Grade: 7 **Content:** Math

Learning Objective:

Hello Grade 7 Students! As a refresher, we will be solving addition equations.

LEARNING GOALS

- Reason about addition equations
- Use bar models to represent one-step addition equations.
- Use inverse operations to solve one-step addition equations.
- Solve one-step addition equations.

Please review the Khan Academy video link below. This will assist you with your printable resources.

Video Links:

Khan Academy:

https://www.khanacademy.org/math/pre-algebra/pre-algebra-equations-expressions/pre-algebra-one-step-add-subequationss/v/adding-and-subtracting-the-same-thing-from-both-sides

Skills Practice: see the attached practice pages

2

Bar None

Solving One-Step Addition Equations

WARM UP

Determine each sum or difference.

1. $5.67 \ 1 \ 8.73$

2. $8.73 \ 2 \ 5.67$

3. $\frac{3}{7} \ 1 \ \frac{4}{5}$

4. $\frac{20}{3} \ 2 \ \frac{15}{4}$

LEARNING GOALS

- Reason about addition equations.
- Use bar models to represent one-step addition equations.
- Use inverse operations to solve one-step addition equations.
- Solve one-step addition equations.

KEY TERMS

- bar model
- one-step equation
- inverse operations

Throughout this course, you have used a variety of tools to solve mathematical problems, including area models, pictures, tables, tape diagrams, double number lines, graphs, and expressions. What tools might help you in solving equations?

Consider the number 0. What comes to mind?

Getting Started

Be creative! Use different types of numbers and operations in your expressions.

Form of 0

1. Write five different numeric expressions for the number 0.

Share your numeric expressions with your classmates.

2. Did you and your classmates use common strategies to write your expressions? How many possible numeric expressions could you write for this number?

ACTIVITY **2.1**

Reasoning About Addition Equations

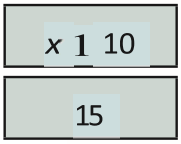
Reasoning about equations and determining solutions with *bar models* provides a visual representation of the structure of the equations. A **bar model** uses rectangular bars to represent known unknown quantities.

Remember, a solution to an equation is a value for the variable that makes and

the equation a true statement.

WORKED EXAMPLE

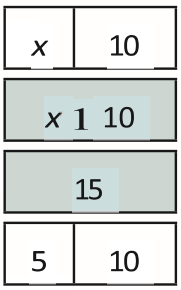
Consider the addition equation $x + 10 = 15$.



This equation states that for some value of x, the expression $x + 10$ is equal to 15. This can be represented using a bar model.

Because the expressions $x + 10$ and 15 are equal, their bars are of equal length. Even after the bars are decomposed, the lengths maintain their equality.

Just like with area models, bar models can be decomposed. The expression $x + 10$ can be decomposed into a part representing x and a part representing 10. The number 15 can be decomposed in a similar way: $15 = 5 + 10$.



The bar model demonstrates that these two equations are equivalent.

$$x + 10 = 15$$

$$x + 10 = 5 + 10$$

By examining the structure of the second equation, you can see that 5 is the value for x that makes this equation true.

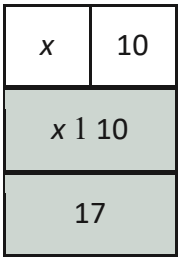
You are dealing with unknowns. Do not worry if the lengths of the parts are not accurate.

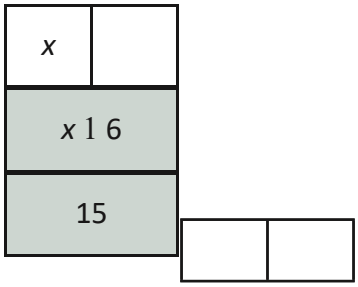
1. Why is the number 15 decomposed into the numeric expression $5 + 10$?

Notice how the bars maintain the same length throughout the entire model.

2. Describe how the model in the worked example would be different for each equation. Complete the bar model for each.

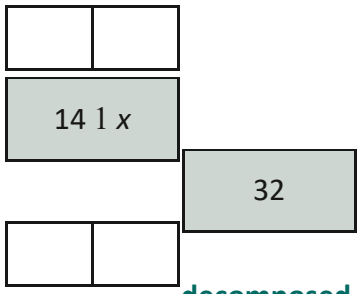
a. $x + 10 = 17$ **b. $x + 6 = 15$**





3. Consider the equation $14 + x = 32$.

a. Complete the bar model.

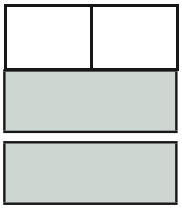


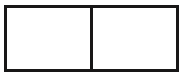
b. Write the equation represented by the decomposed expressions in the bar model.

c. Which value for x makes the equation a true statement?

4. Consider the equation $90 = x + 64$.

a. Complete the bar model.





b. Write the expression represented by the decomposed expressions in the bar model.

c. Which value for *x* makes the equation a true statement?

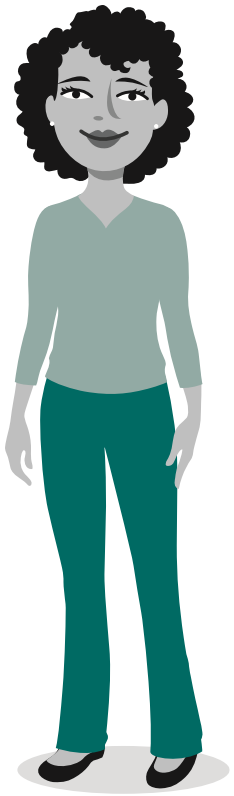
5. In each bar model, how did you determine how to decompose the given expressions?

ACTIVITY 2.2

Solving Addition Equations

In Activity 2.1, *Reasoning About Equations*, you used bar models to solve *one-step equations*. A **one-step equation** is an equation that can be solved using only one operation. How can you use what you learned from creating bar models to solve any equation?

> The Additive Identity Property states that for any number m, $m + 0 = m$. In other words, when you add 0 to any number, it stays the same. It keeps its identity!



Now that you understand the bar model, you can write equivalent equations with the same structure. While you can use reasoning to determine the value for the variable that makes an equation true, you can also use the properties and *inverse operations* to isolate the variable. **Inverse operations** are pairs of operations that reverse the effects of each other. For example, subtraction and addition are inverse operations.

a. What is the solution to $h + 6 = 19$?

WORKED EXAMPLE

Solve the equation $h + 6 = 19$.

$h + 6 = 13 + 6$	Write equivalent expressions that mirror structure.
$h + 6 - 6 = 13 + 6 - 6$	Use inverse operations to reverse the addition of 6 to h.
$h + 0 = 13 + 0$	Combine like terms and apply the Additive Identity Property.
$h = 13$	

1. Examine the worked example.

b. Are there other solutions to the equation? How do you know?

2. Use the same strategy to solve each equation.

a. $35 = 12 + m$ **b. $t + 24 = 85$**

3. Analyze Kaniah's strategy to solve the equation 11 5 *m* 1 7.

Kaniah

When solving the addition equation 11 =m + 7, I can simply subtract 7 from both sides without first writing an equivalent equation.

$$11 = m + 7$$
$$11 - 7 = m + 7 - 7$$
$$4 = m$$

The value for m that makes this equation true is 4.

a. What Property of Equality is Kaniah using in her strategy?

b. How could Kaniah check that her solution is correct?

4. Use Kaniah's strategy to solve each equation. Check to see that your solution makes the original equation a true statement.

a. 120 1 *y* 5 315 b. 5— $\frac{3}{}$ 5 *x* 1 4— $\frac{1}{}$

4 **2**

c. $b + 5.67 = 12.89$

d. $2356 = a + 1699$

e. $\frac{7}{12} = g + \frac{1}{4}$

f. $w + 3.14 = 27$

g. $13\frac{7}{8} = c + 9\frac{3}{4}$

h. $19 + p = 105$

ACTIVITY **2.3**

Reasoning About More Interesting Addition Equations

1. Braeden thinks that he can use decomposition to reason about more complicated equations, such as $4x + 5 = 20 + 3x$.

   Is Braeden correct? Show your work.

2. Think about each algebraic equation. Use reasoning to describe a relationship between c and d that makes the mathematical sentence true.

   a. $c + 23 = d + 14$

   b. $45 + c = 66 + d$

   c. $c + 3d = 2c$

   d. $4c + d + 10 = 8c + 2d$

TALK the TALK

It All Adds Up

1. What does it mean to solve an equation?

2. Describe how to solve any one-step addition equation. How do you check to see if a value is the solution to an equation?

3. Write two different one-step equations for each solution provided.

   a. $m = 12$

   b. $5 = x$

   c. $5.6 = h$

   d. $j = 6\frac{4}{7}$

NOTES

Assignment

Write

Write a definition for each term in your own words.

- one-step equation
- solution
- inverse operations

Remember

A solution to an equation is the value or values for the variable that makes the equation true. To solve a one-step addition equation, isolate the variable using number sense or the Subtraction Property of Equality.

Practice

Use a bar model to solve each equation.

1. $x + 7 = 15$
2. $19 = x + 13$
3. $14.5 = 6 + y$
4. $a + \frac{1}{2} = 4\frac{3}{4}$

Solve each equation. Check each solution.

5. $34 = x + 17$
6. $a + 25 = 92$
7. $7\frac{3}{5} + b = 10\frac{3}{4}$
8. $24\frac{1}{2} = t + 5\frac{1}{4}$
9. $r + 3.4 = 13.1$
10. $4.21 = 2.98 + s$

Stretch

Solve each equation. Check each solution.

1. $34 = x - 17$
2. $a - 25 = 92$
3. $r - 3.4 = 13.1$
4. $24\frac{1}{2} = t - 5\frac{1}{4}$

Review

Use the Properties of Equality to write 2 equations that have the given solution. Identify which property of equality was used.

1. $j = 3$
2. $8 = m$

Define variables and write an algebraic expression to represent each situation.

3. Terrance has one fewer sibling than Casey. Kolbie has three more siblings than Terrance.
4. Connor has half as many comic books as Devyn. Isaac has 4 more comic books than Connor.

Rewrite each expression.

5. $\frac{2}{3}x + \frac{4}{5}x$
6. $\frac{1}{3}\left(\frac{2}{5}x\right)$

Answers

Answers will vary.

1. This means to be good at something, it takes a little imagination and a lot of hard work.
2. This means when you do succeed, it is often because you have learned from making a lot of mistakes first.
3. This means to take the shot and don't worry about missing, because if you don't try, it is impossible to make the shot.
4. This means that you should give it your all and then give a little bit more.

Getting Started

Putting It All in Perspective

In your opinion, what does each famous quotation or saying really mean?

1. **"Genius is one percent inspiration and ninety-nine percent perspiration."**
   -Thomas Edison

2. **"Success is 99 percent failure."**
   -Soichiro Honda

3. **"You miss 100 percent of the shots you never take."**
   -Wayne Gretzky

4. **"Always give 110%. It's the extra 10% that everyone remembers."**
   -Frank Sonnenberg

M2-124 • TOPIC 2: Percents

Answers

1. Answers will vary.
2. Dylan is correct. Noah left off the percent sign on 0.1%

and compared the number

ACTIVITY **2.1**

s been given a note card that contains a number

g Fractions, s, and Percents

raction, decimal, or percent.

Think about all of the different ways to express your number.

the set of numbers from least to greatest.

1

rategies used by your class to order the numbers.

an were assigned the numbers $0.\overline{6}$ and 0.1% but d on which was larger. Noah says that $0.\overline{6}$ is less 6 is less than 0.1%. Dylan says that since 0.1% s as 0.001 and 0.001 is less than $0.\overline{6}$, 0.1% is less than $0.0\overline{6}$.

2

rect? Explain your reasoning.

3

nbers from least to greatest.

0.99, $\frac{1}{17}$, $\frac{9}{20}$, 95%, 25%, $\frac{3}{8}$, 70%, 4.3%, 0.81, 0.64

Answers

0.1 with 0.0 6 . Dylan wrote the percent as a decimal ¯ and compared the two decimal values.

3. 4.3%, —$^{1}_{9}$, 25%, — $^{3}_{8}$, 0.64, 70%,

0.81, ——$^{17}_{20}$, 95%, 0.99

Answers

1a. 75% 1b. 50% 1c. 25% 1d. 10%
1e. 60%
1f. 0%

2a. 40% 2b. 75% 2c. 33%

ACTIVITY 2.2

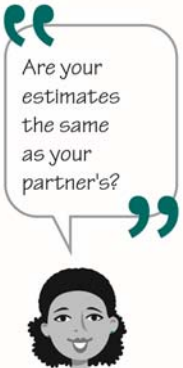
Estimating Percents from Pictures

You know that 100% means one, or the whole, and 50% means half. You can estimate a lot of percents when using a visual model.

A laptop computer uses an icon of a battery on the toolbar to show how much power is left in the battery. When you glance at the icon, you can get a good estimate of how much battery life remains before you need to recharge the battery.

1. Estimate how much battery power remains by writing the percent under each battery icon.

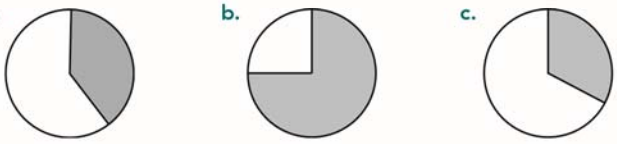
a. b. c.

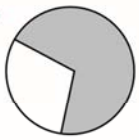


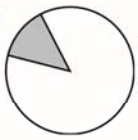
d. e. f.

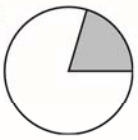
2. Estimate the shaded part of each circle shown, and write it as a percent.

a. b. c.



d. 

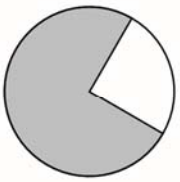
e. 

f. 

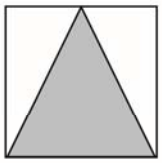
3. Estimate the shaded part of each model, and write it as a fraction, a decimal, and a percent. Write the fraction in lowest terms.

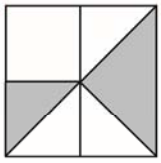
a. 

b. 

c. 

d. 

e. 

f. 

4. Describe the strategies that you used to make your estimations.

Answers

2d. 70%

2e. 12%

2f. 20%

3a. $\frac{2}{3}$, $0.\overline{6}$, $66.\overline{6}\%$

3b. $\frac{1}{5}$, 0.2, 20%

3c. $\frac{3}{4}$, 0.75, 75%

3d. $\frac{4}{5}$, 0.8, 80%

3e. $\frac{1}{2}$, 0.5, 50%

3f. $\frac{3}{8}$, 0.375, 37.5%

4. Answers will vary.

Answers

1a. Fifty percent is half of 100%.

1b. Twenty-five percent is one-fourth of 100%. It is half of 50%.

1c. Ten percent is one-tenth of 100%. It is one-fifth of 50%.

ACTIVITY 2.3

Benchmark Percents

A **benchmark percent** is a percent that is commonly used, such as 1%, 5%, 10%, 25%, 50%, and 100%. With fractions and decimals, benchmarks can be used to make estimations. With percents, however, you can use benchmarks to calculate any whole percent of a number.

100%									
50%					50%				
25%			25%			25%			25%
20%		20%			20%			20%	
10%	10%	10%	10%	10%	10%	10%	10%	10%	10%

1. **Use the tape diagram to state each relationship.**

   a. **How is 50% related to 100%?**

   b. **How is 25% related to 100%? How is 25% related to 50%?**

   c. **How is 10% related to 100%? How is 10% related to 50%?**

ELL Tip

Knowing the origins of a word or phrase can help students understand the meaning in different contexts. Explain that a *benchmark* comes from surveyors in the 1800s. They would place a "mark" on a stone to use as a "bench" for a leveling rod. Therefore, the mark was used as a standard for measuring height. Similarly, *benchmark percents* are standard references of well-known and commonly used values. We use them to compare with other lesser-known values.

2. **Continue the pattern from the tape diagram to state each relationship.**

Remember that 1% = 0.01.

a. How is 5% related to 10%?

b. How is 1% related to 10%? How is 1% related to 5%?

3. **Use the benchmark percents to determine each value if 600 is 100%.**

a. 50% **b. 25%**

c. 10% **d. 5%** **e. 1%**

Answers

2a. Five percent is half of 10%.
2b. One percent is one-tenth of 10%. It is one-fifth of 5%.

3a. 300
3b. 150
3c. 60
3d. 30
3e. 6

Answers

4a. 0.28
4b. 2.8
4c. 2.34 4d. 23.4
4e. 0.0085
4f. 0.085
4g. 0.0586
4h. 0.586
4i. 0.9872
4j. 9.872
4k. 10.852 4l. 108.52

4. Use your calculator to determine the percent of each number.

a. 1% of 285 **b. 10% of 285**

c. 1% of 2345 **d. 10% of 2345**

e. 1% of 0.855 **f. 10% of 0.855**

g. 1% of 5.865 **h. 10% of 5.865**

i. 1% of 98.725 **j. 10% of 98.725**

k. 1% of 1085.25 **l. 10% of 1085.25**

NOTES

5. **What patterns do you notice in your answers in Question 4?**

6. **Write a rule to calculate 1% of any number.**

7. **Write a rule to calculate 10% of any number.**

8. **Use the patterns you recognized in Question 4 to calculate each value.**

   a. **10% of 45.21**

   b. **1% of 45.21**

   c. **10% of 0.72**

   d. **1% of 0.72**

   e. **10% of 2854**

   f. **1% of 2854**

Answers

5. When I calculate 1% of a number, the decimal point moves to the left two places. When I calculate 10% of a number, the decimal point moves to the left one place.
6. I can move the decimal point two places to the left when determining 1% of a number.
7. I can move the decimal point one place to the left when determining 10% of a number.

8a. 4.521
8b. 0.4521
8c. 0.072
8d. 0.0072
8e. 285.4
8f. 28.54