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36-86-84-23
(124.42)



МОСКОВСКИЙ ГОСУДАРСТВЕННЫЙ УНИВЕРСИТЕТ имени М.В.ЛОМОНОСОВА

Вариант 011 ~~11~~ ~~12~~ ~~13~~ ~~14~~ ~~15~~ ~~16~~ ~~17~~ ~~18~~ ~~19~~ ~~20~~ ~~21~~ ~~22~~ ~~23~~ ~~24~~ ~~25~~ ~~26~~ ~~27~~ ~~28~~ ~~29~~ ~~30~~ ~~31~~ ~~32~~ ~~33~~ ~~34~~ ~~35~~ ~~36~~ ~~37~~ ~~38~~ ~~39~~ ~~40~~ ~~41~~ ~~42~~ ~~43~~ ~~44~~ ~~45~~ ~~46~~ ~~47~~ ~~48~~ ~~49~~ ~~50~~ ~~51~~ ~~52~~ ~~53~~ ~~54~~ ~~55~~ ~~56~~ ~~57~~ ~~58~~ ~~59~~ ~~60~~ ~~61~~ ~~62~~ ~~63~~ ~~64~~ ~~65~~ ~~66~~ ~~67~~ ~~68~~ ~~69~~ ~~70~~ ~~71~~ ~~72~~ ~~73~~ ~~74~~ ~~75~~ ~~76~~ ~~77~~ ~~78~~ ~~79~~ ~~80~~ ~~81~~ ~~82~~ ~~83~~ ~~84~~ ~~85~~ ~~86~~ ~~87~~ ~~88~~ ~~89~~ ~~90~~ ~~91~~ ~~92~~ ~~93~~ ~~94~~ ~~95~~ ~~96~~ ~~97~~ ~~98~~ ~~99~~ ~~100~~ ~~101~~ ~~102~~ ~~103~~ ~~104~~ ~~105~~ ~~106~~ ~~107~~ ~~108~~ ~~109~~ ~~110~~ ~~111~~ ~~112~~ ~~113~~ ~~114~~ ~~115~~ ~~116~~ ~~117~~ ~~118~~ ~~119~~ ~~120~~ ~~121~~ ~~122~~ ~~123~~ ~~124~~ ~~125~~ ~~126~~ ~~127~~ ~~128~~ ~~129~~ ~~130~~ ~~131~~ ~~132~~ ~~133~~ ~~134~~ ~~135~~ ~~136~~ ~~137~~ ~~138~~ ~~139~~ ~~140~~ ~~141~~ ~~142~~ ~~143~~ ~~144~~ 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Место проведения Москва
город

ПИСЬМЕННАЯ РАБОТА

Олимпиада школьников Ломоносов
наименование олимпиады

по математике
профиль олимпиады

Калмыца Георгий Львович
фамилия, имя, отчество участника (в родительном падеже)

Дата
«19» марта 2026 года

Подпись участника
Калмыц

гипот

N_3



$7 \cdot 6 \cdot 7 \cdot 6 \cdot 7 \cdot 3 =$

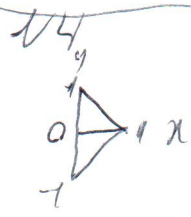
$= 42^2 \cdot 3 =$

$= 5292$

$$\begin{array}{r} 5292 \\ 4 \\ \hline 21168 \end{array}$$

$$\begin{array}{r} 42 \\ \sqrt{2} \\ 4 \end{array}$$

$$\begin{array}{r} 16 \\ + 1764 \\ \hline 1780 \\ + 28 \\ \hline 1808 \\ + 21 \\ \hline 1829 \end{array}$$



$\sin 11\pi/4 = \sin 12\pi/4$

$13\pi/4 = 11\pi/4 + 2\pi$
 $11\pi/4 = 11\pi/4$
 $17\pi/4 = 5\pi/4 + 2\pi$

$2\pi, 25\pi$
 $n = n + n \in \mathbb{Z}(0, \pi)$

$24\pi = 9 + 2\pi$
 $n = \frac{1}{24} \cdot \frac{1+2\pi}{24}$

$\sin 11\pi/4 = \sin 5\pi/4$
 $15\pi/4 = \pi/4 + 2\pi$
 $13\pi/4 = 5\pi/4 + 2\pi$

Черныш

$\cos 2\pi > 0$
 $6(1 - \cos^2 \pi) = 4 + 6 \cos^2 \pi$
 $1 - \frac{6 \cos^2 \pi}{\sin^2 \pi} = \frac{\sin^2 \pi - 6 \cos^2 \pi}{\sin^2 \pi}$

$\sqrt{-6 \cos 2\pi} = 4 \sin \pi \cos \pi$
 $= 2 \sin 2\pi$

$-6 \cos 2\pi = 4 \sin 2\pi$

$\cos 2\pi = 0$

$\tan 2\pi = \frac{3}{2}$

$\sin 2\pi = -\frac{3}{2} \cos 2\pi$

$(\frac{9}{4} + 1) \cos^2 2\pi = 1$

$\cos 2\pi = \frac{2\sqrt{3}}{-13}$

$\cos 2\pi < 0$

$\cos 2\pi = -\frac{2\sqrt{3}}{13} = 2(\cos^2 \pi - 1)$

$2(\cos^2 \pi - 1) = \frac{\sqrt{3} - 2}{2\sqrt{3}}$

$\cos \pi = \frac{\sqrt{\sqrt{3} - 2}}{2\sqrt{3}}$

$n = \frac{n}{2} = a_1 + \dots + a_n = 1$

$n = \frac{1+2n}{2} = 13$

$13\pi/4 = 13\pi/4 + 2\pi$
 $7\pi/4 = 7\pi/4 + 2\pi$

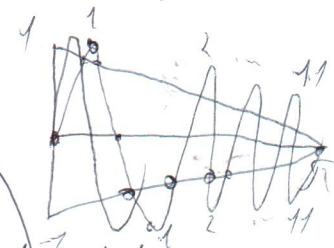
$n = n$
 $n = \frac{1+2n}{2} = 14$

$y = -n + 1$

$y = n - 1$

$n = n - 1 - \sin \pi = 11\pi/4$
 $t = \cos \pi$

$\sin 11\pi/4; \sin 12\pi/4; \sin 13\pi/4$



$t = \frac{1}{\sqrt{2}} \pi = 1, 22$

$t = \frac{1}{\sqrt{2}} \pi = 0, 26$

$t = \frac{3}{4} \pi = -1, 30$

$22 \cdot 2 = 43, 51, 59$

Number

$\frac{100a + 10bc}{a+bc} = 9$
 $a+bc = 11$

$a(100 - 9k) + b(10 - 9k) + c(10 - 9k) = 11(10 - 9k)$
 $a+bc = 11$

$100 \frac{a}{a+bc} + 10 \frac{b}{a+bc} + \frac{c}{a+bc}$

$\frac{162}{9} = 18 = 9$

$\frac{243}{9} = 27 = 9$

162; 243; 324; 405; 486; 567; 648; 729; 810; 891; 972

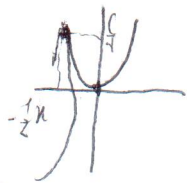
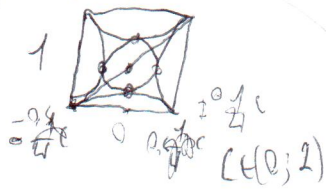
$162 + 648 + 972 = 1782$

$\frac{1620}{162}$

Черновик

N 6 +

N 3



$$y = kx^2$$

$$k = -\frac{c}{2} - \frac{1}{2} = c$$

$$y = \sqrt{\frac{k+c}{c}}$$

$$\sqrt{\frac{k+c}{c}} = k^2$$

$$k^2 = \frac{1}{4}$$

$$k = \pm \frac{1}{2}$$

$$y = \sqrt{\frac{1}{4}}$$

$$y = \sqrt{\frac{k - \sqrt{3} \pm \sqrt{3}}{c}} = \frac{1}{2}$$

$$y = \frac{1}{4} \cdot k = \frac{1}{2} \cdot k$$

$$k = (1/4 - 1/2) \cdot \frac{1}{4}$$

$$k = (1/4 - 1/2) \cdot \frac{1}{4} = \frac{1}{2}$$

$$y = \sqrt{\frac{k+c}{c}} = \frac{1}{2}$$

$$y = \sqrt{\frac{k - \frac{1}{2} \pm \frac{1}{4}}{c}} = \frac{1}{2} \cdot \frac{1}{4}$$

$$\sqrt{\frac{k - \frac{1}{2} \pm \frac{1}{4}}{c}} = \frac{1}{2} \cdot \frac{1}{4} = k^2$$

$$\sqrt{\frac{k - \frac{1}{2} \pm \frac{1}{4}}{c}} = k^2$$

$$\sqrt{\frac{k - \frac{1}{2} \pm \frac{1}{4}}{c}} = k^2$$

$$\sqrt{\frac{k - \frac{1}{2} \pm \frac{1}{4}}{c}} = k^2 + \frac{1}{2} \cdot \frac{1}{4} = \frac{1}{2} \cdot \frac{1}{4}$$

$$\frac{k - \frac{1}{2} \pm \frac{1}{4}}{c} = (k^2 + \frac{1}{2} \cdot \frac{1}{4})^2 = k^2(4k^2 + 1)$$

$$c^3 k^4 + 2c^2 k^2 - k - \frac{1}{2} \pm \frac{1}{4} = 0$$

$$\frac{1}{2} \cdot \frac{1}{4} = 4c^3 k^3 - 2c^2 k - c^3 k - 1 = 0$$

$$c^3 k^4 + c^2 k^2 - \frac{c^3}{2} k^2 - k + \frac{1}{4} - \frac{1}{4} \pm \frac{1}{8} + \frac{1}{2} - \frac{1}{4} = 0$$

AB(9;3)

a(3M; 4M); 6)

b(3; 0; 2)

ab(3-3y; -y; -4)

$\frac{5ab}{2} (0 - 4y) - 4y - 6$

$t(4y - 4y; -4y; 0)$

$y = 3y$

~~$k = 3(3y)^2 + (4y)^2 - 28 = 5$~~

$(-3/4; 0; 4)$

$(3; 4; 0)$

$(0; 0; 2)$

$(-5; 2; 0)$

$(5; -6; 0)$

$\sqrt{38.25}$

38.42762

$\sqrt{352}$

$\sqrt{353}$

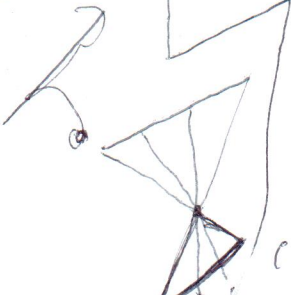
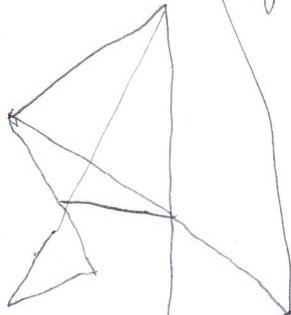
$\frac{1}{42}$

~~$1/6$~~

$(3; 0; 2)$

$(6; 2; 0)$

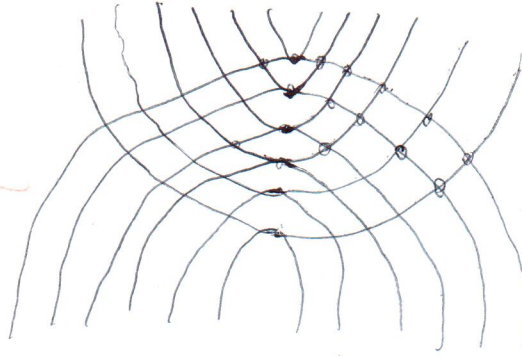
$(9; -6; 0)$



36-86-84-23
(124.42)

Черныш

$$f', \text{ в } \lambda \text{ дога} \approx \frac{3\lambda^2}{\lambda^2 \pi \lambda} + \frac{1}{\lambda^2 \pi \lambda} - 2 \text{ \#}$$



$$\frac{3\lambda^2}{4} = 105$$

$$\lambda = 38.4$$

$$\lambda = 2\sqrt{35} \leftarrow \pi$$

$$-6 \cos \lambda + 45 \sin^2 \lambda$$

$$25 \sin^2 \lambda - 3 \cos \lambda = 0$$

$$25 \sin^2 \lambda - 3 \cos \lambda = 0$$

Имитация
N1

$$\sqrt{6(1-\operatorname{ctg}^2 x)} = 4 \cos x$$

~~OD3~~

$$\text{OD3: } \begin{cases} \cos 2x < 0 \\ \sin x \neq 0 \end{cases}$$

$$\sqrt{6 \frac{1 - \frac{\cos^2 x}{\sin^2 x}}{\sin^2 x}} = 4 \cos x$$

$$\sqrt{\frac{6(\sin^2 x - \cos^2 x)}{\sin^4 x}} = 4 \cos x$$

$$\sqrt{\frac{-6 \cos 2x}{\sin^2 x}} = 4 \cos x$$

$$\begin{cases} -\frac{6 \cos 2x}{\sin^2 x} = 16 \cos^2 x \\ \cos x > 0 \end{cases}$$

$$\begin{cases} -6 \cos 2x = 4 \sin^2 2x \\ \cos x > 0 \end{cases} \quad \begin{cases} 4 - 4 \cos^2 2x + 6 \cos 2x = 0 \\ \cos x > 0 \end{cases}$$

$$\begin{cases} 2 \cos^2 2x - 3 \cos 2x - 2 = 0 \\ \cos x > 0 \end{cases}$$

$$t = \cos 2x$$

$$2t^2 - 3t - 2 = 0$$

$$D = 9 + 16 = 25$$

$$t = \frac{3 \pm 5}{4} = 2$$

$$t = \frac{3 - 5}{4} = -\frac{1}{2}$$

$$\begin{cases} \cos 2x = 2 \\ \cos x > 0 \\ \cos 2x = -\frac{1}{2} \\ \cos x > 0 \end{cases}$$

$$\begin{cases} \emptyset \\ \cos 2x = -\frac{1}{2} \\ \cos x > 0 \end{cases}$$

$$\begin{cases} 2 \cos^2 x - 1 + \frac{1}{2} = 0 \\ \cos x > 0 \end{cases}$$

$$\begin{cases} 2 \cos^2 x = \frac{1}{2} \\ \cos x > 0 \end{cases} \quad \begin{cases} \cos x = \pm \frac{1}{2} \\ \cos x > 0 \end{cases} \Rightarrow \cos x = \frac{1}{2}$$

$$x = \pm \frac{\pi}{3} + 2\pi n; n \in \mathbb{Z} \quad \text{(учетом OD)}$$

Ответ: $x = \pm \frac{\pi}{3} + 2\pi n; n \in \mathbb{Z}$
N2

Пусть \overline{abc} -число в множестве A , тогда

$$\frac{\overline{abc}}{a+b+c} \in \mathbb{Z}; \frac{\overline{abc}}{a+bc} = 9 \Rightarrow \overline{abc} : 9$$

$$\overline{abc} : 9 \Rightarrow a+bc : 9$$

$$\frac{\overline{abc}}{a+bc} = 9 \Rightarrow \overline{abc} : 81$$

Числовик

~~162, 243, 324,~~

162, 243, 324, 405, 486, 567, 648, 729, 810, 891, 972 - все трёхзначные числа, кратные 81

162, 243, 324, 405, 486, 648, 810, 972 - все трёхзначные числа, кратные 81 и принадлежащие промежутку A $\overline{abc} : 81$ \Rightarrow 162, 243, 324, 405, ~~486~~, 648, 810, 972 - все числа, принадлежащие промежутку A 162 + 648 + 972 = 1782 - сумма первого, второго и последнего
Ответ: 1782

$\binom{2}{3} = 3$ - способа выбрать какими двумя осями будут параллельны параллельные катеты

Рассмотрим случай, когда катеты параллельны осям x, y , для остальных случаев количество вариантов будет таким же

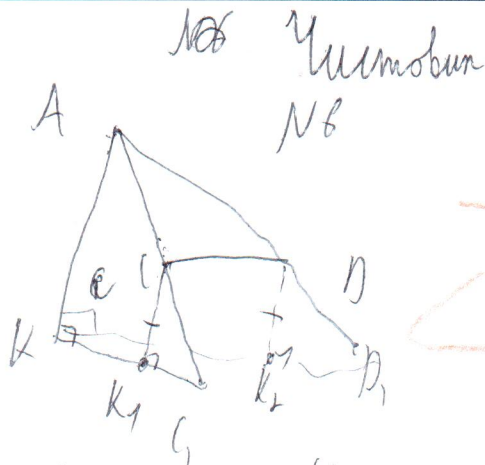
$6 \cdot 7 = 42$ способа выбрать координаты x для вершин катета, параллельного оси x и y 3-ей вершине Δ она будет такой же, как у вершини прямого угла

$6 \cdot 7 = 42$ способа выбрать координаты y для вершин катета, параллельного оси y (у 3-ей вершине она будет такой же, как у вершини прямого угла)

Катеты параллельны осям $x, y \Rightarrow$ треугольник параллелен плоскости $Oxy \Rightarrow$ 7 способов выбрать координату z для вершини треугольника \Rightarrow

 \Rightarrow общее количество способов $3 \cdot 42 \cdot 42 \cdot 7 = 37044$

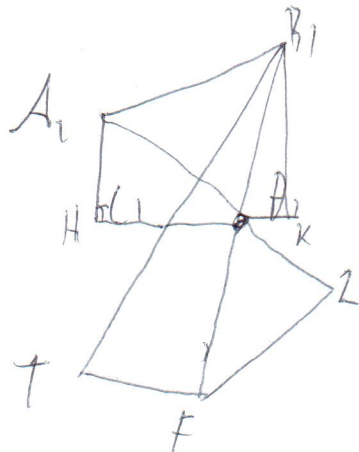
Ответ: 37044 прямоугольных треугольника



$\triangle A_1 K_1 L_1 \sim \triangle C_1 L_1 K_1$ (по подобиям)
 $\triangle A D_1 K_1 \sim \triangle A D_1 L_1 K_1$

$\Rightarrow \frac{C_1 K_1}{K_1 L_1} = \frac{L_1 K_1}{A K_1} = \frac{D_1 K_1}{A K_1} = \frac{D_1 K_1}{K_1 D_1} = 1$ (по свойствам подобия)

Отсюда $A_1 -$ половина высоты $\triangle K_1 L_1 K_2$



$S_{\triangle C_1 D_1 L_1 F} = \frac{1}{2} S_{A_1 B_1 D_1} = \frac{1}{2} S_{B_1 C_1 D_1}$

$B_1 C_1 = \sqrt{36+49} = \sqrt{85} \quad B_1 K = 7$

$B_1 D_1 = \sqrt{49+49} = \sqrt{98} \quad A_1 K = 4$

$C_1 D_1 = 3$

~~$S_{\triangle C_1 D_1 L_1 F} = \frac{1}{2}$~~

$A_1 B_1 = \sqrt{81+9} = 3\sqrt{10}$

$A_1 D_1 = \sqrt{36+16} = \sqrt{52}$

$B_1 D_1 = \sqrt{58}$

$S_{\triangle C_1 D_1 L_1 F} = \frac{1}{2} \left(\frac{7 \cdot 3}{2} \right) \sqrt{58}$