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I. Model Problems.
II. Practice
III. Challenge Problems
IV. Answer Key

Web Resources
Rational Expressions:
www.mathwarehouse.com/algebra/rational-expression/

YouTube www.mathwarehouse.com/algebra/rational-expression/how-to-simplify-rational-expressions.php

Online Graphing Calculator(free): www.mathworksheetsgo.com/calculator/

Simplifying Rational Expressions

Recall: $\frac{1}{0}$ is undefined

I. Model Problems

In these examples we will find the restrictions for rational expressions.

Example 1: **Find the restrictions of $\frac{2}{x+4}$.**

Set the denominator equal to 0.

Solve for *x*.

$$\begin{array}{rl} x+4 & =0 \\ -4 & \quad -4 \\ \hline x & =-4 \end{array}$$

Answer: $x \neq -4$

Example 2: **Find the restrictions of $\frac{2}{x^2+5x+6}$.**

Set the denominator equal to 0.

Solve for *x*.

$$\begin{array}{rl} x^2+5x+6 & =0 \\ (x+2)(x+3) & =0 \\ x+2=0 \quad & x+3=0 \\ \hline x & =-2.-3 \end{array}$$

Answer: $x \neq -3, -2$

In this example we will simplify a rational expression.

Example 3: $\frac{5x-10}{x^2+5x-14}$

Factor the numerator and denominator.

$$\frac{5(x-2)}{(x-2)(x+7)}$$

Find the restrictions.

$$x-2=0 \qquad x+7=0$$
$$x \neq -7,2$$

Simplify by canceling common factors.

$$\frac{5\cancel{(x-2)}}{\cancel{(x-2)}(x+7)}$$
$$\frac{5}{x+7}$$

Answer: $\frac{5}{x+7}, x \neq -7,2$

II. Practice Problems

Find the restrictions.

1. $\frac{1}{x}$
2. $\frac{1}{x-4}$
3. $\frac{1}{a-7}$
4. $\frac{2a}{a+6}$
5. $\frac{3a+1}{1+3a}$
6. $\frac{4}{7x+2}$
7. $\frac{12}{(x-7)(x+12)}$
8. $\frac{4b}{(3b+2)(b-7)}$
9. $\frac{7c+8}{(c+4)(c-2)(3c+5)}$
10. $\frac{3x}{x^2+7x+12}$
11. $\frac{2x^2+1}{x^2-6x-7}$
12. $\frac{17x-2}{3x^3-6x^2-144x}$

Simplify and find the restrictions.

13. $\frac{4x-12}{x^2+4x-21}$
14. $\frac{x^2-5x-14}{x^2-6x-16}$
15. $\frac{8x^2+20x}{2x+5}$
16. $\frac{6-x}{2x^2-11x-6}$
17. $\frac{x^3+8x^2-48x}{x^2+11x-60}$
18. $\frac{15x+60}{9x^2-144}$
19. $\frac{4x^2+15}{6x^2+37x+56}$
20. $\frac{2x^2-14x}{6x^2+24x}$

III. Challenge Problems

1. Find the student's error $\frac{x^2+7x+10}{x^2+x-20} = \frac{(x+5)(x+2)}{(x+5)(x-4)} = \frac{x+2}{x-4}, x \neq 4.$
2. Graph $\frac{1}{x+1}$.
3. Where are the asymptotes of the graph of $y = \frac{1}{x^2+2x-15}$?

IV. Answer Key

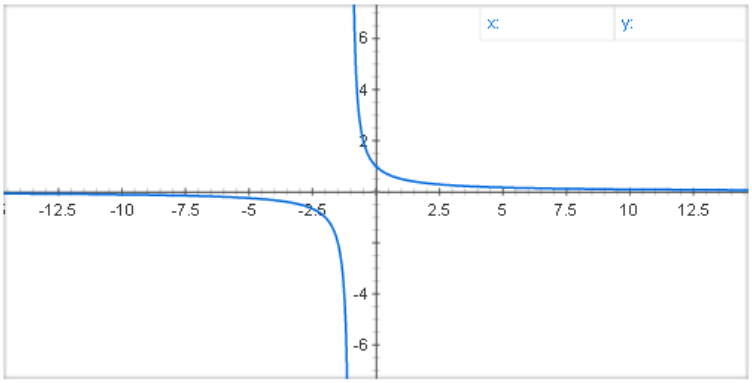
1. $x \neq 0$
2. $x \neq 4$
3. $a \neq 7$
4. $a \neq -6$
5. $a \neq -\frac{1}{3}$
6. $x \neq -\frac{2}{7}$
7. $x \neq -12, 7$
8. $b \neq -\frac{2}{3}, 7$
9. $c \neq -4, -\frac{5}{3}, 2$
10. $x \neq -4, -3$
11. $\frac{2x^2+1}{(x+1)(x-7)}$, $x \neq -1, 7$
12. $\frac{17x-2}{3x(x-8)(x+6)}, x \neq -6, 0, 8$
13. $\frac{4}{x+7}, x \neq -7, 3$
14. $\frac{x-7}{x-8}, x \neq -2, 8$
15. $4x,\ x \neq -\frac{5}{2}$
16. $\frac{-1}{2x-1}, x \neq \frac{1}{2}, 6$
17. $\frac{x(x+12)}{x+15}, x \neq -15, 4$
18. $\frac{5}{3(x-4)}, x \neq \pm 4$
19. $\frac{4x^2+15}{(2x+7)(3x+8)}, x \neq -\frac{7}{2}, -\frac{8}{3}$
20. $\frac{x-7}{3(x+4)}, x \neq -4, 0$

Challenge Problems

1. Find restrictions before simplifying. , $x \neq -5$ is also a restriction.

   The final answer is $\frac{x+2}{x-4}, x \neq -5, 4$

2. The graphs will look like this



3. $x = 3$ and $x = -5$