2.1/2.2 Multiplying and Dividing Rational Expressions – Worksheet

MCR3U

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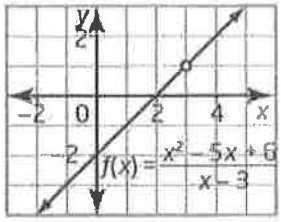
SOLUTIONS

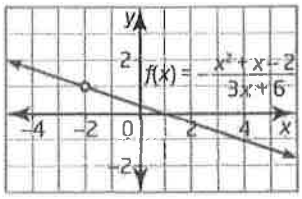
1) State the restrictions for each function.

a)



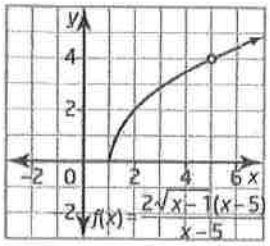
$x \neq 3$

b)



$x \neq -2$

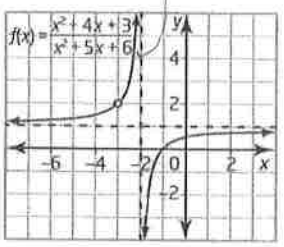
c)



$x \neq 5$

$x \geq 1$

d)



$x \neq -2, -3$

2) Simplify each expression and state all restrictions on x.

a) $\frac{x-8}{x^2-13x+40}$

$= \frac{x-8}{(x-8)(x-5)}$

$= \frac{1}{x-5}$, $x \neq 5, 8$

b) $\frac{x^2-3x-18}{x^2+x-42}$

$= \frac{(x-6)(x+3)}{(x+7)(x-6)}$

$= \frac{x+3}{x+7}$, $x \neq -7, 6$

c) $\frac{x+8}{x^2+6x-16}$

$= \frac{x+8}{(x+8)(x-2)}$

$= \frac{1}{x-2}$, $x \neq -8, 2$

3) Simplify and state the restrictions on the variables.

a) $\frac{14y}{11x} \times \frac{121y}{7x}$

$= \frac{22y^2}{x^2}$, $x \neq 0$

b) $\frac{15b^3}{4b} \times \frac{20b}{30b^2}$

$= \frac{5b^4}{2b^3}$

$= \frac{5b}{2}$, $b \neq 0$

c) $\frac{5x}{9y} \div \frac{5x}{18y^2}$

$= \frac{5x}{9y} \times \frac{18y^2}{5x}$

$= 2y$, $x \neq 0, y \neq 0$

d) $\frac{26ab}{4a} \div \frac{39a^4b^3}{12b^4}$

$= \frac{26ab}{4a} \times \frac{12b^4}{39a^4b^3}$

$= \frac{6ab^5}{3a^5b^3}$

$= \frac{2b^2}{a^4}$, $a \neq 0$, $b \neq 0$

4) Simplify and state the restrictions on the variable.

a) $\frac{25}{x+10} \times \frac{x+10}{5}$

$= 5$, $x \neq -10$

b) $\frac{x+5}{x-3} \times \frac{x-3}{x+7}$

$= \frac{x+5}{x+7}$, $x \neq 3, -7$

c) $\frac{x+1}{x} \div \frac{x+1}{2x}$

$= \frac{x+1}{x} \cdot \frac{2x}{x+1}$

$= 2, \; x \neq 0, -1$

d) $\frac{x+12}{x+10} \div \frac{x+12}{x-5}$

$= \frac{x+12}{x+10} \cdot \frac{x-5}{x+12}$

$= \frac{x-5}{x+10}, \; x \neq -10, -12, 5$

5) Simplify and state the restrictions on the variable.

a) $\frac{3x^2}{12x^2+18x} \times \frac{4x+6}{3x+30}$

$= \frac{3x^2}{6x(2x+3)} \cdot \frac{2(2x+3)}{3(x+10)}$

$= \frac{12x^2}{36x(x+10)} \rightarrow = \frac{x}{3(x+10)}, \; x \neq -10, -\frac{3}{2}, 0$

b) $\frac{4x+24}{x^2+8x} \times \frac{12x^2}{3x+18}$

$= \frac{4(x+6)}{x(x+8)} \cdot \frac{4 \cdot 3x^2}{3(x+6)}$

$= \frac{16x^2}{x(x+8)} \rightarrow = \frac{16x}{x+8}, \; x \neq -8, -6, 0$

c) $\frac{x^2+10x+21}{x+3} \times \frac{x+2}{x^2+9x+14}$

$= \frac{(x+7)(x+3)}{x+3} \cdot \frac{x+2}{(x+2)(x+7)}$

$= 1, \; x \neq -3, -2, -7$

d) $\frac{x^2+2x-15}{x^2-9x+18} \times \frac{x-6}{x+5}$

$= \frac{(x+5)(x-3)}{(x-6)(x-3)} \cdot \frac{(x-6)}{(x+5)}$

$= 1, \; x \neq -5, 3, 6$

6) Simplify and state the restrictions on the variable

a) $\frac{x^2+15x}{4x+24} \div \frac{3x}{3x+18}$

$= \frac{x(x+15)}{4(x+6)} \times \frac{3(x+6)}{3x}$

$= \frac{x+15}{4}, \; x \neq -6, 0$

b) $\frac{6x}{8x-72} \div \frac{9x}{2x-18}$

$= \frac{2 \cdot 3x}{8(x-9)} \cdot \frac{2(x-9)}{3 \cdot 3x}$

$= \frac{4}{24}$

$= \frac{1}{6}, \; x \neq 0, 9$

c) $\frac{x^2+15x+26}{6x^2} \div \frac{x^2-3x-10}{30x^3}$

$= \frac{(x+2)(x+13)}{6x^2} \times \frac{5 \cdot 6 x^3}{(x-5)(x+2)}$

$= \frac{5x(x+13)}{x-5}$; $x \neq -2, 0, 5$

d) $\frac{x^2+11x+24}{x^2+2x-3} \div \frac{x-8}{x-1}$

$= \frac{(x+8)(x+3)}{(x+3)(x-1)} \cdot \frac{x-1}{x-8}$

$= \frac{x+8}{x-8}$; $x \neq -3, 1, 8$

7) Simplify and state the restrictions on the variable

a) $\frac{a^2-25}{a+2} \cdot \frac{a^2-4}{a^2-7a+10}$

$= \frac{(a-5)(a+5)}{a+2} \cdot \frac{(a-2)(a+2)}{(a-2)(a-5)}$

$= a+5$; $a \neq -2, 2, 5$

b) $\frac{y^2-4y-21}{3y^2+6y} \cdot \frac{y^2+8y}{y^2+11y+24}$

$= \frac{(y-7)(y+3)}{3y(y+2)} \cdot \frac{y(y+8)}{(y+8)(y+3)}$

$= \frac{y-7}{3(y+2)}$; $y \neq -8, -3, -2, 0$

c) $\frac{p^2-2p+1}{p+1} \div \frac{p^2-1}{p+1}$

$= \frac{(p-1)(p-1)}{p+1} \times \frac{p+1}{(p-1)(p+1)}$

$= \frac{p-1}{p+1}$; $p \neq -1, 1$

d) $\frac{x^2+6x-27}{x^2+11x+18} \div \frac{x-3}{x^2+x-2}$

$= \frac{(x+9)(x-3)}{(x+9)(x+2)} \div \frac{x-3}{(x+2)(x-1)}$

$= \frac{(x+9)(x-3)}{(x+9)(x+2)} \cdot \frac{(x+2)(x-1)}{x-3}$

$= x-1$; $x \neq -9, -2, 1, 3$

Answers

1) a) $x \neq 3$ **b)** $x \neq -2$ **c)** $x \geq 1,\ x \neq 5$ **d)** $x \neq -3,\ x \neq -2$

2) a) $\frac{1}{x-5}, x \neq 5,\ x \neq 8$ **b)** $\frac{x+3}{x+7}, x \neq -7,\ x \neq 6$ **c)** $\frac{1}{x-2}, x \neq -8,\ x \neq 2$

3) a) $\frac{22y^2}{x^2},\ x \neq 0$ **b)** $\frac{5b}{2},\ b \neq 0$ **c)** $2y,\ x \neq 0,\ y \neq 0$ **d)** $\frac{2b^2}{a^4},\ a \neq 0,\ b \neq 0$

4) a) $5, x \neq -10$ **b)** $\frac{x+5}{x+7},\ x \neq -7,\ x \neq 3$ **c)** $2,\ x \neq -1, x \neq 0$ **d)** $\frac{x-5}{x+10},\ x \neq -12, x \neq -10, x \neq 5$

5) a) $\frac{x}{3(x+10)}, x \neq -10, -\frac{3}{2}, 0$ **b)** $\frac{16x}{x+8}, x \neq -8, -6, 0$ **c)** $1, x \neq -7, -3, -2$ **d)** $1, x \neq -5,\ 3,\ 6$

6) a) $\frac{x+15}{4},\ x \neq -6, 0$ **b)** $\frac{1}{6},\ x \neq 0,\ 9$ **c)** $\frac{5x(x+13)}{x-5},\ x \neq -2, 0, 5$ **d)** $\frac{x+8}{x-8}, x \neq -3, 1, 8$

7) a) $a + 5, a \neq 2, -2, 5$ **b)** $\frac{y-7}{3(y+2)}, y \neq -8, -3, -2, 0$ **c)** $\frac{p-1}{p+1}, p \neq -1, 1$ **d)** $x - 1, x \neq -9, -2, 1, 3$