WHAT is equivalence?

Common Core State Standards

Content Standards
8.EE.7, 8.EE.7a, 8.EE.7b

Mathematical Practices
1, 2, 3, 4

Robotics You want to attend a two-week robotic day camp that costs $700. Your parents will pay the deposit of $400 if you pay the rest in weekly payments of $15. Use the questions below to help you find the number of weeks you will need to make payments.

1. Complete the table below. How much is paid after 2, 3, and 4 weeks?

Payments	Amount Paid
0	$400 + 15(0) = 400$
1	$400 + 15(1) = 415$
2	$400 + 15(2) = 430$
3	$400 + 15(3) = 445$
4	$400 + 15(4) = 460$

2. It will take a long time to solve the problem with a table. Instead, write and solve an equation to find the number of payments p you will need to make.

$400 + 15p = 700; p = 20$

3. How many payments will yo

1	$400 + 15(1) = 415$
2	$400 + 15(2) = 430$
3	$400 + 15(3) = 445$
4	$400 + 15(4) = 460$

2. It will take a long time to solve the problem with a table. Instead, write and solve an equation to find the number of payments p you will need to make.

$400 + 15p = 700; p = 20$

3. How many payments will you make? 20

4. Suppose you received $75 in birthday money that you want to use towards the camp. Write and solve an equation to find the number of payments p you will need to make. $400 + 75 + 15p = 700; 15$

Which MP **Mathematical Practices** did you use?
Shade the circle(s) that applies.

©Ingram Publishing/Fotosearch

2. **Thirteen is 7 more than one-fifth of a number.**

Words	Thirteen is 7 more than one-fifth of a number.
Variable	Let n represent the number.
Equation	$13 = \frac{1}{5}n + 7$

Show your work.

a. $15 = 6n + 3$

b. $10 + \frac{n}{6} = 5$

c. $12 - \frac{2}{3}n = 18$

Got it? **Do these problems to find out.**

a. Fifteen equals three more than six times a number.

b. Ten increased by the quotient of a number and 6 is 5.

c. The difference between 12 and $\frac{2}{3}$ of a number is 18.

Copyright © McGraw-Hill Education

8:48 AM 9/15/201

Words	Bench plus \$24.99 per weight equals \$849.86
Variable	Let w represent the number of weights.
Equation	$500 + 24.99 \cdot w = 849.86$

$$\begin{aligned}
500 + 24.99w &= 849.86 && \text{Write the equation.}\\
-500 \quad &= -500 && \text{Subtraction Property of Equality}\\
24.99w &= 349.86 && \text{Simplify.}\\
\frac{24.99w}{24.99} &= \frac{349.86}{24.99} && \text{Division Property of Equality}\\
w &= 14 && \text{Simplify.}
\end{aligned}$$

So, 14 weights were purchased.

Got it? **Do this problem to find out.**

d. The current temperature is 54°F. It is expected to rise 2.5°F each hour. In how many hours will the temperature be 84°F?

Show your work.

d. 12 h

Copyright © McGraw-Hill Education

8:48 AM
9/15/2016

Guided Practice

Translate each sentence into an equation. (Examples 1 and 2)

1. One more than three times a number is 7. $3n + 1 = 7$
2. Seven less than one-fourth of a number is −1. $\frac{1}{4}n - 7 = -1$
3. The quotient of a number and 5, less 10, is 3. $\frac{n}{5} - 10 = 3$
4. You already owe $4.32 in overdue rental fees and are returning a movie that is 4 days late. Now you owe $6.48. Define a variable. Then write and solve an equation to find the daily fine for an overdue movie. (Examples 3–5)

   d = the daily fine; $4.32 + 4d = 6.48$; $0.54
5. **Building on the Essential Question** Why is it important to define a variable before writing an equation?

   Sample answer: Assigning a variable to the unknown helps you when translating the verbal model into an algebraic equation.

Rate Yourself!

- ☐ I understand how to write two-step equations.

  Great! You're ready to move on!
- ☐ I still have some questions about writing two-step equations.

  Problem! Go online to Tutor

Copyright © McGraw-H

Independent Practice

Go online for Step-by-Step Solutions

eHelp

Translate each sentence into an equation. (Examples 1 and 2)

1. Four less than five times a number is equal to 11. $5n - 4 = 11$
2. Fifteen more than half a number is 9. $\frac{1}{2}n + 15 = 9$
3. Six less than seven times a number is equal to −20. $7n - 6 = -20$
4. Eight more than four times a number is −12. $4n + 8 = -12$

Define a variable. Then write and solve an equation to solve each problem. (Examples 3–5)

5. **Financial Literacy** The cost for a certain music plan is $9.99 per year plus $0.25 per song you download. If you paid $113.74 one year, find the number of songs you downloaded. s = the number of songs; $0.25s + 9.99 = 113.74$; 415 songs

6. Amy has saved $725 for a new guitar and lessons. Her guitar costs $475, and guitar lessons are $25 per hour. Determine how many hours of lessons she can afford. x = the number of hours; $475 + 25x = 725$; 10 hours

7. From ground level to the tip of the torch, the Statue of Liberty and its pedestal are 92.99 meters tall. The pedestal is 0.89 meter taller than the statue. How tall is the Statue of Liberty?

s = height of the Statue of Liberty; $s + (s + 0.89) = 92.99$; 46.05 m

8. MP **Reason Abstractly** Elsie would like to take snowboarding lessons at Powder Mountain. She has saved $550 for lessons and a junior season pass. How many more semi-private lessons than private lessons can she take? 2 lessons

Powder Mountain Ski Resort Snowboarding Lessons	
Semi-Private	$45/lesson
Private	$60/lesson
Junior Season Pass	$315

t © McGraw-Hill Education C Squared Studios/Getty Images

9. When diving, the peregrine falcon can reach speeds of up to 175 miles per hour. Write and solve equations to find each of the following.

a. The top speed of a peregrine falcon is 20 miles per hour less than three times the top speed of a cheetah. What is the cheetah's top speed? $175 = 3c - 20$; 65 mph

b. A sailfish can swim up to 1 mile per hour less than one fifth the top speed of a peregrine falcon. Find the top speed that a sailfish can swim. $s = \frac{1}{5} \cdot 175 - 1$; 34 mph

c. The peregrine falcon can reach speeds about 13 miles per hour more than 6 times the speed of the fastest human. What is the approximate top speed of the fastest human? $175 = 6h + 13$; 27 mph

H.O.T. Problems Higher Order Thinking

10. MP **Model with Mathematics** If 12 less [illegible] number is 5. Write a different sentence

H.O.T. Problems Higher Order Thinking

10. **Model with Mathematics** If 12 less than 4 times a number is 8, the number is 5. Write a different sentence where the unknown number is also 5. **Sample answer: 6 times a number plus 5 equals 35.**

11. **Persevere with Problems** The ages of three siblings combined is 27. The oldest is twice the age of the youngest. The middle child is 3 years older than the youngest. Write and solve an equation to find the ages of each sibling. **$n + 2n + (n + 3) = 27$; 6, 9, 12**

12. **Model with Mathematics** Write about a real-world situation that can be solved using a two-step equation. Then write the equation and solve the problem. **Sample answer: Renting a locker at the gym costs $7 a week. You get a $4 discount when you return the key. If your total cost is $24 and you returned the key, how many weeks did you rent a locker? $7x - 4 = 24$; 4 weeks**

13. **Model with Mathematics** Describe two real-world situations that can be represented by the same two-step equation. **See students' work.**

Situation 1:

©iStock