

Model and Solve Equations

variable

- a letter that represents an unknown number or numbers

$$3n + 5 = 20$$

EQUATION

$$S = \frac{d}{t}$$

FORMULA

opposite operation

- an operation that undoes a related operation
- + and - are opposite operations
- \times and \div are opposite operations

$$4n - 2$$

EXPRESSION

At the 2002 winter Olympics, Canada earned three medals for speed skating. Speed skaters can reach speeds of 800 m/min. They travel a distance of d metres around a track in t minutes. This is modelled by the formula $d = 800t$. At this speed, how long will a skater take to complete a 1500-m race? How can you find out?

$$d = 800t$$

$$1500 = 800t$$

number next to a letter means multiply.

$$\frac{1500}{800} = \frac{800t}{800}$$

$$1.875 \text{ mins} = t$$

$$= 112.5 \text{ seconds}$$

$$= 1 \text{ min } 52.5 \text{ seconds}$$

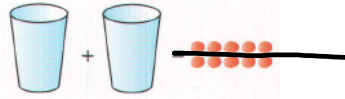
1. You have 10 chocolates to share equally with a friend.

a) Model this situation with cups and counters.

b) How many counters go in each cup? How did you determine this?

c) Write equations to model the steps of your solution.

d) What is your **variable**? What does it represent?



5 counters
in each cup

Let $c = \#$ of counters
in each cup

$$\frac{2c}{2} = \frac{10}{2}$$

$$c = 5$$

\Rightarrow 5 counters in each cup.

2. You have some candies in your pocket. A friend gives you five more candies. When you count all your candies, you have 14.

a) Model this situation using cups and counters.

b) What does the cup represent? How can you find the value of the cup?

c) Write equations to model the steps of your solution.

d) What does your variable represent?

Let $n = \#$ of candies I
had

$$n + 5 = 14$$

$$n + 5 - 5 = 14 - 5$$

$$n = 9$$

\Rightarrow I had 9 candies

Example 1: Solve a Problem Using a Balanced Equation

Elana has a bunch of grapes. Her friend Maya pulls off 10 grapes. There are two grapes left on the stem.

- Model this situation using cups and counters.
- Find the value of the cup. What does the cup represent?
- Use a balanced equation to find how many grapes Elana started with. Define your variable.

Let n = # of grapes to start with

$$n - 10 = 2$$

$$n - 10 + 10 = 2 + 10$$

$$n = 12$$

Example 2: Apply the Opposite Operation

Model each equation. Solve by inspection. Then, solve using the **opposite operation**. Verify your solution.

- $2t = 10$
- $9 = u + 3$

$$a) \frac{2t}{2} = \frac{10}{2}$$

$$t = 5$$

$$b) 9 = u + 3$$

$$9 - 3 = u + 3 - 3$$

$$6 = u$$

Key Ideas

- Equations can be solved in several ways. You can

- Solve by inspection.

$$16 = x - 5 \quad \text{The answer is } x = 21.$$

- Model the equation.



- Perform the opposite operation on both sides of the equal sign.

$$\begin{aligned} k \times 9.7 &= 164.9 \\ k \times 9.7 \div 9.7 &= 164.9 \div 9.7 \\ k &= 17 \end{aligned}$$

- To check your solution, substitute your answer into the equation. Then, compare the left side of the equal sign to the right side.

$$\begin{aligned} \text{Substitute } k &= 17. \\ \text{Left Side} &= k \times 9.7 & \text{Right Side} &= 164.9 \\ &= 17 \times 9.7 \\ &= 164.9 \\ \text{Left Side} &= \text{Right Side} \end{aligned}$$

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