ОПРЕДЕЛИТЕЛИ
Домашняя работа.

1.2.59.

$$\begin{vmatrix} 2 & -3 \\ 5 & -4 \end{vmatrix} = 2\cdot(-4) - (-3)\cdot 5 = -8+15 = 7$$

1.2.60

$$\begin{vmatrix} \alpha & \beta \\ 0 & 0 \end{vmatrix} = \alpha\cdot 0 - \beta\cdot 0 = 0$$

1.2.61

$$\begin{vmatrix} x^2 & x \\ xy^2 & y^2 \end{vmatrix} = x^2\cdot y^2 - x\cdot xy^2 = 0$$

1.2.62

$$\begin{vmatrix} \alpha & 3\alpha \\ \beta & 3\beta \end{vmatrix} = \alpha\cdot 3\beta - 3\alpha\cdot\beta = 0$$

1.2.63

$$\begin{vmatrix} \cos(\varphi) & \sin(\varphi) \\ \sin(\varphi) & \cos(\varphi) \end{vmatrix} = \cos(\varphi)\cdot\cos(\varphi) - \sin(\varphi)\cdot\sin(\varphi) =$$

$$= \cos^2(\varphi) - \sin^2(\varphi) = \cos(2\varphi)$$

1.2.64

$$\begin{vmatrix} x & x-1 \\ x^2+x+1 & x^2 \end{vmatrix} = x\cdot x^2 - (x-1)\cdot(x^2+x+1) =$$

$$= x^3 - (x^3-1) = x^3 - x^3 + 1 = 1$$

1.2.65

$$\begin{vmatrix} 2x-3 & 4 \\ -x & -3 \end{vmatrix} = 0$$

$$\begin{vmatrix} 2x-3 & 4 \\ -x & -3 \end{vmatrix} = (2x-3)\cdot(-3)-4\cdot(-x) =$$

$$= -2x+9$$

$-2x+9=0$; $2x=9$; $x=\frac{9}{2}$

1.2.66

$$\begin{vmatrix} x+3 & x+1 \\ x-1 & x-2 \end{vmatrix} = 0$$

$$\begin{vmatrix} x+3 & x+1 \\ x-1 & x-2 \end{vmatrix} = (x+3)\cdot(x-2)-(x+1)\cdot(x-1) = x-5$$

$x-5=0$; $x=5$

1.2.67

$$\begin{vmatrix} 3-x & x+2 \\ x+1 & x-1 \end{vmatrix} = 6$$

$$\begin{vmatrix} 3-x & x+2 \\ x+1 & x-1 \end{vmatrix} = (3-x)\cdot(x-1)-(x+2)\cdot(x+1) =$$

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

$-2x^2+x-5=6$; $2x^2-x+11=0$; $D=1^2-4\cdot 11\cdot 2<0$

Значит: решений нет

$x=\varnothing$

1.2.68

$\begin{vmatrix} x-2 & y+3 \\ 1-y & x-2 \end{vmatrix} = -4$

$\begin{vmatrix} x-2 & y+3 \\ 1-y & x-2 \end{vmatrix} = (x-2)\cdot(x-2) - (y+3)\cdot(1-y) =$

$= (x-2)^2 + y^2 + 2y - 3$

$(x-2)^2 + y^2 + 2y - 3 = -4$; $(x-2)^2 + y^2 + 2y + 1 = 0$

$(x-2)^2 + (y+1)^2 = 0$

$\begin{cases} (x-2)^2 \geqslant 0 \\ (y+1)^2 \geqslant 0 \end{cases} \Rightarrow (x-2)^2 = (y+1)^2 = 0 \Rightarrow \boxed{\begin{cases} x = 2 \\ y = -1 \end{cases}}$

1.2.69

$\begin{vmatrix} x-2 & y+3 \\ 7-y & x+4 \end{vmatrix} = -34$

$\begin{vmatrix} x-2 & y+3 \\ 7-y & x+4 \end{vmatrix} = (x-2)\cdot(x+4) - (y+3)\cdot(7-y) =$

$= x^2 + 4x - 2x - 8 - (7y - y^2 + 21 - 3y) = x^2 + 2x - 29 - 4y + y^2$

$x^2 + 2x - 29 - 4y + y^2 = -34$; $x^2 + 2x + 1 + y^2 - 4y + 4 = 0$

$(x+1)^2 + (y-2)^2 = 0$

$\begin{cases} (x+1)^2 \geqslant 0 \\ (y-2)^2 \geqslant 0 \end{cases} \Rightarrow (x+1)^2 = (y-2)^2 = 0 \Rightarrow \boxed{\begin{cases} x = -1 \\ y = 2 \end{cases}}$

1.2.70

$\begin{vmatrix} \sin 2x & -\sin 3x \\ \cos 2x & \cos 3x \end{vmatrix} = 0$

$\begin{vmatrix} \sin 2x & -\sin 3x \\ \cos 2x & \cos 3x \end{vmatrix} = \sin 2x \cdot \cos 3x - (-\sin 3x) \cdot$

$\cdot \cos 2x = \sin 2x \cdot \cos 3x + \sin 3x \cdot \cos 2x =$

$= \sin(5x)$ $(\sin(a) \cdot \cos(b) + \sin(b) \cdot \cos(a) = \sin(a+b))$

$\sin(5x) = 0$

$5x = \pi k, k \in \mathbb{Z}$

$x = \frac{\pi k}{5}, k \in \mathbb{Z}$

1.2.71

$\begin{vmatrix} 1 & 1 & 1 \\ 2 & 3 & 3 \\ 4 & 6 & 7 \end{vmatrix} = 1 \cdot \begin{vmatrix} 3 & 3 \\ 6 & 7 \end{vmatrix} - 1 \cdot \begin{vmatrix} 2 & 3 \\ 4 & 7 \end{vmatrix} + 1 \cdot \begin{vmatrix} 2 & 3 \\ 4 & 6 \end{vmatrix} =$

$= (3 \cdot 7 - 3 \cdot 6) - (2 \cdot 7 - 3 \cdot 4) + (2 \cdot 6 - 3 \cdot 4) =$

$= 3 - 2 + 0 = 1$

1.2.72

$\begin{vmatrix} 1 & 1 & 0 \\ 2 & 3 & 1 \\ 0 & 2 & 3 \end{vmatrix} = 1 \cdot \begin{vmatrix} 3 & 1 \\ 2 & 3 \end{vmatrix} - 1 \cdot \begin{vmatrix} 2 & 1 \\ 0 & 3 \end{vmatrix} + 0 \cdot \begin{vmatrix} 2 & 3 \\ 0 & 2 \end{vmatrix} =$

$= (3 \cdot 3 - 2 \cdot 1) - (2 \cdot 3) = 1$

1.2.73

$$\begin{vmatrix} -2 & 3 & 5 \\ 4 & 1 & -2 \\ 1 & -3 & 2 \end{vmatrix} = -2\cdot\begin{vmatrix} 1 & -2 \\ -3 & 2 \end{vmatrix} - 3\cdot\begin{vmatrix} 4 & -2 \\ 1 & 2 \end{vmatrix} + 5\cdot\begin{vmatrix} 4 & 1 \\ 1 & -3 \end{vmatrix} =$$

$$= -2\cdot(2-6) - 3\cdot(8+2) + 5(-12-1) = 8-30-$$

$$-65 = -87$$

1.2.74

$$\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = a\cdot\begin{vmatrix} c & a \\ a & b \end{vmatrix} - b\cdot\begin{vmatrix} b & a \\ c & b \end{vmatrix} + c\cdot\begin{vmatrix} b & c \\ c & a \end{vmatrix} =$$

$$= a\cdot(cb-a^2) - b\cdot(b^2-ac) + c(ba-c^2) =$$

$$= 3abc - a^3 - b^3 - c^3$$

1.2.75

$$\begin{vmatrix} \alpha & 0 & 0 \\ 0 & \beta & 0 \\ 0 & 0 & \gamma \end{vmatrix} = \alpha\cdot\beta\cdot\gamma + 0\cdot0\cdot0 + 0\cdot0\cdot0 - 0\cdot0\cdot0 - 0\cdot0\cdot0 -$$

$$-0\cdot0\cdot0 = \alpha\beta\gamma$$

1.2.76

$$\begin{vmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{vmatrix} = 0\cdot0\cdot0 + 1\cdot1\cdot1 + 1\cdot1\cdot1 - 1\cdot0\cdot1 - 1\cdot1\cdot0 - 1\cdot1\cdot0 =$$

$$= 2$$

1.2.77

$$\begin{vmatrix} \cos\alpha & \cos\beta & 0 \\ \cos\alpha & 0 & \cos\gamma \\ 0 & \cos\beta & \cos\gamma \end{vmatrix} = \cos\alpha\cdot 0\cdot\cos\gamma + \cos\beta\cdot\cos\gamma\cdot 0 +$$

$$+\cos\alpha\cdot\cos\beta\cdot 0 - 0\cdot 0\cdot 0 - \cos\beta\cdot\cos\alpha\cdot\cos\gamma -$$

$$-\cos\alpha\cdot\cos\gamma\cdot\cos\beta = -2\cdot\cos\alpha\cdot\cos\beta\cdot\cos\gamma$$

1.2.78

$$\begin{vmatrix} 0 & x & 0 \\ x & 1 & x \\ 0 & x & 0 \end{vmatrix} = 0\cdot 1\cdot 0 + x\cdot x\cdot 0 + x\cdot x\cdot 0 - 0\cdot 1\cdot 0 -$$

$$-x\cdot x\cdot 0 - x\cdot x\cdot 0 = 0$$

1.2.79

$$\begin{vmatrix} 2 & 3 & 5 \\ 0 & -1 & 0 \\ 6 & 7 & 8 \end{vmatrix} = -0 - 1\cdot\begin{vmatrix} 2 & 5 \\ 6 & 8 \end{vmatrix} - 0 =$$

$$= -1\cdot(16-30) = 14$$

1.2.80

$$\begin{vmatrix} 1 & 2 & 0 \\ 3 & 4 & 0 \\ 5 & 6 & 7 \end{vmatrix} = 0 - 0 + 7\cdot\begin{vmatrix} 1 & 2 \\ 3 & 4 \end{vmatrix} = 7\cdot(4-6) = -14$$

1.2.81

$$\begin{vmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 0 \end{vmatrix} = 7\cdot\begin{vmatrix} 2 & 3 \\ 5 & 6 \end{vmatrix} - 8\cdot\begin{vmatrix} 1 & 3 \\ 4 & 6 \end{vmatrix} + 0 =$$

$$= 7\cdot(12-15) - 8\cdot(6-12) = -21+48 = 27$$

1.2.82

$$\begin{vmatrix} x & y & z \\ 0 & y & z \\ x & 0 & z \end{vmatrix} = 0 + y \cdot \begin{vmatrix} x & z \\ x & z \end{vmatrix} - z \cdot \begin{vmatrix} x & y \\ x & 0 \end{vmatrix} =$$

$$= 0 + y \cdot (xz - z \cdot x) - z \cdot (x \cdot 0 - yx) = xyz$$

1.2.83

$$\begin{vmatrix} \cos\alpha & \cos\beta & \cos\gamma \\ 1 & 1 & 0 \\ 1 & 0 & 1 \end{vmatrix} = -1 \cdot \begin{vmatrix} \cos\beta & \cos\gamma \\ 0 & 1 \end{vmatrix} +$$

$$+ 1 \cdot \begin{vmatrix} \cos\alpha & \cos\gamma \\ 1 & 1 \end{vmatrix} - 0 \cdot \begin{vmatrix} \cos\alpha & \cos\beta \\ 1 & 0 \end{vmatrix} =$$

$$= -1 \cdot (\cos\beta \cdot 1 - \cos\gamma \cdot 0) + 1 \cdot (\cos\alpha \cdot 1 - \cos\gamma \cdot 1) - 0 =$$

$$= \cos\alpha - \cos\beta - \cos\gamma$$

1.2.84

$$\begin{vmatrix} -3 & 2 & 1 \\ x-1 & 0 & 7 \\ 2 & -1 & 3 \end{vmatrix} = 0$$

$$\begin{vmatrix} -3 & 2 & 1 \\ x-1 & 0 & 7 \\ 2 & -1 & 3 \end{vmatrix} = -2 \cdot \begin{vmatrix} x-1 & 7 \\ 2 & 3 \end{vmatrix} + 0 \cdot \begin{vmatrix} -3 & 1 \\ 2 & 3 \end{vmatrix} -$$

$$-(-1) \cdot \begin{vmatrix} -3 & 1 \\ x-1 & 7 \end{vmatrix} = -2 \cdot (3x - 17) + 0 + 1 \cdot (-20 - x) =$$

$$= -7x + 14$$

$-7x + 14 = 0$; $x = 2$

1.2.85

$$\begin{vmatrix} 2 & 0 & -1 \\ 1 & x+5 & 2-x \\ 3 & -1 & 2 \end{vmatrix} \leq 4$$

$$\begin{vmatrix} 2 & 0 & -1 \\ 1 & x+5 & 2-x \\ 3 & -1 & 2 \end{vmatrix} = 2 \cdot \begin{vmatrix} x+5 & 2-x \\ -1 & 2 \end{vmatrix} - 0 \cdot \begin{vmatrix} 1 & 2-x \\ 3 & 2 \end{vmatrix} +$$

$$+(-1) \cdot \begin{vmatrix} 1 & x+5 \\ 3 & -1 \end{vmatrix} = 2 \cdot (x+12) + 0 + (-1) \cdot (-16-3x) =$$

$$= 2x + 24 - (-16-3x) = 5x + 40$$

$5x + 40 \leq 4$; $5x \leq -36$; $x \leq -7{,}2$

1.2.86

$$\begin{vmatrix} x+2 & 4 & -1 \\ -2 & 2 & x-1 \\ 1 & 3 & 0 \end{vmatrix} = 0$$

$$\begin{vmatrix} x+2 & 4 & -1 \\ -2 & 2 & x-1 \\ 1 & 3 & 0 \end{vmatrix} = 1 \cdot \begin{vmatrix} 4 & -1 \\ 2 & x-1 \end{vmatrix} - 3 \cdot \begin{vmatrix} x+2 & -1 \\ -2 & x-1 \end{vmatrix} +$$

$$+0 \cdot \begin{vmatrix} x+2 & 4 \\ -2 & 2 \end{vmatrix} = 4x - 2 - 3 \cdot (x^2 + x - 4) + 0 =$$

$$= 4x - 2 - 3x^2 - 3x + 12 = -3x^2 + x + 10$$

$-3x^2 + x + 10 = 0$; $(x-2)(3x+5) = 0$; $\boxed{\left[\begin{array}{l} x = -\frac{5}{3} \\ x = 2 \end{array}\right.}$

1.2.87

$$\begin{vmatrix} -3 & x-1 & 1 \\ x+2 & 2 & 3 \\ 0 & 1 & x \end{vmatrix} = 6$$

$$\begin{vmatrix} -3 & x-1 & 1 \\ x+2 & 2 & 3 \\ 0 & 1 & x \end{vmatrix} = 0 \cdot \begin{vmatrix} x-1 & 1 \\ 2 & 3 \end{vmatrix} - 1 \cdot \begin{vmatrix} -3 & 1 \\ x+2 & 3 \end{vmatrix} +$$

$$+ x \cdot \begin{vmatrix} -3 & x-1 \\ x+2 & 2 \end{vmatrix} = 0 - (-11 - x) + x \cdot (-4 - x^2 - x) =$$

$$= 11 + x - 4x - x^3 - x^2 = 11 - 3x - x^2 - x^3$$

$$-x^3 - x^2 - 3x + 11 = 6$$

$$-x^3 + x^2 - 2x^2 + 2x - 5x + 5 = 0$$

$$-(x-1)(x^2+2x+5) = 0$$

$$\left[\begin{array}{l} x-1=0 \\ x^2+2x+5=0 \end{array}\right. \quad \left[\begin{array}{l} \underline{x=1} \\ x=\varnothing \end{array}\right.$$

1.2.88

$$\begin{vmatrix} 3 & 2 & -1 \\ x+2 & 0 & 1 \\ -2 & 3-x & 1 \end{vmatrix} < 0$$

$$\begin{vmatrix} 3 & 2 & -1 \\ x+2 & 0 & 1 \\ -2 & 3-x & 1 \end{vmatrix} = -(x+2) \cdot \begin{vmatrix} 2 & -1 \\ 3-x & 1 \end{vmatrix} + 0 \cdot \begin{vmatrix} 3 & -1 \\ -2 & 1 \end{vmatrix} -$$

$$-1 \cdot \begin{vmatrix} 3 & 2 \\ -2 & 3-x \end{vmatrix} = -(x+2)(5-x) + 0 - (13-3x) = x^2 - 23$$

$$x^2 - 23 < 0 \Rightarrow \underline{x \in (-\sqrt{23}, \sqrt{23})}$$

1.2.89

$$\begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix} = (*)$$

1° $(*)$ = [из 1 строки выч. 2-ю] =

$$= \begin{vmatrix} 0 & a-b & a^2-b^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix} = \begin{vmatrix} 0 & a-b & (a-b)(a+b) \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix} =$$

$$= (a-b) \cdot \begin{vmatrix} 0 & 1 & a+b \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix} \Rightarrow \vdots (a-b)$$

2° $(*)$ = [из 2 строки выч. 3-ю] =

$$= \begin{vmatrix} 1 & a & a^2 \\ 0 & b-c & b^2-c^2 \\ 1 & c & c^2 \end{vmatrix} = \begin{vmatrix} 1 & a & a^2 \\ 0 & b-c & (b-c)(b+c) \\ 1 & c & c^2 \end{vmatrix} =$$

$$= (b-c) \cdot \begin{vmatrix} 1 & a & a^2 \\ 0 & 1 & b+c \\ 1 & c & c^2 \end{vmatrix} \Rightarrow \vdots (b-c)$$

3° $(*)$ = [из 3 строки выч. 1-ю] =

$$= \begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 0 & c-a & c^2-a^2 \end{vmatrix} = \begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 0 & c-a & (c-a)(c+a) \end{vmatrix} =$$

$$= (c-a) \cdot \begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 0 & 1 & c+a \end{vmatrix} \Rightarrow \vdots (c-a)$$

1.2.90

$$\begin{vmatrix} 1 & a & bc \\ 1 & b & ca \\ 1 & c & ab \end{vmatrix} = (*)$$

1° $(*) = [1 \text{ строка} - 2\text{-я}] =$

$$= \begin{vmatrix} 0 & a-b & bc-ca \\ 1 & b & ca \\ 1 & c & ab \end{vmatrix} = \begin{vmatrix} 0 & a-b & -c(a-b) \\ 1 & b & ca \\ 1 & c & ab \end{vmatrix} =$$

$$= (a-b) \cdot \begin{vmatrix} 0 & 1 & -c \\ 1 & b & ca \\ 1 & c & ab \end{vmatrix} \Rightarrow \vdots (a-b)$$

2° $(*) = [2 \text{ строка} - 3\text{-я}] =$

$$= \begin{vmatrix} 1 & a & bc \\ 0 & b-c & ca-ab \\ 1 & c & ab \end{vmatrix} = \begin{vmatrix} 1 & a & bc \\ 0 & b-c & -a(b-c) \\ 1 & c & ab \end{vmatrix} =$$

$$= (b-c) \cdot \begin{vmatrix} 1 & a & bc \\ 0 & 1 & -a \\ 1 & c & ab \end{vmatrix} \Rightarrow \vdots (b-c)$$

3° $(*) = [3 \text{ строка} - 1\text{-я}] = \begin{vmatrix} 1 & a & bc \\ 1 & b & ca \\ 0 & c-a & ab-bc \end{vmatrix} =$

$$= \begin{vmatrix} 1 & a & bc \\ 1 & b & ca \\ 0 & c-a & -b(c-a) \end{vmatrix} = (c-a) \cdot \begin{vmatrix} 1 & a & bc \\ 1 & b & ca \\ 0 & 1 & -b \end{vmatrix} \Rightarrow \vdots (c-a)$$

1.2.91

$$\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{vmatrix} = (*)$$

1^0 $(*)$ = [из 1-го столбца выч. 2-й] =

$$= \begin{vmatrix} 0 & 1 & 1 \\ a-b & b & c \\ a^3-b^3 & b^3 & c^3 \end{vmatrix} = \begin{vmatrix} 0 & 1 & 1 \\ a-b & b & c \\ (a-b)(a^2+ab+b^2) & b^3 & c^3 \end{vmatrix} =$$

$$= (a-b)\cdot \begin{vmatrix} 0 & 1 & 1 \\ 1 & b & c \\ a^2+ab+b^2 & b^3 & c^3 \end{vmatrix} \Rightarrow \vdots (a-b)$$

2^0 $(*)$ = [из 2-го столбца выч. 3-й] =

$$= \begin{vmatrix} 1 & 0 & 1 \\ a & b-c & c \\ a^3 & b^3-c^3 & c^3 \end{vmatrix} = \begin{vmatrix} 1 & 0 & 1 \\ a & b-c & c \\ a^3 & (b-c)(b^2+bc+c^2) & c^3 \end{vmatrix} =$$

$$= (b-c)\cdot \begin{vmatrix} 1 & 0 & 1 \\ a & 1 & c \\ a^3 & b^2+bc+c^2 & c^3 \end{vmatrix} \Rightarrow \vdots (b-c)$$

3^0 $(*)$ = [из 3-го столбца выч. 1-й] =

$$= \begin{vmatrix} 1 & 1 & 0 \\ a & b & c-a \\ a^3 & b^3 & c^3-a^3 \end{vmatrix} = \begin{vmatrix} 1 & 1 & 0 \\ a & b & c-a \\ a^3 & b^3 & (c-a)(c^2+ac+a^2) \end{vmatrix} =$$

$$= (c-a)\cdot \begin{vmatrix} 1 & 1 & 0 \\ a & b & 1 \\ a^3 & b^3 & c^2+ac+a^2 \end{vmatrix} \Rightarrow \vdots (c-a)$$

1.2.92

$$\begin{vmatrix} \sin\alpha & \cos\alpha & \sin(\alpha+\delta) \\ \sin\beta & \cos\beta & \sin(\beta+\delta) \\ \sin\gamma & \cos\gamma & \sin(\gamma+\delta) \end{vmatrix} = \left[\sin(a+b) = \sin a\cdot\cos b + \cos a\cdot\sin b \right]$$

$$= \begin{vmatrix} \sin\alpha & \cos\alpha & \sin\alpha\cdot\cos\delta + \cos\alpha\cdot\sin\delta \\ \sin\beta & \cos\beta & \sin\beta\cdot\cos\delta + \cos\beta\cdot\sin\delta \\ \sin\gamma & \cos\gamma & \sin\gamma\cdot\cos\delta + \cos\gamma\cdot\sin\delta \end{vmatrix} =$$

$$= \begin{vmatrix} \sin\alpha & \cos\alpha & \sin\alpha\cdot\cos\delta \\ \sin\beta & \cos\beta & \sin\beta\cdot\cos\delta \\ \sin\gamma & \cos\gamma & \sin\gamma\cdot\cos\delta \end{vmatrix} + \begin{vmatrix} \sin\alpha & \cos\alpha & \cos\alpha\cdot\sin\delta \\ \sin\beta & \cos\beta & \cos\beta\cdot\sin\delta \\ \sin\gamma & \cos\gamma & \cos\gamma\cdot\sin\delta \end{vmatrix} =$$

$$= \cos\delta\cdot \begin{vmatrix} \sin\alpha & \cos\alpha & \sin\alpha \\ \sin\beta & \cos\beta & \sin\beta \\ \sin\gamma & \cos\gamma & \sin\gamma \end{vmatrix} + \sin\delta\cdot \begin{vmatrix} \sin\alpha & \cos\alpha & \cos\alpha \\ \sin\beta & \cos\beta & \cos\beta \\ \sin\gamma & \cos\gamma & \cos\gamma \end{vmatrix} =$$

= [1) столбик 1 = столбик 2 => |...| = 0
2) столбик 2 = столбик 3 => |...| = 0] =

$$= \cos\delta\cdot 0 + \sin\delta\cdot 0 = 0$$

1.2.93

$$\begin{vmatrix} a & a^2+1 & (a+1)^2 \\ b & b^2+1 & (b+1)^2 \\ c & c^2+1 & (c+1)^2 \end{vmatrix} = \left[(x+1)^2 = x^2+2x+1 = x^2+1+2x \right] =$$

$$= \begin{vmatrix} a & a^2+1 & a^2+1+2a \\ b & b^2+1 & b^2+1+2b \\ c & c^2+1 & c^2+1+2c \end{vmatrix} = \begin{vmatrix} a & a^2+1 & a^2+1 \\ b & b^2+1 & b^2+1 \\ c & c^2+1 & c^2+1 \end{vmatrix} + \begin{vmatrix} a & a^2+1 & 2a \\ b & b^2+1 & 2b \\ c & c^2+1 & 2c \end{vmatrix} =$$

= [1) 2-й столб. = 3-й столб. => |...| = 0
2) 1-й столб. пропорционален 3-му столб. => |...| = 0]

$$= 0 + 0 = 0$$

1.2.94

$$\begin{vmatrix} x & a & b & 0 & c \\ 0 & y & 0 & 0 & d \\ 0 & e & z & 0 & f \\ 0 & 0 & 0 & 0 & v \\ g & h & k & u & e \end{vmatrix} = -0+0-0+0-$$

$$-v\cdot\begin{vmatrix} x & a & b & 0 \\ 0 & y & 0 & 0 \\ 0 & e & z & 0 \\ g & h & k & u \end{vmatrix} = \overset{-v\cdot}{\cancel{y}}\left(-0 + y\cdot\begin{vmatrix} x & b & 0 \\ 0 & z & 0 \\ g & k & u \end{vmatrix} - 0 + 0\right) =$$

$$= -v\cdot y\cdot\left(-0 + z\cdot\begin{vmatrix} x & 0 \\ g & u \end{vmatrix} - 0\right) = -v\cdot y\cdot z\cdot x\cdot u =$$

$$= \underline{-uvxyz}$$

1.2.95

$$\begin{vmatrix} 0 & 5 & 2 & 0 \\ 8 & 3 & 5 & 4 \\ 7 & 2 & 4 & 1 \\ 0 & 4 & 1 & 0 \end{vmatrix} = -0 + 4\cdot\begin{vmatrix} 0 & 2 & 0 \\ 8 & 5 & 4 \\ 7 & 4 & 1 \end{vmatrix} - 1\cdot\begin{vmatrix} 0 & 5 & 0 \\ 8 & 3 & 4 \\ 7 & 2 & 1 \end{vmatrix} + 0 =$$

$$= 4\cdot\left(0 - 2\cdot\begin{vmatrix} 8 & 4 \\ 7 & 1 \end{vmatrix} + 0\right) - \left(0 - 5\cdot\begin{vmatrix} 8 & 4 \\ 7 & 1 \end{vmatrix} + 0\right) =$$

$$= 4\cdot(-2\cdot(-20)) - (-5\cdot(-20)) = 8\cdot 20 - 5\cdot 20 = 60$$

1.2.96

$$\begin{vmatrix} 5 & a & 2 & -1 \\ 4 & b & 4 & -3 \\ 2 & c & 3 & -2 \\ 4 & d & 5 & -4 \end{vmatrix} = 5\cdot\begin{vmatrix} b & 4 & -3 \\ c & 3 & -2 \\ d & 5 & -4 \end{vmatrix} - a\cdot\begin{vmatrix} 4 & 4 & -3 \\ 2 & 3 & -2 \\ 4 & 5 & -4 \end{vmatrix} +$$

$$+2\cdot\begin{vmatrix} 4 & b & -3 \\ 2 & c & -2 \\ 4 & d & -4 \end{vmatrix} - (-1)\cdot\begin{vmatrix} 4 & b & 4 \\ 2 & c & 3 \\ 4 & d & 5 \end{vmatrix} =$$

$= 5\cdot(b\cdot 3\cdot(-4) + 4\cdot(-2)\cdot d + (-3)\cdot c\cdot 5 - (d\cdot 3\cdot(-3) +$

$+ 5\cdot(-2)\cdot b + (-4)\cdot c\cdot 4)) - a\cdot(4\cdot 3\cdot(-4) + 4\cdot(-2)\cdot 4 +$

$+(-3)\cdot 2\cdot 5 - (4\cdot 3\cdot(-3) + 5\cdot(-2)\cdot 4 + (-4)\cdot 2\cdot 4)) +$

$+2\cdot(4\cdot c\cdot(-4) + b\cdot(-2)\cdot 4 + (-3)\cdot 2\cdot d - (4\cdot c\cdot(-3) +$

$+d\cdot(-2)\cdot 4 + (-4)\cdot 2\cdot d)) + (4\cdot c\cdot 5 + b\cdot 3\cdot 4 + 4\cdot 2\cdot d -$

$-(4\cdot c\cdot 4 + d\cdot 3\cdot 4 + 5\cdot 2\cdot b)) = 5\cdot(-2b + d + c) -$

$- a\cdot(-2) + 2\cdot(-4c + 2d) + 1\cdot(4c + 2b - 4d) =$

$= -10b + 5d + 5c + 2a - 8c + 4d + 4c + 2b - 4d =$

$= \underline{-8b + 5d + c + 2a}$

1.2.97

$$\begin{vmatrix} 3 & 2 & 2 & 2 \\ 9 & -8 & 5 & 10 \\ 5 & -8 & 5 & 8 \\ 6 & -5 & 4 & 7 \end{vmatrix} = 3\cdot\begin{vmatrix} -8 & 5 & 10 \\ -8 & 5 & 8 \\ -5 & 4 & 7 \end{vmatrix} - 2\cdot\begin{vmatrix} 9 & 5 & 10 \\ 5 & 5 & 8 \\ 6 & 4 & 7 \end{vmatrix} +$$

$$+2\cdot\begin{vmatrix} 9 & -8 & 10 \\ 5 & -8 & 8 \\ 6 & -5 & 7 \end{vmatrix} - 2\cdot\begin{vmatrix} 9 & -8 & 5 \\ 5 & -8 & 5 \\ 6 & -5 & 4 \end{vmatrix} = 3\cdot(-8\cdot 5\cdot 7 +$$

$+5\cdot 8\cdot(-5) + 10\cdot(-8)\cdot 4 - ((-5)\cdot 5\cdot 10 + 4\cdot 8\cdot(-8) + 7\cdot(-8)\cdot 5))$

$-2\cdot(9\cdot 5\cdot 7 + 5\cdot 8\cdot 6 + 10\cdot 5\cdot 4 - (6\cdot 5\cdot 10 + 4\cdot 8\cdot 9 +$

$+7\cdot 5\cdot 5)) + 2\cdot(9\cdot(-8)\cdot 7 + (-8)\cdot 8\cdot 6 + 10\cdot 5\cdot(-5) -$

$-(6\cdot(-8)\cdot 10+(-5)\cdot 8\cdot 9+7\cdot 5\cdot(-8))-$

$-2\cdot(9\cdot(-8)\cdot 4+(-8)\cdot 5\cdot 6+5\cdot 5\cdot(-5)-$

$-(6\cdot(-8)\cdot 5+(-5)\cdot 5\cdot 9+4\cdot 5\cdot(-8)))=$

$=3\cdot(-14)-2\cdot(-8)+2\cdot(-18)-2\cdot(-28)=$

$=-42+16-36+56=\underline{-6}$

<u>1.2.98</u>

$$\begin{vmatrix} 7 & 3 & 2 & 6 \\ 8 & -9 & 4 & 9 \\ 7 & -2 & 7 & 3 \\ 5 & -3 & 3 & 4 \end{vmatrix} = 7\cdot\begin{vmatrix} -9 & 4 & 9 \\ -2 & 7 & 3 \\ -3 & 3 & 4 \end{vmatrix} - 3\cdot\begin{vmatrix} 8 & 4 & 9 \\ 7 & 7 & 3 \\ 5 & 3 & 4 \end{vmatrix} +$$

$$+2\cdot\begin{vmatrix} 8 & -9 & 9 \\ 7 & -2 & 3 \\ 5 & -3 & 4 \end{vmatrix} - 6\cdot\begin{vmatrix} 8 & -9 & 4 \\ 7 & -2 & 7 \\ 5 & -3 & 3 \end{vmatrix} =$$

$=7\cdot(-9\cdot 7\cdot 4+4\cdot 3\cdot(-3)+9\cdot(-2)\cdot 3-(-3\cdot 7\cdot 9+3\cdot 3\cdot(-9)+$

$+4\cdot(-2)\cdot 4))-3\cdot(8\cdot 7\cdot 4+4\cdot 3\cdot 5+9\cdot 7\cdot 3-$

$-(5\cdot 7\cdot 9+3\cdot 3\cdot 8+4\cdot 7\cdot 4))+2\cdot(8\cdot(-2)\cdot 4+(-9)\cdot 3\cdot 5+$

$+9\cdot 7\cdot(-3)-(5\cdot(-2)\cdot 9+(-3)\cdot 3\cdot 8+4\cdot 7\cdot(-9)))-$

$-6\cdot(8\cdot(-2)\cdot 3+(-9)\cdot 7\cdot 5+4\cdot 7\cdot(-3)-(5\cdot(-2)\cdot 4+$

$+(-3)\cdot 7\cdot 8+3\cdot 7\cdot(-9)))=7\cdot(-40)-3\cdot(-26)+$

$+2\cdot 26-6\cdot(-50)=-280+78+52+300=\underline{150}$

1.2.99

$$\begin{vmatrix} 3 & 6 & 5 & 6 & 4 \\ 5 & 9 & 7 & 8 & 6 \\ 6 & 12 & 13 & 9 & 7 \\ 4 & 6 & 6 & 5 & 4 \\ 2 & 5 & 4 & 5 & 3 \end{vmatrix} = 3 \cdot \overset{(1)}{\begin{vmatrix} 9 & 7 & 8 & 6 \\ 12 & 13 & 9 & 7 \\ 6 & 6 & 5 & 4 \\ 5 & 4 & 5 & 3 \end{vmatrix}} -$$

$$-6 \cdot \overset{(2)}{\begin{vmatrix} 5 & 7 & 8 & 6 \\ 6 & 13 & 9 & 7 \\ 4 & 6 & 5 & 4 \\ 2 & 4 & 5 & 3 \end{vmatrix}} + 5 \cdot \overset{(3)}{\begin{vmatrix} 5 & 9 & 8 & 6 \\ 6 & 12 & 9 & 7 \\ 4 & 6 & 5 & 4 \\ 2 & 5 & 5 & 3 \end{vmatrix}} - 6 \cdot \overset{(4)}{\begin{vmatrix} 5 & 9 & 7 & 6 \\ 6 & 12 & 13 & 7 \\ 4 & 6 & 6 & 4 \\ 2 & 5 & 4 & 3 \end{vmatrix}} +$$

$$+4 \cdot \overset{(5)}{\begin{vmatrix} 5 & 9 & 7 & 8 \\ 6 & 12 & 13 & 9 \\ 4 & 6 & 6 & 5 \\ 2 & 5 & 4 & 5 \end{vmatrix}} = (*)$$

$$1^\circ \quad \begin{vmatrix} 9 & 7 & 8 & 6 \\ 12 & 13 & 9 & 7 \\ 6 & 6 & 5 & 4 \\ 5 & 4 & 5 & 3 \end{vmatrix} = 9 \cdot \begin{vmatrix} 13 & 9 & 7 \\ 6 & 5 & 4 \\ 4 & 5 & 3 \end{vmatrix} - 7 \cdot \begin{vmatrix} 12 & 9 & 7 \\ 6 & 5 & 4 \\ 5 & 5 & 3 \end{vmatrix} +$$

$$+8 \cdot \begin{vmatrix} 12 & 13 & 7 \\ 6 & 6 & 4 \\ 5 & 4 & 3 \end{vmatrix} - 6 \cdot \begin{vmatrix} 12 & 13 & 9 \\ 6 & 6 & 5 \\ 5 & 4 & 5 \end{vmatrix} =$$

$$= 9 \cdot (13 \cdot 5 \cdot 5 + 9 \cdot 4 \cdot 4 + 7 \cdot 6 \cdot 5 - 7 \cdot 5 \cdot 4 - 9 \cdot 6 \cdot 3 - 13 \cdot 4 \cdot 5) -$$

$$- 7 \cdot (12 \cdot 5 \cdot 3 + 9 \cdot 4 \cdot 5 + 7 \cdot 6 \cdot 5 - 7 \cdot 5 \cdot 5 - 9 \cdot 6 \cdot 3 -$$

$$- 12 \cdot 4 \cdot 5) + 8 \cdot (12 \cdot 6 \cdot 3 + 13 \cdot 4 \cdot 5 + 7 \cdot 6 \cdot 4 - 7 \cdot 6 \cdot 5 -$$

$$- 13 \cdot 6 \cdot 3 - 12 \cdot 4 \cdot 4) - 6 \cdot (12 \cdot 6 \cdot 5 + 13 \cdot 5 \cdot 5 + 9 \cdot 6 \cdot 4 -$$

$$- 9 \cdot 6 \cdot 5 - 13 \cdot 6 \cdot 5 - 12 \cdot 5 \cdot 4) = 9 \cdot (-13) - 7 \cdot (-7) +$$

$$+ 8 \cdot 8 - 6 \cdot 1 = -117 + 49 + 64 - 6 = -10$$

$$2^\circ \quad \begin{vmatrix} 5 & 7 & 8 & 6 \\ 6 & 13 & 9 & 7 \\ 4 & 6 & 5 & 4 \\ 2 & 4 & 5 & 3 \end{vmatrix} = 5\cdot\begin{vmatrix} 13 & 9 & 7 \\ 6 & 5 & 4 \\ 4 & 5 & 3 \end{vmatrix} - 7\cdot\begin{vmatrix} 6 & 9 & 7 \\ 4 & 5 & 4 \\ 2 & 5 & 3 \end{vmatrix} +$$

$$+ 8\cdot\begin{vmatrix} 6 & 13 & 7 \\ 4 & 6 & 4 \\ 2 & 4 & 3 \end{vmatrix} - 6\cdot\begin{vmatrix} 6 & 13 & 9 \\ 4 & 6 & 5 \\ 2 & 4 & 5 \end{vmatrix} =$$

$$= 5\cdot(13\cdot5\cdot5 + 9\cdot4\cdot4 + 6\cdot5\cdot7 - 7\cdot5\cdot4 - 13\cdot4\cdot5 -$$

$$- 9\cdot6\cdot3) - 7\cdot(6\cdot5\cdot3 + 9\cdot4\cdot2 + 7\cdot4\cdot5 - 7\cdot5\cdot2 -$$

$$- 9\cdot4\cdot3 - 6\cdot4\cdot5) + 8\cdot(6\cdot6\cdot3 + 13\cdot4\cdot2 + 7\cdot4\cdot4 -$$

$$- 7\cdot6\cdot2 - 13\cdot4\cdot3 - 6\cdot4\cdot4) - 6\cdot(6\cdot6\cdot5 + 13\cdot5\cdot2 +$$

$$+ 9\cdot4\cdot4 - 9\cdot6\cdot2 - 13\cdot4\cdot5 - 6\cdot5\cdot4) =$$

$$= 5\cdot(-13) - 7\cdot4 + 8\cdot(-12) - 6\cdot(-34) =$$

$$= -65 - 28 - 96 + 204 = \underline{15}$$

$$3^\circ \quad \begin{vmatrix} 5 & 9 & 8 & 6 \\ 6 & 12 & 9 & 7 \\ 4 & 6 & 5 & 4 \\ 2 & 5 & 5 & 3 \end{vmatrix} = 5\cdot\begin{vmatrix} 12 & 9 & 7 \\ 6 & 5 & 4 \\ 5 & 2 & 3 \end{vmatrix} -$$

$$- 9\cdot\begin{vmatrix} 6 & 9 & 7 \\ 4 & 5 & 4 \\ 2 & 5 & 3 \end{vmatrix} + 8\cdot\begin{vmatrix} 6 & 12 & 7 \\ 4 & 6 & 4 \\ 2 & 5 & 3 \end{vmatrix} - 6\cdot\begin{vmatrix} 6 & 12 & 9 \\ 4 & 6 & 5 \\ 2 & 5 & 5 \end{vmatrix} =$$

$$= 5\cdot(12\cdot5\cdot3 + 9\cdot4\cdot5 + 7\cdot6\cdot2 - 7\cdot5\cdot5 - 9\cdot6\cdot3 - 12\cdot4\cdot2) -$$

$$- 9\cdot(6\cdot5\cdot3 + 9\cdot4\cdot2 + 7\cdot4\cdot5 - 7\cdot5\cdot2 - 9\cdot4\cdot3 - 6\cdot4\cdot5) +$$

$$+ 8\cdot(6\cdot6\cdot3 + 12\cdot4\cdot2 + 7\cdot4\cdot5 - 7\cdot6\cdot2 - 12\cdot4\cdot3 - 6\cdot4\cdot5) -$$

$$- 6\cdot(6\cdot6\cdot5 + 12\cdot5\cdot2 + 9\cdot4\cdot5 - 9\cdot6\cdot2 - 12\cdot4\cdot5 - 6\cdot5\cdot5) =$$

$= 5\cdot(-7) - 9\cdot 4 + 8\cdot(-4) - 6\cdot(-18) = -35 - 36 - 32 + 108 = \underset{\sim}{5}$

4° $\begin{vmatrix} 5 & 9 & 7 & 6 \\ 6 & 12 & 13 & 7 \\ 4 & 6 & 6 & 4 \\ 2 & 5 & 4 & 3 \end{vmatrix} = 5\cdot\begin{vmatrix} 12 & 13 & 7 \\ 6 & 6 & 4 \\ 5 & 4 & 3 \end{vmatrix} - 9\cdot\begin{vmatrix} 6 & 13 & 7 \\ 4 & 6 & 4 \\ 2 & 4 & 3 \end{vmatrix} +$

$+ 7\cdot\begin{vmatrix} 6 & 12 & 7 \\ 4 & 6 & 4 \\ 2 & 5 & 3 \end{vmatrix} - 6\cdot\begin{vmatrix} 6 & 12 & 13 \\ 4 & 6 & 6 \\ 2 & 5 & 4 \end{vmatrix} =$

$= 5\cdot(12\cdot 6\cdot 3 + 13\cdot 4\cdot 5 + 7\cdot 6\cdot 4 - 7\cdot 6\cdot 5 - 13\cdot 6\cdot 3 - 12\cdot 4\cdot 4) -$

$- 9\cdot(6\cdot 6\cdot 3 + 13\cdot 4\cdot 2 + 7\cdot 4\cdot 4 - 7\cdot 6\cdot 2 - 13\cdot 4\cdot 3 - 6\cdot 4\cdot 4) +$

$+ 7\cdot(6\cdot 6\cdot 3 + 12\cdot 4\cdot 2 + 7\cdot 4\cdot 5 - 7\cdot 6\cdot 2 - 12\cdot 4\cdot 3 - 6\cdot 4\cdot 5) -$

$- 6\cdot(6\cdot 6\cdot 4 + 12\cdot 6\cdot 2 + 13\cdot 4\cdot 5 - 13\cdot 6\cdot 2 - 12\cdot 4\cdot 4 - 6\cdot 6\cdot 5) =$

$= 5\cdot 8 - 9\cdot(-12) + 7\cdot(-4) - 6\cdot 20 = 40 + 108 - 28 - 120 = \underset{\sim}{0}$

5° $\begin{vmatrix} 5 & 9 & 7 & 8 \\ 6 & 12 & 13 & 9 \\ 4 & 6 & 6 & 5 \\ 2 & 5 & 4 & 5 \end{vmatrix} = 5\cdot\begin{vmatrix} 12 & 13 & 9 \\ 6 & 6 & 5 \\ 5 & 4 & 5 \end{vmatrix} - 9\cdot\begin{vmatrix} 6 & 13 & 9 \\ 4 & 6 & 5 \\ 2 & 4 & 5 \end{vmatrix} +$

$+ 7\cdot\begin{vmatrix} 6 & 12 & 9 \\ 4 & 6 & 5 \\ 2 & 5 & 5 \end{vmatrix} - 8\cdot\begin{vmatrix} 6 & 12 & 13 \\ 4 & 6 & 6 \\ 2 & 5 & 4 \end{vmatrix} =$

$= 5\cdot(12\cdot 6\cdot 5 + 13\cdot 5\cdot 5 + 9\cdot 6\cdot 4 - 9\cdot 6\cdot 5 - 13\cdot 6\cdot 5 - 12\cdot 5\cdot 4) -$

$- 9\cdot(6\cdot 6\cdot 5 + 13\cdot 5\cdot 2 + 9\cdot 4\cdot 4 - 9\cdot 6\cdot 2 - 13\cdot 4\cdot 5 - 6\cdot 5\cdot 4) +$

$+ 7\cdot(6\cdot 6\cdot 5 + 12\cdot 5\cdot 2 + 9\cdot 4\cdot 5 - 9\cdot 6\cdot 2 - 12\cdot 4\cdot 5 - 6\cdot 5\cdot 5) -$

$- 8\cdot(6\cdot 6\cdot 4 + 12\cdot 6\cdot 2 + 13\cdot 4\cdot 5 - 13\cdot 6\cdot 2 - 12\cdot 4\cdot 4 - 6\cdot 6\cdot 5) =$

$= 5\cdot 1 - 9\cdot(-34) + 7(-18) - 8\cdot 20 = 5 + 306 - 126 - 160 = 25$

$(*) = 3 \cdot (-10) - 6 \cdot 15 + 5 \cdot 5 - 6 \cdot 0 + 4 \cdot 25 =$

$= -30 - 90 + 25 - 0 + 100 = \underline{5}$