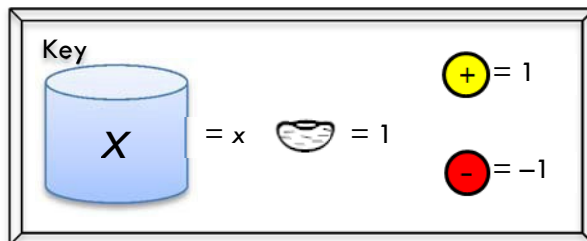


## Modeling, Solving & Representing Solutions on a Number Line

### Independent Practice – Answer Key

**Directions:** For each problem situation below, write an equation you can use to solve the problem. Use cups and counters to solve the equation. Represent the solution on a number line and use substitution to verify your solution.



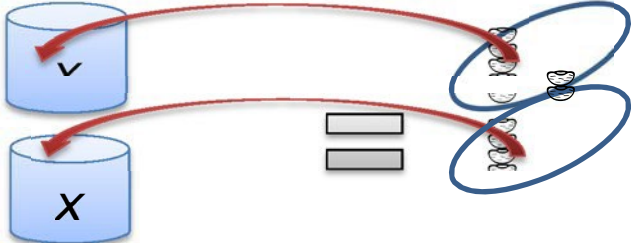
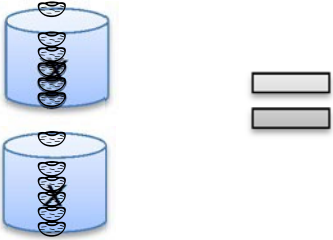
1. Josh is thinking of a number. Five more than twice his number equals 17. What number is Josh thinking of?

a) Write the equation.

$$2x + 5 = 17$$

b) Solve the equation using cups and counters. Sketch each step.

| Model | Symbols               |
|-------|-----------------------|
|       | $2x + 5 = 17$         |
|       | $2x + 5 - 5 = 17 - 5$ |
|       | $2x = 12$             |

|                                                                                   |                         |
|-----------------------------------------------------------------------------------|-------------------------|
|  | $2x \div 2 = 12 \div 2$ |
|  | $x = 6$                 |

c) Represent the solution on a number line.

**5**

**10**

**15**

d) Use substitution to determine whether 4, 6, or 8 are solutions to the equation.

$$2(4) + 5 = 17$$

$$8 + 5 = 17$$

$$13 \neq 17$$

**4 is not a solution.**

$$2(6) + 5 = 17$$

$$12 + 5 = 17$$

$$17 = 17$$

**6 is a solution.**

$$2(8) + 5 = 17$$

$$16 + 5 = 17$$

$$21 \neq 17$$

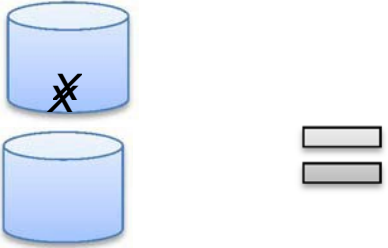
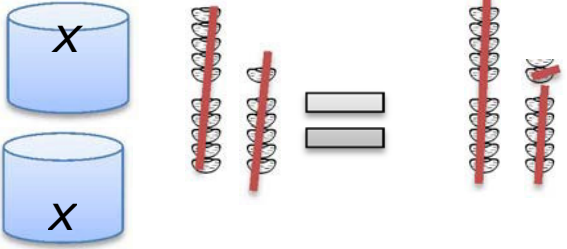
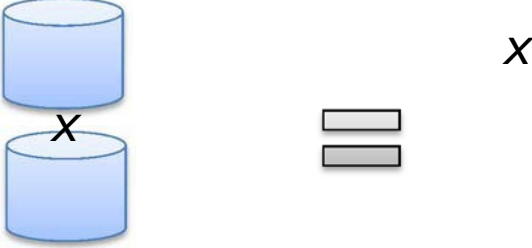
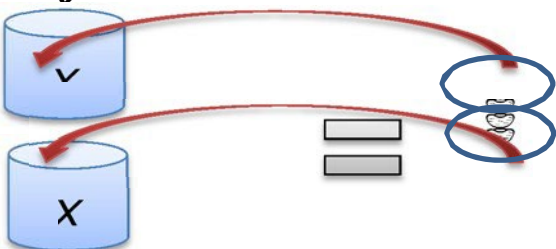
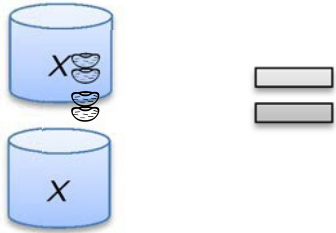
**8 is not a solution.**

2. A rectangle has a length of 8 meters and a perimeter of 20 meters.  
What is the width,  $x$ , of the rectangle?

a) Write the equation.

$$2x + 16 = 20$$

b) Solve the equation using cups and counters. Sketch each step.

| Model                                                                               | Symbols                  |
|-------------------------------------------------------------------------------------|--------------------------|
|    | $2x + 16 = 20$           |
|   | $2x + 16 - 16 = 20 - 16$ |
|  | $2x = 4$                 |
|  | $2x \div 2 = 4 \div 2$   |
|  | $x = 2$                  |



c) Represent the solution on a number line.

**0            1            2            3            4            5            6**

d) Use substitution to determine whether 2, 4, or 6 are solutions to the equation.

$$2(2) + 16 = 20$$

$$4 + 16 = 20$$

$$20 = 20$$

**2 is a solution.**

$$2(4) + 16 = 20$$

$$8 + 16$$

$$24 \neq 20$$

**4 is not a solution.**

$$2(6) + 16 = 20$$

$$12 + 16 = 20$$

$$28 \neq 20$$

**6 is not a solution.**

3. Maria's age is 4 years less than three times Jackson's age. Maria is 23 years old. How old is Jackson?

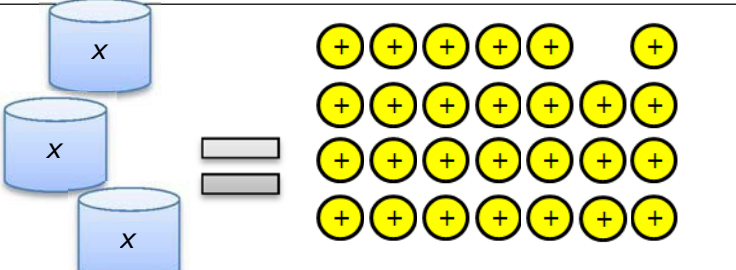
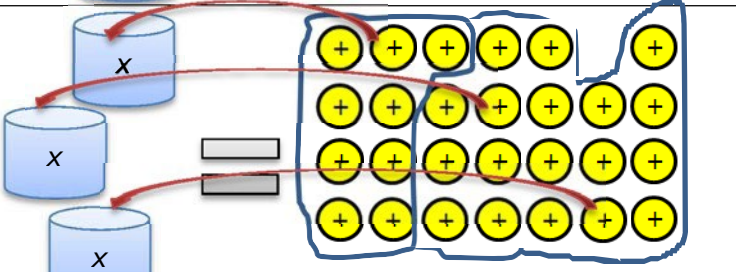
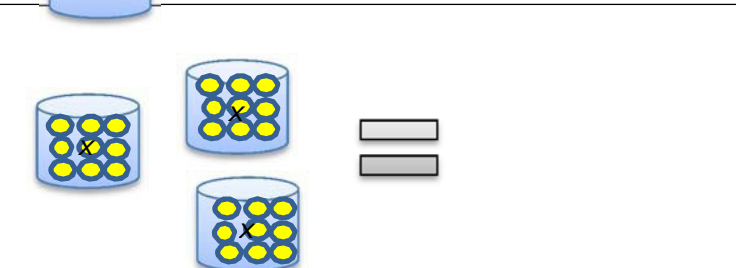
a) Write the equation.

$$3x - 4 = 23$$

b) Solve the equation using cups and two-color counters. Sketch each step.

| Model | Symbols               |
|-------|-----------------------|
|       | $3x - 4 = 23$         |
|       | $3x - 4 + 4 = 23 + 4$ |



|                                                                                    |                         |
|------------------------------------------------------------------------------------|-------------------------|
|  | $3x = 27$               |
|  | $3x \div 3 = 27 \div 3$ |
|  | $x = 9$                 |

c) Represent the solution on a number line.

**0**

**5**

**10**

d) Use substitution to determine whether 6, 9, or 12 are solutions to the equation.

$$3(6) - 4 = 23$$

$$18 - 4 = 23$$

$$14 \neq 23$$

**6 is not a solution.**

$$3(9) - 4 = 23$$

$$27 - 4 = 23$$

$$23 = 23$$

**9 is a solution.**

$$3(12) - 4 = 23$$

$$36 - 4 = 23$$

$$32 \neq 23$$

**12 is not a solution.**

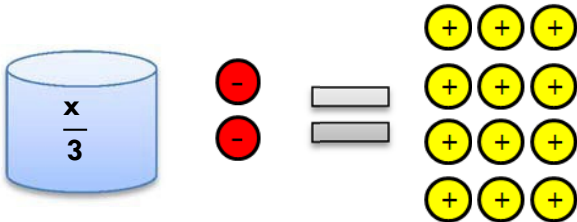
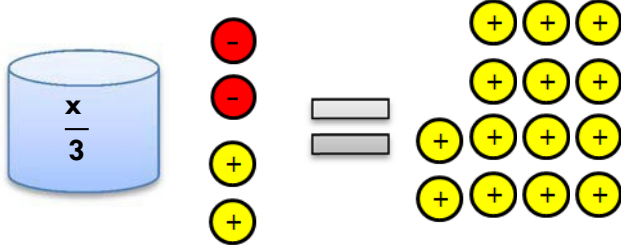
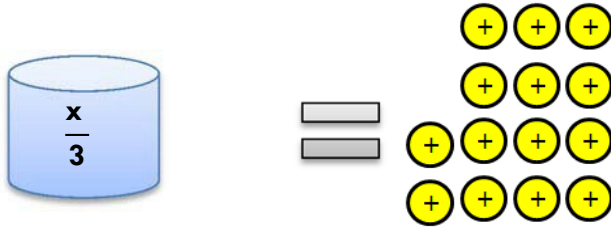
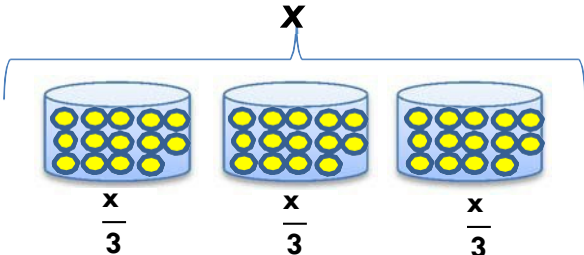
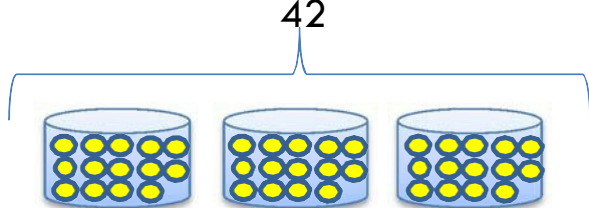


4. Amanda and two friends earned money from their combined garage sale. After Amanda spent \$2 out of her earnings she had \$12 left. How much money,  $x$ , did the combined garage sale earn?

a) Write the equation.

$$\frac{x}{3} - 2 = 12$$

b) Solve the equation using cups and counters. Sketch each step.

| Model                                                                                | Symbols                              |
|--------------------------------------------------------------------------------------|--------------------------------------|
|     | $\frac{x}{3} - 2 = 12$               |
|   | $\frac{x}{3} - 2 + 2 = 12 + 2$       |
|  | $\frac{x}{3} = 14$                   |
|   | $3 \times \frac{x}{3} = 14 \times 3$ |
|   | $x = 42$                             |



c) Represent the solution on a number line.

**30      32      34      36      38      40      42**

d) Use substitution to determine whether 39, 42, or 45 are solutions to the equation.

$$\begin{array}{r} 39 \\ 3 \end{array} - 2 = 12$$

$$\begin{array}{r} 13 - 2 = 12 \\ 11 \neq 12 \end{array}$$

**39 is not a solution.**

$$\begin{array}{r} 42 \\ 3 \end{array} - 2 = 12$$

$$\begin{array}{r} 14 - 2 = 12 \\ 12 = 12 \end{array}$$

**42 is a solution.**

$$\begin{array}{r} 45 \\ 3 \end{array} - 2 = 12$$

$$\begin{array}{r} 15 - 2 = 12 \\ 13 \neq 12 \end{array}$$

**45 is not a solution.**

## Debriefing Questions

1. How did you use the model to represent each expression?  
**Let the cup represent  $x$ . For positive whole numbers, you can either use beans or yellow counters. For negative numbers, use red counters.**
2. For equations with a sum or difference, how did you determine the value of  $x$ ? **Remove beans from both sides of the equal sign or use add the same amount of two-color counters to both sides of the equal sign and remove zero pairs.**
3. For equations with a product, how did you determine the value of  $x$ ? **Divide the beans or counters among the number of cups until each cup has the same number of beans or counters.**
4. For equations with a quotient, how did you determine the value of  $x$ ? **First determine the fractional part of  $x$  and then multiply that part by the number of parts.**



## Extra Practice:

Write equations for the following problem situations and solve the equations.

1. The perimeter of a rectangle is 48 centimeters. The length is 10 cm. What is the width of the rectangle,  $w$ ?

$$\begin{aligned}2(10) + 2w &= 48 \\ w &= 14 \text{ centimeters}\end{aligned}$$

2. Billy sold half of his video games and then bought nine more. He now has 28 video games. With how many did he begin?

$$\frac{x}{2} + 9 = 28$$

$$x = 38 \text{ video games}$$

3. Juan caught a fish that weighed 7.5 pounds. Orlando caught 3 fish that each weighed the same. All 4 fish together weighed 32.25 pounds. What is the weight,  $x$ , of Orlando's fish?

$$\begin{aligned}7.5 + 3x &= 32.25 \\ x &= 8.25 \text{ pounds}\end{aligned}$$

4. Mr. Sanchez said, "300 reduced by twice my age is 192." How old,  $x$ , is Mr. Sanchez?

$$\begin{aligned}300 - 2x &= 192 \\ x &= 54 \text{ years old}\end{aligned}$$

5. An angle has a measure of  $51.4^\circ$ . Its complement has a measure of  $2x^\circ$ . What is the value of  $x$ ?

$$\begin{aligned}51.4 + 2x &= 90 \\ x &= 19.3\end{aligned}$$

6. The measures of the interior angles of a triangle are  $20^\circ$ ,  $25^\circ$  and  $3x^\circ$ . What is the value of  $x$ ?

$$\begin{aligned}20 + 25 + 3x &= 180 \\ x &= 45\end{aligned}$$

