{7}{25}$

$24^2 = R^2 + R^2 + 2R^2 \cdot \frac{7}{25}$

$R = 15$ (C)

28. $A(-4;2)$ $B(6;5)$ $C(1;-4)$

$\frac{x-6}{6-1} = \frac{y-5}{5+4}$ $9x - 5y - 29 = 0$.

$k_1 \cdot k_2 = -1$ $k_1 = \frac{9}{5}$ $k_2 = -\frac{5}{9}$.

$A(-4;2)$ $y = -\frac{5}{9}x + b$.

$2 = -\frac{5}{9} \cdot (-4) + b$ $b = -\frac{2}{9}$

$y = -\frac{5}{9}x - \frac{2}{9}$ $5x + 9y + 2 = 0$ (C).

29. $\vec{a}(2;-1;1)$

$|\vec{a}|_{vol} = \sqrt{(-1)^2 + 1^2} = \sqrt{2}$ (C)

30. 

$\frac{V}{V_1} = \left(\frac{4h}{h}\right)^3$ $V_1 = \frac{V}{64}$.

$\frac{V}{V_2} = \left(\frac{4h}{2h}\right)^3$ $V_2 = \frac{V}{8}$

$\frac{V}{V_3} = \left(\frac{4h}{3h}\right)^3$ $V_3 = \frac{27}{64}V$.

$V_2 - V_1 = \frac{V}{8} - \frac{V}{64} = \frac{7V}{64}$ (A)

Variant - 14.

1. $a = 6c_1 + 2$
$b = 6c_2 + 4$ (A)
$a+b = 6(c_1+c_2)+6$
$a+b = 6(c_1+c_2+1)$

2. $\left(\frac{\sqrt{7}+\sqrt{5}}{\sqrt{3}+1} \cdot \frac{\sqrt{7}-\sqrt{5}}{\sqrt{3}-1}\right) : \left(\frac{3\sqrt{3}}{\frac{1}{\sqrt{3}}} - \frac{\sqrt{3}}{9} + \frac{\frac{\sqrt{3}}{1}}{\sqrt{27}}\right)$ (C)

$= \frac{2}{2} : \frac{3\sqrt{3}-\sqrt{3}+\sqrt{3}}{9} = 1 : \frac{3\sqrt{3}}{9} = \frac{9}{3\sqrt{3}} = \sqrt{3}$

3. $3^{18} = x+1$ $3^{18}-1 = x$ $9^9-1 = x$.
$729^3 - 1 = x$ $(728)(729^2+729+1) = x$
13,14 (B)

4. $a = \sqrt{2}-1$ $b = \sqrt{2}+1$ $a \cdot b = 1$.
$a+b = 2\sqrt{2}$
$a^3+b^3 = (a+b)^3 - 3ab(a+b) =$ (D)
$= 8 \cdot 2\sqrt{2} - 3 \cdot 2\sqrt{2} = 10\sqrt{2}$

5. $\frac{256m^4-1}{256m^4-128m^3+32m^2-8m+1} =$

$= \frac{(4m)^4-1^4}{256m^4-128m^3+16m^2+16m^2-8m+1} =$

$= \frac{(4m-1)(4m+1)(16m^2+1)}{16m^2(16m^2-8m+1)+16m^2-8m+1} =$ (B)

$= \frac{(4m-1)(4m+1)(16m^2+1)}{(16m^2-8m+1)(16m^2+1)} = \frac{4m+1}{4m-1}$

6. $a_1 = 37$ $d = 1,5$ $a_n = 2b_n$.
$b_1 = 11$ $d = 1,5$ $a_1+(n-1)\cdot d = 2(b_1+(n-1)d)$
$37+1,5(n-1) = 22+3(n-1)$ (C)
$15 = 1,5(n-1)$ $n = 11$, $n-1 = 10$.

7. $\frac{x}{x^2-4} + \frac{x-2}{x^2+2x} = \frac{x+2}{x^2-2x}$ $2x+(x-2)(x-4) = x+2$
(A) $x \neq 2$ $x = 3$

8. $\sqrt{21-\sqrt{21+x}} = x$
$21-\sqrt{21+x} = x^2$.
$21-x^2 = \sqrt{21+x}$
$441-42x^2+x^4 = 21+x$.
$x^4-42x^2-x+420 = 0$.
$x = 4$. (B)

9. $\begin{cases} 2ax = x^{1-2b^3}+9 & 2ax-9 = x^{1-2b^3} \\ 3cx = x^{2b^3-1}-5 & 3cx = \frac{1}{2ax-9}-5 \end{cases}$
$c = \frac{46-10ax}{3x(2ax-9)}$ (A)

10. $\frac{5}{|x+2|+2} < |x+2|-2$.
$5 < (x+2)^2-4$. $(x+2)^2 > 9$
$(x+2-3)(x+2+3) > 0$
$(x-1)(x+5) > 0$
$(-\infty;-5) \cup (1;\infty)$.
(D) $-5;-4;-3;-2;-1;0;1$

11. $a_6+a_{10} = 18$ $a_9+a_{11} = 38$. (D)
$S_{15} = \frac{a_1+a_{15}}{2} \cdot 15 = \frac{18}{2} \cdot 15 = 135$

12. $\begin{cases} \frac{b_1}{1-q} = 3 \\ \frac{b_1^3}{1-q^3} = 81 \end{cases}$ (:) $b_1 = 3(1-q)$
$\frac{27(1-q)^3}{1-q^3} = 81$.
$(1-q)^3 = 3(1-q^3)$ $q = -2$
$\boxed{q = -\frac{1}{2}}$ $q = 1$. (A)

13. $2+\operatorname{tg}\alpha\cdot\operatorname{tg}\beta+(\operatorname{tg}\alpha+\operatorname{tg}\beta)\operatorname{ctg}(\alpha+\beta) =$
$= 2+\operatorname{tg}\alpha\cdot\operatorname{tg}\beta+(\operatorname{tg}\alpha+\operatorname{tg}\beta)\cdot\frac{1-\operatorname{tg}\alpha\operatorname{tg}\beta}{\operatorname{tg}\alpha+\operatorname{tg}\beta} = 3$ (A)

14. $\sin x = \frac{1}{2}$ $\cos x = \frac{\sqrt{3}}{2}$ (C)

$6{,}8 + 2\cos^2 x = 6{,}8 + 2\cdot\frac{3}{4} = 8{,}3$

15. $\cos(x+\pi k) = \cos x$

$\cos(x+\pi k) - \cos x = 0$.

$-2\sin\frac{x+\pi k-x}{2}\sin\frac{x+\pi k+x}{2} = 0$

$\sin\frac{\pi}{2}k = 0$ $\frac{\pi}{2}k = \pi n$.

$k = 2n$ (A)

16. $f(x) = \frac{7\cdot 2^{2x} + 5\cdot 2^{-2x}}{2}$

$g(x) = \frac{7\cdot 2^{2x} - 5\cdot 2^{-2x}}{2}$

$f^2(x) - g^2(x) = \left(\frac{7\cdot 2^{2x} + 5\cdot 2^{-2x} + 7\cdot 2^{2x} - 5\cdot 2^{-2x}}{2}\right)\cdot$

$\left(\frac{7\cdot 2^{2x} + 5\cdot 2^{-2x} - 7\cdot 2^{2x} + 5\cdot 2^{-2x}}{2}\right) =$

$7\cdot 2^{2x}\cdot 5\cdot 2^{-2x} = 35$ (B)

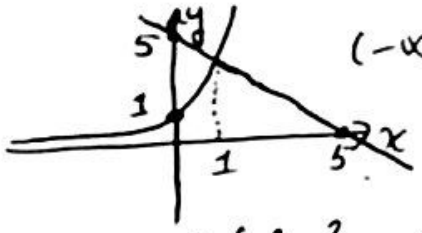
17. $6^x - 6^{-x} = 6$ $(6^x - 6)\cdot 6^x = (a-6)\cdot a =$

$6^x = a$ $= a^2 - 6a = 1$

$a - \frac{1}{a} = 6$ $a^2 - 6a - 1 = 0$. (A)

$a^2 - 6a = 1$

18. $4^x \le 5 - x$.



$(-\infty; 1]$ (A)

19. $a = \frac{1}{6}\left(\log_2^3 3 - \log_2^3 6 - \log_2^3 12 + \log_2^3 24\right)$

$\log_2 3 = x$ $\log_2 6 = x+1$ $\log_2 12 = x+2$

$\log_2 24 = 3+x$ (B)

$a = \frac{1}{6}\left(x^3 - (x+1)^3 - (x+2)^3 + (x+3)^3\right)$

$a = 2x+3 = 2\log_2 3 + 3$ $2^{2\log_2 3 + 3} = 8\cdot 9 = 72$.

20. $3^{\log_3^2 x} + x^{\log_3 x} = 162$.

$3^{\log_3 x\cdot\log_3 x} = x^{\log_3 x}$

$2\cdot x^{\log_3 x} = 162$ $x^{\log_3 x} = 81$

$\log_3 x\cdot\log_3 x = 4$ $\log_3 x = 2$

$\log_3 x = -2$ $x = 9$ $x = \frac{1}{9}$

$9^4\cdot\frac{1}{9^4} = 1$ (D)

21. $\log_{100} x^2 + \lg^2 x < 6$.

$2\cdot\frac{1}{2}\lg x + \lg^2 x < 6$.

$\lg^2 x + \lg x - 6 < 0$.

$\lg x = -3$ $\lg x = 2$.

$x = 10^{-3}$ $x = 10^2$.

$\frac{1}{1000}$ 100

$\left(\frac{1}{1000}; 100\right)$ (C)

22. $\frac{1+99}{2}\cdot 99 = 4950$.

$f^2(x)$ $\frac{1}{f(x)}$ $x = 10$

$2\cdot f(x)\cdot f'(x)$ | $-\frac{1}{f^2(x)}\cdot f'(x)$

$2\cdot f(10)\cdot f'(10) = 4$ $-\frac{f'(10)}{f^2(10)} = -2$.

$f'(10) = 2$.

23. $f(x) = \frac{x^2}{x^3+1}$ $\left(\sqrt[3]{e-1}; 2\right)$

$f(x) = \frac{3x^2}{3(x^3+1)}$

$F(x) = \frac{1}{3}\ln|x^3+1| + C$.

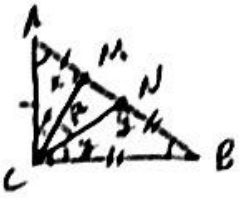
$2 = \frac{1}{3}\ln|e-1+1| + C$.

$C = 2 - \frac{1}{3} = \frac{5}{3}$ (A)

$F(x) = \frac{1}{3}\ln(x^3+1) + \frac{5}{3}$.

24. (D)

25. (D) $|2x-3|=-4$ $\varnothing$

26. 

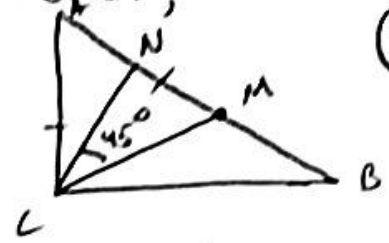
$x+\beta+y=90^\circ$

$2x+2y+2\alpha=120^\circ+120^\circ$

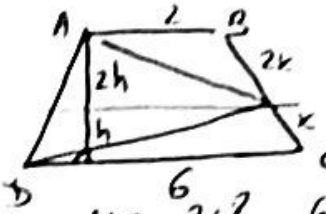
$x+y=135^\circ$.

$\beta=45^\circ$.

Demak,



(D)

27. 

$\frac{2+6}{2}\cdot 3h=48$

$h=4$

$48-\frac{2\cdot 8}{2}-\frac{6\cdot 4}{2}=28$.

28. $A(3;0)$ $B(-1;2)$ $y=x+2$.

$(x;x+2)$.

$(x-3)^2+(x+2)^2=(x+1)^2+(x+2-2)^2$

(A) $x=3$ $y=5$. $R=5$.

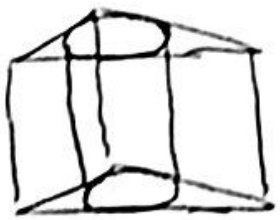
$(x-3)^2+(y-5)^2=25$.

29. $\begin{cases}2x+5y=3\\3x+4y=2\end{cases}$ $M(0;4)$

$x=-\frac{2}{7}$ $y=\frac{5}{7}$

$\frac{x+\frac{2}{7}}{-\frac{2}{7}-0}=\frac{y-\frac{5}{7}}{\frac{5}{7}-4}$

$23x-2y+8=0$ (A)

30. 

$a=2\sqrt{3}$

$r=\frac{\sqrt{3}}{6}\cdot 2\sqrt{3}=1$.

$H=4$.

$S_t=2\pi r^2+2\pi rH=$

$=2\pi+2\pi\cdot 4=10\pi$

Variant-15 (A)

1. $\overline{72x5y}$ 36
$4 \wedge 9$
$y=2$ $y=6$
$x=2$ $x=7$ (A)

2. $\frac{a^2-ac^2+2c^2-4}{a^2+2a+2c^2-c^4} - \frac{a^2-4a+4}{a^2+ac^2-2a-2c^2} =$

$\frac{(a-2)(a+2)+c^2(2-a)}{(a-c^2)(a+c^2)+2(a+c^2)} - \frac{(a-2)^2}{a(a+c^2)-2(a+c^2)} =$

$= \frac{(a-2)(a+2-c^2)}{(a+c^2)(a-c^2+2)} - \frac{(a-2)^2}{(a+c^2)(a-2)} =$

$= \frac{a-2}{a+c^2} - \frac{a-2}{a+c^2} = 0$ (A)

3. $\frac{a}{b} = \frac{c}{d} = \frac{e}{f} = \frac{3}{4}$ $\frac{a \cdot c \cdot e}{b \cdot d \cdot f} = \left(\frac{3}{4}\right)^3$ (B)

4. $\sqrt[5]{b^5} - \sqrt[4]{b^4} + \sqrt[6]{b^6} - \sqrt[7]{b^7}$ $b<0$
$b - |b| + |b| - b = 0$ (B)

5. $\sqrt{a+\sqrt{a+\sqrt{a+\ldots}}} = 2$ $\sqrt{a+2} = 2$
$a=2$ $\sqrt{2\cdot\sqrt{2\cdot\sqrt{2\ldots}}} = x$ $\sqrt{2\cdot x} = 2$
$x=2$ (A)

6. $\frac{300-150}{3} + 300 = 350$ (C)

7. $2x^2 - (2\sqrt{3}+3\sqrt{2})x + \sqrt{6}+2 = 0.$
$x^2 - \frac{2\sqrt{3}+3\sqrt{2}}{2}x + \frac{\sqrt{6}+2}{2} = 0$
$x_1 = \frac{\sqrt{2}}{2}$ $x_2 = \sqrt{3}+\sqrt{2}$ (A)

8. $\frac{1}{x+1} = 1-k$ $\frac{1}{1-k} - 1 = k$
$x<0$ $\frac{k}{1-k} < 0$ $(0;1)$ (A)

9. $\frac{1}{4} < \frac{3}{b} < \frac{1}{2}$ $\frac{1}{6} < \frac{2}{a} < \frac{1}{3}$
$\frac{3}{12} < \frac{3}{b} < \frac{3}{6}$ $\frac{2}{12} < \frac{2}{a} < \frac{2}{6}$
$6 < b < 12$ $6 < a < 12$

$-6 < a-b < 6$ -5 (A)

10. $2x^2+4x-4 > a$ $2x^2+4x-4-a > 0$
$D<0$ $16-4\cdot2\cdot(-4-a) < 0.$
$2+4+a<0$ $a<-6$ (A)
$a=-7$

11. $d \neq 0$ $a_4+\ldots+a_{14} = 99$ $a_n = 9$
(B) $\frac{a_4+a_{14}}{2}\cdot 11 = 99$ $a_9 = 9$ $n=?$ $n=9$

12. $7\sin^2 x - 1 + 7\cos^2 x = 7-1 = 6$
(A)

13. $\cos 15\alpha + \cos 13\alpha + \cos 11\alpha + \cos 9\alpha =$
$= 2\cos 12\alpha \cos 3\alpha + 2\cos 12\alpha \cos\alpha =$
$= 2\cos 12\alpha(\cos 3\alpha + \cos\alpha) =$
$= 2\cos 12\alpha \cdot 2\cos 2\alpha \cos\alpha$ (B)

14. $ctg\,\alpha = \frac{1}{5}$ $tg\,3\alpha = \frac{3tg\alpha - tg^3\alpha}{1-3tg^2\alpha}$
(A) $tg\,\alpha = 5$ $tg\,3\alpha = \frac{3\cdot5-5^3}{1-3\cdot5^2} = \frac{55}{37}$

15. $2\cos\left(2x+\frac{\pi}{9}\right) + \sqrt{3} = 0$
$\cos\left(2x+\frac{\pi}{9}\right) = -\frac{\sqrt{3}}{2}$ (A)
$2x + \frac{\pi}{9} = \frac{5\pi}{6} + 2\pi n$ $x = \frac{13\pi}{36} + \pi n.$
$2x + \frac{\pi}{9} = -\frac{5\pi}{6} + 2\pi n$ $x = -\frac{17\pi}{36} + \pi n$

16. $y = 50x+79$ $k=50.$
$y = 50x - 4{,}7$ $y = kx - 4{,}7$
$(0,1;0,3)$ (B)

17. $y = \frac{\sin x(ctg x+1) + \cos x\cdot(tg x+1)}{2} =$
$= \frac{\cos x + \sin x + \cos x + \sin x}{2} = \sin x + \cos x$
$\sin x \neq 0 \Rightarrow \cos x \neq \pm1$
$\cos x \neq 0 \Leftrightarrow \sin x \neq \pm1$ (C)
$[-\sqrt{2};-1)\cup(-1;1)\cup(1;\sqrt{2}]$

18. $\frac{0{,}04^{x+y}}{0{,}008^x} > 0{,}0016^{x-y}$
$5^{-2(x+y)} : 5^{-3x} > 5^{-4(x-y)}$

$5^{x-2y+3x} > 5^{-4x+4y}$ (D)

$x-2y > -4x+4y$.

$5x > 6y$. $5x-6y>0$

19. $y = \ln(x^2-2x-3) < 0$.

$x^2-2x-3 < 1$.

$\begin{cases} x^2-2x-4<0 \\ x^2-2x-3>0 \end{cases}$

$(1-\sqrt{5}; -1) \cup (3; 1+\sqrt{5})$ (C)

20. $\log_{x+8}(64-x^2) - \frac{1}{16}\log^2_{x+8}(x-8)^2 \geq 2$.

$\log_{x+8}(8-x)\cdot(8+x) = 1 + \log_{x+8}(8-x) = 1+a$.

$1+a-\frac{1}{16}(2a)^2 \geq 2$. $4+4a-a^2 \geq 8$.

$1+a-\frac{1}{16}\cdot 4a^2 \geq 2$. $a^2-4a+4 \leq 0$.

$a=2$.

$(x+8)^2 = 8-x$

$\log_{x+8} 8-x = 2$.

$x^2+8x+16 = 8-x$ $x^2+9x+8=0$. (B)

-8 -1

21. $f(x) = \frac{|x^2-2x-8|}{3} - \frac{2x^2}{x^2-16}$.

$x^2-2x-8=0$ $x^2-16=0$

$x=-2$ $x=4$ $x=\pm 4$. (D)

22. $\int_0^1 x^9 \cdot (x^5-1)^{2n}(x^5+1)^{2n} dx = a$.

$\int_0^1 x^9 \cdot (x^{10}-1)^{2n} dx = a$ $\left[\begin{matrix} x^{10}-1=t \\ 10x^9 dx = dt \end{matrix}\right]$

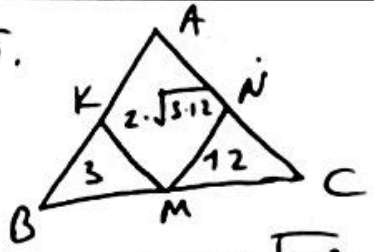
$\int_0^1 \frac{dt}{10} \cdot t^{2n} = \frac{t^{2n+1}}{10(2n+1)}\Big|_0^1 = \frac{(x^{10}-1)^{2n+1}}{10(2n+1)}\Big|_0^1 =$

$= \frac{1}{10(2n+1)} = a$ $\frac{1}{a} = 20n+10$ (A)

23. 1) 3) (C)

24. $4 \cdot 2 = 8$ (B)

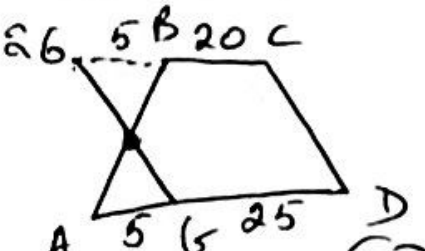
25.



(B)

$S_{\triangle} = 12+3+2\sqrt{3\cdot 12} = 27$

26.



3m ; 2m (D)

27.

(C)

$\begin{cases} R-r=10 \\ R^2 = 20^2+r^2 \end{cases}$

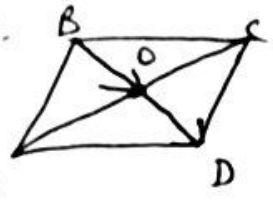
$R^2 = 400 + (R-10)^2$

$R=25$

28. $(-3; -4)$ $(0; 0)$

$d = \sqrt{3^2+4^2} = 5$. (D)

29.

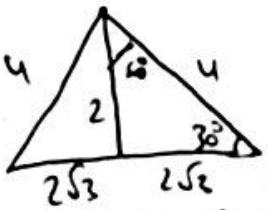


$\overrightarrow{BO} = k \cdot \overrightarrow{BD}$

$\overrightarrow{BD} = 2 \cdot \overrightarrow{BO}$

$k = \frac{1}{2}$ (A)

30.



$l=4$ $R=2$ (C)

$S_T = 2\pi R l = 16\pi$.

Variant-16

1. $20-(15-13-1)$
$20-(15-13)-1$ (A)
$20-15-(13-1)$
$20-(15-13-1)$

2. $\left(\frac{\sqrt{10}+\sqrt{7}}{\sqrt{5}+1}\cdot\frac{\sqrt{10}-\sqrt{7}}{\sqrt{5}-1}\right):\left(\frac{1}{\sqrt{3}}-\frac{\sqrt{3}}{9}+\frac{1}{\sqrt{27}}\right)=$
$\frac{3}{4}:\frac{1}{\sqrt{3}}=\frac{3\sqrt{3}}{4}$ (A)

3. $(x+a-1)^{2018}-x^{30}-1 \quad P(0)=0$
(D) $(a-1)^{2018}-1=0 \quad a-1=1 \quad a=2$
$a-1=-1 \quad a=0$

4. $a^2-b^2+8a-2b+15=a^2+8a-(b^2+2b-15)$
$=(a+b-3)(a-b-5)$ (C)

5. (B)

6. $\frac{\sqrt{6+x^2}}{6+x}=6-x \quad \sqrt{6+x^2}=36-x^2-6+6$
$\sqrt{6+x^2}=42-(x^2+6) \quad a^2+a-42=0$
$-7\ 6$
$a=6 \quad \sqrt{6+x^2}=6 \quad x^2=30 \quad x=\pm\sqrt{30}$
$(\sqrt{30})^2+(-\sqrt{30})^2=60$ (C)

7. $x^2-3x+1=0 \quad x^2+\frac{1}{x^2}=?$
$x^2+1=3x$
$x+\frac{1}{x}=3 \quad x^2+\frac{1}{x^2}=7$ (A)

8. 4-variant 8-testda yechimi keltirilgan.

9. $(x-3)^{16}+\sqrt{x+1}\geq 1 \quad x+1\geq 0 \quad x\geq -1$
(A)

10. $\begin{cases} 2\leq x\leq 28 \\ \frac{7}{3}\leq y\leq 7 \end{cases} \quad \frac{x+3y}{y}=\frac{x}{y}+3$ (B)
$\frac{2}{7}\leq\frac{x}{y}\leq 12 \quad 3\frac{2}{7}\leq\frac{x}{y}+3\leq 15$

11. $d\neq 0 \quad \frac{a_4+a_{14}}{2}\cdot 11=55 \quad a_9=5$
(B)

12. $\left((\sin\alpha)^{-1}+(\operatorname{tg}\alpha)^{-1}\right):\left(\operatorname{tg}\frac{\alpha}{2}\right)^{-1}=$
$\left(\frac{1}{\sin\alpha}+\frac{\cos\alpha}{\sin\alpha}\right)\cdot\frac{\sin\alpha}{1+\cos\alpha}=1$ (C)

13. $(\sin 115^\circ+\sin 25^\circ)(\sin 65^\circ+\sin 155^\circ)$
$+(\sin 25^\circ-\sin 115^\circ)(\sin 155^\circ-\sin 65^\circ)$
$2\sin 70^\circ\cos 45^\circ\cdot 2\sin 110^\circ\cos 45^\circ+$
$(-2\sin 45^\circ\cos 70^\circ)\cdot 2\sin 45^\circ\cos 110^\circ=$
$=2(\sin 70^\circ\cdot\sin 110^\circ-\cos 70^\circ\cdot\cos 110^\circ)=$
$=2$ (D)

14. $0<\alpha,\ \beta<\frac{\pi}{2}$
$\operatorname{tg}\alpha=\frac{\sqrt{3-\sqrt{3}}\cdot\sqrt{3}}{4-\sqrt{3-\sqrt{3}}} \quad \operatorname{tg}\beta=\frac{\sqrt{3-\sqrt{3}}-1}{\sqrt{3}}$
$\alpha-\beta=x \quad \operatorname{tg}(\alpha-\beta)=\operatorname{tg}x$
$$\frac{\frac{\sqrt{3-\sqrt{3}}\cdot\sqrt{3}}{4-\sqrt{3-\sqrt{3}}}-\frac{\sqrt{3-\sqrt{3}}-1}{\sqrt{3}}}{1+\frac{\sqrt{3-\sqrt{3}}\cdot\sqrt{3}}{4-\sqrt{3-\sqrt{3}}}\cdot\frac{\sqrt{3-\sqrt{3}}-1}{\sqrt{3}}}=\frac{\sqrt{3}}{3}$$
$x=\frac{\pi}{6}$ (D)

15. $\cos^2 4x+\operatorname{tg}2x\cdot\sin 4x=\cos 4x$
$\cos^2 4x+\frac{\sin 2x}{\cos 2x}\cdot 2\sin 2x\cos 2x=\cos$
$\cos^2 4x+2\sin^2 2x=\cos 4x$
$\cos^2 4x+1-\cos 4x=\cos 4x$
$\cos 4x=1 \quad 4x=2\pi n$
$x=\frac{\pi}{2}n$ (A)

16. $\begin{cases} f(x)=ax+b \\ g(x)=cx+d \end{cases} \quad \frac{b}{d}=5.$
$f(g(x))=g(f(x)) \quad \frac{c-1}{a-1}$
$f(cx+d)=a(cx+d)+b \quad acx+ad+b$
$g(ax+b)=c(ax+b)+d=acx+$
$+cb+d$
(A) $acx+ad+b=acx+cb+d.$
$ad+5d=5dc+d \quad a+5=5c+$
$a=5c+1-5 \quad a=5c-4$

17. $g(x) > f(x)$ (D)

18. $\frac{2^a + 4\cdot 2^b}{2^a - 2\cdot 2^b} = 5 \quad 2^{a-b+1}$ (D)

$2^a + 4\cdot 2^b = 5\cdot 2^a - 10\cdot 2^b$

$14\cdot 2^b = 4\cdot 2^a \quad 7 = 2^{a-b+1}$

19. $(\log_5 4 + \log_4 5 + 2)(\log_5 4 - \log_{20} 4)$

$\log_4 5 - \log_5 4 \quad \log_4 5 = a.$

$(\frac{1}{a} + a + 2)(\frac{1}{a} - \frac{1}{1+a})\cdot a - \frac{1}{a} =$

$= \frac{a^2+2a+1}{a}\cdot\frac{1}{a(a+1)}\cdot a - \frac{1}{a} =$

$= \frac{a+1}{a} - \frac{1}{a} = 1.$ (A)

20. $y = \log_x e + \ln x \quad x > 1$

(B) $\log_x e + \ln x \geq 2\sqrt{\log_{10} e \cdot \ln x}$

$[2, \infty)$

21. $-3 < \log_{0,5} a < -2 \quad 2 < \log_{0,5} b < 4$

$8 > a > 4 \quad 0,25 > b > \frac{1}{16}$

$2 > a\cdot b > \frac{4}{4}$ (A)

22. $y = f(x) \quad (-2; 10) \quad (0; 0)$

$x_0 = -2 \quad y_0 = 10 \quad k = ?$ (B)

$y = k(x - x_0) + y_0$

$0 = k(0+2) + 10 \quad k = -5$

23. $(1+\operatorname{tg} x)(1+\operatorname{tg} y) = 2.$

$x + y = 45^\circ.$

$\int [(1+\operatorname{tg}(20^\circ + x))(1+\operatorname{tg}(25^\circ - x))]\,dx =$

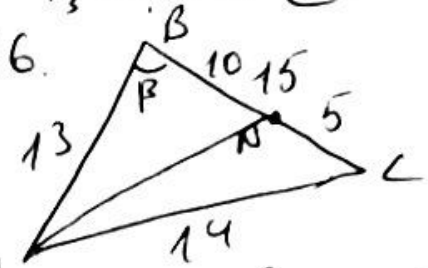
$= \int 2\,dx = 2x + C$ (C)

24. 2; 4 (B)

25. Olma; nok; mandarin

$P_3 = 3! = 6.$ (D)

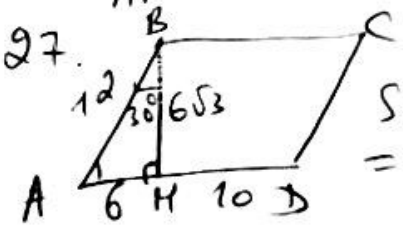
26.



$\begin{cases} 14^2 = 13^2 + 15^2 - 2\cdot 13\cdot 15\cos\beta \\ AN^2 = 13^2 + 10^2 - 2\cdot 13\cdot 10\cdot\cos\beta \end{cases}$

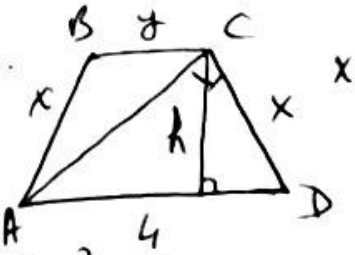
$AN = \sqrt{137}$ (D)

27.



$S = 16\cdot 6\sqrt{3} = 96\sqrt{3}$ (D)

28.



$x^2 + y^2 = 11.$

$h^2 = \frac{4+y}{2}\cdot\frac{4-y}{2}$

$\begin{cases} x^2 + y^2 = 11 \\ \frac{16-y^2}{4} + \left(\frac{4-y}{2}\right)^2 = x^2 \end{cases}$

$x = \sqrt{2}$ (B)

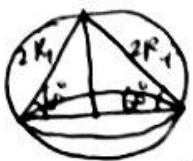
29. $y = x - 4 \quad A(8; -4)$

$y = x + b \quad \frac{x+x}{2} = 8 \quad x = 8$

$\frac{x-4+x+b}{2} = -4 \quad b = -20.$

$y = x - 20$ (D)

30.



$R = 4\sqrt{2}.$

$R = \frac{2R_1}{\sqrt{3}}$

$2R_1 = \sqrt{3}R$

$2R_1 = 4\sqrt{6} \quad R_1 = 2\sqrt{6}$

$S = \pi R_1 \ell = 2\pi R_1^2 = 2\pi\cdot 24 = 48\pi.$

Variant-17

1) $\begin{cases} \frac{a}{b}=\frac{5}{4} \\ EKUB(a;b)=9 \end{cases}$ $a=45$ $b=36$

$a+b=81$ (A)

2) $\sqrt[3]{\frac{12}{25}\sqrt{\frac{244}{15\cdot(38^2-23^2)}}}=$

$=\sqrt[3]{\frac{12}{25}\cdot\sqrt{\frac{2444}{15\cdot15\cdot61}}}=$

$=\sqrt[3]{\frac{12^4}{25}\cdot\frac{2}{15^5}}=\sqrt[3]{\frac{8}{125}}=\frac{2}{5}$ (D)

3) $a=3$ $b=8$

$\frac{5\cdot3\cdot8}{5\cdot3\cdot8-8\cdot3^2}=2,5$ (C)

4) $\frac{\sqrt[3]{a^2}+\sqrt[3]{32a}+\sqrt[3]{16}}{(\sqrt[3]{a}+\sqrt[3]{4})^3(\sqrt[3]{a^2}-\sqrt[3]{4a}+\sqrt[3]{16})}=$

$=\frac{(\sqrt[3]{a}+\sqrt[3]{4})^2}{(\sqrt[3]{a}+\sqrt[3]{4})^3(\sqrt[3]{a^2}-\sqrt[3]{4a}+\sqrt[3]{16})}=$

$=\frac{1}{(\sqrt[3]{a}+\sqrt[3]{4})(\sqrt[3]{a^2}-\sqrt[3]{4a}+\sqrt[3]{16})}=$

$=\frac{1}{a+4}=\frac{1}{16+4}=\frac{1}{20}$ (A)

$a=16$

5) $x=\sqrt{42-\sqrt{42-\sqrt{42-\sqrt{42-}}}}$

$y=\sqrt{x+\sqrt{x+\sqrt{x+\dots}}}$

$z=\sqrt{y\cdot\sqrt{y\cdot\sqrt{y\cdot\dots}}}$ $x+y+z=?$

$x=\sqrt{42-x}$ $x^2=42-x$

$x^2+x-42=0$ $x=6$

$y=\sqrt{6+\sqrt{6+\sqrt{6+\dots}}}$ $y^2=6+y$

$y=3$

$z=\sqrt{3\cdot\sqrt{3\cdot\sqrt{3\cdot\dots}}}$ $z^2=3\cdot z$ (D)

$z=3$ $6+3+3=12.$

6) $\frac{20}{480+20}\cdot100\%=4\%$ (A)

7) $\frac{x+1}{x-1}=5-x$ $x+1=(x-1)(5-x)$ (D)

$x+1=5x-x^2-5+x$

$x^2-5x+6=0$ $x=2$ $x=3$ $2+3=5.$

8) $\sqrt{x+8}-\sqrt{x+4}=2$ $\sqrt{x+8}=2+\sqrt{x+4}$

$x+8=4+x+4+4\sqrt{x+4}$ $4\sqrt{x+4}=0$

$x=-4$ (D)

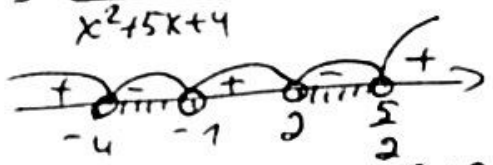
9) $(a^2-2a+1)x=a^2+2a-3$

$a^2-2a+1\neq0$ $a\neq1$ (D)

10) $\frac{19x-2}{x^2+5x+4}>2$ $x_0+2=?$

$0>2-\frac{19x-2}{x^2+5x+4}$ $0>\frac{2x^2+10x+8-19x+2}{x^2+5x+4}$

$0>\frac{2x^2-9x+10}{x^2+5x+4}$



(C)

$-3;-2;$ $x_0=2$ $2+2=4$

11) $(x^2-3x)(x^2-3x+2)\geq24$ $x^2-3x=a$

$a(a+2)\geq24$ $a^2+2a-24\geq0$

$(a+6)(a-4)\geq0$

$(x^2-3x+6)(x^2-3x-4)\geq0.$

$(-\infty;-1]\cup[4;\infty)$

$3-0=3$ (B)

12) $b_5-b_1=18$ $b_3-b_1=12$ $b_{11}=?$

$\begin{cases} b_1(q^4-1)=18 \\ b_1(q^2-1)=12 \end{cases}$ $q^2+1=\frac{18}{12}$ $q^2=\frac{6}{12}=\frac{1}{2}$

$b_1(\frac{1}{2}-1)=12$

$b_1=-24.$

$b_{11}=b_1\cdot q^{10}=-24\cdot\frac{1}{32}=-\frac{3}{4}$ (C)

13) $\cos^4\alpha + \sin^2\alpha\cos^2\alpha =$ (D)

$= \cos^2\alpha(\cos^2\alpha + \sin^2\alpha) = \cos^2\alpha$

14) $\dfrac{\operatorname{arctg}\frac{2}{15} - \operatorname{arctg}\frac{1}{4}}{\operatorname{arcctg}4} = \dfrac{\operatorname{arctg}\frac{\frac{2}{15}-\frac{1}{4}}{1+\frac{2}{15}\cdot\frac{1}{4}}}{\operatorname{arcctg}4} =$

$= \dfrac{\operatorname{arctg}\frac{1}{4}}{\operatorname{arctg}\frac{1}{4}} = 1$ (D)

15) $\cos(\alpha+\pi k) = -\cos\alpha$

$\cos(\alpha+\pi k) + \cos\alpha = 0$

$2\cos\dfrac{2\alpha+\pi k}{2}\cos\dfrac{\pi k}{2} = 0$

$\dfrac{\pi k}{2} = \dfrac{\pi}{2} + \pi n \quad k = 2n+1$ (C)

16) $y = 4x - x^2$ $y = x^2 - 6x + k$

$M(1;3)$

$x_0 = 1 \quad y_0 = 3$

$k = 4 - 2x_0 = 4 - 2\cdot 1 = 2$

$y = 2(x-1) + 3$

$y = 2x + 1 \qquad y = x^2 - 6x + k$

$2x + 1 = x^2 - 6x + k$

$x^2 - 8x + k - 1 = 0$ (C)

$D = 0$

$64 - 4(k-1) = 0$

$16 - k + 1 = 0$

$k = 17$

17. (A) $f(x) = \begin{cases} -x+2, & x<0 \\ \dfrac{x-1}{2}, & x \geq 0 \end{cases}$

$f(f(-1)) = f(3) = \dfrac{3-1}{2} = 1$

$f(-1) = -(-1) + 2 = 3$

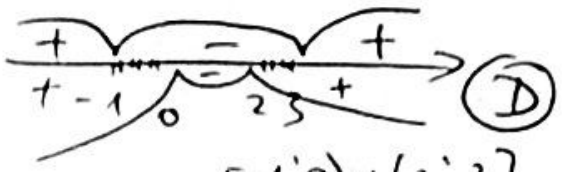
18. $81^x = 16 \quad 9^x = 4$ (A)

19. $y = \sqrt{\log_{\frac{1}{3}}(x^2 - 2x) + 1}$

$\log_{\frac{1}{3}}(x^2-2x) + 1 \geq 0$

$\log_{\frac{1}{3}}(x^2-2x) \leq 1$

$\begin{cases} x^2 - 2x \leq 3 \\ x^2 - 2x > 0 \end{cases} \quad \begin{cases} x^2 - 2x - 3 \leq 0 \\ x(x-2) > 0 \end{cases}$



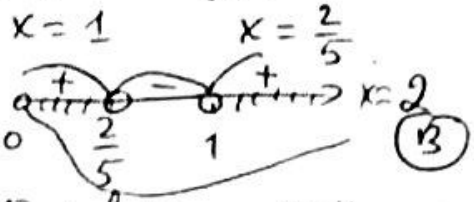
(D)

$[-1;0) \cup (2;3]$

20. $\log_{0,4}(x) \cdot \log_{0,4}(2,5x) \geq \log_{0,4}(0,4)$

$\log_{0,4}(x) \cdot \log_{0,4}(2,5x) \geq 1 = 2$

$\log_{0,4}(x) \cdot \log_{0,4}(2,5x) > 0$



(B)

21 $y = 5 - 2\ln x \qquad \dfrac{5-y}{2}$

$2\ln x = 5 - y \quad x = e$ (B)

$y = e^{\frac{5-x}{2}} \quad (-\infty;\infty)$

22 $\int_{-1}^{1}\sqrt{|x|+x}\,dx = \int_{-1}^{0}\sqrt{-x+x}\,dx +$

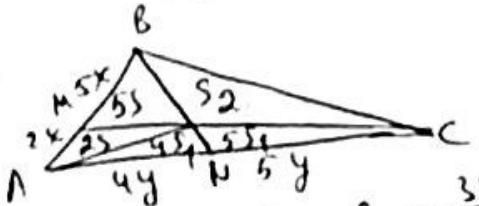
$\int_{0}^{1}\sqrt{x+x}\,dx = \dfrac{(2x)^{\frac{1}{2}+1}}{\frac{1}{2}+1}\Big|_0^1 =$

$= \dfrac{2^{\frac{3}{2}}}{2\cdot\frac{3}{2}} = \dfrac{2\sqrt{2}}{3} = \dfrac{2\sqrt{2}}{3}$ (B)

23. 1) 3) (A)

24. $C_{11}^{6} = \dfrac{11!}{6!5!} = 462$

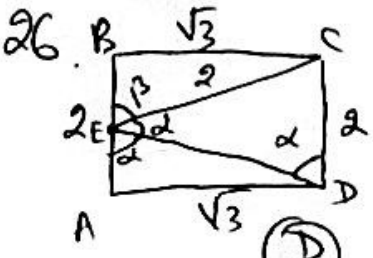
25.



$\dfrac{2S + 4S_1}{5S_1 + S_2} = \dfrac{4}{5} \quad S_2 = \dfrac{35}{4}S$

$\dfrac{2S + 7S_1}{5S_1 + \frac{35}{4}S} = \dfrac{2}{5} \quad S_1 = \dfrac{7}{18}S$

$\dfrac{S_2}{5S_1} = \dfrac{35}{4}S : \left(5\cdot\dfrac{7}{18}S\right) = \dfrac{9}{2}$ (C)

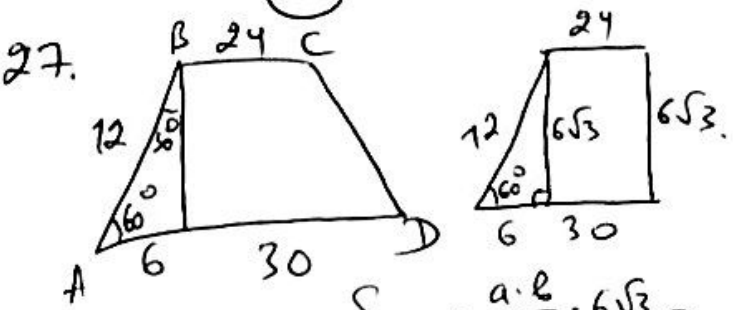
26. 

$\sin\beta = \frac{\sqrt{3}}{2}$.

$\beta = 60^\circ$.

$\alpha = 60^\circ$

(D)

27. 

$S_{COD} = \frac{a \cdot b}{a+b} \cdot \frac{6\sqrt{3}}{2} =$

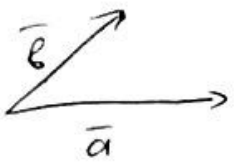
$= \frac{30 \cdot 24}{30+24} \cdot 3\sqrt{3} = 40\sqrt{3}$ (A)

28. $A(0;1)$ $y = 2x+6$.

$k_1 \cdot k_2 = -1$ $k_1 = 2$ $k_2 = -\frac{1}{2}$

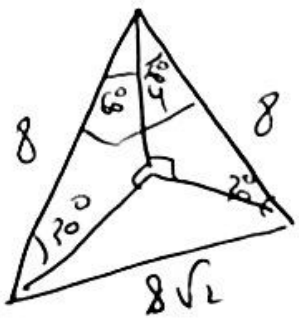
$y = -\frac{1}{2}x + b$ $1 = b$

$y = -\frac{1}{2}x + 1$ $(-4;3)$ (A)

29. 

$|\bar{a}| = |\bar{e}| = 1$

$d_1 \perp d_2$ (B)

30. 

(A)

Variant-18

1. $EKUK(6;8;12)=24$

b; c; e (B)

2. $\frac{\sqrt[3]{40}}{\sqrt[3]{625}} = \sqrt[3]{\frac{8}{125}} = \frac{2}{5}$ (D)

3. $(x+1)(x+3)(x+5)(x+7)+10$ (D)

$(x^2+8x+7)(x^2+8x+15)+10=$

$=a(a+8)+10 = a^2+8a+16-6=$

$=(a+4)^2-6 = (x^2+8x+11)^2-6$

4. $\frac{(3a+1)^{40}+1}{(3a+1)^{20}}=0$

$\frac{(3a+1)^{40}+1}{(3a+1)^{20}}=1$

$\frac{(3a+1)^{40}+1}{(3a+1)^{20}}=2 \quad ((3a+1)^{20}-1)^2=0$

$(3a+1)^{20}=1$

$a=0$ (C)

$a=-\frac{2}{3}$

$3a+1=1$

$3a+1=-1$

5. $a+b+c=3 \quad ab+ac+bc=2$

$a^3+b^3+c^3-3abc$

$(a+b+c)^2=9 \quad a^2+b^2+c^2+2(ab+bc+ac)=9$

$a^2+b^2+c^2=5$

$(a+b+c)^3 = x^3+y^3+z^3+3x^2y+3x^2z+3xy^2+$

$3y^2z+3xz^2+3yz^2+6xyz$.

$27 = a^3+b^3+c^3+3a(ab+ac+bc)+$

$+3b(ab+bc+ac)+3c(ab+ac+bc)-3abc$

$27 = a^3+b^3+c^3-3abc+3(a+b+c)(ab+ac+bc)$

$27-3\cdot 3\cdot 2 = a^3+b^3+c^3-3abc$ (B)

6. $\sqrt[4]{4+x}+\sqrt{-x-4}-\sqrt{40+x}-\sqrt{40-4}=-6$

$x=-4$ (D)

$4+x\geq 0 \quad x\geq -4$

$-x-4\geq 0 \quad x\leq -4$

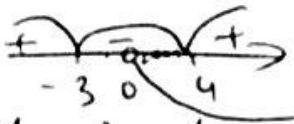
7. $\frac{1,3\cdot 10^9}{5,6\cdot 10^7}\approx 23$ (C)

8. $-2\cdot(5-3x)=7x+3$ (A)

$-10+6x=7x+3 \quad x=-13$

9. $x^2+2ax+a(a-1)=0$

$\begin{cases} D\cdot(a-1)<12 \\ 4a^2-4a(a-1)>0 \end{cases} \quad \begin{cases} a^2-a-12<0 \\ 4a>0 \end{cases}$



$(0;4)$ (C)

10. $\frac{1}{4}<\frac{3}{8}<\frac{1}{2} \quad \frac{3}{12}<\frac{3}{6}<\frac{3}{6}$

$\frac{1}{6}<\frac{2}{a}<\frac{1}{3} \quad \frac{1}{12}<\frac{2}{a}<\frac{2}{6}$

$6<b<12 \quad 6<a<12$

$-6<a-b<6$. (A)

11. $(2-m)x^2+3(m+1)x+2>0$

$\begin{cases} 2-m>0 \\ 9(m+1)^2-4\cdot(2-m)\cdot 2<0 \end{cases}$

$\begin{cases} m<2 \\ 9m^2+18m+9-16+8m<0 \end{cases}$

$\begin{cases} m<2 \\ 9m^2+26m-7<0 \end{cases}$ (A)

$\left(\frac{-13-2\sqrt{58}}{9}; \frac{-13+2\sqrt{58}}{9}\right)$

12. $a_{15}=7a_9 \quad a_9+6d=7a_9$

$6d=6a_9 \quad a_9=d$

$a_1+8d=d \quad a_1=-7d$

$S_{15}=\frac{2\cdot(-7d)+14d}{2}\cdot 0=0$ (A)

13. $\cos 40^\circ+\cos 80^\circ-\cos 20^\circ=$

(B) $=2\cos 60^\circ\cos 20^\circ-\cos 20^\circ=0$

14. $\arcsin(\cos 10)+\arccos(\sin 10)$

$=\frac{\pi}{2}-\arccos(\cos 10)+\frac{\pi}{2}-\arcsin(\sin 10)$

$\pi-(4\pi-10+3\pi-10)=\pi-7\pi+20$

$=20-6\pi$ (C)

15. $3\cos 4x+1=0$

$\cos 4x=-\frac{1}{3}$

$4x=\pm(\pi-\arccos\frac{1}{3})+2\pi n$

$x=\pm\frac{1}{4}(\pi-\arccos\frac{1}{3})+\frac{\pi n}{2}$

$n=0 \quad x=\pm\frac{1}{4}(\pi-\arccos\frac{1}{3})$

$n=1 \quad x=-\frac{1}{4}(\pi-\arccos\frac{1}{3})+\frac{\pi}{2}$

16. $f(x)=6\sqrt{2-x}+8\sqrt{x} \le \sqrt{6^2+8^2}\sqrt{2-x+x} =$
$=10\sqrt{2}$ (D)

17. $\frac{2^a+4\cdot 2^b}{2^a-2\cdot 2^b}=-7$ $2^{a}+2^{a}\cdot 2^{b+2} = -7\cdot 2^{a}+14\cdot 2^{b}$
$8\cdot 2^a = 10\cdot 2^b$ (D)
$2^{a-b}=\frac{10}{8}=1{,}25$

18. $a=6$
$\left(25^{\frac{1}{2\log_4 25}}+2\log_2\log_2\log_2 a^{2\log_a 4}\right)\cdot 4^{-\frac{2}{\log_5 4}}-0^2 =$
$=\frac{(7+9)\cdot\frac{1}{9}-36}{-5}=7^{1-9}$ (C)

19. $\log_{\frac{1}{3}}|1-3x|<-1$ $|1-3x|>3$
$1-3x>3$ $1-3x<-3$ (A)
$x<-\frac{2}{3}$ $x>\frac{4}{3}$

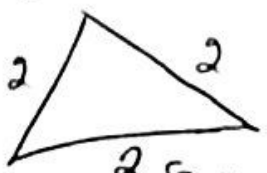
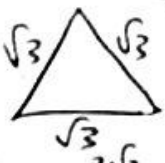
20. $y=5\sin 9x+3\sin 15x$
$y'=45\cos 9x+45\cos 15x=$
$=90\cos 12x\cos 3x$ (A)

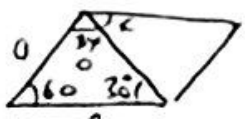
21. $v(t)=t^2-3t+1$ (B)
$a(t)=2t-3=2\cdot 6-3=9$

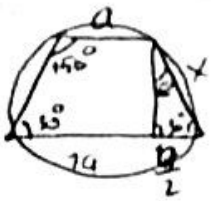
22. $\int_0^1 x(x+3)(2x-1)\,dx=$
(A) $\int_0^1 (2x^3+5x^2-3x)\,dx=\frac{x^4}{2}+\frac{5x^3}{3}-\frac{3x^2}{2}\Big|_0^1=\frac{2}{3}$

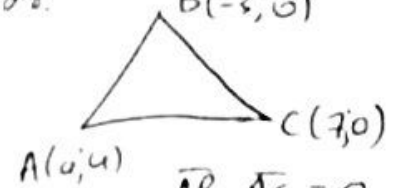
23. 1) 3) (D)

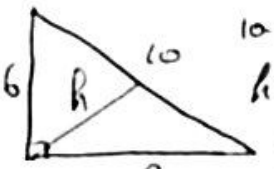
24. $A=\{1;3;5;6;7;8;9;10\}$ $A\cap B=\{1;5;6;7;8;10\}$
$B=\{1;5;6;7;8;10;11\}$
(A) $2^6=64$

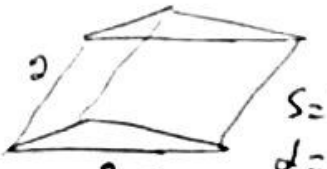
25. 
$h=\frac{\sqrt{3}}{2}\cdot 2=\sqrt{3}$

$B_1=\frac{\sqrt{3}}{4}\cdot 4=\sqrt{3}$ $B_2=\frac{\sqrt{3}}{4}\cdot 3=\frac{3\sqrt{3}}{4}$
$S=\frac{\sqrt{3}}{1-\frac{3}{4}}=4\sqrt{3}$ (B)

26. 
$2(a+b)=120$
$a+b=60$
$b=2a$
$x+3x=120^\circ$ $x=30^\circ$
$a=10$ $b=40$.
$S=20\cdot 40\cdot\frac{\sqrt{3}}{2}=400\sqrt{3}$ (C)

27. 
$r=4\sqrt{3}$

$\frac{\frac{a}{2}}{x}=\cos 30^\circ$
$x=\frac{a}{\sqrt{3}}$ $2x=\frac{2}{\sqrt{3}}a$
(A) $d=2\cdot 4\sqrt{3}\cdot\frac{1}{2}=4\sqrt{3}$.
$d^2=4a^2+\frac{a^2}{3}-2\cdot 2a\cdot\frac{a}{\sqrt{3}}\cdot\frac{\sqrt{3}}{2}$
$\sqrt{3}=2a^2+\frac{a^2}{3}$ $\sqrt{3}=\frac{7}{3}a^2$ $a^2=\frac{3\sqrt{3}}{7}$
$S=\frac{2a\cdot\frac{2}{\sqrt{3}}a}{2}\cdot\frac{1}{2}=\frac{a^2}{\sqrt{3}}=\frac{3}{7}$.

28. 
$\angle BAC=90^\circ$
$\vec{AB}\cdot\vec{AC}=0$.
$\vec{AB}(-3-a;-4)$ $\vec{AC}(7-a;-4)$
$(-3-a)(7-a)+16=0$ (B)
$-21+3a-7a+a^2+16=0$
$a^2-4a-5=0$ $a=-1$ $a=5$

29. 
$10\,h=6\cdot 8$
$h=4{,}8$
$d=4{,}8\cdot\sin 60^\circ$
$d=2{,}4$ (A)

30. 
$S=\frac{\sqrt{3}}{4}\cdot 4=\sqrt{3}$
$d=60^\circ$
$h=2\cdot\frac{\sqrt{3}}{2}$ $h=a\sin 60^\circ$
$V=S\cdot h=\sqrt{3}\cdot\sqrt{3}=3$ (B)

Variant-19.

1. $x:37=1827$. (D)
$x=1827\cdot 37$.
$1827\cdot 37:29=2331$

2. $\frac{4}{7x}=-\frac{3}{4y}=\frac{5}{8z}$ $y<0$.
(C) $32z=35x$. $y<x<z$

3. $a^4+4b^4=p$.
(C) $a=1$ $b=1$ $1+1=2$.

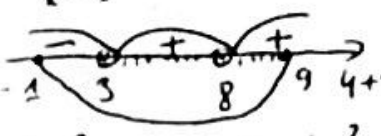
4. $\frac{x^3+27}{2x-2}\cdot\frac{x^2-1}{x^2+4x+3}\cdot\frac{6x+12}{3x^2-9x+27}:(x+2)$
(B) $\frac{(x+3)(x^2-3x+9)}{2(x-1)}\cdot\frac{(x-1)(x+1)}{(x+1)(x+3)}\cdot\frac{6(x+2)}{3(x^2-3x+9)}\cdot\frac{1}{x+2}=1$

5. $\begin{cases}\sqrt{ab}=a+6\\ \frac{a+b}{2}=b-7\end{cases}$ $\begin{cases}ab=a^2+12a+36\\ a+b=2b-14\end{cases}$ $a=b-14$
(A) $a\cdot(a+14)=a^2+12a+36$. $a=18$ $b=32$

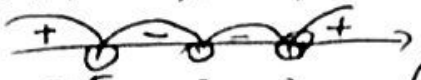
6. $(x-3)^6+(x^2-2x-1)^3=0$
$(x-3)^6=-(x^2-2x-1)^3$ @ALPHIRAGANUS
$(x-3)^2=-(x^2-2x-1)$ (B)
$x^2-6x+9=-x^2+2x+1$
$2x^2-8x+8=0$ $x=2$
$x^2-4x+4=0$ $x_1+x_2=4$.

7. $|x^2-25|+|3x+15|=0$ (D)
$\begin{cases}x^2-25=0\\ 3x+15=0\end{cases}$ $\begin{cases}x=\pm 5\\ x=-5\end{cases}$ $\Rightarrow x=-5$

8. $x^2+(k+2)^2x+2k-4=0$
$x_1<2$ $x_2<2$.
$x_1-2<0$ $x_2-2<0$.
$(x_1-2)(x_2-2)>0$.
$x_1x_2-2(x_1+x_2)+4>0$.
$2k-4-2(k+2)^2+4>0$.
$k-k^2-4k-4>0$.
$k^2+3k+4<0$ $k\in\mathbb{R}$ $k=-1$. (C)

9. $\frac{(8-x)^2}{x-3}>0$ $[-1;9]$.
(C)


$4+5+6+7+9=31$

10. $|x^2+7x+10|+|x^2-4|>|2x^2+7x+6|$
$(x^2+7x+10)(x^2-4)<0$.


(C)
$-4-3+(-1)+0+1=-7$.

11. $b_1+b_4=27$ $b_2+b_5=72$
$b_1+b_2+b_3+b_4=?$
$q>1$.
$\begin{cases}b_1+b_4=27 & b_1=3\\ b_1b_4=72 & b_4=24\end{cases}$ $q=2$
$3+6+12+24=45$ (B)

12. $\cos 1^\circ+\cos 2^\circ+\cos 3^\circ+\dots+\cos 179^\circ=0$
$\cos x+\cos y=0$. (C)
$x+y=180^\circ$

13. $\arccos(\cos 3)=3$ (A)

14. $\begin{cases}\operatorname{tg}\alpha+\operatorname{tg}\beta=4\\ \operatorname{ctg}\alpha\operatorname{ctg}\beta=2\end{cases}$ $\begin{cases}\sin(\alpha+\beta)=4\cos\alpha\cos\beta\\ \sin(\alpha+\beta)=2\sin\alpha\sin\beta\end{cases}$ ⊖
$0=2\cos\alpha\cos\beta+\cos(\alpha+\beta)$ $\cos(\alpha+\beta)=-2\cos\alpha\cos\beta$
$\operatorname{tg}(\alpha+\beta)=\frac{\sin(\alpha+\beta)}{\cos(\alpha+\beta)}=\frac{4\cos\alpha\cos\beta}{-2\cos\alpha\cos\beta}=-2$ (D)

15. $y=|3x+2|+|2x-3|$
(A) $3x=-2$ $x=-\frac{2}{3}$
$|2\cdot\frac{2}{3}+3|=\frac{13}{3}$ $4,(3)$

16. $y=6\cos x\cdot\operatorname{tg}x=6\sin x$.
(B) $\cos x\neq 0\Rightarrow\sin x\neq\pm 1$ $(-6;6)$

17. $[-3;4]$ (D)

18. $2^a=81$ $\log_2 81=a$ $a\cdot b=\log_2 81\cdot\log_3 8$
(B) $3^b=8$ $\log_3 8=b$ $a\cdot b=12$.

@ALPHIRAGANUS

19. $3^{1+x}\cdot 2^{1-x}+3^{x}\cdot 2^{-x}<10{,}5$

$3^x\cdot 2^{-x}(3\cdot 2+1)<10{,}5$

$3^x\cdot 2^{-x}\cdot 7<\frac{21}{2}$

$3^x\cdot 2^{-x}<\frac{3}{2}$ $\quad 2^{-x-1}<3^{1-x}$

$\left(\frac{3}{2}\right)^x<\frac{3}{2}$ $\quad x<1$ $\quad x=0$ (B)

20. $\begin{cases}\log_{\sqrt{10}+3}(\sqrt{7}-\sqrt{6})=a\\ \log_{\sqrt{7}+\sqrt{6}}(\sqrt{10}-3)=x\end{cases}$ (*)

$\log_{\sqrt{10}+3}(\sqrt{7}-\sqrt{6})\cdot\log_{\sqrt{7}+\sqrt{6}}(\sqrt{10}-3)=a\cdot x$

$\log_{\sqrt{7}+\sqrt{6}}(\sqrt{7}-\sqrt{6})\cdot\log_{\sqrt{10}+3}(\sqrt{10}-3)=a\cdot x$

$1=a\cdot x$ $\quad x=\frac{1}{a}$ (A)

21. $\sin x\cdot\log_3 x\cdot\sqrt{3-x}=0$

$\sin x=0$ $\quad \log_3 x=0$ $\quad 3-x\geq 0$ $\quad x\leq 3$

$\boxed{x=\pi}$ $\quad x>0$ $\quad \boxed{x=3}$ (D)

$[0;3]$ $\quad x=\pi$ $\quad x=\pi$

22. $y=x^3-kx^2+4kx+5$

$3x^2-2kx+4k$

(A) $\quad 4k^2-4\cdot 4k3<0$.

$k=11$ $\quad 4k(k-12)<0$.

$(0;12)$

23. $\int_1^2\left(x+\frac{1}{x}\right)^2dx=\int_1^2\left(x^2+2+\frac{1}{x^2}\right)dx=$

$=\frac{x^3}{3}+2x-\frac{1}{x}\Big|_1^2=\frac{29}{6}$ (A)

24. 1) 2) (C)

25. KOMBINATORIKA $=13$ TA.

I $\quad$ I $=21$ A.

$\frac{2}{13}$ (C)

26. $\begin{cases}x+y=7\\ 5x=7y\end{cases}$

$\frac{MN}{5}=\frac{7\cdot 9}{12\cdot 9}$

$MN=\frac{35}{12}=2\frac{11}{12}$ (B)

27. (C) $\quad tg\,\delta=\frac{d_1}{d_2}=\frac{a}{a\sqrt{3}}$ $\quad \delta=30°$ $\quad 2\delta=60°$ $120°$

28. (A) 12

$\frac{9}{R}=\frac{15}{15-R}$ $\quad R=\frac{45}{8}$

29. $-1<a<0$ $\quad 3<b<4$ (D)

30. (A)

$r=\frac{a}{2\sqrt{3}}=\frac{2\sqrt{3}}{2\sqrt{3}}=1$

$a=2\sqrt{3}$ $\quad H=3$ $\quad H=3$.

$S_1=2\pi r(r+H)=2\pi\cdot 1(1+3)=8\pi$.

Variant - 20

1. $\begin{matrix} abc \\ bca \\ cab \\ \hline 666 \end{matrix}$ $a+b+c=6$ (A)

2. $\frac{1}{16}+\frac{2}{18}+\frac{3}{16}+\ldots+\frac{15}{16}+\frac{16}{18}=$

$=\frac{1+3+\ldots+15}{16}+\frac{2+4+\ldots+16}{18}=$

$=\frac{\frac{1+15}{2}\cdot 8}{16}+\frac{\frac{2+16}{2}\cdot 8}{18}=8$ (A)

3. $\frac{a+b}{a-b}=\sqrt{7}$ $\frac{a}{b}+\frac{b}{a}=?$

$\frac{1+\frac{b}{a}}{1-\frac{b}{a}}=\sqrt{7}$ $1+\frac{b}{a}=\sqrt{7}-\sqrt{7}\cdot\frac{b}{a}$

$\frac{b}{a}=\frac{\sqrt{7}-1}{\sqrt{7}+1}$

$\frac{\sqrt{7}-1}{\sqrt{7}+1}+\frac{\sqrt{7}+1}{\sqrt{7}-1}=\frac{8}{3}$ (C)

4. $a=18\sqrt{2}$

$\left(\left(\sqrt{a^3\cdot 3^{-3}}-\sqrt{27\cdot a^{-3}}\right):\left(\frac{a^2+9}{3a}+1\right)\right)\cdot$

$\cdot\frac{(a-3)^{-1}}{(6a^3)^{-\frac{1}{2}}}-6=$

1) $\sqrt{\frac{a^3}{27}}-\sqrt{\frac{27}{a^3}}=\frac{a^3-27}{\sqrt{27a^3}}=\frac{(a-3)(a^2+3a+9)}{3a\sqrt{3a}}$

2) $\frac{a^2+9+3a}{3a}$ $1):2)=\frac{a-3}{\sqrt{3a}}$ (A)

3) $\frac{a-3}{\sqrt{3a}}\cdot\frac{1}{(a-3)}\cdot\frac{a\sqrt{6a}}{1}-6=\sqrt{2}a-6=30$

5. $\frac{\sqrt[4]{x}+\sqrt[4]{y}}{\sqrt{x}-\sqrt{y}}=\frac{1}{\sqrt[4]{x}-\sqrt[4]{y}}$ (A)

6. $\begin{cases} x\cdot 2+y\cdot 2=\frac{5}{8} \\ x\cdot 3+y\cdot 2=\frac{7}{8} \end{cases}$ $x\cdot t=1$ (A)

$x=\frac{1}{4}$ $t=4$.

7. $5x^3-10x^2+x-2=0$

(D) $5x^2(x-2)+(x-2)=0$ $(x-2)(5x^2+1)=0$

8. $\begin{cases} y^2=x^2-6x+9 \\ x^2+2y=2 \end{cases}$ $y=x-3$ $y=3-x$.

(C) $x^2+2(x-3)=2$ $x^2+2(3-x)=2$

$+1a.$ $x^2+2x-8=0$ $x^2-2x+4=0$.

9. $\sqrt{25-x^2}\le\frac{12}{x}$ $25-x^2\ge 0$.

(D) $1+2+3+4+5=15$ $[-5;5]$ $x>0$.

10. $-3x^2+9x+0,25<a$ (C)

$3x^2-9x+a-0,25>0$ $a=8$

$D<0$

$81-12(a-0,25)<0$. $a>7$.

11. $x+x+1+x+2+x+3+x+4=100$

$x=18$ $x+4=22$ (A)

12. $\left(\cos^{-1}3\alpha+\operatorname{ctg}\left(\frac{5\pi}{2}+3\alpha\right)\right)\cdot\operatorname{ctg}\left(\frac{5}{4}\pi-\frac{3\alpha}{2}\right)$

(A) $\left(\frac{1}{\cos 3\alpha}+\frac{\sin 3\alpha}{\cos 3\alpha}\right)\cdot\frac{1+\operatorname{tg}\frac{3\alpha}{2}}{1-\operatorname{tg}\frac{3\alpha}{2}}=$

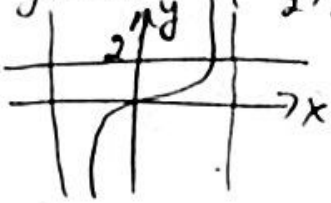
$=\frac{\left(\cos\frac{3}{2}\alpha-\sin\frac{3}{2}\alpha\right)^2}{\left(\cos\frac{3}{2}\alpha\right)^2-\left(\sin\frac{3}{2}\alpha\right)^2}\cdot\frac{\cos\frac{3}{2}\alpha+\sin\frac{3}{2}\alpha}{\cos\frac{3}{2}\alpha-\sin\frac{3}{2}\alpha}=1$.

13. $(\operatorname{tg}5^\circ+\operatorname{tg}3^\circ)\cdot\operatorname{ctg}8^\circ+(\operatorname{tg}5^\circ-\operatorname{tg}3^\circ)\cdot\operatorname{ctg}2^\circ$

(A) $\frac{\sin 8^\circ}{\cos 5^\circ\cdot\cos 3^\circ}\cdot\frac{\cos 8^\circ}{\sin 8^\circ}+\frac{\sin 2^\circ}{\cos 5^\circ\cdot\cos 3^\circ}\cdot\frac{\cos 2^\circ}{\sin 2^\circ}=1$.

14. $\arcsin(\sin 10)=3\pi-10$ (A)

15. $\operatorname{tg}x=2$ $\left(-\frac{\pi}{2};\frac{\pi}{2}\right)$



(B)

16. $f(x)=7^{-x}$ $g(x)=8^{-x}$ $h(x)=9^{-x}$

$f(44)=7^{-44}=2401^{-11}$

$g(33)=8^{-33}=512^{-11}$

$h(22)=9^{-22}=64^{-11}$ (A)

$h(22)>g(33)>f(44)$

17. (B)

18. $\begin{cases} x^{13}=12^y \\ x^2-11x-12=0 \end{cases}$ $x=-1$ $x=12$

$12^{13}=12^y$ $\emptyset$.

$y=13$ (A)

19. (C)

20. $-2 < \log_{0,5} a < -1$ $\quad 2 < a < 4$

$1 < \log_{0,5} b < 3$ $\quad 0,5 > b > 0,5^3$

$\frac{1}{4} < ab < 2$

(A)

21. $f(x) = g(3x+2)$ $f'(3) = ?$

$g'(11) = 12$

$f'(x) = 3\,g'(3x+2)$ (A)

$x = 3$ $f'(3) = 3 \cdot g'(11)$

$f'(3) = 3 \cdot (-12) = -36$

22. $\int_3^0 (3x-1)\,dx = 4$ $\quad \frac{3x^2}{2} - x \Big|_3^a = 4$

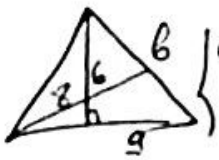
$\frac{3a^2}{2} - a - \frac{27}{2} + 3 = 4$

$a = \frac{1 \pm 2\sqrt{22}}{3}$ (A)

23. 1) 3) (A)

24. $8 \cdot 7 = 56$ (A)

25.



$a \cdot 6 = 8 \cdot b$

$\frac{a^2}{4} + 36 = b^2$

$a = \frac{24\sqrt{5}}{5}$ $\quad b = \frac{18\sqrt{5}}{5}$

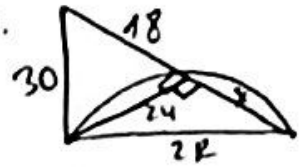
$S = \frac{\frac{24}{5}\sqrt{5} \cdot 6}{2} = 14,4\sqrt{5}$ (C)

26. $P = 2a + 2b = 14$ $\quad a + b = 7$ $\quad a = 7 - b$

$S = a \cdot b = a(7-a) = -a^2 + 7a$ $\quad a = 3,5$

$S'(a) = 0$. $\quad S = 3,5^2 = 12,25$ (B)

27.



$24^2 = 18 \cdot x$ $\quad x = 32$

$x^2 + 24^2 = (2R)^2$ $\quad R = 20$ (C)

28. $M(2;3)$ $\quad 5x - 4y - 20 = 0$. $\quad y = \frac{5}{4}x - 5$

$y = -\frac{4}{5}x + b$ $\quad y = -\frac{4}{5}x + \frac{23}{5}$ (D)

$3 = -\frac{4}{5} \cdot 2 + b$ $\quad 4x + 5y - 23 = 0$

$b = \frac{23}{5}$

29. $\frac{d}{\frac{d}{2}} = \frac{a}{x}$ $\quad x = \frac{a}{2}$.

30. $60 \times 40 \times 5$ sm. $\quad 1$ mm.

$600 \cdot 400 \cdot 50 = 120 \cdot 10^5 = 12 \cdot 10^6$ mm

$12\ m^2$ (D)

Variant-21

1. $(2^2+6^2+10^2+14^2+18^2)-(1^2+5^2+9^2+13^2+17^2)=$
$3+11+19+27+35=95$ (A)

2. $a=2-\sqrt{3}$ $b=2+\sqrt{3}$
$a+b=4$ $a\cdot b=1$.
$a^3+b^3=(a+b)^3-3ab(a+b)$
(D) $64-12=52$

3. $\frac{x}{ax-2a^2}-\frac{2}{x^2+x-2ax-2a}\cdot\left(1+\frac{3x+x^2}{3+x}\right)$

$=\frac{x}{a(x-2a)}-\frac{2}{x(x+1)-2a(x+1)}\cdot(1+x)=$ (B)

$=\frac{x}{a(x-2a)}-\frac{2}{(x+1)(x-2a)}\cdot(1+x)=\frac{1}{a}=4$

4. $a+b+c=2$ $ab+ac+bc=4$.
$a^3+b^3+c^3-3abc=?$ $a+b=2-c$.
$(a+b)^3=(2-c)^3$
$a^3+3a^2b+3ab^2+b^3=8-12c+6c^2-c^3$
$a^3+b^3+c^3=8-12c+6c^2-3ab(a+b)$
$a^3+b^3+c^3=8-12c+6c^2-3ab(2-c)$
$a^3+b^3+c^3=8-12c+6c^2-6ab+3abc$
$a^3+b^3+c^3-3abc=8-12c+6(c^2-ab)$

$a+b=2-c$ $c(a+b)=4-ab$.
$c(2-c)=4-ab$ $2c-4=c^2-ab$.
$a^3+b^3+c^3-3abc=8-12c+6\cdot(2c-4)$ (B)
$a^3+b^3+c^3-3abc=8-12c+12c-24=-16$

5. $\sqrt{4^8+2\cdot6^8+9^8}-\sqrt{4^7+6^8+9^8}=$
$=\sqrt{(2^8+3^8)^2}-\sqrt{(2^7+3^8)^2}=2^8-2^7=2^7$ (D)

6. $\begin{cases}a_1\cdot a_2=165\\ a_2\cdot a_3=285\\ a_2(a_1+a_3)=450\end{cases}$ (+) $2a_2^2=450$ $a_2^2=225$ $a_2=15$ $a_3=19$ $a_1=11$ (C)

7. $|x^2-2x-15|=2x-x^2+15$
(C) $x^2-2x-15\le0$ $[-3,5]$

8. $\sqrt{7-\sqrt{7+x}}=x$ $x>0$ $x=2$.

9. $(5-2x)^{10}<(-x^2-4x-7)^5$
$(5-2x)^2<(-x^2-4x-7)$
$25-20x+4x^2<-x^2-4x-7$
$5x^2-16x+32<0$ $\varnothing$ (D)

10. $(m-4)x^2-2x+m+1>0$
$\begin{cases}m-4>0\\ 4-4(m+1)(m-4)<0\end{cases}$ $\left(\frac{3+\sqrt{29}}{2},\infty\right)$ (B)

11. $\begin{cases}b_5-b_1=18\\ b_3-b_1=12\end{cases}$ $\begin{cases}b_1(q^4-1)=18\\ b_1(q^2-1)=12\end{cases}$ (:)
$q^2+1=\frac{3}{2}$ $q^2=\frac{1}{2}$ $b_1=-24$
$b_{11}=b_1\cdot q^{10}=-24\cdot\frac{1}{32}=-\frac{3}{4}$ (D)

12. $\left(2\cdot\frac{1}{\sin2}+2\operatorname{ctg}2\right)\cdot\left(\operatorname{tg}\frac{2}{2}\right)^{-1}=$
$=\frac{2}{\sin2}+\frac{2\cos2}{\sin2}\cdot\frac{1+\cos2}{\sin2}=$ (B)
$=\frac{2(1+\cos2)}{\sin2}\cdot\frac{1+\cos2}{\sin2}=2\operatorname{ctg}^2\frac{2}{2}$.

13. $\cos40^\circ+\cos80^\circ-\cos20^\circ=$ (D)
$=2\cdot\cos60^\circ\cdot\cos20^\circ-\cos20^\circ=0$.

14. $\sqrt{3}\sin x+\frac{3}{2}=0$ $\sin x=-\frac{\sqrt{3}}{2}$.
$x=(-1)^{n+1}\frac{\pi}{3}+\pi n$.
$n=0$ $x=0-\frac{\pi}{3}=-\frac{\pi}{3}$. (D)

15. $f(x)=\left(\frac{1}{3}\right)^{x^2-6x+11}=$
(B) $=\left(\frac{1}{3}\right)^{(x-3)^2+2}$ $(0;\frac{1}{9}]$

16. (B)

17. $\begin{cases} 11^x + 8^y = 75 \\ 3\cdot 11^x + 8^y = 97 \end{cases}$ ⊖ (B)

$2\cdot 11^x = 22 \quad 11^x = 11 \quad x = 1$ $\quad y = 2$

18. $\log_a b = -11 \quad \log_a \sqrt[3]{\frac{a}{b}} =$ (C)

$= \frac{1}{3}(1 - \log_a b) = \frac{1}{3}(1+11) = 4$

19. $y = \ln(3x^2 - 12x + 15) = \ln(3(x^2 - 4x + 4 + 1))$

$= \ln(3((x-2)^2+1))$ $[\ln 3, \infty)$ (D)

20. $\log_{0,2}^2(x+1) < 4 \quad \log_5^2(x+1) < 4$.

$(\log_5(x+1) - 2)(\log_5(x+1) + 2) < 0$.

$x = 24 \quad x = -\frac{24}{25}$ (C)

$(-\frac{24}{25}; 24)$

21. $y = f(x) \quad (-2;10) \quad (1;10) \quad x_0 = -2$.

$f'(-2) = k$. (D) $\quad y_0 = 10$.

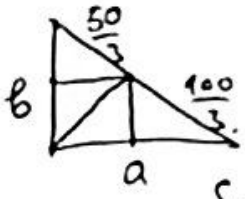
$y = k(x - x_0) + y_0$

$10 = k(1+2) + 10 \quad k = 0$. (C)

22. $\int_0^1 \frac{4}{3x+2}\,dx = \frac{4}{3}\ln|3x+2|\Big|_0^1 = \frac{4}{3}\ln 2{,}5$

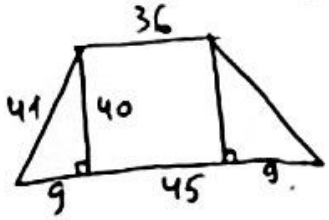
23. 1) 3) (D)

24. $7\cdot 5\cdot 4 = 140$ (B)

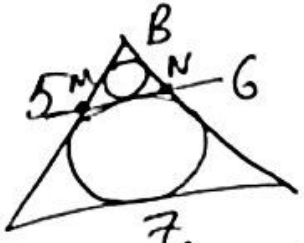
25. 

$\begin{cases} 2a = b \\ a^2 + b^2 = 50^2 \end{cases}$ (B)

$S = \frac{2a\cdot 9}{2} = a^2 = 500$.

26. 

36;54 (D)

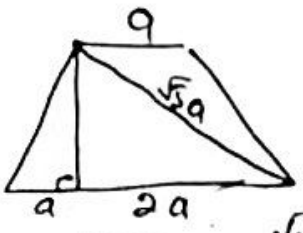
27. 

(A)

D $\frac{r}{R} = \frac{P_{MBN}}{P_{ABC}} = \frac{5+6-7}{5+6+7} = \frac{2}{9}$.

28. $A(-2;1) \quad B(a;-6)$

$a = -2$ (C)

29. 

(A)

$\frac{H}{\sqrt{5}a} = \sin$

$\frac{H}{a} = \sin$

$\sqrt{5}\sin\alpha = \sin$

$\cos\alpha = \sqrt{0{,}992}$

$\sqrt{5}\cdot\sqrt{0{,}128} = \sin$

$\cos\beta = 0{,}3$ $\quad \sin\beta = \sqrt{0{,}91}$

30. $V = \frac{1}{12}\cdot 12\cdot 12\cdot 12\sqrt{3} = 144$

$V = \frac{1}{12}abc\,tg\,1$ (B)

Variant-22

1. $a=6a_1+2$, $b=6b_1+4$ (+). (C)
$a+b=6(a_1+b_1+1)$

2. $\frac{3}{7}=0,(428571)$ (A)

$2018 \mid 6$, $2016 \mid 336$, 2

3. $\frac{a^4-10a^2+169}{a^2+6a+13}=\frac{a^4+26a^2+169-36a^2}{a^2+6a+13}=$
$=\frac{(a^2+13)^2-(6a)^2}{a^2+6a+13}=\frac{(a^2-6a+13)(a^2+6a+13)}{a^2+6a+13}=$
$=a^2-6a+13$ (C)

4. $a-b=\sqrt{x}+3$ $a-b>0$ $a>b$ (A)

5. (B) $400-250=150$ $400+50=450$

6. $\left(\frac{x^2}{9}+\frac{16}{x^2}\right)-2\cdot\left(\frac{x}{3}-\frac{4}{x}\right)-\frac{19}{9}=0$.
$\frac{x}{3}-\frac{4}{x}=a$ $\frac{x^2}{9}-2\cdot\frac{x}{3}\cdot\frac{4}{x}+\frac{16}{x^2}=a^2$
$a^2+\frac{8}{3}-2a-\frac{19}{9}=0$
$a_1=\frac{1}{3}$ $a_2=\frac{5}{3}$

$\frac{x}{3}-\frac{4}{x}=\frac{1}{3}$ $x_1=-3$ $x_2=4$ (A)
$\frac{x}{3}-\frac{4}{x}=\frac{5}{3}$ $x^2-5x-12=0$.
$-12\cdot(-12)=144$

7. $\sqrt{x+\sqrt{4x+\sqrt{16x+\ldots+\sqrt{4^{10}\cdot x+3}}}}=\sqrt{x}+1$
$x+\sqrt{4x+\sqrt{16x+\ldots+\sqrt{4^{10}\cdot x+3}}}=x+2\sqrt{x}+1$
$4x+\sqrt{16x+\ldots+\sqrt{4^{10}\cdot x+3}}=4x+4\sqrt{x}+1$
$16x+\ldots+\sqrt{4^{10}\cdot x+3}=16x+8\sqrt{x}+1$
$4^{10}\cdot x+3=4^{10}\cdot x+2^{11}\sqrt{x}+1$
$2=2^{11}\cdot\sqrt{x}$ $\sqrt{x}=2^{-10}$
$x=2^{-20}$ (B)

8. $x^2-6x+3=0$ $x^2+\frac{9}{x^2}=?$
$x^2+3=6x$
$x+\frac{3}{x}=6$ $x^2+2\cdot x\cdot\frac{3}{x}+\frac{9}{x^2}=36$
$x^2+\frac{9}{x^2}=30$ (A)

9. $x<-1$ $y>1$ $y^5>x^3$ (A)

10. $x+4<\sqrt{x+46}$
$x+46-42<\sqrt{x+46}$
$a^2-a-42<0$
$(a+6)(a-7)<0$
$0<7$. $\sqrt{x+46}<7$.
$\begin{cases} x+46<49 & x<3 \\ x+46\geq 0 & x\geq -46 \end{cases}$ (B)

11. $\{a+\sqrt{a}\}+\{a-\sqrt{a}\}=>\sqrt{a}\notin\mathbb{N}=1$
$\{a+\sqrt{a}\}+\{a-\sqrt{a}\}=>\sqrt{a}\in\mathbb{N}=0$
$1009=22+987$
$22\cdot 0+987\cdot 1=987$ (D)

12. $a_{17}=8a_{10}$ $S_{17}=?$
(A) $a_{10}+7d=8a_{10}$. $d=a_{10}$.
$d=a_1+9d$ $a_1=-8d$.
$S_{17}=\frac{a_1+a_{17}}{2}\cdot 17=\frac{2a_1+16d}{2}\cdot 17=0$.

13. $\frac{\sin 60^\circ}{\sin 20^\circ}-2\cos 40^\circ=$ (C)
$=\frac{\sin 60^\circ-2\cos 40^\circ\cdot\sin 20^\circ}{\sin 20^\circ}=$
$=\frac{\sin 60^\circ-2\cdot\frac{1}{2}(\sin 20^\circ+\sin 60^\circ)}{\sin 20^\circ}$
$=1$.

14. $\frac{|\log_{\cos}(\operatorname{tg}\frac{\pi}{3})|}{\log_{\cos}(\operatorname{tg}\frac{\pi}{7})}+\frac{3\cdot|5\sqrt{3}-2\sqrt{7}|}{3\sqrt{3}-2\sqrt{7}}+$
$+\frac{9\cdot|\arccos(-0,5)-\frac{\pi}{2}|}{\arccos(-0,5)-\frac{\pi}{2}}=-1+(-3)+9$ (C)
$=5$.

15. $\operatorname{ctg}\left(\frac{\pi}{3}x-\pi\right)=1$

$\operatorname{ctg}\frac{\pi}{2}x=1$ (A)

$\frac{\pi}{2}x=\frac{\pi}{4}+\pi n \quad x=\frac{1}{2}+2n$

16. $y=(x+3)^{-\frac{6}{7}}=\frac{1}{\sqrt[7]{(x+3)^6}} \quad x+3\neq 0$

$(-\infty;-3)\cup(-3;\infty)$ (D)

17. $\begin{cases} x\cdot 2^x - y\cdot 4^y = x\cdot 4^y - y\cdot 2^x \\ 3^x\cdot 9^y = 81 \end{cases}$

$\begin{cases} (x+y)\cdot 2^x = (x+y)\cdot 4^y \\ 3^x\cdot 3^{2y}=3^4 \end{cases}$

$\begin{cases} (x+y)(2^x-2^{2y})=0 \\ 3^{x+2y}=3^4 \end{cases}$ (C)

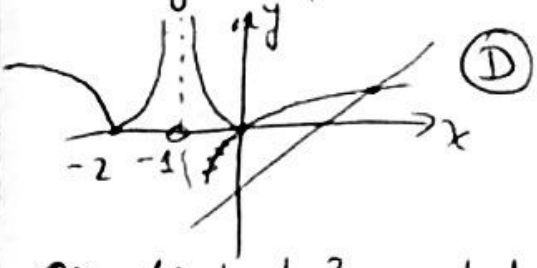
$\begin{cases} x+y=0 \\ x+2y=4 \end{cases} \quad \begin{cases} x=2y \\ x+2y=4 \end{cases}$

$(-4;4) \quad (2;1)$

18. $\log_a b = x$ (B)

$\frac{1-x^3}{(x+\frac{1}{x}+1)\cdot(1-x)}\cdot\frac{1}{2}\cdot\frac{1}{x}=\frac{1}{2}$

19. $|\lg|x+1||=x-3$



(D)

20. $f(x)=|x^2-2x-3|\div|x+2|$

$f'(0)=?$ (D)

$f(x)=-x^2+2x+3-x-2$

$f'(x)=-2x+1 \quad f'(0)=1$

21. $y=4x^5-15x^4-5 \quad (-1;1)$.

$y'=20x^4-60x^3=0 \quad y(0)=-5$

$20x^3(x-3)=0 \quad y(3)=4\cdot 3^5-5\cdot 3^5-5$

$x=0 \quad x=3$. (C)

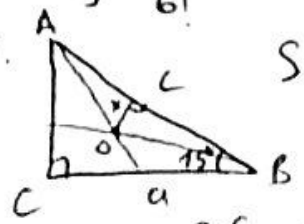
22. $\int_{\frac{\pi}{4}}^{\pi}\cos\left(3x-\frac{\pi}{4}\right)dx=\frac{1}{3}\sin\left(3x-\frac{\pi}{4}\right)\Big|_{\frac{\pi}{4}}^{\pi}=$

$=\frac{\sqrt{2}}{6}-\frac{1}{3}$ (D)

23. (D)

24. $A_9^3=\frac{9!}{6!}=7\cdot 8\cdot 9=504$ (B)

25.



$S=9$

$S_{AOB}=\frac{c\cdot x}{2}=3$.

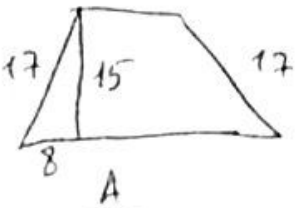
$\sin 45^\circ\frac{a\cdot c}{2}=9 \quad 2\cdot\frac{c^2}{2}\sin 45^\circ\cos 45^\circ=9\cdot 2$

$a=c\cos 45^\circ \quad \frac{c^2}{2}\cdot\frac{1}{2}=18$

$\frac{c\cdot x}{2}=3 \quad \frac{6\sqrt{2}\cdot x}{2}=3 \quad c=\sqrt{72}=6\sqrt{2}$.

$x=\frac{\sqrt{2}}{2}$ (D)

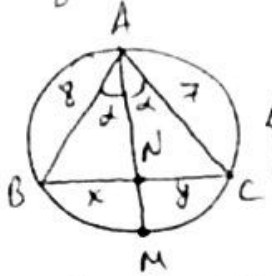
26.



(B)

$\begin{cases} \frac{a-b}{2}=8 \\ \frac{a+b}{2}=17 \end{cases} \quad a=25 \quad b=9.$

27.



$\begin{cases} x+y=9 \\ 8y=7x \end{cases} \quad x-y=\frac{2}{5}$

$x=\frac{24}{5} \quad y=\frac{21}{5}$ (B).

28. $A(4;2) \quad B(6;-5) \quad C(-5;4) \quad D(x;y)$

$\overline{AC}(-9;2) \quad \overline{BD}(x-6;y+5)$

(C) $\overline{AC}\cdot\overline{BD}=0 \quad -9(x-6)+2(y+5)=0$.

$9x-2y-64=0$.

29. $A(2;3;5) \quad B(-1;3;4) \quad C(x;0;0)$

$AC=BC$ (B)

$(x-2)^2+3^2+5^2=(x+1)^2+3^2+4^2 \quad x=2$

30. $50:5=10 \quad 10^3=1000$ (B).

Variant-23

1. $\begin{cases} a+b=242 \\ a=4b+22 \end{cases}$ $b=?$

$4b+b+22=242$

$5b=220$

$b=44$ (B)

2. $\dfrac{7}{1+\dfrac{2}{x-1}}$ $x-1\neq0$ $x\neq1$ $x+1\neq0$ $x\neq-1$

(A)

3. $x=\frac{10}{3}$

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

(B) $(x-5+1)^3=\left(\frac{10}{3}-5+1\right)^3=-\frac{8}{27}$

4. $a\geq0$ $b>0$ $\sqrt{a}\leq b$

$f(a;b)=\sqrt{\frac{a+b^2}{b}+2\sqrt{a}}-\sqrt{\frac{a+b^2}{b}-2\sqrt{a}}$

$=\sqrt{\frac{(\sqrt{a}+b)^2}{b}}-\sqrt{\frac{(b-\sqrt{a})^2}{b}}=\frac{\sqrt{a}+b}{\sqrt{b}}-\frac{b-\sqrt{a}}{\sqrt{b}}$

$=\frac{2\sqrt{a}}{\sqrt{b}}$ (C)

5. $\frac{(x+3)(x^2-3x+9)}{2(x-1)}\cdot\frac{(x-1)(x+1)}{(x+1)(x+3)}\cdot\frac{6(x+2)}{3(x^2-3x+9)}=$

$=x+2$ (A)

6. $4\cdot s=1$ $s=\frac{1}{4}$

$12\cdot k=1$ $k=\frac{1}{12}$

$s\cdot\frac{t}{2}+k\cdot\frac{t}{2}=1$ $\frac{t}{2}\cdot\left(\frac{1}{4}+\frac{1}{12}\right)=1$

$\frac{t}{2}(s+k)=1$ (D)

$t=6$

7. $\sqrt{15-x}+\sqrt{3-x}=6$

$15-x\geq0$ $x\leq15$

$3-x\geq0$ $x\leq3$

$\sqrt{15-x}=6-\sqrt{3-x}$

$15-x=36-12\sqrt{3-x}+3-x$

$12\sqrt{3-x}=24$ $\sqrt{3-x}=2$

$3-x=4$ $x=-1$ (D)

8. $\begin{cases} ax=x^{1-b}+2 \\ cx=x^{b-1}-1 \end{cases}$ $x^{b-1}=\frac{1}{ax-2}=cx+1$

$\frac{1}{ax-2}-1=cx$ $\frac{1-ax+2}{x(ax-2)}=c$ (A)

9. $(x^2+3x+1)(x^2+3x+3)\leq35$ $x^2+3x+1=a$

$a\cdot(a+2)\leq35$ $a^2+2a-35\leq0$

$(a+7)(a-5)\leq0$

$(x^2+3x+8)(x^2+3x-4)\leq0$ $[-4;1]$

$\varnothing$ -4 1 (A)

10. $\left|\frac{6-2x}{1+3x}\right|>0$ (A) $\frac{6-2x}{1+3x}\neq0$ $x\neq3$ $x\neq-\frac{1}{3}$

11. $\begin{cases} b_3=9 \\ b_1+b_2=4 \end{cases}$ (!) $\begin{cases} b_1q^2=9 \\ b_1(1+q)=4 \end{cases}$ $\frac{q^2}{1+q}=\frac{9}{4}$

$q^2-\frac{9}{4}q-\frac{9}{4}=0$ $q=3$

$b_1\cdot3^2=9$ $b_1=1$

$b_5=b_1\cdot q^4=81$ (C)

12. $\frac{1}{\cos200^\circ}-tg170^\circ\cdot tg20^\circ=$

$\frac{1}{-\cos20^\circ}+tg10^\circ\cdot tg20^\circ=$

$\frac{-\cos10^\circ+\sin10^\circ\cdot\sin20^\circ}{\cos10^\circ\cdot\cos20^\circ}=$ (B)

$=\frac{\cos10^\circ(-1+2\sin^2 10^\circ)}{\cos10^\circ\cdot\cos20^\circ}=-1$

13. $ctg15^\circ+ctg30^\circ+ctg45^\circ+\ldots+ctg165^\circ=0$

(A) $ctgx+ctgy=0$ $x+y=180^\circ$

14. $\arccos(\cos4)=\arccos(\cos(2\pi-4))$

$=2\pi-4$ (A)

15. $6\sin^2x+5\sin x\cos x+3\cos^2x=2$

$(:\cos^2x)$

$[-\pi;0]$ $6tg^2x+5tgx+3=\frac{2}{\cos^2x}=2(1+tg^2x)$

$6a^2+5a+3=2+2a^2$

$4a^2+5a+1=0$ $a=-1$ $a=-\frac{1}{4}$

$tgx=-1$ $tgx=-\frac{1}{4}$

$x=-\frac{\pi}{4}+\pi n$ $x=-arctg\frac{1}{4}+\pi n$

(C) 2 ta

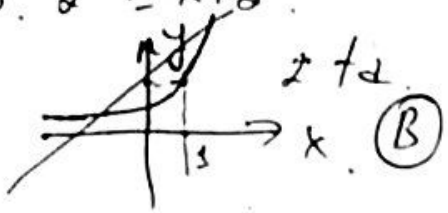
16. $f(x)=(a+b-4)x^3+2x^2+(b-1)x$

$\begin{cases} a+b-4=0 \\ b-1=0 \end{cases}$ $b=1$ $a=3$. (D)

$f(x)=2x^2$ $f(3)=2\cdot 3^2=18$.

17. (B)

18. $2^{x-1}=x+2$



(B)

19. $\left\{ \frac{\{\lg 200\}}{\{\lg 50\}} \right\} + \{\log_5 12{,}5\}$

$a=[a]+\{a\}$ $\{a\}=a-[a]$

1) $\{\lg 200\}=\lg 200-[\lg 200]=$
$=\lg 200-2=\lg 200-\lg 100=$
$=\lg 2$.

2) $\{\lg 50\}=\lg 50-[\lg 50]=$
$=\lg 50-1=\lg 50-\lg 10=$
$=\lg 5$

3) $\left\{ \frac{\lg 2}{\lg 5} \right\}=\{\log_5 2\}=$
$=\log_5 2-[\log_5 2]=\log_5 2$.

4) $\{\log_5 12{,}5\}=\{\log_5 \frac{25}{2}\}=$
$=\log_5 \frac{25}{2}-[\log_5 \frac{25}{2}]=$
$=2-\log_5 2-1=1-\log_5 2$.

5) $\log_5 2+1-\log_5 2=1$ (B)

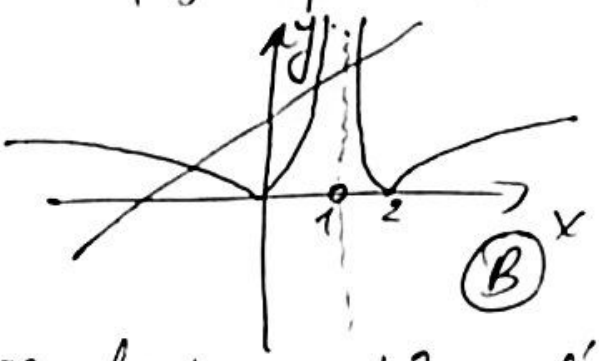
20. $\log_{x-1} x^2=\log_{x-1}(6x-8)$.

$x^2-6x+8=0$

$2 \quad 4$. $\boxed{x=4}$

$1+5=6$. (A)

21. $|\lg|x-1||=x+1$.



(B)

22. $f(x)=6+5\operatorname{tg}^2 2x$ $f'(\pi)=?$

$f'(x)=10\operatorname{tg}2x\cdot\frac{2}{\cos^2 2x}$ $f'(\pi)=0$ (C)

23. $\int_{-1}^{0}(x+1)(x^2-2)dx=\int_{-1}^{0}(x^3-2x+x^2-2)dx$

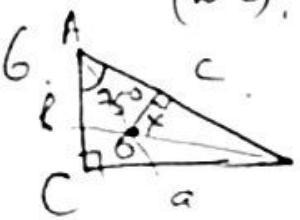
$=\frac{x^4}{4}-x^2+\frac{x^3}{3}-2x\Big|_{-1}^{0}=-\frac{1}{4}+1+\frac{1}{3}-2$

$=-\frac{11}{12}$ (B)

24. (D)

25. $A_{10}^{6}=\frac{10!}{(10-6)!}=\frac{10!}{4!}=151200$ (D)

26.



$S_{AOB}=\frac{S_{ABC}}{3}=3$.

$S_{ABC}=9$

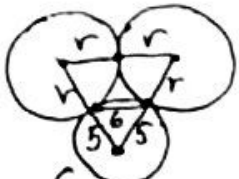
$S_{ABC}=\frac{b\cdot c}{2}\sin 75^\circ=\frac{6\cdot c\cos 75^\circ\cdot\sin 75^\circ}{2}=9$

$b=c\cdot\cos 75^\circ$ $\cdot\frac{c^2}{4}\sin 150^\circ=9$

$S_{AOB}=\frac{cx}{2}=3$ $c^2=72$ $c=6\sqrt{2}$

$x=\frac{6}{c}=\frac{6}{6\sqrt{2}}=\frac{\sqrt{2}}{2}$ (D)

27.



$\frac{5}{5+r}=\frac{6}{2r}$ $r=\frac{15}{2}$ (C)

28.

$P_{ABMN}=?$

$MO=MB$ $MN=MO+ON=5$

$NO=NA$ $MN=MB+NA=5$

$P_{ABMN}=AB+MB+MO+$
$+ON+NA=AB+5+5=18$.

(C)

29. $(x-0)^2+(y-3)^2=R^2$

(A) $(2-0)^2+(0-3)^2=R^2 \quad R^2=13$

$(x-0)^2+(y-3)^2=13$

30. $r=\frac{\sin\alpha}{1+\cos\alpha}\,r_1 \qquad \cos\alpha=\frac{1}{3}$

$a=\sqrt{1,5}$

$r_1=\frac{\sqrt{3}}{6}\cdot\sqrt{\frac{3}{2}}=\frac{1}{2\sqrt{2}}$

$r=\frac{\frac{2\sqrt{2}}{3}}{1+\frac{1}{3}}\cdot\frac{1}{2\sqrt{2}}=\frac{1}{4}$ (C)

Variant-24

1. $\overline{83m07n}$ 8; 6
$n=2$
$\overline{83m072}$
$m=1;4;7$ (D)

2. $\frac{6-5}{2-1}\cdot\sqrt{3}=\sqrt{3}$ (C)

3. $\frac{x}{2}\cdot\sqrt[3]{\frac{y^5}{x^2}}\cdot\sqrt[3]{\frac{8}{xy^4}}=\frac{x}{2}\cdot\frac{2\sqrt[3]{y}}{x}=\sqrt[3]{y}$ (D)

4. $a^2-1=8^{27}(2^{79}+1)$ $\frac{a-1}{16^{19}}=?$
$a^2=2^{160}+2^{81}+1$
(A) $a=2^{80}+1$ $\frac{2^{80}+1-1}{2^{76}}=2^4$

5. $\sqrt[3]{a+\sqrt[3]{a+\sqrt[3]{a+\ldots}}}=2$
$\sqrt[3]{a+2}=2$ $a+2=8$ $a=6$
$\sqrt{6-\sqrt{6-\sqrt{6-\ldots}}}=x$ $\sqrt{6-x}=x$
$6-x=x^2$ $x^2+x-6=0$ (B)
-3 (2)

6. $\begin{cases}x\cdot\frac{t}{2}=1\\ y\cdot t=1\end{cases}$ $(x+y)\cdot 12=1$
$x\cdot t_1=\frac{1}{3}$ $t_1=?$
$x=\frac{2}{t}$ $y=\frac{1}{t}$ $\left(\frac{2}{t}+\frac{1}{t}\right)\cdot 12=1$
$\frac{3}{t}\cdot 12=1$ $t=36$ (C)
$x\cdot 18=1$ $x=\frac{1}{18}$ $t_1=6$

7. $xy+x=3y+6$
$xy-3y=6-x$ $y=\frac{6-x}{x-3}=$
(C) $=\frac{3}{x-3}-1$ $x-3=\pm3$ $x=0$ $x=6$
$x-3=\pm1$ $x=4$ $x=2$

8. $x^2-(k-2)x+3k+4=0$
$\begin{cases}x_1<2\\ x_2<2\end{cases}$ $(x_1-2)(x_2-2)>0$
(C) $x_1x_2-2(x_1+x_2)+4>0$
$\frac{-1-11}{2}\cdot 11=-66$ $3k+4-2(k-2)+4>0$
$k>-12$

9. $(x^2-x)(x^2-x-2)<120$ $x^2-x=a$
$a\cdot(a-2)<120$ $a^2-2a-120<0$
$(a+10)(a-12)<0$ -10 12
$(x^2-x+10)(x^2-x-12)<0$ (C)
$(-3;4)$ -3 4; $-2;-1;0;1;2;3$

10. $6\left(\sqrt{8+x}-\sqrt{5-x}\right)\le\sqrt{(8+x)(5-x)}$
$\begin{cases}8+x\ge0\\ 5-x\ge0\end{cases}$ $\begin{cases}x\ge-8\\ x\le5\end{cases}$ (D)

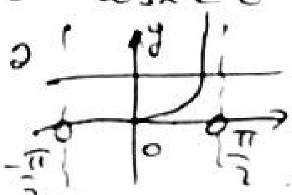
11. $\begin{cases}a_6=3\\ a_2+a_5=16\end{cases}$ $a_1+a_6=a_2+a_5=16$
$a_1=13$ (D)

12. $\pi<\alpha<\frac{3\pi}{2}$
(B) $\sin\alpha\cdot|\cos\alpha|-\cos\alpha\cdot|\sin\alpha|=$
$-\sin\alpha\cdot\cos\alpha+\cos\alpha\cdot\sin\alpha=0$

13. $tg10^\circ\cdot tg20^\circ+1=\frac{\sin10^\circ\cdot\sin20^\circ+\cos10^\circ\cdot\cos20^\circ}{\cos10^\circ\cdot\cos20^\circ}$
$=\frac{\cos10^\circ}{\cos10^\circ\cdot\cos20^\circ}=\frac{1}{\cos20^\circ}$ (A)

14. $\sin x+\cos x=-1{,}02$
$\sin x<0$ $\cos x<0$ III (D)

15. $tg x=2$



(B)

16. $y=\sqrt{27-\frac{1}{3}\left|x-\frac{2}{117}\right|}$
$0\le y\le\sqrt{27}$ (C)
$0+1+2+3+4+5=15$

17. $2^x=101$ $6<x<7$
(B) $|x-8|+|x-6|=8-x+x-6=2$

18. $\sqrt{\log_{16}4+\log_{16}24-\log_{16}6}=$
$=\sqrt{\log_{16}4\cdot24:6}=\sqrt{\log_{16}16}=1$
(D)

19. $\log_4^2 x - \log_4 \sqrt{x} - 1{,}5 = 0$

$\log_4 x = a$.

$a^2 - 0{,}5a - 1{,}5 = 0$.

$a = 1{,}5 \quad a = -1$

$\log_4 x = 1{,}5 \quad x = 8$.

$\log_4 x = -1 \quad x = \frac{1}{4}$.

$8 ! \frac{1}{4} = 32$. (C)

20. $g(x) = x - 3 \quad x = g(x) + 3$

$f(g(x)) = 3(g(x)+3)^2 + 7(g(x)+3) + 3$

$f(g(x)) = 3g^2(x) + 11g(x) + 9$

$f(x) = 3x^2 + 11x + 9$. (B)

$f'(x) = 6x + 11 \quad f'(0) = 11$

21. $y = 4x^5 - 15x^4 - 3 \quad (-1; 1)$

$y' = 20x^4 - 60x^3 = 20x^3(x-3)$

$x = 0 \quad x = 3$ (A)

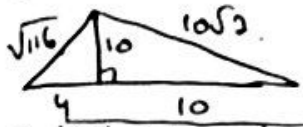
$y(0) = -3 \quad y(3) = -246$.

22. (D)

23. 2; 3; 5; 7; 11; 13; 17; 19; 23; 29

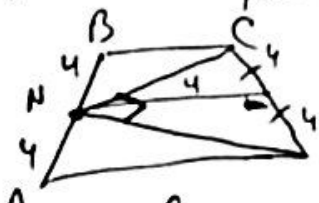
31; 37 12 ta.

$A_{12}^2 = 11 \cdot 12 = 132$ (C)

24. 

$m = \frac{1}{2}\sqrt{2(196 + 200) - 116} = 13$.

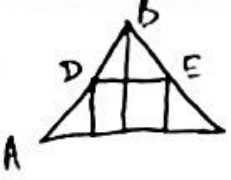
25. $\begin{cases} \alpha - \beta = 40^\circ \\ \alpha + 113 = 180^\circ \end{cases} \quad \alpha = 110^\circ \quad \beta = 70^\circ$ (B)

26. 

(A)

$\frac{a+b}{2} = 4 \quad a + b = 8$.

$P = a + b + 2c = 8 + 2 \cdot 8 = 24$

27. 

$\triangle ABC \sim \triangle BDE$.

$\frac{\frac{\sqrt{3}}{2}a}{\frac{\sqrt{3}}{2}a - m} = \frac{a}{m}$

$\frac{\sqrt{3}}{\sqrt{3}a - 2m} = \frac{1}{m}$. $\sqrt{3}m = \sqrt{3}a - 2m$.

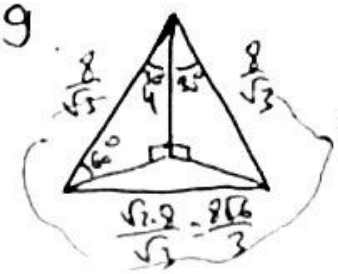
$a = \frac{(\sqrt{3}+2)m}{\sqrt{3}}$

(B)

$S = \frac{\sqrt{3}}{4} \cdot \frac{(\sqrt{3}+2)^2 m^2}{3} = \frac{m^2(7\sqrt{3}+12)}{12}$

28. $(1; 2) \quad (-3; 2) \quad d = \sqrt{4^2 + 0} = 4$

(C)

29. 

(D)

30. $a = 3 \quad l = 3 \quad \alpha = 60^\circ$.

$S_{as} = \frac{\sqrt{3}}{4} \cdot 3^2 = \frac{9\sqrt{3}}{4}$

$h = l \sin 60^\circ = 3 \cdot \frac{\sqrt{3}}{2} = \frac{3\sqrt{3}}{2}$.

$V = \frac{9\sqrt{3}}{4} \cdot \frac{3\sqrt{3}}{2} = \frac{81}{8}$ (A)

Variant-25

1. $a=2017\cdot2018+1$
$a=\ldots6+1=\ldots7$
$r=2$ (D)

2. $2<a<6 \quad 2<b<10$
$\frac{1+\frac{a}{b}}{1+\frac{b}{a}}=\frac{\frac{b+a}{b}}{\frac{a+b}{a}}=\frac{a}{b}=\frac{5}{3}$ (B)

3. $\sqrt[4]{(1-2a+a^2)(a^2-1)(a-1)}:$
$:\frac{a^2+2a-3}{\sqrt[4]{a+1}}=\sqrt[4]{(a-1)^2\cdot(a-1)^2(a+1)}\cdot$
$\cdot\frac{\sqrt[4]{a+1}}{a^2+2a-3}=|a-1|\sqrt[4]{a+1}\cdot\frac{\sqrt[4]{a+1}}{(a+3)(a-1)}=$
$=-\frac{\sqrt{a+1}}{a+3} \quad a\in(-1;1)$ (C)

4. $\sqrt[4]{256a^4b^8c^{12}}=4(-a)\cdot b^2\cdot(c)^3$ (C)

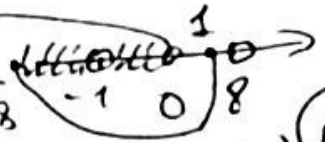
5. $a<0 \quad b>0 \quad a\sqrt{b^2}+b\sqrt{a^2}-$
$-|a-b|=ab-ba-|a-b|=-|a-b|=$
$=a-b$ (D)

6. $\frac{\sqrt{x+1-4\sqrt{x-3}}+\sqrt{x+1+4\sqrt{x-3}}}{\sqrt{(\sqrt{x-3}-2)^2}+\sqrt{(\sqrt{x-3}+2)^2}}=$ (3;7)
$=2-\sqrt{x-3}+\sqrt{x-3}+2=4$ (C)

7. $\frac{3x+2}{x^2-x-12}=\frac{\frac{x+3}{a}}{x-4}+\frac{\frac{x-4}{b}}{x+3}$
$3x+2=ax+3a+bx-4b$
$\begin{cases}3=a+b & a=2\\ 2=3a-4b & b=1\end{cases}$ (A)

8. $x^2-6x+3=0$
$\frac{ab(b^2-a^2)}{a-b}=\frac{ab(b-a)(b+a)}{a-b}=$
$=-ab(a+b)=-3\cdot6=-18$
$a+b=6$
$a\cdot b=3$ (B)

9. $x^2-kx-k+6=0 \quad \sqrt{x_1x_2}=1$
$x_1+x_2=k \quad x_1x_2=6-k$
$\sqrt{6-k}=1 \quad k=5$ (B)
$\frac{x_1+x_2}{2}=\frac{k}{2}=2,5$

10. $x^5|x^2-7x-8|<0$
$\begin{cases}x<0\\ x^2-7x-8\neq0\end{cases}$


(A)
$-8;-7;-6;-5;-4;-3;-2; \quad (-8;-1)\cup(-1;0)$

11 $\frac{1+n}{2}\cdot n=2018 \quad n^2+n-4036=0$
$n=\frac{-1+\sqrt{1+4\cdot4036}}{2}$
$n\in N \quad n>63 \quad n=64$ (D)

12 $\begin{cases}x+y=242\\ x=4y+22\end{cases}$ (A) $5y+22=242$
$5y=220 \quad y=44$

13. $\cos10^\circ-2\cos50^\circ\cos70^\circ=$
$=2\sin30^\circ\cdot\sin40^\circ-2\sin40^\circ=$
$=-\sin40^\circ=-\cos50^\circ$ (A)

14. $tg\,258^\circ=a$
$ctg\,12^\circ=tg\,258^\circ=a$
$\cos24^\circ\cdot\frac{a^2-2a+1+a^2+2a+1}{(a+1)(a-1)}=$
$=\cos24^\circ\cdot\frac{2(a^2+1)}{a^2-1}=\frac{1-tg^212^\circ}{1+tg^212^\circ}\cdot\frac{2(a^2+1)}{a^2-1}=$
$=\frac{1-\frac{1}{a^2}}{1+\frac{1}{a^2}}\cdot\frac{2(a^2+1)}{a^2-1}=2$ (C)

15. $\sin(\pi-x)+\cos(\frac{\pi}{2}+x)=\sqrt{3}$
(D) $\sin x+\sin x=\sqrt{3} \quad 0=\sqrt{3}$ ∅

16. $y=x^2-4x+7 \quad (-1;1)$
$y=(x-2)^2+3 \quad x_0=2 \quad y_0=3$
$\frac{x_0+x}{2}=-1 \quad \frac{y_0+y}{2}=1$ (B)
$x=-4 \quad y=-1$
$y=-(x+4)^2-1=-x^2-8x-17$

17. (D)

18. $9^x-(2a-1)\cdot 3^x+a^2-4a=0$

$\begin{cases} D>0 \\ a^2-4a>0 \\ 2a-1>0 \end{cases}$ $(-\infty;0)\cup(4;\infty)$ $a>\frac{1}{2}$

$(2a-1)^2-4(a^2-4a)>0$ (B)

$4a^2-4a+1-4a^2+16a>0$

$12a>-1$ $a>-\frac{1}{12}$

$(4;\infty)$

19. $\left(3^{2+\frac{\log_3 4}{\log_4 3}}-9\cdot 4^{\frac{1}{\log_4 3}+4}\right)^{1+\log_4 25}$ (B)

$=\left(9\cdot 3^{\log_3^2 4}-9\cdot 4^{\log_3 4+4}\cdot 25\right)^{0,5}=$

$=\left(9\cdot 4^{\log_3 4}-9\cdot 4^{\log_3 4}+100\right)^{0,5}=10$

20. $(x^2-5x+4)\ln(5-x^2)=0$

$5-x^2>0$

$x=1$ $x=4$ $5-x^2=1$

$x=\pm 2$

$1\cdot 2\cdot(-2)=-4$ (B)

21. $f'(x)<0$ $g'(x)>0$

$h(x)=f(x)\cdot g(x)$.

$h'(x)=f'(x)\cdot g(x)+f(x)\cdot g'(x)$

$(-)$ $(+)$ $(-)$ $(+)$

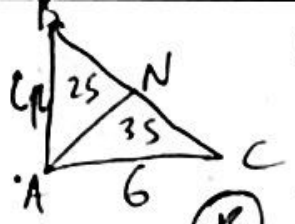
$h'(x)<0$. (B)

22. $\int_1^2 \frac{3x-1}{\sqrt{x}}dx=\int_1^2\left(3\sqrt{x}-\frac{1}{\sqrt{x}}\right)dx=$

$=\frac{3\cdot x^{\frac{1}{2}+1}}{\frac{1}{2}+1}-\frac{x^{-\frac{1}{2}+1}}{-\frac{1}{2}+1}\Big|_1^2=2\sqrt{2}$ (C)

23. (A)

24. $5\cdot 4=20$ (A)

25. 

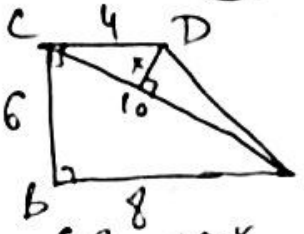
$S_{ABC}=\frac{4\cdot 6}{2}=12$.

$25+35=12$.

$S=2,4$.

$25=4,8$

(B)

26. 

(C)

$\frac{6\cdot 8}{2}+\frac{10\cdot x}{2}=\frac{4+8}{2}\cdot 6$ $x=2,4$

27. $0,7\cdot\frac{360^\circ}{n}=\frac{360^\circ}{m}$ $m;n\in N$.

$\frac{7}{10}=\frac{n}{m}$ $n=7$ (B)

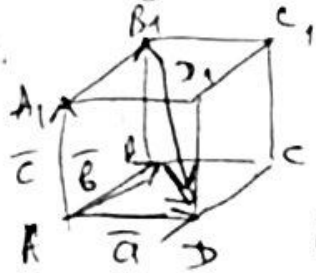
$m=10$

28 $y=2x+6$ $A(0;1)$

$y=2x+b$. $y=2x-4$ (D)

$\frac{2x+6+2x+b}{2}=1$

$\frac{6+b}{2}=1$ $b=-4$

29. 

$\overline{BB_1}=\overline{AA_1}=\overline{c}$

(A)

$\overline{B_1D}=\overline{BD}-\overline{BB_1}=\overline{a}-\overline{b}-\overline{c}$.

$\overline{BD}=\overline{a}-\overline{b}$

30 $H=8$ $d_{y_0N}=13$

$8^2+a^2=13^2$.

$a^2=169-64$.

$a^2=105$.

$(2R)^2=(2a)^2+H^2$

$4R^2=4\cdot 105+64$

$R^2=105+16$ $R=11$

(B)