Name _____ Date_____

# Understanding Equations

1. Check whether the given value of $x$ is a solution to the equation. Justify your answer.

   a. $\frac{1}{3}(x+4) = 20$ $x = 48$

   b. $3x - 1 = 5x + 10$ $x = -5\frac{1}{2}$

2. The total cost of four pens and seven mechanical pencils is $\$13.25$. The cost of each pencil is $75$ cents.

   a. Using an arithmetic approach, find the cost of a pen.

b. Let the cost of a pen be $p$ dollars. Write an expression for the total cost of four pens and seven mechanical pencils in terms of $p$.

c. Write an equation that could be used to find the cost of a pen.

d. Determine a value for $p$ for which the equation you wrote in part (b) is true.

e. Determine a value for $p$ for which the equation you wrote in part (b) is false.

1. Check whether the given value is a solution to the equation.

   a. $4n - 3 = -2n + 9 \qquad n = 2$

   b. $9m - 19 = 3m + 1 \qquad m = \frac{10}{3}$

   c. $3(y + 8) = 2y - 6 \qquad y = 30$

2. Tell whether each number is a solution to the problem modeled by the following equation.

   Mystery Number: Five more than $-8$ times a number is $29$. What is the number?

   Let the mystery number be represented by $n$.

   The equation is $5 + (-8)n = 29$.

   a. Is $3$ a solution to the equation? Why or why not?

   b. Is $-4$ a solution to the equation? Why or why not?

   c. Is $-3$ a solution to the equation? Why or why not?

   d. What is the mystery number?

3. The sum of three consecutive integers is $36$.

   a. Find the smallest integer using a tape diagram.

   b. Let $n$ represent the smallest integer. Write an equation that can be used to find the smallest integer.

   c. Determine if each value of $n$ below is a solution to the equation in part (b).

      $n = 12.5$

      $n = 12$

      $n = 11$

4. Andrew is trying to create a number puzzle for his younger sister to solve. He challenges his sister to find the mystery number. "When $4$ is subtracted from half of a number the result is $5$." The equation to represent the mystery number is $\frac{1}{2}m - 4 = 5$. Andrew's sister tries to guess the mystery number.

   a. Her first guess is $30$. Is she correct? Why or why not?

   b. Her second guess is $2$. Is she correct? Why or why not?

   c. Her final guess is $4\frac{1}{2}$. Is she correct? Why or why not?

1. Check whether the given value of $x$ is a solution to the equation. Justify your answer.

a. $\frac{1}{3}(x+4) = 20$ $\qquad x = 48$

$\frac{1}{3}(48+4) = 20$

$\frac{1}{3}(52) = 20$

$17\frac{1}{3} = 20$

*False, 48 is NOT a solution to* $\frac{1}{3}(x+4) = 20$.

b. $3x - 1 = 5x + 10$ $\qquad x = -5\frac{1}{2}$

$3\left(-5\frac{1}{2}\right) - 1 = 5\left(-5\frac{1}{2}\right) + 10$

$-\frac{33}{2} - 1 = -\frac{55}{2} + 10$

$-\frac{35}{2} = -\frac{35}{2}$

*True,* $-5\frac{1}{2}$ *is a solution to* $3x - 1 = 5x + 10$.

2. The total cost of four pens and seven mechanical pencils is $\$13.25$. The cost of each pencil is 75 cents.

a. Using an arithmetic approach, find the cost of a pen.

$(13.25 - 7(0.75)) \div 4$

$(13.25 - 5.25) \div 4$

$8 \div 4$

*The cost of a pen is* $\$2$.

b. Let the cost of a pen be $p$ dollars. Write an expression for the total cost of four pens and seven mechanical pencils in terms of $p$.

$4p + 7(0.75)$ *or* $4p + 5.25$

c. Write an equation that could be used to find the cost of a pen.

$4p + 7(0.75) = 13.25$ *or* $4p + 5.25 = 13.25$

d. Determine a value for $p$ for which the equation you wrote in part (b) is true.

$4p + 5.25 = 13.25$

$4(2) + 5.25 = 13.25$

$8 + 5.25 = 13.25$

$13.25 = 13.25$

*True, when* $p = 2$, *the equation is true.*

e. Determine a value for $p$ for which the equation you wrote in part (b) is false.

*Any value other than* 2 *will make the equation false.*

1. Check whether the given value is a solution to the equation.

   a. $4n - 3 = -2n + 9 \qquad n = 2$

   $$4(2) - 3 = -2(2) + 9$$
   $$8 - 3 = -4 + 9$$
   $$5 = 5$$

   *True*

   b. $9m - 19 = 3m + 1 \qquad m = \frac{10}{3}$

   $$9\left(\frac{10}{3}\right) - 19 = 3\left(\frac{10}{3}\right) + 1$$
   $$\frac{90}{3} - 19 = \frac{30}{3} + 1$$
   $$30 - 19 = 10 + 1$$
   $$11 = 11$$

   *True*

   c. $3(y + 8) = 2y - 6 \qquad y = 30$

   $$3(30 + 8) = 2(30) - 6$$
   $$3(38) = 60 - 6$$
   $$114 = 54$$

   *False*

2. Tell whether each number is a solution to the problem modeled by the following equation.

   Mystery Number: Five more than $-8$ times a number is $29$. What is the number?

   Let the mystery number be represented by $n$.

   The equation is $5 + (-8)n = 29$.

   a. Is $3$ a solution to the equation? Why or why not?

   *No, because* $5 - 24 \neq 29$.

   b. Is $-4$ a solution to the equation? Why or why not?

   *No, because* $5 + 32 \neq 29$.

   c. Is $-3$ a solution to the equation? Why or why not?

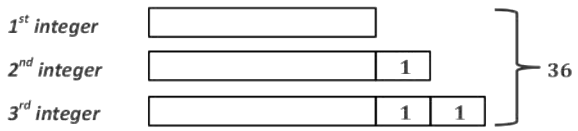
   *Yes, because* $5 + 24 = 29$.

   d. What is the mystery number?

   $-3$ *because* $5$ *more than* $-8$ *times* $-3$ *is* $29$.

3. The sum of three consecutive integers is $36$.

a. Find the smallest integer using a tape diagram.




$36 - 3 = 33$

$33 \div 3 = 11$

*The smallest integer is* $11$.

b. Let $n$ represent the smallest integer. Write an equation that can be used to find the smallest integer.

*Smallest integer:* $n$

*2nd integer:* $(n + 1)$

*3rd integer:* $(n + 2)$

*Sum of the three consecutive integers:* $n + (n + 1) + (n + 2)$

*Equation:* $n + (n + 1) + (n + 2) = 36$.

c. Determine if each value of $n$ below is a solution to the equation in part (b).

| | |
|---|---|
| $n = 12.5$ | *No, it is not an integer and does not make a true equation.* |
| $n = 12$ | *No, it does not make a true equation.* |
| $n = 11$ | *Yes, it makes a true equation.* |

4. Andrew is trying to create a number puzzle for his younger sister to solve. He challenges his sister to find the mystery number. "When $4$ is subtracted from half of a number, the result is $5$." The equation to represent the mystery number is $\frac{1}{2}m - 4 = 5$. Andrew's sister tries to guess the mystery number.

a. Her first guess is $30$. Is she correct? Why or why not?

*No, it does not make a true equation.*

$\frac{1}{2}(30) - 4 = 5$

$15 - 4 = 5$

$11 = 5$

*False*

b. Her second guess is $2$. Is she correct? Why or why not?

*No, it does not make a true equation.*

$\frac{1}{2}(2) - 4 = 5$

$1 - 4 = 5$

$-3 = 5$

*False*

c. **Her final guess is $4\frac{1}{2}$. Is she correct? Why or why not?**

***No, it does not make a true equation.***

$$\frac{1}{2}\left(4\frac{1}{2}\right) - 4 = 5$$

$$2\frac{1}{4} - 4 = 5$$

$$-1\frac{3}{4} = 5$$

***False***