

LESSON 8.3 Skills Practice

8

Name _____ Date _____

Things Are Not Always as They Appear

Solving Rational Equations

Vocabulary

Write the term that best completes each sentence.

1. A(n) _____ is an equation containing one or more rational expressions.
2. A(n) _____ is a solution that results from the process of solving an equation; but is not a valid solution to the equation.

Problem Set

Solve each rational equation using cross multiplication. Describe any restrictions for the value of x . Check your answer(s) and identify any extraneous roots should they occur.

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

Restrictions: $x \neq -3, -1$

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

$$x^2 - 1 = x^2 + x - 6$$

$$-1 = x - 6$$

$$x = 5$$

Check $x = 5$.

$$\frac{5-1}{5+3} \stackrel{?}{=} \frac{5-2}{5+1}$$

$$\frac{4}{8} \stackrel{?}{=} \frac{3}{6}$$

$$\frac{1}{2} = \frac{1}{2} \quad \checkmark$$

8

LESSON 8.3 Skills Practice

page 2

$$2. \frac{x+2}{x-7} = \frac{x}{x-3}$$

$$3. \frac{2x-1}{x+1} - \frac{2x-2}{x}$$

LESSON 8.3 Skills Practice

page 3

8

Name _____ Date _____

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

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

8

LESSON 8.3 Skills Practice

page 4

$$6. \frac{x+5}{x-4} = \frac{x+4}{x-5}$$

Solve each rational equation by multiplying both sides of the equation by the least common denominator. Describe any restrictions for the value of x . Check your answer(s) and identify any extraneous roots should they occur.

$$7. \frac{2}{x} - \frac{3}{2x} = \frac{1}{x^2}$$

Restriction: $x \neq 0$

$$2x^2 \left(\frac{2}{x} - \frac{3}{2x} \right) = 2x^2 \left(\frac{1}{x^2} \right)$$

$$4x - 3x = 2$$

$$x = 2$$

Check $x = 2$.

$$\frac{2}{2} - \frac{3}{2(2)} \stackrel{?}{=} \frac{1}{2^2}$$

$$1 - \frac{3}{4} \stackrel{?}{=} \frac{1}{4}$$

$$\frac{1}{4} = \frac{1}{4} \quad \checkmark$$

LESSON 8.3 Skills Practice

page 5

8

Name _____ Date _____

8. $\frac{1}{x} + \frac{1}{x^2} = 2$

9. $\frac{5}{2x-4} = \frac{15}{x^2-4}$

8

LESSON 8.3 Skills Practice

page 6

$$10. \frac{2}{x+3} + \frac{6}{x^2+3x} = \frac{1}{x}$$

$$11. \frac{2}{x^2-x} - \frac{1}{x-1} = 0$$

LESSON 8.3 Skills Practice

page 7

8

Name _____ Date _____

12.
$$\frac{x}{x+2} + \frac{4x+6}{2x^2+5x+3} = \frac{x-1}{2x+4}$$

8

LESSON 8.3 Skills Practice

page 8

Solve each rational equation using a graphing calculator. Sketch the graph. Describe any restrictions for the value of x . Check your answer(s).

13. $\frac{x}{x+1} = \frac{3}{4}$

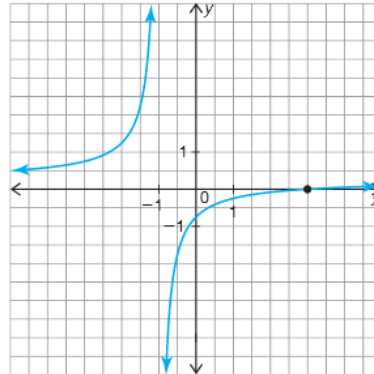
Rewrite the equation so that one side equals 0, then graph $y = \frac{x}{x+1} - \frac{3}{4}$.

The graph shows that $x = -1$ is the location of a vertical asymptote and thus represents a restriction on the variable. The graph also shows that $x = 3$ is a possible solution to the original rational equation.

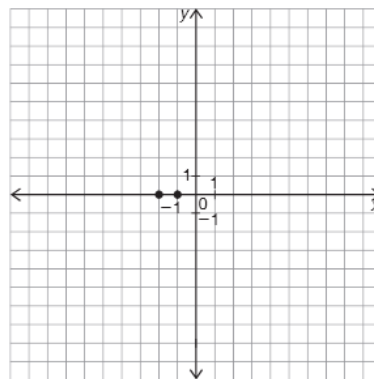
Check $x = 3$.

$$\frac{3}{3+1} \stackrel{?}{=} \frac{3}{4}$$

$$\frac{3}{4} = \frac{3}{4} \quad \checkmark$$



14. $x + 3 = \frac{-2}{x}$



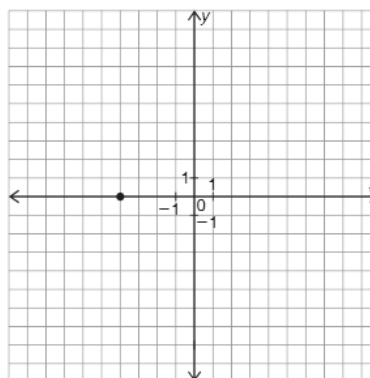
LESSON 8.3 Skills Practice

page 9

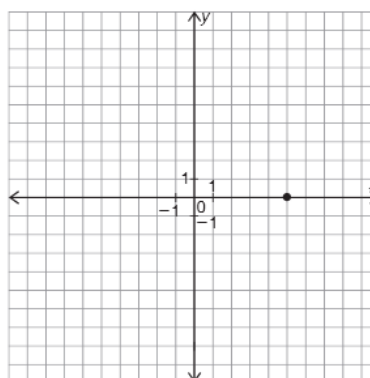
8

Name _____ Date _____

15. $\frac{2}{x} - \frac{1}{2} = \frac{4}{x}$



16. $\frac{1}{2} + \frac{4}{x-1} = \frac{x+1}{x-1}$



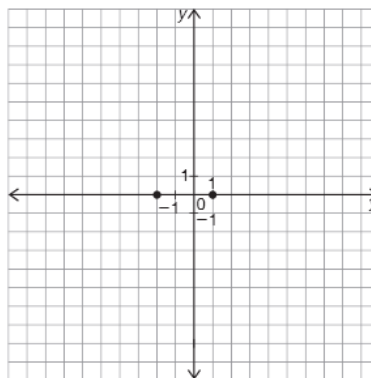
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8

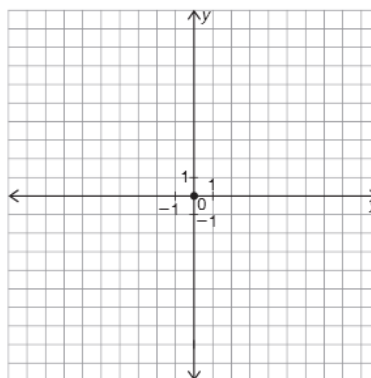
LESSON 8.3 Skills Practice

page 10

17. $\frac{x}{x-2} = \frac{-1}{x}$



18. $\frac{x}{x-3} = \frac{x}{x+4}$



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LESSON 8.3 Skills Practice

page 11

8

Name _____ Date _____

Solve each rational equation without using a graphing calculator. Describe any restrictions for the value of x . Check your answer(s) and identify any extraneous roots should they occur.

$$19. \frac{3}{x-1} = \frac{4}{3x+2}$$

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

$$(x-1)(3x+2)\left(\frac{3}{x-1}\right) = (x-1)(3x+2)\left(\frac{4}{3x+2}\right)$$

$$9x + 6 = 4x - 4$$

$$5x = -10$$

$$x = -2$$

Check $x = -2$.

$$\frac{3}{-2-1} \stackrel{?}{=} \frac{4}{3(-2)+2}$$

$$\frac{3}{-3} \stackrel{?}{=} \frac{4}{-4}$$

$$-1 = -1 \quad \checkmark$$

$$20. \frac{9}{x-3} = \frac{27}{x^2-3x} + \frac{6}{x}$$

8

LESSON 8.3 Skills Practice

page 12

$$21. \frac{x+1}{x-2} = \frac{3x}{x-2} - \frac{2x+4}{x}$$

$$22. \frac{-x}{2x+1} = \frac{5}{x-4}$$

LESSON 8.3 Skills Practice

page 13

8

Name _____ Date _____

23. $1 + \frac{4}{x+4} = \frac{-3}{x^2-16}$

24. $\frac{5x}{x-2} - 7 = \frac{10}{x-2}$