Unit 4 Day 10
Solving Rational Equations

Warm-up: Simplify without a calculator!

(Leave your answer as a simplified fraction)

1. $\dfrac{5}{12} - \dfrac{1}{12} =$

3. $\dfrac{4}{5} + \dfrac{1}{7} =$

2. $\dfrac{6}{4} - \dfrac{3}{7} =$

4. $\dfrac{2}{3} + \dfrac{5}{6} =$

5. Suppose that y varies inversely as x^2 and that $y = 6$ when $x = 9$.

   a) Find the equation that represents the relationship of x and y.

   b) Find the value of y when $x = 3$.

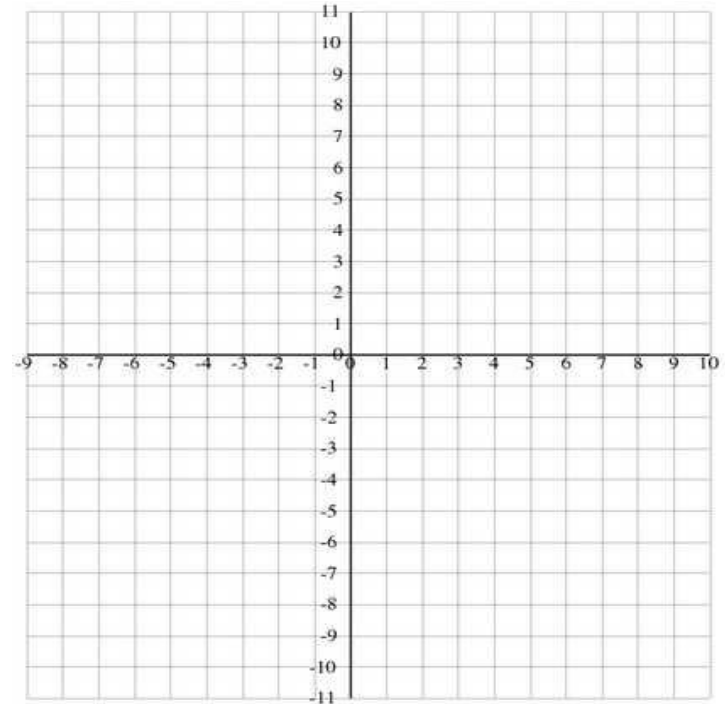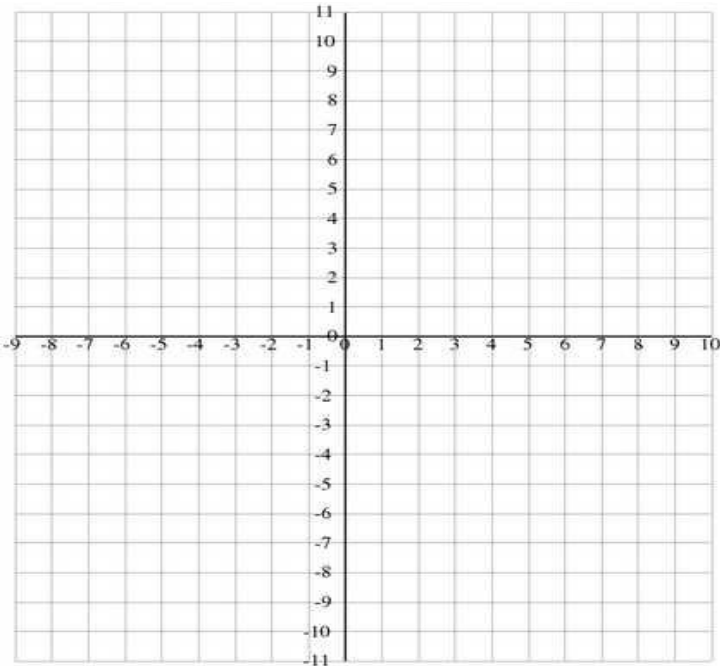Warm – Up
Continues →

Extra Warm Up: BY HAND = NO CALCULATOR!

Create a **table** and completely graph the function by hand!

6. $y = \sqrt[3]{x+2}$

7. $y = \sqrt{x-1}$

8. What is the domain and range of the function:

$$f(x) = \left|4x - 4c\right| - 7$$

Warm-up Answers: Simplify without a calculator!
(Leave your answer as a simplified fraction)

1. $\dfrac{5}{12} - \dfrac{1}{12} = \dfrac{1}{3}$

2. $\dfrac{6}{4} - \dfrac{3}{7} = \dfrac{15}{14}$

3. $\dfrac{4}{5} + \dfrac{1}{7} = \dfrac{33}{35}$

4. $\dfrac{2}{3} + \dfrac{5}{6} = \dfrac{3}{2}$

5. Suppose that y varies inversely as x^2 and that $y = 6$ when $x = 9$.

   a) Find the equation that represents the relationship of x and y.

   $$y = \dfrac{k}{x^2} \quad 6 = \dfrac{k}{(9)^2} \quad k = 486 \quad y = \dfrac{486}{x^2}$$
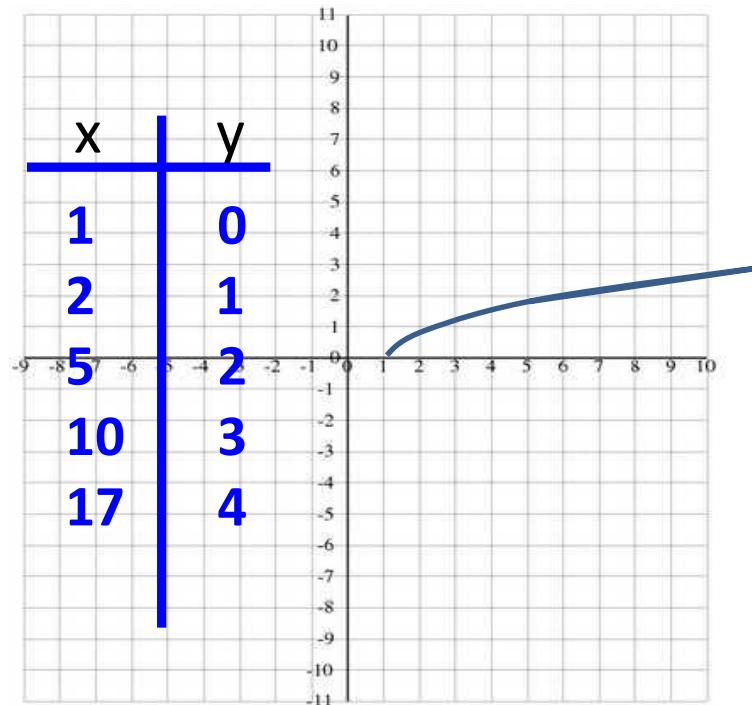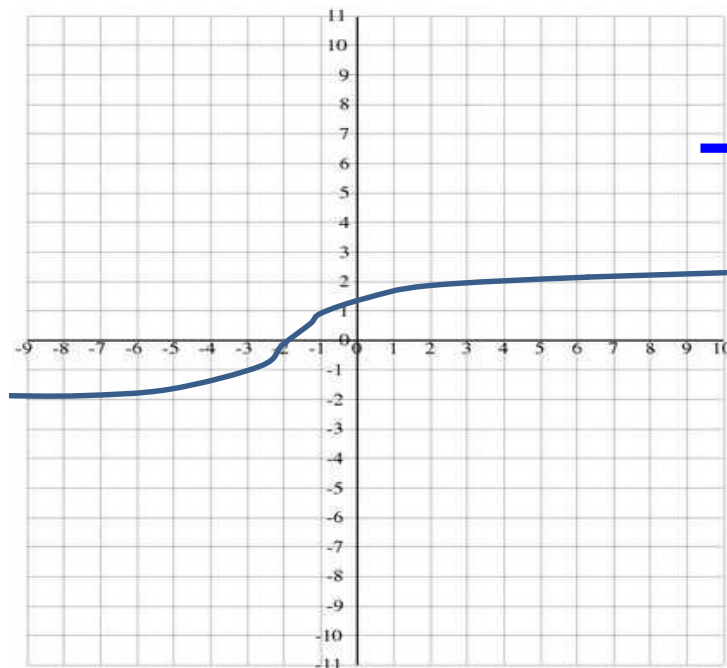
   b) Find the value of y when $x = 3$.
   $$y = \dfrac{486}{(3)^2} = \dfrac{486}{9} = 54$$

Warm Up ANSWERS: BY HAND = NO CALCULATOR!

Create a **table** and completely graph the function by hand!

6. $y = \sqrt[3]{x+2}$ **7.** $y = \sqrt{x-1}$

x	y
-10	-2
-3	-1
-2	0
-1	1
6	2

x	y
1	0
2	1
5	2
10	3
17	4

8. What is the domain and range of the function:

$$f(x) = |4x - 4c| - 7$$

Domain: $(-\infty, \infty)$

Range: $[-7, \infty)$

Tonight's Homework Packet p. 16

Remember:
*Mini Quizzes
   do occur!
*Test is soon!

Homework Answers

1. <u>Direct Variation</u>: **Divide y by x** for each ordered pair. If the result is a constant (k), then the function is a direct variation.

2. <u>Inverse Variation</u>: **Multiply x by y** for each ordered pair. If the result is constant, the function is an inverse variation.

3. Direct, k = 7   4. Neither   5. Direct, k = 9

6. Inverse, k = 12   7. Inverse, k = 4   8. Inverse, k = 32

9. x = 2   10. x = 10

Homework Answers

11. a. $k = 1915.2$ b. $y \approx 3.02$ c. $x = 27.36$

12. a. $k = 324000$ b. $y = 7200$

13. a. $k = 5400$
    b. $x = 77.14$ min
    c. $y = 72$
    d. $x = 54$ min

14. a. As time increases, the amount of water leaked increases
    b. $k = 5$
    c. 500 gallons
    d. 20 hours

Homework Answers

15. y = 4x ; y = 24

16. y = -108/x ; x = -21.6

17. y = 12xz ; y = 288

18. y = 64/x ; x = 21.33

19. I = 120/R

20. a) The force is cut in half (divided by 2) $F = \dfrac{kv^2}{2r}$

   b) The force increases 9 times. $F = \dfrac{k(3v)^2}{r}$

   c) The force increases by 4.5 times. $F = \dfrac{k(1.5v)^2}{.5r}$

Notes p. 39 Solving Rational Equations

A **rational equation** is an equation that contains one or more rational expressions. It can have a variable in the number and/or the denominator. *Our* goal when solving rational equations is to eliminate the fractions and solve the equation for the variable!

Recall that when you graph a rational function, there is a vertical asymptote. This is an x-value that the graph approaches but **NEVER** touches. When you solve rational equations, there are some values for x that must be excluded from the domain because they will make the denominator equal to zero, and dividing by zero is **undefined**.

Any number that causes the denominator to equal zero is called an **excluded value (EV)**.

To find excluded values, **factor the denominator** (if possible), then set the factors equal to zero and solve for the variable; the solutions are excluded values. When solving rational equations, if **all solutions of the rational equation are excluded values** then there is **no solution** to the rational equation!

To solve simple rational equations, the cross product property can be utilized to eliminate the fraction leaving a linear equation to solve. **REMEMBER**: Check your final answers to make sure they are not an excluded value!

Solving Rational Equations

Examples: Using the cross product property, solve the following equations. Do not forget to determine the excluded values.

1. $\dfrac{6}{x} = \dfrac{3}{7}$ EV: **x ≠ 0**

2. $\dfrac{4}{x-7} = \dfrac{6}{x}$ EV: **x ≠ 0, 7**

x = 14

x = 21

3. $\dfrac{-5}{x+4} = \dfrac{1}{x+4}$ EV: **x ≠ -4**

4. $\dfrac{6}{x+5} = \dfrac{x}{6}$ EV: **x ≠ -5**

x = -4

BUT x = -4 is an excluded value So….   **No Solution!**

x = -9, 4

Solving Rational Equations

When your rational equation is <u>in the format</u> fraction = fraction then you can <u>just cross-multiply to solve</u> – and watch for excluded values. Some rational equations, like <u>the ones below, are not that simple.</u> For ones like the type below, we need another method….

Examples: <u>Multiply through by the LCD to solve</u> the following equations. Do not forget to determine the excluded values.

5. $\dfrac{2}{x} - 3 = \dfrac{8}{x}$ EV: __**x ≠ 0**__

6. $\dfrac{7x}{x-3} + 4 = \dfrac{x+1}{x-3}$ EV: __**x ≠ 3**__

LCD is x

$$(x)\frac{2}{x} - 3(x) = \frac{8}{x}(x)$$
$$2 - 3x = 8$$
$$-3x = 6$$
$$x = -2$$

x = -2

LCD is x-3

$$(x-3)\frac{7x}{x-3} + 4(x-3) = \frac{x+1}{x-3}(x-3)$$
$$7x + 4x - 12 = x + 1$$
$$11x - 12 = x + 1$$
$$10x = 13$$
$$x = 1.3$$

x = 1.3

You Try!   Solving Rational Equations

Examples: Solve the rational equation. Do not forget to determine the excluded values.

7. $\dfrac{8}{x+8} = \dfrac{x}{x+2}$ EV: **x ≠ -8, -2**

x = -4, 4

8. $\dfrac{4}{x+2} + 3 = \dfrac{9}{x+2}$ EV: **x ≠ -2**

x = -1/3

9. $\dfrac{3x}{x-1} - 2 = \dfrac{10}{x-1}$ EV: **x ≠ 1**

x = 8

10. $\dfrac{12}{x+2} = \dfrac{7}{x-3}$ EV: **x ≠ -2, 3**

x = 10

(Work on next slide)

You Try Work

Examples: Solve the rational equation. Do not forget to determine the excluded values.

7. $\dfrac{8}{x+8} = \dfrac{x}{x+2}$ EV: $x \neq -8, -2$

$$\cancel{8x} + 16 = x^2 + \cancel{8x}$$
$$x^2 - 16 = 0$$
$$(x+4)(x-4) = 0$$
$$x = 4, -4$$

8. $(x+2) \left(\dfrac{4}{x+2} + 3 = \dfrac{9}{x+2} \right)$ EV: $x \neq -2$

$$4 + 3x + 6 = 9$$
$$10 + 3x = 9$$
$$3x = -1$$
$$x = -\tfrac{1}{3}$$

9. $(x-1)\left(\dfrac{3x}{x-1} - 2 = \dfrac{10}{x-1} \right)$ EV: $x \neq 1$

$$3x - 2x + 2 = 10$$
$$x + 2 = 10$$
$$x = 8$$

10. $\dfrac{12}{x+2} = \dfrac{7}{x-3}$ EV: $x \neq -2, 3$

$$12x - 36 = 7x + 14$$
$$5x = 50$$
$$x = 16$$

Day 10: Solving Rational Equations Practice

Classwork

Solving Rational Equations Practice

Notes p. 40 #1-6

Practice Answers

Solve the rational equation. Do not forget to determine the excluded values.

1. $\dfrac{3}{x} = \dfrac{2}{x+4}$ EV: $x \neq 0, -4$

$$3x + 12 = 2x$$
$$x = -12$$

2. $\dfrac{x+1}{2x+5} = \dfrac{2}{x}$ EV: $x \neq 0, -5/2$

$$x^2 + x = 4x + 10$$
$$x^2 - 3x - 10 = 0$$
$$(x-5)(x+2) = 0$$
$$x = 5, -2$$

3. $x+2$

$\left(\dfrac{3}{x+2} + 5 = \dfrac{4}{x+2}\right)$ EV: $x \neq -2$

$$3 + 5x + 10 = 4$$
$$5x + 13 = 4$$
$$x = -9/5$$

4. $\dfrac{6}{x-3} = \dfrac{x}{18}$ EV: $x \neq 3$

$$108 = x^2 - 3x$$
$$x^2 - 3x - 108 = 0$$
$$(x-12)(x+9) = 0$$
$$x = 12, -9$$

5. EV: x ≠ -4, Answer: x = 0

6. EV: x ≠ 0, 2, Answer: x = 1/4

Practice!

Quiz Corrections

On separate sheet of GRAPH paper, rework the ones you missed. Show your work! Ask teacher or neighbors for help! Be better prepared for our test coming up. ☺

Kahoot!

https://play.kahoot.it/#/?quizId=fe331d08-ae69-4dc1-a78b-c4d28e539abd

Kahoot!

https://create.kahoot.it/?_ga=1.234693214.1782845466.1413554510#quiz/13018359-9177-4366-ab71-14997c675d79

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