

1 公式を書きなさい。(10点)

- (1)  $(x+y)(x-y) = x^2 - y^2$
- (2)  $(x+a)(x+b) = x^2 + (a+b)x + ab$
- (3)  $x^2 + y^2 = (x-y)^2 + 2xy$

2 展開しなさい。(15点)

- (1)  $(2x-3y)^2 = 4x^2 - 12xy + 9y^2$
- (2)  $(2x^2 - x - 3)(x-1) = 2x^3 - 2x^2 - x^2 + x - 3x + 3 = 2x^3 - 3x^2 - 2x + 3$

- (3)  $(2x+5)(3x+4) = 6x^2 + 8x + 15x + 20 = 6x^2 + 23x + 20$

- (4)  $(x+y+z)^2 = (x+y+z)(x+y+z) = x^2 + y^2 + z^2 + 2xy + 2yz + 2zx$

- (5)  $(x+1)^2(x-1)^2 = (x^2+2x+1)(x^2-2x+1) = (x^2-1)^2 = x^4 - 2x^2 + 1$

3 計算しなさい。(10点)

- (1)  $\sqrt{8} + \sqrt{18} - 4\sqrt{2} = 2\sqrt{2} + 3\sqrt{2} - 4\sqrt{2} = \sqrt{2}$
- (2)  $(\sqrt{3} + 2\sqrt{6})^2 = (\sqrt{3} + \sqrt{24})^2 = 3 + 4\sqrt{18} + 24 = 27 + 12\sqrt{2}$
- (3)  $\frac{1}{1+\sqrt{2}} + \frac{1}{\sqrt{2}+\sqrt{3}} + \frac{1}{\sqrt{3}+2} = \frac{1}{\sqrt{2}+1} + \frac{1}{\sqrt{3}+\sqrt{2}} + \frac{1}{2+\sqrt{3}} = \frac{\sqrt{2}-1}{(\sqrt{2}+1)(\sqrt{2}-1)} + \frac{\sqrt{3}-\sqrt{2}}{(\sqrt{3}+\sqrt{2})(\sqrt{3}-\sqrt{2})} + \frac{2-\sqrt{3}}{(2+\sqrt{3})(2-\sqrt{3})} = \sqrt{2}-1 + \sqrt{3}-\sqrt{2} - 2-\sqrt{3} = -1$

4 因数分解しなさい。(15点)

- (1)  $3x^2 + 7x + 2 = (3x+1)(x+2)$
- (2)  $9x^2 - 16y^2 = (3x-4y)(3x+4y)$
- (3)  $x^4 - 8x^2 - 9 = (x^2-9)(x^2+1) = (x+3)(x-3)(x^2+1)$
- (4)  $(x^2+3x)^2 - 2(x^2+3x) - 8 = (x^2+3x+A)(x^2+3x+B) = (x^2+3x-4)(x^2+3x+2)$
- (5)  $2x^2 + 5xy + 3y^2 - 3x - 5y - 2 = (2x^2 + (5y-3)x + 3y^2 - 5y - 2) = (2x + (3y+1))(x + (y-2))$

5 x を分数で表しなさい。(10点)

- (1)  $x = 0.6 = \frac{6}{10} = \frac{3}{5}$
- (2)  $x = 0.21 = \frac{21}{100} = \frac{21}{100}$
- (3)  $x = 0.1\bar{3} = \frac{13}{99}$

6 次の値を求めなさい。(10点)

$$x = \sqrt{6} - \sqrt{2} \quad y = \sqrt{6} + \sqrt{2}$$

(1)  $x + y$

$$\begin{aligned} x + y &= (\sqrt{6} - \sqrt{2}) + (\sqrt{6} + \sqrt{2}) \\ &= 2\sqrt{6} \end{aligned}$$

(2)  $xy$

$$\begin{aligned} xy &= (\sqrt{6} - \sqrt{2})(\sqrt{6} + \sqrt{2}) \\ &= 6 - 2 = 4 \end{aligned}$$

(3)  $x^2y + xy^2$

$$\begin{aligned} x^2y + xy^2 &= xy(x + y) \\ &= 4 \times 2\sqrt{6} \\ &= 8\sqrt{6} \end{aligned}$$

(4)  $x^2 + y^2$

$$\begin{aligned} x^2 + y^2 &= (x + y)^2 - 2xy \\ &= (2\sqrt{6})^2 - 2 \cdot 4 \\ &= 24 - 8 = 16 \end{aligned}$$

7 2重根号を外しなさい。(10点)

(1)  $\sqrt{9 + 2\sqrt{20}}$

$$\begin{aligned} \sqrt{9 + 2\sqrt{20}} &= \sqrt{5 + 4} \\ &= \sqrt{5} + 2 \end{aligned}$$

(2)  $\sqrt{7 - 4\sqrt{3}}$

$$\begin{aligned} \sqrt{7 - 4\sqrt{3}} &= \sqrt{7 - 2\sqrt{12}} \\ &= \sqrt{4 - 2\sqrt{3}} \\ &= 2 - \sqrt{3} \end{aligned}$$

(3)  $\sqrt{4 + \sqrt{15}}$

$$\begin{aligned} \sqrt{4 + \sqrt{15}} &= \sqrt{\frac{8 + 2\sqrt{15}}{2}} \\ &= \frac{\sqrt{5 + 3}}{\sqrt{2}} \\ &= \frac{\sqrt{2} + \sqrt{6}}{2} \end{aligned}$$

8 有理化しなさい。(10点)

(1)  $\frac{2}{\sqrt{3}}$

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

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

$$= \frac{\sqrt{2}(\sqrt{5} + \sqrt{3})}{(\sqrt{5} - \sqrt{3})(\sqrt{5} + \sqrt{3})} = \frac{\sqrt{10} + \sqrt{6}}{2}$$

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

$$= \frac{(2\sqrt{3} + \sqrt{2})(\sqrt{3} + \sqrt{2})}{(\sqrt{3} - \sqrt{2})(\sqrt{3} + \sqrt{2})} = 6 + 2\sqrt{6} + \sqrt{6} + 2 = 8 + 3\sqrt{6}$$

9 方程式、不等式を解きなさい。(10点)

(1)  $|2x - 1| = 3$

ア:  $2x - 1 \geq 0$  のとき

$$\begin{aligned} 2x - 1 &= 3 \\ 2x &= 4 \\ x &= 2 \end{aligned}$$

これは適している

イ:  $2x - 1 < 0$  のとき

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

これは適している

答:  $x = -1, 2$

(2)  $|3x - 7| < 5$

ア:  $3x - 7 \geq 0$  のとき

$$\begin{aligned} 3x - 7 &< 5 \\ 3x &< 12 \\ x &< 4 \end{aligned}$$

$x \geq \frac{7}{3}$  より

$$\frac{7}{3} \leq x < 4$$

イ:  $3x - 7 < 0$  のとき

$$\begin{aligned} -(3x - 7) &< 5 \\ -3x + 7 &< 5 \\ -3x &< -2 \\ x &> \frac{2}{3} \end{aligned}$$

$x < \frac{7}{3}$  より

$$\frac{2}{3} < x < \frac{7}{3}$$

答:  $\frac{2}{3} < x < 4$

1 公式を書きなさい。(10点)

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

(2) x^2 + y^2 = (x-y)^2 + 2xy

(3) (a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca

2 展開しなさい。(15点)

(1) (2x-3y)^2 = 4x^2 - 12xy + 9y^2

(2) (2x^2 - x - 3)(x-1) = 2x^3 - 2x^2 - x^2 + x - 3x + 3 = 2x^3 - 3x^2 - 2x + 3

(3) (x-2y-3z)^2 = x^2 - 4xy + 4y^2 - 6xz + 12yz + 9z^2

(4) (x+1)^2(x-1)^2 = (x^2+2x+1)(x^2-2x+1) = x^4 - 2x^2 + 1

3 計算しなさい。(10点)

(1) (sqrt(3) + 2sqrt(6))^2 = 3 + 4sqrt(18) + 24 = 27 + 12sqrt(2)

(2) |13 - sqrt(170)| + |14 - sqrt(170)| + |19 - sqrt(399)| + |21 - sqrt(399)| = 3

(3) 1/(1+sqrt(2)) + 1/(sqrt(2)+sqrt(3)) + 1/(sqrt(3)+2) = 1

4 因数分解しなさい。(15点)

(1) x^2 - 18x - 360 = (x-30)(x+12)

(2) 120x^2 - 299x - 42 = (8x-21)(15x+2)

(3) x^4 - 8x^2 - 9 = (x^2-9)(x^2+1) = (x+3)(x-3)(x^2+1)

(4) (x^2+3x)^2 - 2(x^2+3x) - 8 = (x+4)(x-1)(x+1)(x+2)

(5) 2x^2 - 5xy + 3y^2 + 3x - 5y - 2 = (2x-y-2)(x-2y+1)

5 x を分数で表しなさい。(10点)

(1) x = 0.6 = 3/5

(2) x = 0.136 = 136/1000 = 17/125

(3) x = 0.13 = 13/100

6 次の値を求めなさい。(10点)

$$x = \frac{1}{\sqrt{6}-\sqrt{2}} \quad y = \frac{1}{\sqrt{6}+\sqrt{2}}$$

(1)  $x+y$

$$\begin{aligned} x+y &= \frac{1}{\sqrt{6}-\sqrt{2}} + \frac{1}{\sqrt{6}+\sqrt{2}} \\ &= \frac{\sqrt{6}+\sqrt{2}}{(\sqrt{6}-\sqrt{2})(\sqrt{6}+\sqrt{2})} + \frac{\sqrt{6}-\sqrt{2}}{(\sqrt{6}-\sqrt{2})(\sqrt{6}+\sqrt{2})} \\ &= \frac{1}{4}(\sqrt{6}+\sqrt{2}) + \frac{1}{4}(\sqrt{6}-\sqrt{2}) = \frac{2}{4}\sqrt{6} = \frac{\sqrt{6}}{2} \end{aligned}$$

(2)  $x^2y + xy^2$

$$\begin{aligned} xy &= \frac{1}{4} \\ x^2y + xy^2 &= xy(x+y) \\ &= \frac{1}{4} \cdot \frac{\sqrt{6}}{2} = \frac{\sqrt{6}}{8} \end{aligned}$$

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

$$\begin{aligned} &= (x+y)^2 - 2xy \\ &= \left(\frac{\sqrt{6}}{2}\right)^2 - 2 \cdot \frac{1}{4} \\ &= \frac{6}{4} - \frac{1}{2} = \frac{3}{2} - \frac{1}{2} = 1 \end{aligned}$$

(4)  $\frac{x}{y} + \frac{y}{x}$

$$\frac{x^2+y^2}{xy} = \frac{1}{\frac{1}{4}} = 4$$

7 2重根号を外しなさい。(10点)

(1)  $\frac{1}{\sqrt{9+2\sqrt{20}}}$

$$\begin{aligned} &= \frac{1}{\sqrt{5+4}} = \frac{1}{\sqrt{5+2}} \\ &= \frac{1}{\sqrt{5+2}} = \frac{\sqrt{5-2}}{(\sqrt{5+2})(\sqrt{5-2})} = \frac{\sqrt{5-2}}{5-2} = \frac{\sqrt{5-2}}{3} \end{aligned}$$

(2)  $\sqrt{7-4\sqrt{3}}$

$$\begin{aligned} &= \sqrt{7-2\sqrt{12}} \\ &= \sqrt{4-2\sqrt{3}} \\ &= 2-\sqrt{3} \end{aligned}$$

(3)  $\sqrt{4+\sqrt{15}}$

$$\begin{aligned} &= \sqrt{\frac{8+2\sqrt{15}}{2}} \\ &= \frac{\sqrt{15+3}}{\sqrt{2}} = \frac{2\sqrt{3}}{\sqrt{2}} = \sqrt{6} \end{aligned}$$

8 有理化しなさい。(10点)

(1)  $\frac{\sqrt{2}}{\sqrt{5}-\sqrt{3}}$

$$\begin{aligned} &= \frac{\sqrt{2}(\sqrt{5}+\sqrt{3})}{(\sqrt{5}-\sqrt{3})(\sqrt{5}+\sqrt{3})} \\ &= \frac{\sqrt{2}(\sqrt{5}+\sqrt{3})}{5-3} = \frac{\sqrt{10}+\sqrt{6}}{2} \end{aligned}$$

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

$$\begin{aligned} &= \frac{(2\sqrt{3}+\sqrt{2})(\sqrt{3}+\sqrt{2})}{(\sqrt{3}-\sqrt{2})(\sqrt{3}+\sqrt{2})} \\ &= \frac{6+2\sqrt{6}+\sqrt{6}+2}{3-2} = 8+3\sqrt{6} \end{aligned}$$

(3)  $\frac{3-\sqrt{7}}{3+\sqrt{7}}$

$$\begin{aligned} &= \frac{(3-\sqrt{7})^2}{(3+\sqrt{7})(3-\sqrt{7})} = \frac{1}{9-7} (9-6\sqrt{7}+7) \\ &= \frac{1}{2} (16-6\sqrt{7}) = 8-3\sqrt{7} \end{aligned}$$

9 方程式, 不等式を解きなさい。(10点)

(1)  $|2x-1|=3$

$2x-1 \geq 0$  のとき

$$\begin{aligned} 2x-1 &= 3 \\ 2x &= 4 \\ x &= 2 \end{aligned}$$

$2x-1 < 0$  のとき

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

答え:  $2, -1$

(2)  $|3x-7| > 5$

$3x-7 \geq 0$  のとき

$$\begin{aligned} 3x-7 &> 5 \\ 3x &> 12 \\ x &> 4 \end{aligned}$$

$3x-7 < 0$  のとき

$$\begin{aligned} -(3x-7) &> 5 \\ -3x+7 &> 5 \\ -3x &> -2 \\ 3x &< 2 \\ x &< \frac{2}{3} \end{aligned}$$

答え:  $x < \frac{2}{3}$  または  $x > 4$