

LESSON
22

Modeling Mathematical Situations

Algebraic Concepts

Review It!

When you model mathematical situations, remember this word:

mathematical expression numbers, letters, and/or symbols that model a word expression

$a + b$ and $\frac{r}{4} + 9r - 1$ are mathematical expressions.

Operation	Some Word Expressions	Math Expression
Addition	n plus 7 add 7 to a number 7 more than n the sum of 7 and n	$n + 7$
Subtraction	k minus 4 subtract 4 from a number 4 less than k the difference between k and 4	$k - 4$
Multiplication	2 times a number b multiply 2 and a number twice a number b the product of 2 and b	$2b$
Division	the quotient of x and 10 divide a number x by 10 x divided by 10 one tenth of a number	$x \div 10$ or $\frac{x}{10}$

Write a mathematical expression for "10 less than twice a number."

Step 1 Write "twice a number, n " _____

Step 2 Write "10 less than." _____

THINK "Less than" is different from "less."

So, "10 less than twice a number" is written as _____.

Try It!

Write a math expression for the words.



1. the sum of twice a number r and 9 _____
2. the quotient of 6 and n , increased by 7 _____
3. 8 less than the product of 5 and k _____
4. 0.8 more than c times 10 _____
5. 9 more than twice p _____
6. the sum of 12 and the product of 7 and w _____
7. the sum of n and 2, divided by 5 _____
8. 8 less than the quotient of w divided by 2 _____
9. half the sum of 9 and v _____
10. 4 more than half a number, m _____

1.
"Twice" represents which operation? multiplication, or division?

2.
Which operations will you use? division and addition, or multiplication and subtraction?

Write a math expression for each situation.

11. Hilda's sister is a years old. Hilda is 9 years less than twice the age of her sister. Write a math expression for Hilda's age.

12. Kevin's hourly wage is \$3.40 more than a third of Delia's hourly wage, d . Write a math expression for Kevin's hourly wage.

11.
Order matters for which words? less than, or twice?

On Your Own!

Circle the answer for each question.

In Questions 1–6, write the math expression that models the word expression.

- 2.7 more than a number
 - $k + 2.7$
 - $k - 2.7$
 - $2.7 - k$
 - $2.7k$
- 8.67 less than a number
 - g
 - $8.67 - g$
 - $g + 8.67$
 - $g - 8.67$
- twice a number, increased by 17
 - $17n + 2$
 - $2n + 17$
 - $\frac{n + 17}{2}$
 - $\frac{n + 2}{17}$
- the product of 12 and a number, decreased by 10
 - $10 - 12x$
 - $12x - 10$
 - $10x - 12$
 - $12 - 10x$
- 9 more than the quotient of a number and 5
 - $(r + 9) \div 5$
 - $r \div 9 + 5$
 - $r \div 5 + 9$
 - $(r + 5) \div 9$
- The width of a field is w yards. The length of the field is 22 yards less than 5 times its width. Which math expression models the length of the field?
 - $22w - 5$
 - $22 - 5w$
 - $5w + 22$
 - $5w - 22$
- Ms. BuAbbud wrote b cards last week. This week she wrote 12 fewer than twice the number of last week's cards. Which math expression models the number of cards she wrote this week?
 - $2b - 12$
 - $12 - 2b$
 - $2b + 12$
 - $12b - 2$
- Eddie spent h hours last week planting corn. This week he spent 18 hours more than 4 times last week's time planting corn. Which math expression models the number of hours he spent this week planting corn?
 - $18h - 4$
 - $4 + 18h$
 - $4h + 18$
 - $4h - 18$

One week, three friends worked together and earned d dollars doing yard work. The next week they worked together and earned \$320. They split the money they earned for both weeks equally among them.

Part A Write a mathematical expression for the amount of money each friend earned for the two weeks. _____

Part B Use what you know about mathematical expressions to explain why your answer is correct. Use words and/or numbers to support your explanation.

Algebraic Concepts

Math Words

Fill in the blanks.

10. An expression that uses numbers, letters, and/or symbols to model a word expression is a(n) _____.

11. A letter that represents a number is a(n) _____.

LESSON 5 **Integers and Rational Numbers**
Review for Mastery: Solving Equations Containing Integers

- You can use addition to solve an equation involving subtraction. Addition undoes subtraction. Adding the same number to both sides of the equation keeps the equation balanced.

$x - 5 = -6$	Check
$x - 5 + 5 = -6 + 5$	$x - 5 = -6$
$x = -1$	$-1 - 5 \stackrel{?}{=} -6$
	$-6 \stackrel{?}{=} -6 \checkmark$

- You can use subtraction to solve an equation involving addition. Subtraction undoes addition. Subtracting the same number from both sides of the equation keeps the equation balanced.

$n + 4 = -15$	Check
$n + 4 - 4 = -15 - 4$	$n + 4 = -15$
$n = -19$	$-19 + 4 \stackrel{?}{=} -15$
	$-15 \stackrel{?}{=} -15 \checkmark$

Solve. Check your answer.

1. $p - 9 = -3$
 $p - 9 + \underline{\hspace{2cm}} = -3 + \underline{\hspace{2cm}}$

2. $w - 2 = -14$
 $w - 2 + \underline{\hspace{2cm}} = -14 + \underline{\hspace{2cm}}$

3. $x - 12 = -5$
 $x - 12 + \underline{\hspace{2cm}} = -5 + \underline{\hspace{2cm}}$

4. $f - 8 = 6$
 $f - 8 + \underline{\hspace{2cm}} = 6 + \underline{\hspace{2cm}}$

5. $6 = m - 7$

6. $-4 = s - 10$

7. $-8 = y - 2$

8. $a + 19 = 7$

9. $b + 15 = -9$

10. $39 + t = 45$

11. $-5 = x + 7$

12. $-2 = k + 11$

13. $10 = -3 + j$

LESSON

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Integers and Rational Numbers

Review for Mastery: Solving Equations Containing Integers (continued)

- You can use division to solve an equation involving multiplication. Division undoes multiplication. Dividing both sides of the equation by the same number keeps the equation balanced.

Check

$$3y = -9$$

$$\frac{3y}{3} = \frac{-9}{3}$$

$$y = -3$$

$$3y = -9$$

$$3 \cdot (-3) \stackrel{?}{=} -9$$

$$-9 \stackrel{?}{=} -9 \checkmark$$

- You can use multiplication to solve an equation involving division. Multiplication undoes division. Multiplying both sides of an equation by the same number keeps the equation balanced.

Check

$$\frac{a}{-5} = -8$$

$$-5 \cdot \frac{a}{-5} = -8 \cdot (-5)$$

$$a = 40$$

$$\frac{a}{-5} = -8$$

$$\frac{40}{-5} \stackrel{?}{=} -8$$

$$-8 \stackrel{?}{=} -8 \checkmark$$

Solve. Check your answer.

14. $5g = -35$

$$\frac{5g}{5} = \frac{-35}{5}$$

15. $-8y = -96$

$$\frac{-8y}{-8} = \frac{-96}{-8}$$

16. $54 = -6f$

$$\frac{54}{-6} = \frac{-6f}{-6}$$

17. $3e = -33$

18. $-49 = 7n$

19. $-75 = -5c$

20. $\frac{n}{4} = -15$

21. $\frac{m}{-6} = -9$

22. $\frac{s}{-10} = 8$

23. $4 = \frac{w}{-6}$

24. $9 = \frac{z}{5}$

25. $-11 = \frac{h}{6}$

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Solving Equations

Review It!

To solve an equation, remove the numbers from the side with the variable until the variable is alone.

Algebraic Concepts

Solve: $7x + 17 = 38$

Step 1 Identify the operations on the same side as the variable.

+ means add. $7x$ means $7 \times x$.

Step 2 Get $7x$ alone on one side.

$$7x + 17 = 38$$

$$7x + 17 - \underline{\hspace{2cm}} = 38 - \underline{\hspace{2cm}}$$

$$7x = \underline{\hspace{2cm}}$$

REMEMBER Subtract the same number from both sides.

Step 3 Get x alone on one side.

$$7x = \underline{\hspace{2cm}}$$

$$7x \div \underline{\hspace{2cm}} = 21 \div \underline{\hspace{2cm}}$$

$$x = \underline{\hspace{2cm}}$$

REMEMBER Divide both sides by the same number.

Step 4 Check: $7 \times 3 + 17 = 21 + 17 = 38$

So, the value of x in this equation is $\underline{\hspace{2cm}}$.

Try It!

Solve each equation.

1. $2x = 2$

2. $3d = 6$

3. $4n = 4$

4. $\frac{x}{3} = 2$

5. $z + 7 = -1$

6. $d - 13 = -3$

7. $3x + 11 = 17$

8. $5x - 2 = 23$

9. $10c + 6 = 46$

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

11. $9x + 13 = 85$

12. $6b - 12 = 60$

Solve.

13. Wu found the length of a rectangular pen by solving the equation $7l + 9 = 37$, where l is the length of the pen in yards. What is the length of the pen?

14. A balloon ride costs \$315. The equation $75h + 15 = 315$ can be used to find the number of hours, h , for a balloon ride. How many hours does the ride last?

Ask Yourself

1.

How can you undo multiplication? subtract, or divide?

5.

What is $-1 - 7$?
 -6 , or -8 ?

7.

x is multiplied by what?
 3 , or 11 ?

13.

What do you subtract first from both sides?
 7 , or 9 ?

Algebraic Concepts

Solving Equations worksheet 2

Explain	Math	Check
	1. $\frac{r}{10} + 4 = 5$	
	2. $7a - 2 = 40$	
	3. $24 = 5x + 4$	
	4. $\frac{w}{5} - 2 = 1$	
	5. $35 = 15m + 5$	
	6. $20 = 3x - 1$	
	7. $2x - 6 = 0$	



Solving Equations Using the Distributive Property

$$\begin{aligned}4(x - 3) &= 20 \\ \xrightarrow{\text{Distributive Property}} & \\ 4x - 12 &= 20 \\ 4x - 12 + 12 &= 20 + 12 \\ 4x &= 32 \\ \frac{4x}{4} &= \frac{32}{4} \\ x &= 8\end{aligned}$$

1. $3(x + 8) = -6$

7. $6(2 - \frac{x}{6}) = 1$

2. $75 = -5(a + 5)$

8. $-36 = 6(y - 2)$

3. $-8(y - 6) = -16$

9. $-7(r + 8) = -14$

4. $20 = 4(\frac{t}{4} - 2)$

10. $3(m + 5) = 42$

5. $17(x - 2) = -34$

11. $-54 = 3(2 + 5m)$

6. $63 = 9(2 - a)$

12. $-3(x - 7) + 2 = 20$

Like Terms Equations

name _____

date _____ class _____

Remember...Simplify first, then use inverse operations to isolate the variable.

1) $7x + 4x = 33$	2) $8k - k = 28$	3) $4n + 17n = 42$
4) $8y - 3y - 1 = 24$	5) $-3k + 1 = 7k = 33$	6) $-5 - 4r + 17r = 73$
7) $6a + 3a + 5 = 68$	8) $8z - 15 - 3z = -15$	9) $11x + 2 + x = 14$
10) $11k - 19k = 24$	11) $-9w + 3 + w = 35$	12) $-7 + 2k - 3k = 0$
13) $15m - 12 - 12m = 16$	14) $m + 7 + 3m = 20$	15) $6w - 3 + 3w = 17$
16) $2m + 9 - 7m = 12$	17) $-4x + 2 - 7x = 15$	18) $k - 7 - 9k = 5$

Check Yourself. Here are the scrambled answers:

-7 -4 -3 $-1\frac{1}{2}$ $-1\frac{2}{11}$ $-\frac{3}{5}$ 0 1 2 $2\frac{2}{9}$ 3 $3\frac{1}{4}$ 4 5 6 7 8 $9\frac{1}{3}$