Warm Up

Add or subtract.

1. $\frac{7}{10} + \frac{5}{10}$ $1\frac{1}{5}$

2. $2\frac{3}{8} - 1\frac{5}{16}$ $1\frac{1}{16}$

3. $4.8 + 3.6$ 8.4

4. $2.4 - 0.05$ 2.35

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Solving Equations with Rational Numbers

Essential Question:
How do you solve equations with rational numbers?

Standard:
MCC8.EE7: Solve linear equations in one variable

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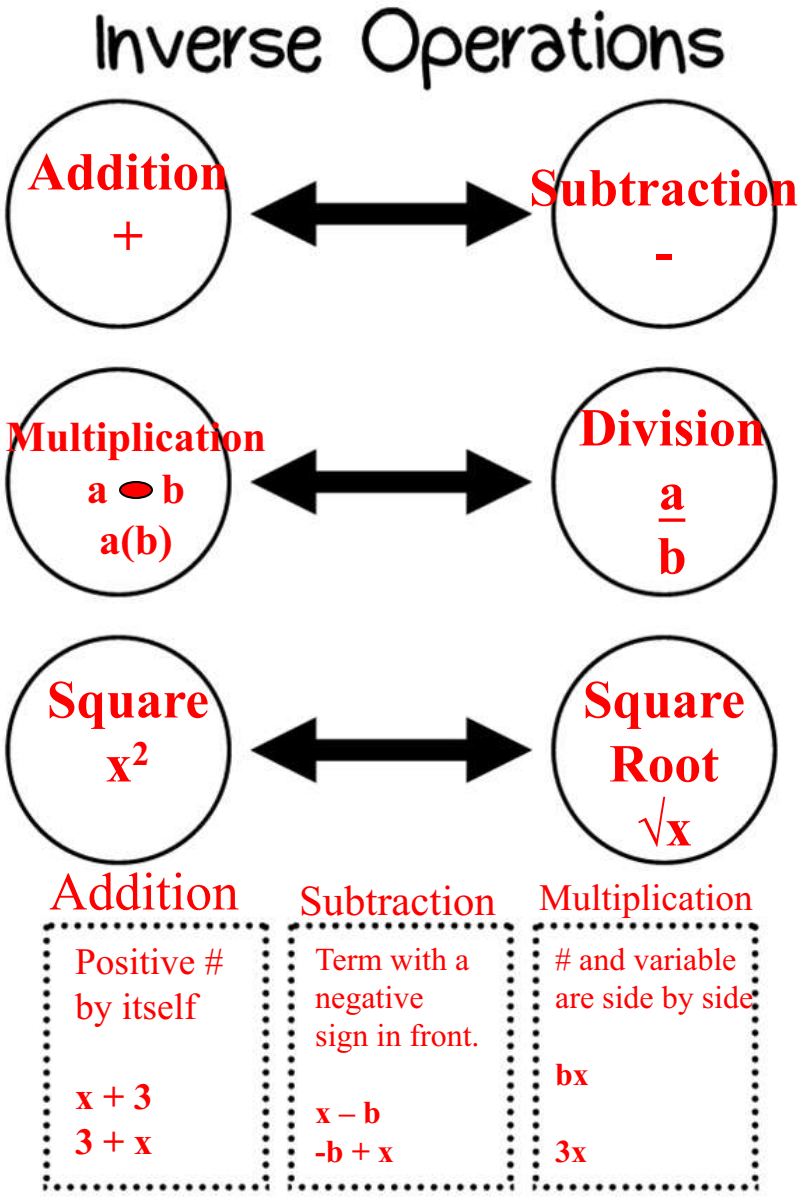
Operations that "undo" each other.



Glue the graphic organizer into your notebook. Fill in the information as we go over it.

Solving Equations with Rational Numbers

Learn to solve equations with rational numbers.

Review Video

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Rebecca spent a total of $52.90 at the clothing store. She bought two things: a T-shirt for $19.95 and a pair of shorts. What did the shorts cost her?

You can write and solve an equation to solve the problem.

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$c + \$19.95 = \$52.90$ *Write the equation. Let* **c** *= cost for a pair of shorts.*

$c + 19.95 = 52.90$ *Use the* ***subtraction property of equality*** *to isolate the variable.*

$- \quad - \quad$ ***Subtract*** *the same number from both sides of the equation.*

$c \quad = \quad$

The shorts cost _____.

TRY THIS!

1a. Two suitcases together weigh 82 pounds. One weighs 28.25 pounds. Write two equations you can use to find the weight of the other suitcase: one with decimals and one with fractions.

1b. Explain how you can use the subtraction property of equality to solve the equation you wrote in **1a**.

1c. What is the solution to the equation? To the problem?

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Additional Examples 1A: Solving Equations with Decimals

Solve.

$m + 4.6 = 9$

$$\begin{aligned} m + 4.6 &= 9 \\ -4.6 &= -4.6 \\ \hline m &= 4.4 \end{aligned}$$

Use the Subtraction Property of Equality. Subtract 4.6 from both sides.

Remember!

Once you have solved an equation it is a good idea to check your answer. To check your answer, substitute your answer for the variable in the original equation.

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MCC8.EE.7b

2 EXAMPLE Using the Addition Property of Equality

After driving for $2\frac{1}{2}$ hours, Alba estimated that it would be another $\frac{2}{3}$ hour before they would reach the lake. How long is the ride to the lake?

$t - \frac{2}{3} = 2\frac{1}{2}$ *Write the equation. Let t = driving time.*

$t - \frac{2}{3} = 2\frac{1}{2}$ *Use the addition property of equality to isolate the variable.*

$+\frac{\quad}{\quad} + \frac{\quad}{\quad}$ *Add the same number to both sides of the equation.*

$t = 2\frac{1}{2} + \frac{2}{3} = \frac{\quad}{\quad} + \frac{2}{3}$ *Write mixed numbers as improper fractions.*

$t = \frac{\quad}{6} + \frac{\quad}{6}$ *Rename the fractions using a common denominator. LCD = 6*

$t = \frac{\quad}{\quad} = \quad\frac{\quad}{\quad}$ *Add and write as a mixed number.*

The ride to the lake is _____ hours long.

TRY THIS!

2. Explain how you can you use the addition property of equality to solve the equation $y - (-4.5) = 6.8$. Then solve it.

_____

Additional Example 2B: Solving Equations with Fractions

Solve.

$$y - \frac{1}{6} = \frac{2}{3}$$

$\frac{1}{6} + y - \frac{1}{6} = \frac{2}{3} + \frac{1}{6}$ *Add $\frac{1}{6}$ to both sides.*

$y = \frac{4}{6} + \frac{1}{6}$ *Find a common denominator; 6.*

$y = \frac{5}{6}$ *Simplify.*

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3 EXAMPLE Using the Division Property of Equality

Will and DeSean are slowly exploring an underwater cave. They have descended to a depth of −75 feet in 12.5 minutes. What is their rate of descent in feet per minute?

$12.5r = -75$ *Write the equation. Let r = rate of descent.*

$\frac{12.5r}{\square} = \frac{-75}{\square}$ *Use the division property of equality to isolate the variable. Divide both sides of the equation by the same number.*

$r = -75 \div \square$ *Divide.*

$r = \square$

They descended at a rate of ____ feet per minute.

The word descended indicates a *negative* amount.

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TRY THIS!

3. Explain how you can you use the division property of equality to solve the equation $\frac{-2}{3}n = 16$. Then solve the equation.

_____

Additional Examples 1B: Solving Equations with Decimals

Solve.

$8.2p = -32.8$

$$\frac{8.2p}{8.2} = \frac{-32.8}{8.2}$$

$$p = -4$$

Use the Division Property of Equality. Divide both sides by 8.2

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A stock that Carmen purchased lost, on average, $3.75 per share each week. If she held the stock for 4 weeks, what was her total loss, per share?

$\frac{m}{4} = -3.75$ *Write the equation. Let m = total stock loss.*

$\frac{m}{4} \times \frac{\quad}{\quad} = \frac{-3.75}{1} \times \frac{\quad}{\quad}$ *Use the multiplication property of equality to isolate the variable. Multiply both sides of the equation by the same number.*

$m = \frac{-3.75}{1} \times \frac{\quad}{\quad}$ *Multiply.*

$m =$

The total loss was _____ per share. ⇦ The word loss indicates a *negative* amount.

TRY THIS!

4a. Explain how you can you use the multiplication property of equality to solve the equation $\frac{w}{-2.25} = -12$. Then solve the equation.

_____

_____

REFLECT

4b. How are multiplication and division related? How can you use that relationship to solve equations involving these operations?

_____

Additional Examples 1C: Solving Equations with Decimals

Solve.

$$\frac{x}{1.2} = 15$$

$$1.2 \cdot \frac{x}{1.2} = 1.2 \cdot 15$$

Use the Multiplication Property of Equality. Multiply both sides by 1.2

$$x = 18$$

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Check It Out: Example 1A & 1B

Solve.

A. $m + 9.1 = 3$

$$m + 9.1 = 3$$
$$-9.1 \quad = \quad -9.1$$
$$m = -6.1$$

Use the Subtraction Property of Equality. Subtract 9.1 from both sides.

B. $5.5b = 75.9$

$$\frac{5.5}{5.5}b = \frac{75.9}{5.5}$$
$$b = 13.8$$

Use the Division Property of Equality. Divide both sides by 5.5

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Check It Out: Example 1C

Solve.

C. $\frac{y}{4.5} = 90$

$4.5 \cdot \frac{y}{4.5} = 4.5 \cdot 90$

Use the Multiplication Property of Equality. Multiply both sides by 4.5

$y = 405$

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Additional Example 2A: Solving Equations with Fractions

Solve.

$$n + \frac{2}{7} = -\frac{3}{7}$$

$$n - \frac{2}{7} + \frac{2}{7} = -\frac{3}{7} - \frac{2}{7}$$ *Subtract $\frac{2}{7}$ from both sides.*

$$n = -\frac{5}{7}$$

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Additional Example 2C: Solving Equations with Fractions

Solve.

$$\frac{5}{6}x = \frac{5}{8}$$

$$\frac{\cancel{6}}{\cancel{5}} \cdot \frac{\cancel{5}}{\cancel{6}}x = \frac{\cancel{5}}{\cancel{8}_{4}} \cdot \frac{\cancel{6}^{3}}{\cancel{5}}$$

Multiply both sides by $\frac{6}{5}$.

$$x = \frac{3}{4}$$

Simplify.

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Additional Example 3: Solving Word Problems Using Equations

Mr. Rios wants to prepare a dessert, but only has $2\frac{2}{3}$ tablespoons of sugar. If each serving of the dessert has $\frac{2}{3}$ tablespoon of sugar, how many servings can he make for the party?

Write an equation:

Total servings	×	*Amount needed for each dessert*	=	*Amount of sugar*

$$s \times \frac{2}{3} = 2\frac{2}{3}$$

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Additional Example 3 Continued

Now solve the equation.

$$s \times \frac{2}{3} = 2\frac{2}{3}$$

$$s \times \frac{2}{3} \cdot \frac{3}{2} = 2\frac{2}{3} \cdot \frac{3}{2}$$ *Multiply both sides by* $\frac{3}{2}$.

$$s = \frac{8}{3} \cdot \frac{3}{2}$$

$$s = \frac{24}{6}, \text{ or } 4$$ *Simplify.*

Mr. Rios can make 4 servings.

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Check It Out: Example 3

Rick's car holds $\frac{2}{3}$ the amount of gasoline as his wife's van. If the car's gas tank can hold $\frac{31}{2}$ gallons of gasoline, how much gasoline can the tank in the minivan hold?

Write an equation:

Van's gas tank	•	Ratio of car's tank to van's tank	=	Capacity of car's tank
g	•	$\frac{2}{3}$	=	$\frac{31}{2}$

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Check It Out: Example 3 Continued

Now solve the equation.

$$g \cdot \frac{2}{3} = \frac{31}{2}$$

$$g \cdot \frac{3}{2} \cdot \frac{2}{3} = \frac{31}{2} \cdot \frac{3}{2}$$ *Multiply both sides by $\frac{3}{2}$.*

$$g = \frac{93}{4}$$ *Simplify.*

$$g = 23\frac{1}{4}$$

The van's gas tank holds $23\frac{1}{4}$ gallons of gasoline.

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PRACTICE

Tell which property of equality you would use to solve each equation.

1. $n + (-6.5) = 14.7$

2. $\frac{p}{0.3} = 1.5$

3. $b - 1\frac{5}{8} = \frac{-4}{5}$

4. $\frac{r}{-4} = 2$

5. $-3t = 24$

6. $y + 5 = \frac{3}{5}$

Pg. 106 Do #1-6

Check your answers with your partner. Who's right?

Homework:

Workbook pg. 107 - Leave your fraction answers as improper fractions.