

Name _____ . Period _____

Rational Expressions and Equations

Practice Problems

Directions: Simplify. Don't forget to list excluded values. 7.1

<p>1.</p> $\frac{12x^2 - 30x}{20x^3 - 50x^2}$ $\frac{\cancel{6}x(2x-5)}{\cancel{10}x^2(2x-5)}$ $\frac{3}{5x}$ <p style="text-align: right;">$x \neq 0, \frac{5}{2}$</p>	<p>2.</p> $\frac{4a^2 - 36}{24 - 8a}$ $\frac{4(a^2 - 9)}{8(3-a)} \rightarrow \frac{4(a-3)(a+3)}{28(3-a)}$ $\frac{(a-3)(a+3)}{-2(a-3)} \rightarrow \frac{a+3}{-2} \text{ or } -\frac{(a+3)}{2}$ <p style="text-align: right;">$a \neq 3$</p>
<p>3.</p> $\frac{n^2 - 13n + 40}{3n^2 - 14n - 5}$ $\frac{(n-8)(n+5)}{(3n+1)(n+5)}$ $\frac{n-8}{3n+1}$ <p style="text-align: right;">$n \neq \frac{5}{3}, -\frac{1}{3}$</p>	<p>4.</p> $\frac{6p^2 - 13p + 5}{2p^2 + 17p - 9} \cdot \frac{p^2 + 16p + 63}{4p + 28}$ $\frac{(3p-5)(2p-1)(p+7)(p+9)}{(2p-1)(p+9) \cdot 4(p+7)}$ $\frac{3p-5}{4}$ <p style="text-align: right;">$p \neq -9, -7, \frac{1}{2}$</p>
<p>5.</p> $\frac{50 - 2w^2}{3w^2 + 9w - 30} \cdot \frac{w^2 + 5w - 14}{6w - 30}$ $\frac{2(25 - w^2)}{3(w^2 + 3w - 10)} \cdot \frac{(w+7)(w-2)}{6(w-5)}$ $\frac{2(5-w)(5+w)}{3(w+5)(w-2)} \cdot \frac{(w+7)(w-2)}{6(w-5)}$ $\frac{-(w-5)(w+7)}{9(w-5)}$ $\frac{-(w+7)}{9}$ <p style="text-align: right;">$w \neq -5, 2, 5$</p>	<p>6.</p> $\frac{5y+5}{2} \div \frac{25y-20}{40y^2-32y}$ $\frac{5(y+1)}{2} \cdot \frac{5(5y-4)}{8y(5y-4)}$ $\frac{5(y+1)}{2} \cdot \frac{5(5y-4)}{5(5y-4)}$ $4y(y+1)$ <p style="text-align: right;">$y \neq \frac{4}{5}, 0$</p>

7.2

7.

$$\frac{2c^2 + 4c - 6}{4c^2 - 7c + 3} \div \frac{16c^2 + 48c}{16c^2 - 9}$$

$$\frac{2(c^2 + 2c - 3)}{(4c - 3)(c - 1)} \cdot \frac{16c(c + 3)}{(4c - 3)(4c + 3)}$$

$$\frac{\cancel{2}(c+3)\cancel{(c-1)}\cancel{(4c-3)}(4c+3)}{\cancel{(4c-3)}\cancel{(c-1)}\cancel{16}c(c+3)}$$

$$\frac{4c+3}{8c} \quad c \neq -\frac{3}{4}, 0, -3$$

8.

$$\frac{6x}{x^2 - 16} - \frac{x - 20}{x^2 - 16}$$

$$(x-4)(x+4)$$

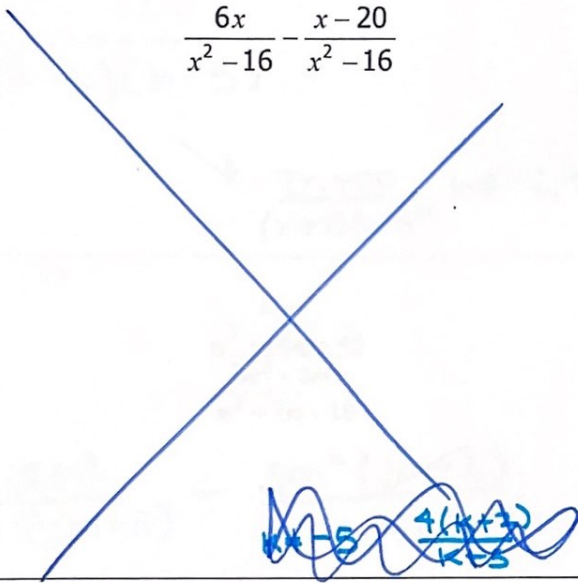
$$\frac{6x - x + 20}{(x-4)(x+4)} \rightarrow \frac{5(x+4)}{(x-4)(x+4)}$$

↓

$$\frac{5}{x-4} \quad x \neq \pm 4$$

9.

$$\frac{6x}{x^2 - 16} - \frac{x - 20}{x^2 - 16}$$



10.

$$\frac{m^2 - 7m - 18}{m^2 - 10m + 9} + \frac{6}{m - 1}$$

$$\frac{(m+9)(m+2)}{(m-9)(m-1)} + \frac{6}{m-1}$$

$$\frac{m+2+6}{m-1} \rightarrow \frac{m+8}{m-1}$$

↓

$$\frac{m+8}{m-1} \quad m \neq 9, 1$$

11.

$$\frac{r}{2r+1} + \frac{12r-6}{4r^2-1} \quad \frac{6(2r-1)}{(2r+1)(2r+1)}$$

$$\frac{r+6}{2r+1}$$

↓

$$\frac{r+6}{2r+1} \quad r \neq \frac{1}{2}, -\frac{1}{2}$$

12.

$$\frac{a+4}{8a} + \frac{5}{24} \quad \text{LCD: } 24a$$

$$\frac{3(a+4) + 5a}{24a}$$

$$\frac{3a+12+5a}{24a} \rightarrow \frac{8a+12}{24a} \rightarrow \frac{1(2a+3)}{3a}$$

↓

$$\frac{2a+3}{6a} \quad a \neq 0$$

13.

$$\frac{2}{h+2} + \frac{5}{h+5}$$

$$\frac{2(h+5) + 5(h+2)}{(h+2)(h+5)}$$

$$\frac{2h+10+5h+10}{(h+2)(h+5)}$$

$$\frac{7h+20}{(h+2)(h+5)}$$

$$\frac{7h+20}{(h+2)(h+5)}$$

$$\frac{7h+20}{(h+2)(h+5)}$$

$$\frac{7h+20}{(h+2)(h+5)}$$

$$\rightarrow \frac{7h+20}{(h+2)(h+5)} \quad h \neq -2, -5$$

14.

$$\frac{3x-1}{x-1} - \frac{x-1}{x-3} + \frac{x+1}{x^2-4x+3}$$

$$(x-1)(x-3)$$

$$\frac{(3x-1)(x-3) - [(x-1)(x-1)] + x+1}{(x-1)(x-3)}$$

$$\frac{3x^2 - 10x + 3 - (x^2 - 2x + 1) + x + 1}{(x-1)(x-3)}$$

$$\frac{3x^2 - 10x + 3 - (x^2 - 2x + 1) + x + 1}{\text{LCD}}$$

$$2x^2 - 7x + 3$$

$$\frac{2x-1}{x-1} \quad x \neq 1, 3$$

7.3

15.

$$\frac{12m^3}{m^2+14m+45} \div \frac{3m^3-6m^2}{m^2+7m-18}$$

$$\frac{12m^3}{(m+9)(m+5)} \div \frac{3m^2(m-2)}{(m+9)(m-2)}$$

$$\frac{4\cancel{12}m^3}{(m+9)(m+5)} \cdot \frac{(m+9)}{3\cancel{m}^2}$$



$$\frac{4m}{m+5} \quad m \neq 0, -9, -5$$

16.

$$\frac{8k+12}{9} \div \frac{k}{\frac{1}{3} + \frac{1}{2}}$$

Denom

$$\frac{\frac{2}{2} \cdot \frac{k}{3} + \frac{1}{2} \cdot \frac{3}{3}}{\frac{2k+3}{6}}$$

$$\frac{8k+12}{9} \div \frac{2k+3}{6}$$

$$\frac{4(2k+3)}{9} \cdot \frac{6^2}{2k+3}$$



$$\frac{80}{3} \quad k \neq -\frac{3}{2}$$

17.

$$\frac{\frac{b-32}{2} - \frac{8}{b}}{1 + \frac{8}{b}}$$

Numerator Denom

$$\frac{bb}{2b} - \frac{2 \cdot 32}{2b} \div \frac{b+8}{b}$$

$$\frac{b^2 - 64}{2b} \cdot \frac{b}{b+8}$$

$$\frac{(b-8)(b+8)}{2b} \cdot \frac{b}{b+8}$$

↘

$$\frac{b-8}{2} \quad b \neq 0, -8$$

18.

$$\frac{\frac{x}{x+1} + \frac{4}{x}}{\frac{4x+7}{3x+3} - \frac{1}{3}}$$

LCD: $x(x+1)$

LCD: $3(x+1)$

Denom

Num

$$\frac{\frac{x}{x+1} \cdot \frac{x}{x} + \frac{4(x+1)}{x(x+1)}}{\frac{4x+7}{3(x+1)} - \frac{1(x+1)}{3(x+1)}}$$

$$\frac{x^2 + 4x + 4}{x(x+1)} \div \frac{4x+7-x-1}{3(x+1)} \quad 3x+6$$

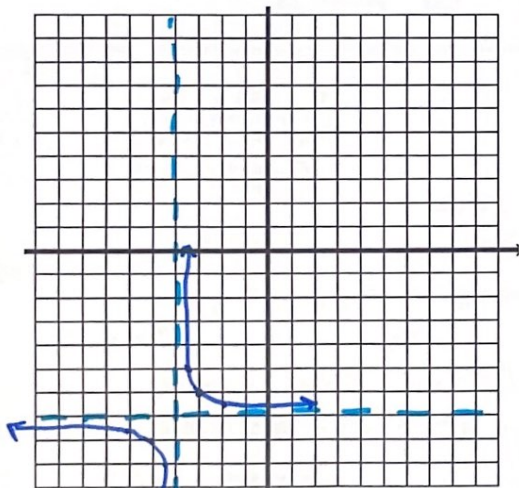
$$\frac{(x+2)(x+2)}{x(x+1)} \cdot \frac{-3(x+1)}{-3(x+2)}$$

↘

$$\frac{x+2}{x} \quad x \neq -1, -2, 0$$

19. Graph and state the key features.

$$f(x) = \frac{1}{x+4} - 7$$



Domain $(-\infty, -4) \cup (-4, \infty)$

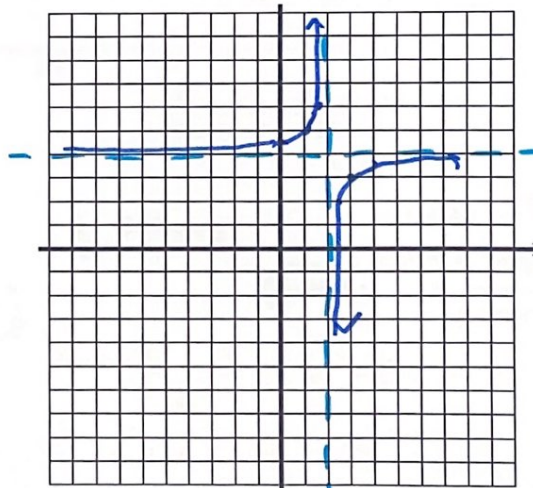
Range $(-\infty, -7) \cup (-7, \infty)$

Horizontal asymptote $x = -7$

Vertical Asymptote $y = -4$

20. Graph and state the key features.

$$f(x) = -\frac{1}{x-2} + 4$$



Domain $(-\infty, 2) \cup (2, \infty)$

Range $(-\infty, 4) \cup (4, \infty)$

Horizontal asymptote $y = 4$

Vertical Asymptote $x = 2$

7.5

21. Write the reciprocal function for the transformation described.

The reciprocal parent function is translated 8 units left and 3 units up. Write an equation to represent this function. Then, identify the asymptotes.

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

$x = -8$ $y = 3$

22. Write the reciprocal function for the transformation described.

The reciprocal parent function is vertically stretched by a factor of 3, reflected over the x-intercept, and the asymptotes intersect at $(-3, 5)$.

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

Directions: Solve. Check your answers!

23.

$$\frac{a-8}{a} = \frac{3}{a+5}$$

$$(a-8)(a+5) = 3a$$

$$a^2 - 3a - 40 = 3a$$

$$a^2 - 6a - 40 = 0$$

$$(a-10)(a+4) = 0$$

Check work!

$$a = -4, 10$$

24.

$$\frac{3}{2n} + \frac{1}{n^2} = \frac{n-2}{2n^2} \quad \text{LCD: } 2n^2$$

$$\frac{3}{2n} \cdot \frac{2n^2}{2n^2} + \frac{1}{n^2} \cdot \frac{2n^2}{2n^2} = \frac{n-2}{2n^2} \cdot \frac{2n^2}{2n^2}$$

$$3n + 2 = n - 2$$

$$2n = -4$$

$$n = -2$$

Check work!

$$n = -2$$

25.

$$\frac{p^2+p+8}{p^2-7p+6} + \frac{2}{p-1} = \frac{2}{3}$$

$$(p-6)(p-1)$$

LCD:

$$3(p-6)(p-1)$$

$$\frac{3(p-6)(p-1) \cdot \frac{p^2+p+8}{(p-6)(p-1)} + 3(p-6)(p-1) \cdot \frac{2}{p-1}}{3(p-6)(p-1)} = \frac{2}{3} \cdot \frac{3(p-6)(p-1)}{3(p-6)(p-1)}$$

$$3(p^2+p+8) + 6(p-6) = 2(p^2-7p+6)$$

$$3p^2+3p+24+6p-36=2p^2-14p-12$$

$$p^2+23p-24=0$$

$$(p+24)(p-1)=0$$

$$p = -24, 1$$

Check work! $p=1$ is extraneous

$$p = -24$$

26.

$$\frac{1}{3} - \frac{1}{4v+3} = \frac{v^2-3v-18}{12v+9}$$

$$3(4v+3)$$

LCD: $3(4v+3)$

$$\frac{1}{3} \cdot \frac{3(4v+3)}{3(4v+3)} - \frac{1}{(4v+3)} \cdot \frac{3(4v+3)}{3(4v+3)} = \frac{v^2-3v-18}{3(4v+3)} \cdot \frac{3(4v+3)}{3(4v+3)}$$

$$4v+3-3 = v^2-3v-18$$

$$v^2-7v-18=0$$

$$(v-9)(v+2)=0$$

$$v = 9, -2$$

↓

$$v = 9, -2$$