

Домашняя работа по алгебре за 8 класс

**к учебнику «Алгебра. Учебник для 8 кл.
общеобразовательных учреждений» Ю.Н. Макарычев
и др. — М.: «Просвещение», 2001 г.**

*учебно-практическое
пособие*

ГЛАВА I. Рациональные дроби
Рациональные дроби и их свойства.

1. Рациональные выражения

№1.

Целыми выражениями являются: $\frac{1}{3}a^2b$; $(x-y)^2 - 4xy$; $\frac{a^2 - 2ab}{12}$.

Дробными выражениями являются: $\frac{m+3}{m-3}$; $\frac{8}{x^2+y^2}$; $(c+3)^2 + \frac{2}{c}$.

№2.

Целыми выражениями являются: $7x^2 - 2xy$; $\frac{a}{9}$; $\frac{1}{4}m^2 - \frac{1}{3}n^2$.

Дробными выражениями являются: $\frac{12}{b}$, $a(a-b) - \frac{b}{3a}$, $\frac{a}{a+3} - 8$.

№3.

При $y = 3$: $\frac{y-1}{y} = \frac{3-1}{3} = \frac{2}{3}$;

При $y = 1$: $\frac{y-1}{y} = \frac{1-1}{1} = 0$;

При $y = -5$: $\frac{y-1}{y} = \frac{-5-1}{-5} = 1\frac{1}{5}$;

При $y = \frac{1}{2}$: $\frac{y-1}{y} = \frac{\frac{1}{2}-1}{\frac{1}{2}} = -1$;

При $y = -1,6$: $\frac{y-1}{y} = \frac{-1,6-1}{-1,6} = 1,625$;

При $y = 100$: $\frac{y-1}{y} = \frac{100-1}{100} = 0,99$;

№4.

При $a = -2$: $\frac{a-8}{20+5} = \frac{-2-8}{2(-2)+5} = \frac{-10}{-4+5} = -10$;

При $b = 3$: $\frac{b^2+6}{2b} = \frac{3^2+6}{2 \cdot 3} = \frac{9+6}{6} = 2\frac{1}{2}$;

$$\text{При } x = \frac{1}{2} : x + \frac{8}{x-1} = \frac{1}{2} + \frac{8}{\frac{1}{2}-1} = \frac{1}{2} - \frac{8 \cdot 2}{1 \cdot 1} = \frac{1}{2} - 16 = -15\frac{1}{2};$$

$$\text{При } y = 1,5 : \frac{y+3}{y} + \frac{y}{y-3} = \frac{1,5+3}{1,5} + \frac{1,5}{1,5-3} = \frac{4,5}{3} + \frac{1,5}{-1,5} = 3 + 1 = 4;$$

№5.

Воспользуемся формулой сокращенного умножения (разность квадратов):

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

$$\frac{(-3-1-1)(-3-1+1)}{(-3)^2 + 1} = \frac{(-5)(-3)}{9+1} = \frac{15}{10} = 1,5;$$

Воспользуемся формулой сокращенного умножения с разностью квадратов:

$$\frac{(1,5+0,5-1)(1,5+0,5+1)}{1,5^2 + 1} = \frac{1 \cdot 3}{2,25 + 1} = \frac{3}{3,25} = \frac{300}{325} \approx 0,92.$$

№6.

$$1) \text{ при } x = -13 : \frac{x+5}{x-3} = \frac{-13+5}{-13-3} = \frac{-8}{-16} = \frac{1}{2};$$

$$2) \text{ при } x = -5 : \frac{x+5}{x-3} = \frac{-5+5}{-5-3} = \frac{0}{-8} = 0;$$

$$3) \text{ при } x = -0,2 : \frac{x+5}{x-3} = \frac{-0,2+5}{-0,2-3} = \frac{4,8}{-3,2} = -1,5;$$

$$4) \text{ при } x = 0 : \frac{x+5}{x-3} = \frac{0+5}{0-3} = -1\frac{2}{3};$$

5) при

$$x = \frac{1}{17} : \frac{x+5}{x-3} = \frac{\frac{1}{17}+5}{\frac{1}{17}-3} = -\frac{86}{17} \div \frac{50}{17} = -\frac{86 \cdot 17}{50 \cdot 17} = -\frac{86}{50} = -1\frac{36}{50} = -1\frac{18}{25};$$

$$6) \text{ при } x = 1 : \frac{x+5}{x-3} = \frac{1+5}{1-3} = -3;$$

$$7) \text{ при } x = 5\frac{2}{3} : \frac{x+5}{x-3} = \frac{5\frac{2}{3}+5}{5\frac{2}{3}-3} = \frac{\frac{32}{3}}{\frac{8}{3}} = \frac{32}{3} \div \frac{8}{3} = \frac{32 \cdot 3}{3 \cdot 8} = 4;$$

8) при $x = 7$: $\frac{x+5}{x-3} = \frac{7+5}{7-3} = 3$;

№7.

а) $\frac{1}{1,01} = \frac{1}{1+0,01} = \frac{1}{1+\alpha} \approx 1-\alpha = 1-0,01 = 0,99$;

б) $\frac{1}{1,002} = \frac{1}{1+0,002} = \frac{1}{1+\alpha} \approx 1-\alpha = 1-0,002 = 0,998$;

в) $\frac{1}{0,99} = \frac{1}{1-0,01} = \frac{1}{1+\alpha} \approx 1-\alpha = 1-(-0,01) = 1,01$;

г) $\frac{1}{0,997} = \frac{1}{1-0,003} = \frac{1}{1+\alpha} \approx 1-\alpha = 1-(-0,003) = 1,003$.

№8.

Запишем формулу для средней скорости: $v = \frac{s}{t}$; получаем:

а) $t = 3$; $s = 180$; тогда $v = \frac{180}{3} = 60$ (км/ч);

б) $t = 2,5$; $s = 225$; тогда $v = \frac{225}{2,5} = 90$ (км/ч);

№9.

Исходя из условия задачи можно составить уравнения:

$$v_1 t + v_2 t = s; \quad t(v_1 + v_2) = s; \quad t = \frac{s}{(v_1 + v_2)};$$

а) $s = 250$, $v_1 = 60$, $v_2 = 40$;

$$t = \frac{250}{60+40} = \frac{250}{100} = 2,5 \text{ (ч)};$$

б) $s = 310$, $v_1 = 75$, $v_2 = 80$;

$$t = \frac{310}{75+80} = \frac{310}{155} = 2 \text{ (ч)}.$$

Ответ: а) $t=2,5$ часа; б) $t=2$ часа.

№10.

Соответствующими дробными выражениями будут:

а) $\frac{xy}{x+y}$;

б) $\frac{a-b}{ab}$.

№11.

Рациональное выражение имеет смысл, если его знаменатель отличен от нуля.

а) При $x - 2 \neq 0$, т.е. $x \neq 2$;

б) при b - любое число, т.к. $b^2 + 7 > 0$ всегда;

в) при $y \neq 0$; $y \neq 3$;

г) при $a \neq 0$; $a \neq 1$;

№12.

а) x - любое число;

б) $6x - 3 \neq 0$; $6x \neq 3$; $x \neq \frac{3}{6}$; $x \neq \frac{1}{2}$;

в) x - любое число;

г) $x \neq 0$; $x \neq -1$;

д) x - любое число; $x^2 + 25$ всегда больше;

е) $x \neq -8$; $x \neq 0$.

№13.

а) $\frac{5y-8}{11}$; y - любое число

б) $\frac{25}{y-9}$; $y-9 \neq 0$, т.е. $y \neq 9$;

в) $\frac{y^2+1}{y^2-2y} = \frac{y^2+1}{y(y-2)}$; $y(y-2) \neq 0$, т.е. $y \neq 0$; $y \neq 2$;

г) $\frac{y-10}{y^2+3}$, y - любое число, поскольку y^2+3 всегда больше нуля;

д) $\frac{y}{y-6} + \frac{15}{y+6}$; $y-6 \neq 0$, $y+6 \neq 0$, т.е. $y \neq -6$; $y \neq 6$;

е) $\frac{32}{y} - \frac{y+1}{y+7}$; $y \neq 0$, $y+7 \neq 0$; т.е. $y \neq 0$, $y \neq -7$

№14.

а) $y = \frac{1}{x-2}$; область определения: $x \neq 2$;

б) $y = \frac{2x+3}{x(x+1)}$; область определения: $x \neq 0$; $x \neq -1$;

в) $y = x + \frac{1}{x+5}$; область определения: $x \neq -5$.

№15.

$$\text{a) } \frac{x-3}{5} = 1; \quad 5\left(\frac{x-3}{5} - 1\right) = 0 \cdot 5;$$

$$\frac{5(x-3)}{5} - 5 = 0; \quad x - 3 - 5 = 0; \quad x = 8;$$

Ответ: $x = 8$;

$$\text{б) } \frac{x-3}{5} = 0; \quad 5\left(\frac{x-3}{5}\right) = 0 \cdot 5;$$

$$x - 3 = 0; \quad x = 3;$$

Ответ: $x = 3$;

$$\text{в) } \frac{x-3}{5} = -1; \quad 5\left(\frac{x-3}{5}\right) = (-1) \cdot 5;$$

$$x - 3 = -5; \quad x = -2;$$

Ответ: $x = -2$;

$$\text{г) } \frac{x-3}{5} = 3; \quad 5\left(\frac{x-3}{5}\right) = 3 \cdot 5;$$

$$x - 3 = 15; \quad x = 18;$$

Ответ: $x = 18$;

№16.

$$\text{a) } \frac{y-5}{8} = 0; \quad y - 5 = 0; \quad y = 5; \quad \text{Ответ: } y = 5;$$

$$\text{б) } \frac{2y+3}{10} = 0; \quad 2y + 3 = 0; \quad y = -1\frac{1}{2}; \quad \text{Ответ: } y = -1\frac{1}{2};$$

$$\text{в) } \frac{x(x-1)}{x+4} = 0; \quad x(x-1) = 0; \quad 1)x = 0; 2)x - 1 = 0; \quad x = 1;$$

при $x = 0$ и $x = 1$, $x + 4 \neq 0$, получаем:

Ответ: $x = 0$; $x = 1$.

$$\text{г) } \frac{x(x+3)}{x-5} = 0; \quad x(x+3) = 0; \quad 1)x = 0; 2)x + 3 = 0; \quad x = -3;$$

при $x = 0$ и $x = -3$, $x - 5 \neq 0$, получаем:

Ответ: $x = 0$; $x = -2$

№17.

$$\text{a) } \frac{a}{b} > 0;$$

$$\text{б) } \frac{a}{b} < 0;$$

в) $\frac{a}{b} < 0$;

г) $\frac{a}{b} > 0$;

№18.

а) $\frac{3}{x^2 + 1} > 0$, поскольку $3 > 0$ и $x^2 + 1 > 0$ при всех x ;

б) $\frac{-5}{y^2 + 4} < 0$, поскольку $-5 < 0$ и $y^2 + 4 > 0$ при всех y ;

в) $\frac{(a-1)^2}{a^2 + 10} \geq 0$, поскольку $(a-1)^2 \geq 0$ и $a^2 + 10 > 0$ при всех a ;

г) $\frac{(b-3)^2}{-b^2 - 1} \leq 0$, поскольку $(b-3)^2 \geq 0$ и $-(b^2 + 1) < 0$ при всех b

№19.

а) При

$$x = 2,47: \frac{2x - 3}{3x + 2} = \frac{2 \cdot 2,47 - 3}{3 \cdot 2,47 + 2} = \frac{4,94 - 3}{7,41 + 2} = \frac{1,94}{9,41} \approx 0,20616365... \approx 0,21;$$

б) При

$$x = 3,18: \frac{7x + 9}{8x - 1} = \frac{7 \cdot 3,18 + 9}{8 \cdot 3,18 - 1} = \frac{22,26 + 9}{25,44 - 1} = \frac{31,26}{24,44} \approx 0,2790507... \approx 0,28$$

УПРАЖНЕНИЯ ДЛЯ ПОВТОРЕНИЯ

№20.

а) $(x - 10)(x + 10) =$

$$= x^2 - 10x + 10x - 100 =$$

$$= (x^2 - 100);$$

б) $(2a + 3)(2a - 3) =$

$$= 4a^2 - 6a + 6a - 9 =$$

$$4a^2 - 9;$$

в) $(y - 5b)(y + 5b) =$

$$= y^2 + 5by - 5by - 25b^2 =$$

$$(y^2 - 25b^2);$$

г) $(y + 8x)(y - 8x) =$

$$= y^2 + 8xy - 8xy - 64x^2 =$$

$$= y^2 - 64x^2;$$

$$\text{д) } (x+7)^2 = x^2 + 14x + 49;$$

$$\text{е) } (b+5)^2 = b^2 + 10b + 25;$$

$$\text{ж) } (a-2x)^2 = a^2 - 4ax + 4x^2;$$

$$\text{з) } (ab-1)^2 = a^2b^2 - 2ab + 1.$$

№21.

$$\text{а) } 15ax + 20ay = 5a(3x + 4y);$$

$$\text{б) } 36by - 9cy = 9y(4b - c);$$

$$\text{в) } x^2 - xy = x(x - y);$$

$$\text{г) } xy - y^2 = y(x - y);$$

$$\text{д) } a^2 + 5ab = a(a + 5b);$$

$$\text{е) } 15c - 10c^2 = 5c(3 - 2c)$$

№22.

$$\text{а) } x^2 - 25 = (x - 5)(x + 5);$$

$$\text{б) } 16 - c^2 = (4 - c)(4 + c);$$

$$\text{в) } a^2 - 6a + 9 = (a - 3)^2;$$

$$\text{г) } +^2 + 8 + +16 = (+ + 4)^2;$$

$$\text{д) } a^3 - 8 = (a - 2)(a^2 + 2a + 4);$$

$$\text{е) } b^3 + 27 = (b + 3)(b^2 - 3b + 9).$$

№23.

$$\text{а) Общий множитель: } x; \frac{2x}{3x} = \frac{2}{3};$$

$$\text{б) Общий множитель: } 5; \frac{15x}{25y} = \frac{3x}{5y};$$

$$\text{в) Общий множитель: } 6a; \frac{6a}{24a} = \frac{1}{4};$$

$$\text{г) Общий множитель: } 7b; \frac{7ab}{21bc} = \frac{a}{3c};$$

д) Общий множитель: xy ; $\frac{-2xy}{5x^2y} = -\frac{2}{5x}$;

е) Общий множитель: $8xy$; $\frac{8x^2y^2}{24xy} = \frac{xy}{3}$

№24.

а) $\frac{10xz}{15yz} = \frac{2x}{3y}$;

б) $\frac{6ab^2}{9bc^2} = \frac{2ab}{3c^2}$;

в) $\frac{2ay^3}{-4a^3b} = \frac{y^3}{-2ab} = -\frac{y^3}{2ab}$;

г) $\frac{-6p^2q}{-2q^3} = \frac{3p^2}{q^2}$;

д) $\frac{-ax^2}{xy} = -\frac{ax}{y}$;

е) $\frac{3axy}{6ay^3} = \frac{x}{2y^2}$;

ж) $\frac{24a^2c^2}{36ac} = \frac{2ac}{3}$;

з) $\frac{63x^3y^3}{42x^6y^4} = \frac{3}{2x^3y}$.

№25.

а) $\frac{4a^2b^3}{2a^4b^2} = \frac{2b}{a^2}$;

б) $\frac{3xy^2}{6x^3y^3} = \frac{1}{2x^2y}$;

в) $\frac{24p^4q^4}{48p^2q^2} = \frac{p^2q^2}{2}$;

г) $\frac{36m^2n}{18mn} = 2m$;

д) $\frac{-32b^5c}{12b^4c^2} = \frac{-8b}{3c} = -\frac{8b}{3c}$;

$$\text{e)} \frac{-6ax}{-18ax} = \frac{1}{3}.$$

№26.

$$\text{a)} \frac{8b}{24c} = \frac{b}{3c};$$

$$\text{б)} \frac{5ay}{15by} = \frac{a}{3b};$$

$$\text{в)} \frac{4a^2}{6ac} = \frac{2a}{3c};$$

$$\text{г)} \frac{7x^2y}{21xy^2} = \frac{x}{3y};$$

$$\text{д)} \frac{a^5b^3}{a^3b^5} = \frac{a^2}{b^2};$$

$$\text{е)} \frac{x^6y^4}{x^4y^6} = \frac{x^2}{y^2};$$

$$\text{ж)} \frac{56m^2n^5}{35mn^5} = \frac{8m}{5} = 1\frac{3}{5}m;$$

$$\text{з)} \frac{25p^4q}{100p^5q} = \frac{1}{4p}.$$

№27.

$$\text{a)} \frac{8^{16}}{16^{12}} = \frac{(2^3)^{16}}{(2^4)^{12}} = \frac{2^{48}}{2^{48}} = 1;$$

$$\text{б)} \frac{81^{25}}{27^{33}} = \frac{(3^4)^{25}}{(3^3)^{33}} = \frac{3^{100}}{3^{99}} = 3^1 = 3.$$

№28.

$$\text{a)} \frac{a(b-2)}{5(b-2)} = \frac{a}{5};$$

$$\text{б)} \frac{3(x+4)}{c(x+4)} = \frac{3}{c};$$

$$\text{в)} \frac{ab(y+3)}{a^2b(y+3)} = \frac{1}{a};$$

$$\text{г)} \frac{15a(a-b)}{20b(a-b)} = \frac{3a}{4b}.$$

№29.

$$\text{а)} \frac{3a+12b}{6ab} = \frac{3(a+4b)}{6ab} = \frac{a+4b}{2ab};$$

$$\text{б)} \frac{15b-20c}{10b} = \frac{5(3b-4c)}{10b} = \frac{3b-4c}{2b};$$

$$\text{в)} \frac{2a-4}{3(a-2)} = \frac{2(a-2)}{(a-2)} = \frac{2}{3};$$

$$\text{г)} \frac{5x(y+2)}{6y+12} = \frac{5x(y+2)}{6(y+2)} = \frac{5x}{6};$$

$$\text{д)} \frac{a-3b}{a^2-3ab} = \frac{a-3b}{a(a-3b)} = \frac{1}{a};$$

$$\text{е)} \frac{3x+15xy}{x+5y} = \frac{3x(x+5y)}{x+5y} = 3x.$$

№30.

$$\text{а)} \frac{y^2-16}{3y+12} = \frac{(y-4)(y+4)}{3(y+4)} = \frac{y-4}{3};$$

$$\text{б)} \frac{5x-15y}{x^2-9y^2} = \frac{5(x-3y)}{(x-3y)(x+3y)} = \frac{5}{x+3y};$$

$$\text{в)} \frac{(c+2)^2}{7c^2+14c} = \frac{(c+2)^2}{7c(c+2)} = \frac{c+2}{7c};$$

$$\text{г)} \frac{6cd-18c}{(d-3)^2} = \frac{6c(d-3)}{(d-3)^2} = \frac{6c}{d-3};$$

$$\text{д)} \frac{a^2+10a+25}{a^2-25} = \frac{(a+5)^2}{(a-5)(a+5)} = \frac{a+5}{a-5};$$

$$\text{е)} \frac{y^2-9}{y^2-6y+9} = \frac{(y-3)(y+3)}{(y-3)^2} = \frac{y+3}{y-3}.$$

№31.

$$\text{а)} \frac{a^2-ab+b^2}{a^3+b^3} = \frac{a^2-ab+b^2}{(a+b)(a^2-ab+b^2)} = \frac{1}{a+b};$$

$$\text{б)} \frac{a^3 - b^3}{a - b} = \frac{(a - b)(a^2 + ab + b^2)}{a - b} = a^2 + ab + b^2$$

№32.

$$\begin{aligned} \text{а)} \frac{15a^2 - 10ab}{3ab - 2b^2} &= \frac{5a(3a - 2b)}{b(3a - 2b)} = \\ &= \frac{5a}{b} = \frac{5(-2)}{-0,1} = \frac{-10}{-0,1} = 100; \end{aligned}$$

ОТВЕТ: 100;

$$\begin{aligned} \text{б)} \frac{9c^2 - 4d^2}{18c^2d - 12cd^2} &= \frac{(3c - 2d)(3c + 2d)}{6cd(3c - 2d)} = \\ \frac{3c + 2d}{6cd} &= \frac{1}{2d} + \frac{1}{3c} = \frac{1}{2 \cdot \frac{1}{2}} + \frac{1}{3 \cdot \frac{2}{3}} = \frac{1}{1} + \frac{1}{2} = 1\frac{1}{2}; \end{aligned}$$

ОТВЕТ: $1\frac{1}{2}$;

$$\begin{aligned} \text{в)} \frac{6x^2 + 12xy}{5xy + 10y^2} &= \frac{6x(x + 2y)}{5y(x + 2y)} = \\ &= \frac{6x}{5y} = \frac{6 \cdot \frac{2}{3}}{5(-0,4)} = \frac{4}{-2} = -2 \end{aligned}$$

ОТВЕТ: -2;

$$\begin{aligned} \text{г)} \frac{x^2 + 6xy + 9y^2}{4x^2 + 12xy} &= \frac{(x + 3y)^2}{4x(x + 3y)} = \frac{x + 3y}{4x} = \\ &= \frac{-0,2 + 3(-0,6)}{4(-0,2)} = \frac{-0,2 - 1,8}{-0,8} = \frac{-2}{-0,8} = \frac{2}{0,8} = 2,5 \end{aligned}$$

ОТВЕТ: 2,5.

№33.

$$\text{а)} \frac{x(y - 7)}{y(y - 7)} = \frac{x}{y};$$

$$\text{б)} \frac{10a - 15b}{16a - 24b} = \frac{5(2a - 3b)}{8(2a - 3b)} = \frac{5}{8};$$

$$\text{в)} \frac{2m + 14}{m^2 - 49} = \frac{2(m + 7)}{(m - 7)(m + 7)} = \frac{2}{m - 7};$$

$$\text{г)} \frac{p^2 - 25q^2}{2p - 10q} = \frac{(p - 5q)(p + 5q)}{2(p - 5q)} = \frac{p + 5q}{2};$$

$$\text{д)} \frac{x^2 - 4x + 4}{x^2 - 2x} = \frac{(x - 2)^2}{x(x - 2)} = \frac{x - 2}{x};$$

$$\text{е)} \frac{3y^2 + 24y}{y^2 16y + 64} = \frac{3y(y + 8)}{(y + 8)^2} = \frac{3y}{y + 8};$$

$$\text{ж)} \frac{a^2 + a + 1}{a^3 - 1} = \frac{a^2 + a + 1}{(a - 1)(a^2 + a + 1)} = \frac{1}{a - 1};$$

$$\text{з)} \frac{b + 2}{b^3 + 8} = \frac{b + 2}{(b + 2)(b^2 - 2b + 4)} = \frac{1}{b^2 - 2b + 4}.$$

№34.

$$\begin{aligned} \text{а)} \quad & (9x^2 - y^2) : (3x + y) = \\ & = \frac{(9x^2 - y^2)}{(3x + y)} = \frac{(3x - y)(3x + y)}{(3x + y)} = 3x - y; \end{aligned}$$

$$\begin{aligned} \text{б)} \quad & (2ab - a) : (4b^2 - 4b + 1) = \\ & = \frac{2ab - a}{4b^2 - 4b + 1} = \frac{a(2b - 1)}{(2b - 1)^2} = \frac{a}{2b - 1}; \end{aligned}$$

$$\begin{aligned} \text{в)} \quad & (x^2 + 2x + 4) : (x^3 - 8) = \\ & = \frac{x^2 + 2x + 4}{(x - 2)(x^2 + 2x + 4)} = \frac{1}{x - 2}; \end{aligned}$$

$$\begin{aligned} \text{г)} \quad & (1 + a^3) : (1 + a) = \\ & = \frac{1 + a^3}{1 + a} = \frac{(1 + a)(1 - a + a^2)}{(1 + a)} = 1 - a + a^2. \end{aligned}$$

№35.

$$\begin{aligned} \text{а)} \quad & \frac{2x + bx - 2y - by}{7x - 7y} = \frac{2(x - y) + b(x - y)}{7(x - y)} = \\ & = \frac{(x - y)(2 + b)}{7(x - y)} = \frac{2 + b}{7}; \end{aligned}$$

$$\text{б)} \frac{8a + 4b}{2ab + b^2 - 2ad - bd} = \frac{4(2a + b)}{(2ab + b^2) - (2ad + bd)} =$$

$$= \frac{4(2a + b)}{b(2a + b) - d(2a + b)} = \frac{4(2a + b)}{(2a + b)(b - d)} = \frac{4}{b - d};$$

$$\text{в)} \frac{xy - x + y - y^2}{x^2 - y^2} = \frac{(xy - y^2) - (x - y)}{(x - y)(x + y)} =$$

$$= \frac{y(x - y) - (x - y)}{(x - y)(x + y)} = \frac{(x - y)(y - 1)}{(x - y)(x + y)} = \frac{y - 1}{x + y};$$

$$\text{г)} \frac{a^2 + 2ac + c^2}{a^2 + ac - ax - cx} = \frac{(a + c)^2}{(a^2 + ac) - (ax + cx)} =$$

$$= \frac{(a + c)^2}{a(a + c) - x(a + c)} = \frac{(a + c)^2}{(a + c)(a - x)} = \frac{a + c}{a - x}.$$

№36.

$$\text{а) Ответ: } \frac{-x}{-y}; \quad -\frac{-x}{y};$$

$$\text{б) Ответ: } \frac{-x}{y}; \quad \frac{x}{-y}.$$

№37.

$$\text{а) } \frac{a - b}{b - a} = -\frac{b - a}{b - a} = -1;$$

$$\text{б) } \frac{(a - b)^2}{(b - a)^2} = \frac{(a - b)^2}{(a - b)^2} = 1;$$

$$\text{в) } \frac{(a - b)^2}{b - a} = \frac{(b - a)^2}{b - a} = b - a;$$

$$\text{г) } \frac{a - b}{(b - a)^2} = \frac{a - b}{(a - b)^2} = \frac{1}{a - b};$$

$$\text{д) } \frac{(-a - b)^2}{a + b} = \frac{((-1)(a + b))^2}{a + b} = \frac{(-1)^2(a + b)^2}{a + b} = a + b;$$

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

№38.

$$\text{a)} \frac{a(x-2y)}{b(2y-x)} = \frac{a(x-2y)}{-b(x-2y)} = -\frac{a}{b};$$

$$\text{б)} \frac{5x(x-y)}{x^3(y-x)} = \frac{5x(x-y)}{-x^3(x-y)} = \frac{5}{-x^2} = -\frac{5}{x^2};$$

$$\text{в)} \frac{3a-36}{12b-ab} = \frac{3(a-12)}{b(12-a)} = \frac{3(a-12)}{-b(a-12)} = -\frac{3}{b};$$

$$\begin{aligned} \text{г)} \frac{7b-14b^2}{42b^2-21b} &= \frac{7b(1-2b)}{21b(2b-1)} = \\ &= \frac{7b(1-2b)}{-21b(1-2b)} = \frac{1}{-3} = -\frac{1}{3}; \end{aligned}$$

$$\begin{aligned} \text{д)} \frac{25-a^2}{3a-15} &= \frac{(5-a)(5+a)}{3(a-5)} = \\ &= \frac{-(a-5)(a+5)}{3(a-5)} = -\frac{5+a}{3}; \end{aligned}$$

$$\begin{aligned} \text{е)} \frac{3-3x}{x^2-2x+1} &= \frac{3(1-x)}{(x-1)^2} = \\ \frac{-3(x-1)}{(x-1)^2} &= -\frac{3}{(x-1)}; \end{aligned}$$

$$\begin{aligned} \text{ж)} \frac{8b^2-8a^2}{a^2-2ab+b^2} &= \frac{8(b^2-a^2)}{(a-b)^2} = \frac{8(b-a)(b+a)}{(a-b)^2} = \\ &= \frac{-8(a-b)(b+a)}{(a-b)^2} = -\frac{8(b+a)}{a-b} = \frac{8(b+a)}{b-a}; \end{aligned}$$

$$\text{з)} \frac{(b-2)^3}{(2-b)^2} = \frac{(b-2)^3}{(b-2)^2} = b-2.$$

№39.

$$\begin{aligned} \text{а)} \frac{ax+bx-ay-by}{bx-by} &= \frac{(ax-ay)+(bx-by)}{b(x-y)} = \\ &= \frac{a(x-y)+b(x-y)}{b(x-y)} = \frac{(x-y)(a+b)}{b(x-y)} = \frac{a+b}{b}; \end{aligned}$$

$$\begin{aligned}\text{б)} \quad \frac{ab - 3b - 2a + 6}{15 - 5a} &= \frac{(ab - 3b) - (2a - 6)}{5(3 - a)} = \\ &= \frac{b(a - 3) - 2(a - 3)}{5(3 - a)} = \frac{(a - 3)(b - 2)}{-5(a - 3)} = \frac{b - 2}{-5} = \frac{2 - b}{5};\end{aligned}$$

$$\begin{aligned}\text{в)} \quad \frac{7p - 35}{15 - 3p} &= \frac{7(p - 5)}{3(5 - p)} = \\ &= -\frac{7(5 - p)}{3(5 - p)} = -\frac{7}{3} = -2\frac{1}{3};\end{aligned}$$

$$\begin{aligned}\text{г)} \quad \frac{18a - 3a^2}{8a^2 - 48a} &= \frac{3a(6 - a)}{8a(a - 6)} = \\ &= \frac{-3a(a - 6)}{8a(a - 6)} = -\frac{3}{8};\end{aligned}$$

$$\text{д)} \quad \frac{4 - x^2}{10 - 5x} = \frac{(2 - x)(2 + x)}{5(2 - x)} = \frac{2 + x}{5};$$

$$\begin{aligned}\text{е)} \quad \frac{a^2 - 6a + 9}{27 - a^3} &= \frac{(a - 3)^2}{(3 - a)(9 + 3a + a^2)} = \\ &= \frac{(3 - a)^2}{(3 - a)(9 + 3a + a^2)} = \frac{3 - a}{9 + 3a + a^2}.\end{aligned}$$

№40.

$$\text{а)} \quad \frac{x^6 + x^4}{x^4 + x^2} = \frac{x^2 x^2 (x^2 + 1)}{x^2 (x^2 + 1)} = x^2;$$

$$\text{б)} \quad \frac{y^6 - y^8}{y^4 - y^2} = \frac{y^4 y^2 (1 - y^2)}{y^2 (y^2 - 1)} = -y^2;$$

$$\text{в)} \quad \frac{b^7 - b^{10}}{b^5 - b^2} = \frac{b^7 (1 - b^3)}{b^2 (b^3 - 1)} = -b^5;$$

$$\text{г)} \quad \frac{c^6 - c^4}{c^3 + c^2} = \frac{c^4 (c^2 - 1)}{c^2 (c + 1)} =$$

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

№41.

$$\text{а) } \frac{a^8 + a^5}{a^5 + a^2} = \frac{a^5(a^3 + 1)}{a^2(a^3 + 1)} = a^3;$$

при $a = -\frac{1}{2}$ получаем:

$$a^3 = \left(-\frac{1}{2}\right)^3 = -\frac{1}{8};$$

Ответ: $-\frac{1}{8}$;

$$\text{б) } \frac{b^{10} - b^8}{b^8 - b^6} = \frac{b^8(b^2 - 1)}{b^6(b^2 - 1)} = b^2$$

при $b = -0,1$ получаем:

$$b^2 = (-0,1)^2 = 0,01;$$

Ответ: 0,01;

№42.

$$\begin{aligned} \text{а) } \frac{(2a - 2b)^2}{a - b} &= \frac{(2(a - b))^2}{a - b} = \\ &= \frac{4(a - b)^2}{a - b} = 4(a - b); \end{aligned}$$

$$\begin{aligned} \text{б) } \frac{(3c + 9d)^2}{c + 3d} &= \frac{(3(c + 3d))^2}{c + 3d} = \\ &= \frac{9(c + 3d)^2}{c + 3d} = 9(c + 3d); \end{aligned}$$

$$\begin{aligned} \text{в) } \frac{(3x + 6y)^2}{5x + 10y} &= \frac{(3(x + 2y))^2}{5(x + 2y)} = \\ &= \frac{9(x + 2y)^2}{5(x + 2y)} = \frac{9(x + 2y)}{5}; \end{aligned}$$

$$\begin{aligned}\Gamma) \frac{4x^2 - y^2}{(10x + 5y)^2} &= \frac{(2x - y)(2x + y)}{(5(2x + y))^2} = \\ \frac{(2x - y)(2x + y)}{25(2x + y)^2} &= \frac{2x - y}{25(2x + y)}.\end{aligned}$$

№43.

$$\text{a)} \frac{5b}{8a^3} = \frac{5b \cdot 3b^2}{8a^3 \cdot 3b^2} = \frac{15b^3}{24a^3b^2};$$

$$\text{б)} \frac{7a}{3b^2} = \frac{7a \cdot 8a^3}{3b^2 \cdot 8a^3} = \frac{56a^4}{24a^3b^2};$$

$$\text{в)} \frac{1}{2ab} = \frac{12a^2b}{2ab \cdot 12a^2b} = \frac{12a^2b}{24a^3b^2};$$

$$\Gamma) \frac{2}{a^2b^2} = \frac{2 \cdot 24a}{a^2b^2 \cdot 24a} = \frac{48a}{24a^3b^2}.$$

№44.

$$\text{a)} 2a + b = \frac{2a + b}{1} = \frac{(2a + b)b}{1};$$

$$\text{б)} 2a + b = \frac{2a + b}{1} = \frac{(2a + b)5}{5};$$

$$\text{в)} 2a + b = \frac{2a + b}{1} = \frac{(2a + b)3a}{3a};$$

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

№45.

$$\text{a)} \frac{x}{a - b} = \frac{x(a - b)}{(a - b)(a - b)} = \frac{x(a - b)}{(a - b)^2};$$

$$\text{б)} \frac{y}{x - a} = \frac{y(x + a)}{(x - a)(x + a)} = \frac{y(x + a)}{(x^2 - a^2)};$$

$$\text{в)} \frac{2y}{x - 1} = \frac{2y(x^2 + x + 1)}{(x - 1)(x^2 + x + 1)} = \frac{2y(x^2 + x + 1)}{x^3 - 1};$$

$$\Gamma) \frac{3a}{a^2 + ab + b^2} = \frac{3a(a - b)}{(a^2 + ab + b^2)(a - b)} = \frac{3a(a - b)}{a^3 - b^3};$$

$$\text{д)} \frac{7}{y-b} = -\frac{7}{b-y};$$

$$\text{е)} \frac{a}{a-10} = -\frac{a}{10-a};$$

$$\text{ж)} \frac{p}{p-2} = -\frac{p(2+p)}{(2-p)(2+p)} = -\frac{p(2+p)}{4-p^2};$$

$$\begin{aligned} \text{з)} \frac{a+3}{6-2a} &= -\frac{a+3}{2(a-3)} = \\ &= -\frac{(a+3)(a+3)}{2(a-3)(a+3)} = -\frac{(a+3)^2}{2(a^2-9)}. \end{aligned}$$

№46.

$$\text{а)} \frac{8}{3xy^2} = \frac{8 \cdot 5x}{3xy^2 \cdot 5x} = \frac{40x}{15x^2y^2};$$

$$\text{б)} \frac{b}{7a^2c} = \frac{b \cdot 5ac^2}{7a^2c \cdot 5ac^2} = \frac{5abc^2}{35a^3c^3};$$

$$\text{в)} \frac{a}{a-2} = \frac{a \cdot a}{a(a-2)} = \frac{a^2}{a^2-2a};$$

$$\text{г)} \frac{1}{x+1} = \frac{x^2-x+1}{(x+1)(x^2-x+1)} = \frac{x^2-x+1}{x^3+1};$$

$$\text{д)} \frac{12}{y-x} = -\frac{12}{x-y};$$

$$\text{е)} \frac{a}{a-4} = -\frac{a(4+a)}{(4-a)(4+a)} = -\frac{4a+a^2}{16-a^2}.$$

УПРАЖНЕНИЯ ДЛЯ ПОВТОРЕНИЯ

№47.

$$\text{а)} x = \frac{-16}{5} = -3\frac{1}{5};$$

$$\text{б)} x = \frac{1}{5} : 2 = \frac{1}{10};$$

$$\text{в)} x = 4 : \frac{1}{3} = 12;$$

$$\text{г)} \quad x = \frac{-2}{4} = -\frac{1}{2};$$

$$\text{д)} \quad x = 3:0,6 = 3: \frac{6}{10} = 3 \cdot \frac{10}{6} = \frac{10}{2} = 5;$$

$$\text{е)} \quad x = 5: (-0,7) = -5 \cdot \frac{7}{10} = -5 \cdot \frac{10}{7} = -\frac{50}{7} = -7 \frac{1}{7}.$$

№48.

$$\begin{aligned} \text{а)} \quad & 6b^2 - (2b + 5)(3b - 7) = \\ & = 6b^2 - (6b^2 + b - 35) = \\ & = 6b^2 - 6b^2 - b + 35 = -b + 35; \end{aligned}$$

$$\begin{aligned} \text{б)} \quad & 16x^2 - (4x + 0,5)(4x - 0,5) = \\ & = 16x^2 - 16x^2 + 0,25 = 0,25; \end{aligned}$$

$$\begin{aligned} \text{в)} \quad & 2y(y - 1,5x) - 5(x + 4y)(y - x) = \\ & = 2y^2 - 3xy - 5(4y^2 - x^2 - 3xy) = \\ & = 2y^2 - 3xy + 5x^2 + 15xy - 20y^2 = \\ & = 5x^2 - 18y^2 + 12xy; \end{aligned}$$

$$\begin{aligned} \text{г)} \quad & 3(a - 2b)(2b + a) - 0,5b(a - 24b) = \\ & = 3(a^2 - 4b^2) - 0,5ab + 12b^2 = \\ & = 3a^2 - 12b^2 - 0,5ab + 12b^2 = \\ & = 3a^2 - 0,5ab. \end{aligned}$$

№49.

$$\text{а)} \quad 5bc - 5c = 5c(b - 1);$$

$$\text{б)} \quad 10n + 15n^2 = 5n(2 + 3n);$$

$$\text{в)} \quad 8ab + 12bc = 4b(2a + 3c);$$

$$\begin{aligned} \text{г)} \quad & 5y - 5x + y^2 - xy = \\ & = (5y - 5x) + (y^2) - xy = \\ & = 5(y - x) + y(y - x) = \\ & = (y - x)(5 + y); \end{aligned}$$

$$\begin{aligned} \text{д)} \quad & pq - 4p + 12 - 3q = \\ & = (pq - 4p) + (12 - 3q) = \end{aligned}$$

$$= p(q-4) + 3(4-q) =$$

$$= p(q-4) - 3(q-4) =$$

$$= (q-4)(p-3);$$

$$\text{е) } a^2 - 9 = (a-3)(a+3);$$

$$\text{ж) } x^2 + 10x + 25 =$$

$$= (x+5)^2 = (x+5)(x+5);$$

$$\text{з) } y^2 - 2y + 1 =$$

$$= (y-1)^2 = (y-1)(y-1);$$

$$\text{и) } a^3 + 64 = (a+4)(a^2 - 4a + 16);$$

$$\text{к) } b^3 - 1 = (b-1)(b^2 + b + 1).$$

№50.

$$1) -\frac{5 \cdot 7}{16} < 0;$$

$$2) \frac{5}{16} : 6 = \frac{5}{16} : \frac{6}{1} = \frac{5 \cdot 1}{6 \cdot 16} = \frac{5}{16} \cdot \frac{1}{6} > 0;$$

$$3) \frac{5}{16} \cdot 0,1 = \frac{5 \cdot 1}{16 \cdot 10} = \frac{5}{16} \cdot \frac{1}{10} > 0;$$

$$\text{Ответ: } -\frac{5 \cdot 7}{16}, \quad \frac{5 \cdot 1}{10 \cdot 16}, \quad \frac{5 \cdot 1}{6 \cdot 16}.$$

2. Сумма и разность дробей

3. Сложение и вычитание дробей с одинаковыми знаменателями

№51.

$$\text{а) } \frac{x}{3} + \frac{y}{3} = \frac{x+y}{3};$$

$$\text{б) } \frac{a}{5} - \frac{b}{5} = \frac{a-b}{5};$$

$$\text{в) } \frac{a}{y} + \frac{2a}{y} = \frac{3a}{y};$$

$$\text{г) } \frac{5b^2}{a} - \frac{13b^2}{a} = \frac{5b^2 - 13b^2}{a} = -\frac{8b^2}{a};$$

$$д) \frac{x+y}{9} - \frac{x}{9} = \frac{x+y-x}{9} = \frac{y}{9};$$

$$е) \frac{2c-x}{b} - \frac{x}{b} = \frac{2c-x-x}{b} = \frac{2c-2x}{b} = \frac{2(c-x)}{b}.$$

№52.

$$а) \frac{m}{p} - \frac{m-p}{p} = \frac{m}{p} + \frac{(-m)+p}{p} = \frac{m-m+p}{p} = \frac{p}{p} = 1;$$

$$б) \frac{a+b}{6} - \frac{a-2b}{6} = \frac{a+b-a+2b}{6} = \frac{3b}{6} = \frac{b}{2};$$

$$в) \frac{x+5}{9} - \frac{x+2}{9} = \frac{x+5-x-2}{9} = \frac{3}{9} = \frac{1}{3};$$

$$г) \frac{11x-5}{14x} + \frac{3x-2}{14x} = \frac{11x-5+3x-2}{14x} = \frac{14x-7}{14x} = \frac{2x-1}{2x};$$

$$д) \frac{7y-13}{10y} - \frac{2y+3}{10y} = \frac{7y-13-2y-3}{10y} = \frac{5y-16}{10y};$$

$$е) \frac{8c+25}{6c} + \frac{5-2c}{6c} = \frac{8c+25+5-2c}{6c} = \frac{6c+30}{6c} = \frac{c+5}{c}.$$

№53.

$$а) \frac{2x-3y}{4xy} + \frac{11y-2x}{4xy} = \frac{2x-3y+11y-2x}{4xy} = \frac{8y}{4xy} = \frac{2}{x};$$

$$б) \frac{5a+b^5}{8b} - \frac{5a-7b^5}{8b} = \frac{5a+b^5-5a+7b^5}{8b} = \frac{8b^5}{8b} = b^4;$$

$$\begin{aligned}\text{в)} \quad & \frac{3x - y^4}{4y^5} - \frac{y^4 + 3x}{4y^5} = \\ & = \frac{3x - y^4 - y^4 - 3x}{4y^5} = -\frac{2y^4}{4y^5} = -\frac{1}{2y};\end{aligned}$$

$$\begin{aligned}\text{г)} \quad & \frac{a-2}{8a} + \frac{2a+5}{8a} - \frac{3-a}{8a} = \\ & = \frac{a-2+2a+5-3+a}{8a} = \frac{4a}{8a} = \frac{1}{2};\end{aligned}$$

$$\begin{aligned}\text{д)} \quad & \frac{7y-5}{12y} - \frac{10y-19}{12y} + \frac{10-15y}{12y} = \\ & = \frac{7y-5-10y+19+10-15y}{12y} = \\ & = \frac{-18y+24}{12y} = \frac{4-3y}{2y};\end{aligned}$$

$$\begin{aligned}\text{е)} \quad & \frac{11a-2b}{4a} + \frac{2a-3b}{4a} - \frac{a-b}{4a} = \\ & = \frac{11a-2b+2a-3b-a+b}{4a} = \\ & \frac{12a-4b}{4a} = \frac{4(3a-b)}{4a} = \frac{3a-b}{a}.\end{aligned}$$

№54.

$$\begin{aligned}\text{а)} \quad & \frac{17-12x}{x} + \frac{10-x}{x} = \\ & = \frac{17-12x+10-x}{x} = \frac{27-13x}{x};\end{aligned}$$

$$\begin{aligned}\text{б)} \quad & \frac{12p-1}{3p^2} - \frac{1-3p}{3p^2} = \\ & = \frac{12p-1-1+3p}{3p^2} = \frac{15p-2}{3p^2};\end{aligned}$$

$$\begin{aligned}\text{в)} \quad & \frac{6y-3}{5y} - \frac{y+2}{5y} = \frac{6y-3-y-2}{5y} = \\ & = \frac{5y-5}{5y} = \frac{5(y-1)}{5y} = \frac{y-1}{y};\end{aligned}$$

$$\text{г)} \quad \frac{b}{6} - \frac{3a-2b}{6} = \frac{b-3a+2b}{6} =$$

$$\frac{3b-3a}{6} = \frac{3(b-a)}{6} = \frac{b-a}{2};$$

$$\text{д)} \frac{3p-q}{5p} - \frac{2p+6q}{5p} + \frac{p-4q}{5p} =$$

$$\frac{3p-q-2p-6q+p-4q}{5p} = \frac{2p-11q}{5p};$$

$$\text{е)} \frac{5c-2d}{4c} - \frac{3d}{4c} + \frac{d-5c}{4c} =$$

$$= \frac{5c-2d-3d+d-5c}{4c} = -\frac{4d}{4c} = -\frac{d}{c};$$

$$\text{ж)} \frac{2a}{b} - \frac{1-6a}{b} + \frac{13-8a}{b} =$$

$$= \frac{2a-1+6a+13-8a}{b} = \frac{12}{b};$$

$$\text{з)} \frac{4b-2}{3b} - \frac{2b-1}{3b} + \frac{1}{3b} =$$

$$= \frac{4b-2-2b+1+1}{3b} = \frac{2b}{3b} = \frac{2}{3}.$$

№55.

$$\text{а)} \frac{16}{x-4} - \frac{x^2}{x-4} = \frac{16-x^2}{x-4} =$$

$$= \frac{-(4-x)(4+x)}{4-x} = -(4+x);$$

$$\text{б)} \frac{25}{a+5} - \frac{a^2}{a+5} = \frac{25-a^2}{a+5} =$$

$$\frac{(5-a)(5+a)}{a+5} = 5-a;$$

$$\text{в)} \frac{3a-1}{a^2-b^2} - \frac{3b-1}{a^2-b^2} = \frac{3a-1-3b+1}{a^2-b^2} =$$

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

$$\text{г)} \frac{x-3}{x^2-64} + \frac{11}{x^2-64} = \frac{x-3+11}{x^2-64} =$$

$$= \frac{x+8}{(x-8)(x+8)} = \frac{1}{x-8};$$

$$\begin{aligned} \text{д)} \quad \frac{2a+b}{(a-b)^2} + \frac{2b-5a}{(a-b)^2} &= \frac{2a+b+2b-5a}{(a-b)^2} = \\ &= \frac{3b-3a}{(a-b)^2} = -\frac{3(b-a)}{(b-a)(b+a)} = -\frac{3}{a-b} = \frac{3}{b-a}; \end{aligned}$$

$$\begin{aligned} \text{е)} \quad \frac{13x+6y}{(x+y)^2} - \frac{11x+4y}{(x+y)^2} &= \\ &= \frac{13x+6y-11x-4y}{(x+y)^2} = \frac{2x+2y}{(x+y)^2} = \\ &= \frac{2(x+y)}{(x+y)^2} = \frac{2}{x+y}. \end{aligned}$$

№56.

$$\begin{aligned} \text{а)} \quad \frac{(a+b)^2}{ab} - \frac{(a-b)^2}{ab} &= \\ &= \frac{a^2+2ab+b^2-a^2+2ab-b^2}{ab} = \frac{4ab}{ab} = 4; \\ \text{б)} \quad \frac{(a+b)^2}{a^2+b^2} + \frac{(a-b)^2}{a^2+b^2} &= \frac{(a+b)^2+(a-b)^2}{a^2+b^2} = \\ &= \frac{a^2+2ab+b^2+a^2-2ab+b^2}{a^2+b^2} = \\ &= \frac{2a^2+2b^2}{a^2+b^2} = \frac{2(a^2+b^2)}{a^2+b^2} = 2. \end{aligned}$$

№57.

$$\begin{aligned} \text{а)} \quad \frac{x^2+1}{x-3} - \frac{10}{x-3} &= \frac{x^2+1-10}{x-3} = \\ &= \frac{x^2-9}{x-3} = \frac{(x-3)(x+3)}{x-3} = x+3, \end{aligned}$$

при $x = 97$ получаем: $x+3 = 97+3 = 100$;

Ответ: 100;

$$\begin{aligned} \text{б)} \quad \frac{y+7}{y^2-25} - \frac{2y+2}{y^2-25} &= \frac{y+7-2y-2}{y^2-25} = \\ &= \frac{5-y}{(y-5)(y+5)} = -\frac{y-5}{(y-5)(y+5)} = -\frac{1}{y+5}; \end{aligned}$$

при $y = -5,1$ получаем:

$$-\frac{1}{y+5} = -\frac{1}{(-5,1)+5} = -\frac{1}{-0,1} = \frac{1}{0,1} = 10;$$

Ответ: 10.

№58.

$$\begin{aligned} \text{а) } \frac{a^2 - 43}{a - 6} + \frac{7}{a - 6} &= \frac{a^2 - 43 + 7}{a - 6} = \\ &= \frac{a^2 - 36}{a - 6} = \frac{(a - 6)(a + 6)}{a - 6} = a + 6; \end{aligned}$$

при $a = 10,25$ получаем: $a + 6 = 10,25 + 6 = 16,25$;

Ответ: 16,25;

$$\begin{aligned} \text{б) } \frac{9b - 1}{b^2 - 9} - \frac{6b - 10}{b^2 - 9} &= \frac{9b - 1 - 6b + 10}{b^2 - 9} = \\ &= \frac{3b + 9}{(b - 3)(b + 3)} = \frac{3(b + 3)}{(b - 3)(b + 3)} = \frac{3}{b - 3}; \end{aligned}$$

при $b = 3,5$ получаем: $\frac{3}{b - 3} = \frac{3}{3,5 - 3} = \frac{3}{0,5} = 3 : \frac{1}{2} = 3 \cdot 2 = 6$;

Ответ: 6.

№59.

$$\text{а) } \frac{x}{y - 1} + \frac{5}{1 - y} = \frac{x}{y - 1} - \frac{5}{y - 1} = \frac{x - 5}{y - 1};$$

$$\text{б) } \frac{a}{c - 3} - \frac{6}{3 - c} = \frac{a}{c - 3} + \frac{6}{c - 3} = \frac{a + 6}{c - 3};$$

$$\begin{aligned} \text{в) } \frac{2m}{m - n} + \frac{2n}{n - m} &= \frac{2m}{m - n} - \frac{2n}{m - n} = \\ &= \frac{2m - 2n}{m - n} = \frac{2(m - n)}{m - n} = 2; \end{aligned}$$

$$\begin{aligned} \text{г) } \frac{5p}{2q - p} + \frac{10}{p - 2q} &= \frac{5p}{2q - p} - \frac{10}{2q - p} = \\ &= \frac{5(p - 2q)}{2q - p} = -\frac{5(2q - p)}{2q - p} = -5; \end{aligned}$$

$$\begin{aligned} \text{д) } \frac{a^2 + 16}{a - 4} + \frac{8a}{4 - a} &= \frac{a^2 + 16}{a - 4} - \frac{8a}{a - 4} = \\ &= \frac{a^2 - 8a + 16}{a - 4} = \frac{(a - 4)^2}{a - 4} = a - 4; \end{aligned}$$

$$\begin{aligned}
 \text{e) } \frac{x^2 + 9y^2}{x - 3y} + \frac{6xy}{3y - x} &= \frac{x^2 + 9y^2 + (-6xy)}{x - 3y} = \\
 &= \frac{x^2 + 9y^2 - 6xy}{x - 3y} = \frac{x^2 - 6xy + 9y^2}{x - 3y} = \\
 &= \frac{(x - 3y)^2}{x - 3y} = x - 3y.
 \end{aligned}$$

№60.

$$\begin{aligned}
 \text{a) } \frac{10p}{p - q} + \frac{3p}{q - p} &= \frac{10p}{p - q} - \frac{3p}{p - q} = \\
 &= \frac{10p - 3p}{p - q} = \frac{7p}{p - q};
 \end{aligned}$$

$$\begin{aligned}
 \text{б) } \frac{5a}{a - b} + \frac{5b}{b - a} &= \frac{5a}{a - b} - \frac{5b}{a - b} = \\
 &= \frac{5a - 5b}{a - b} = \frac{5(a - b)}{a - b} = 5;
 \end{aligned}$$

$$\begin{aligned}
 \text{в) } \frac{x - 3}{x - 1} - \frac{2}{1 - x} &= \frac{x - 3}{x - 1} + \frac{2}{x - 1} = \\
 &= \frac{x - 3 + 2}{x - 1} = \frac{x - 1}{x - 1} = 1;
 \end{aligned}$$

$$\begin{aligned}
 \text{г) } \frac{a}{2a - b} + \frac{3a - b}{b - 2a} &= \frac{a}{2a - b} - \frac{3a - b}{2a - b} = \\
 &= \frac{a - 3a + b}{2a - b} = \frac{b - 2a}{2a - b} = -\frac{2a - b}{2a - b} = -1;
 \end{aligned}$$

$$\begin{aligned}
 \text{д) } \frac{a}{a^2 - 9} + \frac{3}{9 - a^2} &= \frac{a}{a^2 - 9} - \frac{3}{a^2 - 9} = \\
 &= \frac{a - 3}{(a - 3)(a + 3)} = \frac{1}{a + 3};
 \end{aligned}$$

$$\begin{aligned}
 \text{е) } \frac{y^2}{y - 1} + \frac{1}{1 - y} &= \frac{y^2}{y - 1} - \frac{1}{y - 1} = \\
 &= \frac{y^2 - 1}{y - 1} = \frac{(y - 1)(y + 1)}{y - 1} = y + 1.
 \end{aligned}$$

№61.

$$\text{a) } \frac{3x + 5}{2x - 1} + \frac{7x + 3}{1 - 2x} = \frac{3x + 5}{2x - 1} - \frac{7x + 3}{2x - 1} =$$

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

не зависит от x ;

$$\begin{aligned} \text{б)} \quad & \frac{5x + 1}{5x - 20} + \frac{x + 17}{20 - 5x} = \frac{5x + 1}{5x - 20} - \frac{x + 17}{5x - 20} = \\ & = \frac{5x + 1 - x - 17}{5x - 20} = \frac{4x - 16}{5(x - 4)} = \frac{4(x - 4)}{5(x - 4)} = \frac{4}{5}; \end{aligned}$$

не зависит от x .

№62.

$$\begin{aligned} \text{а)} \quad & \frac{x^2}{(x - 5)^2} - \frac{25}{(5 - x)^2} = \frac{x^2}{(x - 5)^2} - \frac{25}{(x - 5)^2} = \\ & = \frac{x^2 - 25}{(x - 5)^2} = \frac{(x - 5)(x + 5)}{(x - 5)(x - 5)} = \frac{x + 5}{x - 5}; \end{aligned}$$

$$\begin{aligned} \text{б)} \quad & \frac{x^2 + 25}{(x - 5)^3} + \frac{10x}{(5 - x)^3} = \frac{x^2 + 25}{(x - 5)^3} - \frac{10x}{(x - 5)^3} = \\ & = \frac{x^2 - 10x + 25}{(x - 5)^3} = \frac{(x - 5)^2}{(x - 5)^3} = \frac{1}{x - 5}. \end{aligned}$$

№63.

$$\begin{aligned} \text{а)} \quad & \frac{x^2}{x^2 - 16} - \frac{8(x - 2)}{x^2 - 16} = \frac{x^2 - 8x + 16}{x^2 - 16} = \\ & = \frac{(x - 4)^2}{(x - 4)(x + 4)} = \frac{x - 4}{x + 4}; \end{aligned}$$

$$\begin{aligned} \text{б)} \quad & \frac{64 - 2ab}{(a - 8)^2} + \frac{2ab - a^2}{(8 - a)^2} = \frac{64 - 2ab}{(a - 8)^2} + \frac{2ab - a^2}{(a - 8)^2} = \\ & = \frac{64 - 2ab + 2ab - a^2}{(a - 8)^2} = \frac{64 - a^2}{(a - 8)^2} = \end{aligned}$$

$$\frac{(a - 8)(8 + a)}{(8 - a)(8 - a)} = \frac{8 + a}{8 - a}.$$

№64.

а) подставим $c = x$:

$$\frac{a + b}{x} = \frac{a}{x} + \frac{b}{x};$$

б) подставим $c = x$:

$$\frac{2a^2 + a}{y} = \frac{2a^2}{y} + \frac{a}{y};$$

в) подставим $c = x$:

$$\frac{x^2 + 6y^2}{2xy} = \frac{x^2}{2xy} + \frac{6y^2}{2xy} = \frac{x}{2y} + \frac{3y}{x};$$

г) подставим $c = x$:

$$\frac{12a + y^2}{6ay} = \frac{12a}{6ay} + \frac{y^2}{6ay} = \frac{2}{y} + \frac{y}{6a}.$$

№65.

а) $\frac{x^2 + y^2}{x^4} = \frac{x^2}{x^4} + \frac{y^2}{x^4} = \frac{1}{x^4} + \frac{y^2}{x^4};$

б) $\frac{2x - y}{b} = \frac{2x}{b} - \frac{y}{b};$

в) $\frac{a^2 + 1}{2a} = \frac{a^2}{2a} + \frac{1}{2a} = \frac{a}{2} + \frac{1}{2a};$

г) $\frac{a^2 - 3ab}{a^3} = \frac{a^2}{a^3} - \frac{3ab}{a^3} = \frac{1}{a} - \frac{3b}{a^2};$

УПРАЖНЕНИЯ ДЛЯ ПОВТОРЕНИЯ

№66.

а) подставим $a = 2$:

$$\frac{3a^2}{2a-1} = \frac{3 \cdot 2^2}{2 \cdot 2 - 1} = \frac{12}{3} = 4;$$

Ответ: 4;

б) подставим $a = -\frac{1}{3}$:

$$\frac{3a^2}{2a-1} = \frac{3 \cdot \left(-\frac{1}{3}\right)^2}{2 \cdot \left(-\frac{1}{3}\right) - 1} = \frac{3 \cdot \frac{1}{9}}{-\frac{2}{3} - 1} =$$

$$= \frac{1}{3} : \left(-\frac{5}{3}\right) = -\frac{1 \cdot 3}{3 \cdot 5} = -\frac{1}{5}.$$

Ответ: $-\frac{1}{5}$.

№67.

$$\text{a) } 3(5x - 4) - 8x = 4x + 9;$$

$$15x - 12 - 8x = 4x + 9;$$

$$3x = 21;$$

$$x = 7;$$

Ответ: $x = 7$;

$$\text{б) } 19x - 8(x - 3) = 66 - 3x;$$

$$19x - 8x + 24 = 66 - 3x;$$

$$11x + 3x = 66 - 24;$$

$$14x = 42;$$

$$x = 3;$$

$$\text{ОТВЕТ: } x = 3;$$

$$\text{в) } 0,2(0,7x - 5) + 0,02 = 1,4(x - 1,6);$$

$$0,14x - 1 + 0,02 = 1,4x - 2,24;$$

$$0,14x - 0,98 = 1,4x - 2,24;$$

$$1,26 = 1,26x;$$

$$x = 1;$$

$$\text{ОТВЕТ: } x = 1;$$

$$\text{г) } 2,7(0,1x + 3,2) + 0,6(1,3 - x) = 16,02;$$

$$0,27x + 8,64 + 0,78 - 0,6x = 16,02;$$

$$-0,33x = 16,02 - 8,64 - 0,78;$$

$$-0,33x = 6,6;$$

$$x = 6,6 : (-0,33);$$

$$x = -\frac{66}{10} \cdot \frac{100}{33} = \frac{660}{33} = -20;$$

$$\text{ОТВЕТ: } x = -20.$$

№68.

$$\text{а) } 8x^2 - 16x^3y = 8x^3(x - 2y);$$

$$\text{б) } 15xy^5 + 10y^2 = 5y^2(3xy^3 + 2);$$

$$\begin{aligned} \text{в) } 8a^2 - 50y^2 &= 2(4a^2 - 25y^2) = \\ &= 2(2a - 5y)(2a + 5y); \end{aligned}$$

$$\text{г) } 18b^2 - 98a^2 = 2(9b^2 - 49a^2) = \\ = 2(3b - 7a)(3b + 7a);$$

$$\text{д) } x^3 - 125 = (x - 5)(x^2 + 5x + 25);$$

$$\text{е) } y^3 + 8 = (y + 2)(y^2 - 2y + 4);$$

$$\text{ж) } ab + 8a + 9b + 72 = a(b + 8) + 9(b + 8) = \\ = (b + 8)(a + 9);$$

$$\text{з) } 6m - 12 - 2n + mn = 6(m - 2) + n(m - 2) = \\ = (m - 2)(6 + n).$$

№69.

Достаточно выяснить, когда знаменатель дроби отличен от нуля.

$$\text{а) } 2a + 25 \neq 0; \quad 2a \neq -25; \quad a \neq -\frac{25}{2}; \quad a \neq -12,5;$$

$$\text{б) } y - \text{любое число, так как } 9 + y^2 > 0 \text{ при всех } y;$$

$$\text{в) } 3x(x + 12) \neq 0; \quad 1) 3x \neq 0; \quad x \neq 0; \quad 2) x + 12 \neq 0; \quad x \neq -12;$$

$$\text{Итак: } x \neq 0; \quad x \neq -12;$$

$$\text{г) } (a + 1)(a - 4) \neq 0; \quad 1) a + 1 \neq 0; \quad a \neq -1; \quad 2) a - 4 \neq 0; \quad a \neq 4;$$

$$\text{Итак: } a \neq -1; \quad a \neq 4.$$

4. Сложение и вычитание дробей с разными знаменателями

№70.

$$\text{а) } \frac{x}{2} + \frac{y}{3} = \frac{3x + 2y}{6};$$

$$\text{б) } \frac{c}{4} - \frac{d}{12} = \frac{3c - d}{12};$$

$$\text{в) } \frac{p}{q} + \frac{q}{p} = \frac{p^2 + q^2}{qp};$$

$$\text{г) } \frac{a}{b} - \frac{b^2}{a} = \frac{a^2 - b^3}{ab};$$

$$д) \frac{3}{2x} - \frac{2}{3x} = \frac{9-4}{6x} = \frac{5}{6x};$$

$$е) \frac{a}{5c} + \frac{3a}{4c} = \frac{4a+15a}{20c} = \frac{19a}{20c};$$

$$ж) \frac{5x}{8y} + \frac{x}{4y} = \frac{5x+2x}{8y} = \frac{7x}{8y};$$

$$з) \frac{17y}{24c} - \frac{25y}{36c} = \frac{51y-50y}{72c} = \frac{y}{72c};$$

$$и) \frac{5a}{18b} - \frac{7a}{45b} = \frac{25a-14a}{90b} = \frac{11a}{90b}.$$

№71.

$$\begin{aligned} а) \frac{5y-3}{6y} + \frac{y+2}{4y} &= \\ &= \frac{2(5y-3)+3(y+2)}{12y} = \frac{13y}{12y} = \frac{13}{12}; \end{aligned}$$

$$\begin{aligned} б) \frac{3x+5}{35x} + \frac{x-3}{21x} &= \\ &= \frac{3(3x+5)+5(x-3)}{105x} = \frac{14x}{105x} = \frac{2}{15}; \end{aligned}$$

$$\begin{aligned} в) \frac{b+2}{15b} - \frac{3c-5}{45c} &= \\ &= \frac{3c(b+2)-b(3c-5)}{45bc} = \frac{6c+5b}{45bc}; \end{aligned}$$

$$г) \frac{8b+y}{40b} - \frac{6y+b}{30y} =$$

$$= \frac{24by + 3y^2 - 24by - 4b^2}{120y} = \frac{3y^2 - 4b^2}{120y};$$

№72.

$$\text{a)} \quad \frac{3x}{4} - \frac{5x}{9} = \frac{27x - 20x}{36} = \frac{7x}{36};$$

$$\text{б)} \quad \frac{6a}{5} - \frac{3a}{4} = \frac{24a - 15a}{20} = \frac{9a}{20};$$

$$\text{в)} \quad \frac{7a}{12b} - \frac{2a}{15b} = \frac{35a - 8a}{60b} = \frac{27a}{60b} = \frac{9a}{20b};$$

$$\text{г)} \quad \frac{9p}{10} - \frac{7p}{12} = \frac{54p - 35p}{60} = \frac{19p}{60};$$

$$\begin{aligned} \text{д)} \quad \frac{15a - b}{12a} - \frac{a - 4b}{9a} &= \\ &= \frac{45a - 3b - 4a + 16b}{36a} = \frac{41a + 13b}{36a}; \end{aligned}$$

$$\begin{aligned} \text{е)} \quad \frac{7x + 4}{8y} - \frac{3x - 1}{6y} &= \\ &= \frac{21x + 12 - 12x + 4}{24y} = \frac{9x + 16}{24y}. \end{aligned}$$

№73.

$$\text{a)} \quad \frac{b}{a^2} - \frac{1}{a} = \frac{b - a}{a^2};$$

$$\text{б)} \quad \frac{1 - x}{x^3} + \frac{1}{x^2} = \frac{1 - x + x}{x^3} = \frac{1}{x^3};$$

$$\text{B)} \quad \frac{1}{2a^7} + \frac{4-2a^3}{a^{10}} =$$

$$= \frac{a^3 + 8 - 4a^3}{2a^{10}} = \frac{8 - 3a^3}{2a^{10}};$$

$$\text{Г)} \quad \frac{a+b}{a^2} + \frac{a-b}{ab} =$$

$$= \frac{ab + b^2 + a^2 - ab}{a^2b} = \frac{a^2 + b^2}{a^2b};$$

$$\text{Д)} \quad \frac{2a-3b}{a^2b} + \frac{4a-5b}{ab^2} =$$

$$= \frac{2ab - 3b^2 + 4a^2 - 5ab}{a^2b^2} = \frac{4a^2 - 3ab - 3b^2}{a^2b^2};$$

$$\text{е)} \quad \frac{x-2y}{xy^2} - \frac{2y-x}{x^2y} =$$

$$= \frac{x^2 - 2xy - 2y^2 + xy}{x^2y^2} = \frac{x^2 - 2y^2 - xy}{x^2y^2}.$$

№74.

$$\text{a)} \quad \frac{2xy-1}{4x^3} - \frac{3y-x}{6x^2} =$$

$$= \frac{6xy - 3 - 6xy + 2x^2}{12x^3} = \frac{2x^2 - 3}{12x^3};$$

$$\text{б)} \quad \frac{1-b^2}{3ab} + \frac{2b^3-1}{6ab^2} = \frac{2b(1-b^2) + 2b^3 - 1}{6ab^2} =$$

$$= \frac{2b - 2b^3 + 2b^3 - 1}{6ab^2} = \frac{2b - 1}{6ab^2};$$

$$\text{в) } \frac{1}{3a^3} - \frac{2}{5a^5} = \frac{5a^2 - 6}{15a^5};$$

$$\text{г) } \frac{b^2}{6x^5} - \frac{b}{3x^6} = \frac{xb^2 - 2b}{6x^6}.$$

№75.

$$\text{а) } \frac{1}{ab} + \frac{1}{ac} + \frac{1}{bc} = \frac{c}{abc} + \frac{b}{abc} + \frac{a}{abc} = \frac{a+b+c}{abc};$$

$$\begin{aligned} \text{б) } \frac{ab-b}{a} - \frac{ab-a}{b} - \frac{a^2-b^2}{ab} &= \\ &= \frac{b(ab-b) - a(ab-a) - a^2 + b^2}{ab} = \\ &= \frac{ab^2 - b^2 - a^2b + a^2 - a^2 + b^2}{ab} = \\ &= \frac{ab^2 - a^2b}{ab} = b - a; \end{aligned}$$

$$\begin{aligned} \text{в) } \frac{b-a}{ab} + \frac{c-b}{bc} - \frac{c-a}{ac} &= \\ &= \frac{cb - ac + ac - ab - bc + ab}{abc} = 0; \end{aligned}$$

$$\text{г) } \frac{3ab+2b^2}{ab} - \frac{a+2b}{a} + \frac{a-2b}{b} =$$

$$\begin{aligned}
 &= \frac{3ab + b^2}{ab} - \frac{b(a + 2b)}{ab} + \frac{a(a - 2b)}{ab} = \\
 &= \frac{3ab + 2b^2 - ab - 2b^2 + a^2 - 2ab}{ab} = \frac{a^2}{ab} = \frac{a}{b}.
 \end{aligned}$$

№76.

$$\begin{aligned}
 \text{a)} \quad & \frac{x-y}{xy} - \frac{x-z}{xz} = \frac{zx - zy - yx + yz}{xyz} = \\
 &= \frac{zx - yx}{xyz} = \frac{z-y}{yz};
 \end{aligned}$$

$$\text{б)} \quad \frac{a-2b}{3b} - \frac{b-2a}{3a} = \frac{a^2 - 2ab - b^2 + 2ab}{3ab} = \frac{a^2 - b^2}{3ab};$$

$$\begin{aligned}
 \text{в)} \quad & \frac{p-q}{p^3q^2} - \frac{p+q}{p^2q^3} = \\
 &= \frac{qp - q^2 - p^2 - pq}{p^3q^3} = -\frac{q^2 + p^2}{p^3q^3};
 \end{aligned}$$

$$\begin{aligned}
 \text{г)} \quad & \frac{3m-n}{3m^2n} - \frac{2n-m}{2mn^2} = \frac{2m(3m-n) - 3m(2n-m)}{6m^2n^2} = \\
 &= \frac{6mn - 2n^2 - 6mn + 3m^2}{6m^2n^2} = \frac{3m^2 - 2n^2}{6m^2n^2};
 \end{aligned}$$

$$\begin{aligned}
 \text{д)} \quad & \frac{3b+2c}{9b^2c} - \frac{2c-5b}{6bc^2} = \\
 &= \frac{6bc + 4c^2 - bc + 15b^2}{18b^2c^2} = \frac{4c^2 + 15b^2}{18b^2c^2};
 \end{aligned}$$

$$\begin{aligned}\text{е) } \frac{2x-7y}{2x^2y} - \frac{5y-8x}{5xy^2} &= \\ &= \frac{10xy-35y^2-10xy+16x^2}{10x^2y^2} = \frac{16x^2-35y^2}{10x^2y^2},\end{aligned}$$

№77.

$$\text{а) } x + \frac{1}{y} = \frac{x}{1} + \frac{1}{y} = \frac{xy+1}{y};$$

$$\text{б) } \frac{1}{a} - a = \frac{1}{a} - \frac{a}{1} = \frac{1-a^2}{a};$$

$$\text{в) } 3a - \frac{a}{4} = \frac{3a}{1} - \frac{a}{4} = \frac{12a-a}{4} = \frac{11a}{4};$$

$$\text{г) } 5b - \frac{2}{b} = \frac{5b}{1} - \frac{2}{b} = \frac{5b^2-2}{b};$$

$$\text{д) } \frac{a^2+b}{a} - a = \frac{a^2+b}{a} - \frac{a}{1} =$$

$$= \frac{a^2+b-a^2}{a} = \frac{b}{a};$$

$$\text{е) } 2p - \frac{4p^2+1}{2p} = \frac{2p}{1} - \frac{4p^2+1}{2p} =$$

$$= \frac{4p^2 - (4p^2+1)}{2p} = \frac{4p^2-4p^2-1}{2p} = -\frac{1}{2p};$$

$$\text{ж) } \frac{(a-b)^2}{2a} + b = \frac{(a-b)^2}{2a} \cdot \frac{b}{1} =$$

$$= \frac{a^2 - 2ab + b^2 + 2ab}{2a} = \frac{a^2 + b^2}{2a};$$

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

$$= \frac{2bc - (b^2 + 2bc + c^2)}{2b} =$$

$$= \frac{2bc - b^2 - bc - c^2}{2b} =$$

$$= \frac{-b^2 - c^2}{2b} = -\frac{b^2 + c^2}{2b}.$$

№78.

$$a) \ 5 - \frac{c}{2} = \frac{5}{1} - \frac{c}{2} = \frac{10 - c}{2};$$

$$6) \ 5y^2 - \frac{15y^2 - 1}{3} = \frac{15y^2 - 15y^2 + 1}{3} = \frac{1}{3};$$

$$b) \ a + b - \frac{a-3}{3} = \frac{a}{1} + \frac{b}{1} - \frac{a-3}{3} =$$

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

$$= \frac{2a + 3b + 3}{3};$$

$$r) \ \frac{2b^2 - 1}{b} - b + 5 = \frac{2b^2 - 1 - b^2 + 5b}{b} =$$

$$= \frac{b^2 + 5b - 1}{b}.$$

№79.

$$\text{a)} \quad 1 - \frac{a}{5} - \frac{b}{4} = \frac{1}{1} - \frac{a}{5} - \frac{b}{4} = \frac{20 - 4a - 5b}{20};$$

$$\text{б)} \quad 12 - \frac{1}{a} - \frac{1}{b} = \frac{12}{1} - \frac{1}{a} - \frac{1}{b} = \frac{12ab - b - a}{ab};$$

$$\text{в)} \quad \frac{a-2}{2} - 1 - \frac{a-3}{3} = \frac{a-2}{2} - \frac{1}{1} - \frac{a-3}{3} =$$

$$= \frac{3a - 6 - 6 - 2a + 6}{6} = \frac{a - 6}{6};$$

$$\text{г)} \quad 4a - \frac{a-1}{4} - \frac{a+2}{3} = \frac{4a}{1} - \frac{a-1}{4} - \frac{a+2}{3} =$$

$$= \frac{48a - 3a + 3 - 4a - 8}{12} = \frac{41a - 5}{12};$$

$$\text{д)} \quad \frac{a+b}{4} - a + b = \frac{a+b}{4} - \frac{a}{1} + \frac{b}{1} = \frac{5b - 3a}{4};$$

$$\text{е)} \quad a + b - \frac{a^2 + b^2}{a} = \frac{a}{1} + \frac{b}{1} - \frac{a^2 + b^2}{a} =$$

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

№80.

$$\text{a)} \quad x - \frac{x-y}{2} + \frac{x+y}{4} = \frac{x}{1} - \frac{x-y}{2} + \frac{x+y}{4} =$$

$$= \frac{4x - 2x + 2y + x + y}{4} = \frac{3x + 3y}{4};$$

$$\text{б)} \frac{3}{x} - 2 - \frac{5}{x} = \frac{3}{x} - \frac{2}{1} - \frac{5}{x} =$$

$$= \frac{3 - 2x - 5}{x} = -\frac{2x + 2}{x};$$

$$\text{в)} 3 - \frac{2x - y}{4} + \frac{x + 4y}{12} = \frac{3}{1} - \frac{2x - y}{4} + \frac{x + 4y}{12} =$$

$$= \frac{36 - 6x + 3y + x + 4y}{12} = \frac{36 - 5x + 7y}{12};$$

$$\text{г)} \frac{6a - 4b}{5} - \frac{b + 7a}{3} - 2 = \frac{6a - 4b}{5} - \frac{b + 7a}{3} - \frac{2}{1} =$$

$$= \frac{18a - 12b - 5b - 35a - 30}{15} = -\frac{17a + 17b + 30}{15}.$$

№81.

$$\text{а)} \frac{b - c}{b} + \frac{b}{b + c} = \frac{(b + c)(b - c) + b^2}{b(b + c)} =$$

$$= \frac{b^2 - c^2 + b^2}{b(b + c)} = \frac{2b^2 - c^2}{b(b + c)};$$

$$\text{б)} \frac{x + 1}{x - 2} - \frac{x + 3}{x} = \frac{x(x + 1) - (x - 2)(x + 3)}{(x - 2)x} =$$

$$= \frac{x^2 + x - x^2 - x + 6}{x(x - 2)} = \frac{6}{x(x - 2)};$$

$$\begin{aligned} \text{B)} \quad \frac{m}{m-n} - \frac{n}{m+n} &= \frac{(m+n)m - n(m-n)}{(m-n)(m+n)} = \\ &= \frac{m^2 + mn - mn + n^2}{(m-n)(m+n)} = \frac{m^2 + n^2}{m^2 - n^2}; \end{aligned}$$

$$\begin{aligned} \text{Г)} \quad \frac{2a}{2a-1} - \frac{1}{2a+1} &= \frac{2a(2a+1) - (2a-1)}{(2a-1)(2a+1)} = \\ &= \frac{4a^2 + 2a - 2a + 1}{(2a-1)(2a+1)} = \frac{4a^2 + 1}{4a^2 - 1}; \end{aligned}$$

$$\begin{aligned} \text{Д)} \quad \frac{a}{a+2} - \frac{a}{a-2} &= \frac{a(a-2) - a(a+2)}{(a+2)(a-2)} = \\ &= \frac{a^2 - 2a - a^2 - 2a}{a^2 - 4} = \frac{4a}{4 - a^2}; \end{aligned}$$

$$\begin{aligned} \text{е)} \quad \frac{p}{3p-1} - \frac{p}{3p+1} &= \frac{p(3p+1) - p(3p-1)}{(3p-1)(3p+1)} = \\ &= \frac{3p^2 + p - 3p^2 + p}{9p^2 - 1} = \frac{2p}{9p^2 - 1}. \end{aligned}$$

№82.

$$\text{а)} \quad \frac{3x}{5(x+y)} - \frac{2y}{3(x+y)} = \frac{9x - 10y}{15(x+y)};$$

$$\text{б)} \quad \frac{a^2}{5(a-b)} - \frac{b^2}{4(a-b)} = \frac{4a^2 - 5b^2}{20(a-b)};$$

$$\text{в)} \quad \frac{3}{ax - ay} + \frac{2}{by - bx} =$$

$$= \frac{3}{a(x-y)} - \frac{2}{b(x-y)} = \frac{3b-2a}{ab(x-y)};$$

$$\text{r)} \frac{13c}{bm-bn} - \frac{12b}{cn-cm} =$$

$$= \frac{13c}{b(m-n)} + \frac{12b}{c(m-n)} = \frac{13c^2 + 12b^2}{bc(m-n)};$$

$$\text{д)} \frac{a}{2x+4} - \frac{a}{3x+6} = \frac{a}{2(x+2)} - \frac{a}{3(x+2)} =$$

$$= \frac{3a-2a}{6(x+2)} = \frac{a}{6(x+2)};$$

$$\text{е)} \frac{p}{7a-14} + \frac{1}{2-a} =$$

$$= \frac{p}{7(a-2)} - \frac{1}{a-2} = \frac{p-7}{7(a-2)}.$$

№83.

$$\text{а)} \frac{p}{2x+1} - \frac{p}{3x-2} = \frac{p(3x-2) - p(2x+1)}{(3x-2)(2x+1)} =$$

$$= \frac{3xp-2p-2xp-p}{(3x-2)(2x+1)} = \frac{p(x-3)}{(3x-2)(2x+1)};$$

$$\text{б)} \frac{6a}{x-2y} + \frac{2a}{x+y} = \frac{6a(x+y) + 2a(x-2y)}{(x+y)(x-2y)} =$$

$$= \frac{8ax+2ay}{(x+y)(x-2y)} = \frac{2a(4x+y)}{(x+y)(x-2y)};$$

$$\begin{aligned} \text{в)} \quad \frac{a}{5x-10} + \frac{a}{6x-12} &= \frac{a}{5(x-2)} + \frac{a}{6(x-2)} = \\ &= \frac{6a+5a}{30(x-2)} = \frac{11a}{30(x-2)}; \end{aligned}$$

$$\begin{aligned} \text{г)} \quad \frac{5b}{12a-36} - \frac{b}{48-16a} &= \frac{5b}{12(a-3)} + \frac{b}{16(a-3)} = \\ &= \frac{20b+3b}{48(a-3)} = \frac{23b}{48(a-3)}. \end{aligned}$$

№84.

$$\begin{aligned} \text{а)} \quad \frac{5y+3}{2y+2} - \frac{7y+4}{3y+3} &= \frac{5y+3}{2(y+1)} - \frac{7y+4}{3(y+1)} = \\ &= \frac{15y+9-14y-8}{6(y+1)} = \frac{y+1}{6(y+1)} = \frac{1}{6}. \end{aligned}$$

не зависит от y ;

$$\begin{aligned} \text{б)} \quad \frac{11y+13}{3y-3} + \frac{15y+17}{4-4y} &= \frac{11y+13}{3(y-1)} - \frac{15y+17}{4(y-1)} = \\ &= \frac{44y+52-45y-51}{12(y-1)} = \frac{-y+1}{12(y-1)} = \\ &= -\frac{y-1}{12(y-1)} = -\frac{1}{12}, \end{aligned}$$

не зависит от y ;

№85.

$$\begin{aligned} \text{a)} \quad \frac{a^2}{ax-x^2} + \frac{x}{x-a} &= \frac{a^2}{x(a-x)} - \frac{x}{a-x} = \\ &= \frac{a^2-x^2}{x(a-x)} = \frac{(a-x)(a+x)}{x(a-x)} = \frac{a+x}{x}; \end{aligned}$$

$$\begin{aligned} \text{б)} \quad \frac{b^2-4by}{2y^2-by} - \frac{4y}{b-2y} &= \frac{b^2-4by}{y(2y-b)} + \frac{4y}{2y-b} = \\ &= \frac{b^2-4by+4y^2}{y(2y-b)} = \frac{(b-2y)^2}{y(2y-b)} = \frac{2y-b}{y}; \end{aligned}$$

$$\begin{aligned} \text{в)} \quad \frac{b}{2a^2-ab} - \frac{4a}{2ab-b^2} &= \frac{b}{a(2a-b)} - \frac{4a}{b(2a-b)} = \\ &= \frac{b^2-4a^2}{ab(2a-b)} = \frac{(b-2a)(b+2a)}{ab(2a-b)} = -\frac{b+2a}{ab}; \end{aligned}$$

$$\begin{aligned} \text{г)} \quad \frac{4y}{3x^2+2xy} - \frac{9x}{3xy+2x^2} &= \frac{4y}{x(3x+2y)} - \frac{9x}{x(3y+2x)} = \\ &= \frac{4y(3y+2x)-x(3x+2y)}{x(3x+2y)(3y+2x)} = \frac{12y^2-10xy-27x^2}{x(3x+2y)(3y+2x)}; \end{aligned}$$

№86.

$$\begin{aligned} \text{a)} \quad \frac{x-25}{5x-25} + \frac{3x+5}{x^2-5x} &= \frac{x-25}{5(x-5)} + \frac{3x+5}{x(x-5)} = \\ &= \frac{x(x-25)+5(3x+5)}{5x(x-5)} = \frac{x^2-10x+25}{5x(x-5)} = \\ &= \frac{(x-5)^2}{5x(x-5)} = \frac{x-5}{5x}; \end{aligned}$$

$$\begin{aligned}
 \text{б)} \quad & \frac{12-y}{6y-36} - \frac{6}{y^2-6y} = \frac{12-y}{6(y-6)} - \frac{6}{y(y-6)} = \\
 & = \frac{12y-y^2-36}{6y(y-6)} = -\frac{(y-6)^2}{6y(y-6)} = \\
 & = -\frac{y-6}{6y} = \frac{6-y}{6y};
 \end{aligned}$$

$$\begin{aligned}
 \text{б)} \quad & \frac{1}{a^2+ab} + \frac{1}{ab+b^2} = \frac{1}{a(a+b)} + \frac{1}{b(a+b)} = \\
 & = \frac{b+a}{ab(a+b)} = \frac{1}{ab};
 \end{aligned}$$

$$\begin{aligned}
 \text{г)} \quad & \frac{1}{b^2-ab} - \frac{1}{ab-a^2} = \frac{1}{b(b-a)} - \frac{1}{a(b-a)} = \\
 & = \frac{a}{ab(b-a)} - \frac{b}{ab(b-a)} = \frac{a-b}{ab(b-a)} \equiv \frac{1}{ab}.
 \end{aligned}$$

№87.

$$\begin{aligned}
 \text{а)} \quad & 1 - \frac{a+b}{a-b} = \frac{1}{1} - \frac{a+b}{a-b} = \frac{a-b-(a+b)}{a-b} = \\
 & = \frac{a-b-a-b}{a-b} = \frac{2b}{b-a};
 \end{aligned}$$

$$\begin{aligned}
 \text{б)} \quad & \frac{a^2+b^2}{a-b} - a = \frac{a^2+b^2}{a-b} - \frac{a}{1} = \frac{a^2+b^2-a(a-b)}{a-b} = \\
 & = \frac{b^2+ab}{a-b} = \frac{b(b+a)}{a-b};
 \end{aligned}$$

$$\text{B)} \quad m - n + \frac{n^2}{m+n} = \frac{m}{1} - \frac{n}{1} + \frac{n^2}{m+n} =$$

$$= \frac{m(m+n) - n(m+n) + n^2}{m+n} = \frac{m^2}{m+n};$$

$$\text{Г)} \quad a + b - \frac{a^2 + b^2}{a+b} = \frac{(a+b)^2 - (a^2 + b^2)}{a+b} = \frac{2ab}{a+b};$$

$$\text{Д)} \quad x - \frac{9}{x-3} - 3 = \frac{x}{1} - \frac{9}{x-3} - \frac{3}{1} =$$

$$= \frac{x^2 - 3x - 9 - 3x + 9}{x-3} = \frac{x^2 - 6x}{x-3};$$

$$\text{е)} \quad a^2 - \frac{a^4 + 1}{a^2 - 1} + 1 = \frac{a^2}{1} - \frac{a^4 + 1}{a^2 - 1} + \frac{1}{1} =$$

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

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

№88.

$$\text{a)} \quad \frac{a^2 + 3a}{ab - 5b + 8a - 40} - \frac{a}{b+8} = \frac{a^2 + 3a}{(a-5)(b+8)} - \frac{a}{b+8} =$$

$$= \frac{a^2 + 3a - a(a-5)}{(a-5)(b+8)} = \frac{a^2 + 3a - a^2 + 5a}{(a-5)(b+8)} = \frac{8a}{(a-5)(b+8)};$$

$$\text{б)} \quad \frac{y}{3x-2} - \frac{3y}{6xy+9x-4y-6} = \frac{y}{3x-2} - \frac{3y}{(2y+3)(3x-2)} =$$

$$= \frac{y(2y+3)-3y}{(2y+3)(3x-2)} = \frac{2y^2+3y-3y}{(2y+3)(3x-2)} = \frac{2y^2}{(2y+3)(3x-2)}.$$

№89.

$$\text{a)} \frac{x^2}{3ax-2-x+6a} - \frac{x}{3a-1} = \frac{x^2}{(3a-1)(x+2)} - \frac{x}{3a-1} =$$

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

$$= \frac{2x}{(1-3a)(x+2)};$$

$$\text{б)} \frac{3x}{2y+3} + \frac{x^2+3x}{4xy-3-2y+6x} = \frac{3x}{2y+3} + \frac{x^2+3x}{2x(2y+3)-(2y+3)} =$$

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

$$= \frac{7x^2}{(2y+3)(2x-1)}.$$

№90.

$$\text{a)} \frac{x^2-3xy}{(x+y)(x-y)} + \frac{y}{(x-y)} = \frac{x^2-3xy+y(x+y)}{(x+y)(x-y)} =$$

$$= \frac{x^2-2xy+y^2}{(x+y)(x-y)} = \frac{(x-y)^2}{(x+y)(x-y)} = \frac{(x-y)}{(x+y)};$$

$$\text{б)} \frac{c}{b-c} + \frac{b^2-3bc}{b^2-c^2} = \frac{c(b+c)+b^2-3bc}{b^2-c^2} =$$

$$= \frac{c(b+c) + b^2 - 3bc}{(b-c)(b+c)} = \frac{bc + c^2 + b^2 - 3bc}{(b-c)(b+c)} =$$

$$= \frac{b^2 - 2bc + c^2}{(b-c)(b+c)} = \frac{(b-c)^2}{(b-c)(b+c)} = \frac{b-c}{b+c};$$

$$\text{B) } \frac{a-2y}{a+y} - \frac{y^2-5ay}{a^2-y^2} = \frac{(a-y)(a-2y) - (y^2-5ay)}{(a-y)(a+y)} =$$

$$= \frac{a^2 - 2ay - ay + 2y^2 - y^2 + 5ay}{(a-y)(a+y)} = \frac{y^2 + 2ay + a^2}{(a-y)(a+y)} =$$

$$= \frac{(a+y)^2}{(a-y)(a+y)} = \frac{a+y}{a-y};$$

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

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

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