

Hints & selected answers version!

CREATING AND SOLVING EQUATIONS FROM STORY PROBLEMS



- 1) **PICTURE** and/or state a **POSSIBLE ANSWER** before you begin work on the problem, even if it is an estimate or a wild guess.
- 2) Begin by defining unknowns using letters (variables)
- 3) List all of the unknowns using a different letter (variable)
- 4) Once you have all of the unknowns listed and assigned, try to define one variable **IN TERMS OF** one of the others. For example, if you have two unknowns, such as the price of a book and the price of a DVD, you might call them ***b*** and ***d*** respectively. But, if you know that the book costs \$6 more than the DVD, you can define the price of the book **IN TERMS OF** the price of the DVD as follows:

$$b = d + 6$$

Check out the **FYI** on the next page to see how this can work for you!

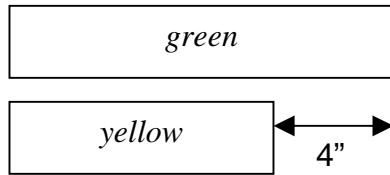
- 5) Accept the fact that the *Guess-and-check* method is officially for whiners!!
- 6) **RE-STATE** the problem using an **ALGEBRAIC EQUATION**. In order to create an equation, you must create two expressions that **BALANCE** one another. An expression can be something as complex as “ $3(x+1) + 4x - 7$ ” or as simple as “19”.



Jose cut a 40-inch long board into two pieces and painted one piece green and the other piece yellow. The green board is four inches longer than the yellow board. How long is each of the boards?

Write an equation and solve.

OK Robin, let's see how we can get started. First, let's draw a picture:



Nice job, Alfred. Next, let's assign variables (letters) to any unknowns. At first glance, we have two unknowns:

g is length of the green board

y is length of the yellow board

So, our first stab at an equation looks like this:

$$g + y = 40$$

But wait! Holy Substitution, Batman!! We can define g **IN TERMS OF** y , as follows:

$$g = y + 4$$

So Robin, do you mean we can re-write the equation using just one variable?! Like this?

$$(y + 4) + y = 40$$

Even *The Riddler* can't confuse us now, Batman! Let's SOLVE!!

$$(y + 4) + y = 40$$

CLT

$$2y + 4 = 40$$

subtract 4 from both sides

$$\frac{-4}{2} \quad \frac{-4}{2}$$

$$\frac{2y}{2} = \frac{36}{2}$$

divide both sides by 2

$$y = 18$$

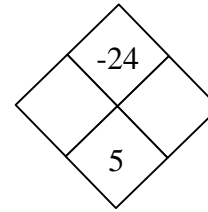
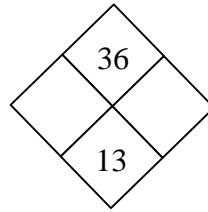
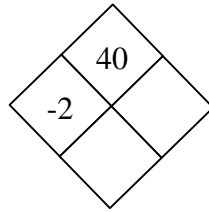
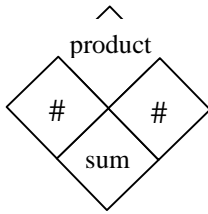
So, if the length of the yellow board is **18**, then the length of the green board must be **22**!!

Yup, $18 + 22 = 40$

Holy PEMDAS, Batman!! Let's do some more!!



1.



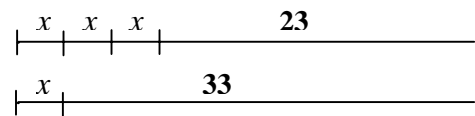
2. A fallen tree branch 94 inches long is cut into seven logs, all the same length. A ten-inch piece is left over. How long is each log?

Hint: The length of the small logs is unknown, so let's call it l .

There is a 10-inch piece leftover. The sum of 7 small logs and the 10-inch piece is 94.

So... $7l + 10 = 94$

3. The two line segments at right have equal lengths.
Write an equation that represents the diagram.
How long is x ?



Hint: Use an equation to balance the two equal lengths and then solve.

So... $3x + 23 = x + 33$

4. For parts (a), (b), and (c), write an **algebraic expression** that represents each amount. Then generalize your process in part (d).

- a) A three-foot piece of string is cut. If one piece is x feet long, how long is the other piece? **Hint: DRAW A PICTURE!!**



- b) Twenty raffle tickets were sold. If g girls bought raffle tickets, how many boys bought raffle tickets? **Hint: 20 minus ?**

- c) A pizza has twelve slices. If Karen eats p slices, how many slices are left?

- d) Write a sentence or two that explains a general method for expressing two parts of a whole using a single variable. Use the words “unknown part” and “known part” in your explanation.

5. Find three consecutive even numbers whose sum is 84.

(No guess-and-check. Set up your unknowns, you Penguin you!)

Hint: Start with three number. Since we don't know what they are, we'll assign variables. Let's call them m , n and p .

Simply defined:

m is the first number

n is the second number

p is the third number

Since they are CONSECUTIVE EVEN numbers, we know the following:

$$n = m + 2$$

$$p = m + 4$$

Aren't we just sooooo smart?! Now, YOU should be able to write an equation that shows the sum of these three numbers, using only the variable m . This is because YOU were able to state n and p IN TERMS OF m (I'm so proud!).

6. Mary Kate and Ashley are twins. They have a brother who is eleven years younger and a sister who is four years older. The sum of the ages of all four siblings is 69. Find the older sister's age.

m Mary Kate
a Ashley
b brother
s sister

In a similar fashion as problem #5, you should be able to define *a*, *b*, and *s* IN TERMS OF *m*.

7. Simplify each expression by removing parentheses and combining like terms:

a) $3(2x+7)-10$

c) $-5-2(x-9)$

Hint: Distribute, then CLT

b) $-3(m+2)+4m+7$

d) $2x^2+3x-7-5(x^2-x+3)$

8. The perimeter of a triangle is 76 centimeters. The second side is twice as long as the first side. The third side is four centimeters shorter than the second side. How long is each side?

Hint: Start with three variables, and then define the second side in terms of the first. Then, define the third side in terms of the second.

9. After a home remodeling project, Susan paid \$12,490 to a contractor who used the money to pay himself, a plumber, an electrician and a tiling expert. The plumber and electrician received the same amount, while the tiling expert received \$2,000 less. The contractor received three times as much as the tiling expert. How much did each person get?

Hint: You should have a strategy from the previous problems

10. Part of \$20,000 is invested at 12% interest. The rest is invested at 8% interest. The total interest earned from the two accounts is \$1800. How much money was invested at each rate?

Hint: Review the strategies from problem #4 above, in order to define the two amounts of money that you have in each account. You have x in one account, since the sum is 20,000, how much do you start out with in the second account?

11. *Simplify each expression:*

Hint: “Do the math” using the coefficients.

a) $2x + \frac{1}{2}x$

c) $1y - 0.2y$

Hint: What’s $2 + \frac{1}{2}$?

Hint: What’s $1.0 - 0.2$?

b) $x + .03x$

d) $2m - \frac{1}{3}m$

Hint: What’s $1.00 + 0.03$?

Hint: What’s $2 - 1/3$?

N.B. the coefficient of x that is “known but not shown” is **1**

12. The length of a rectangle is twice its width. Its perimeter is 36 centimeters. Find the area of the rectangle.
13. If one side of a square is increased by 12 feet and an adjacent side is decreased by three feet, a rectangle is formed whose perimeter is 64 feet. Draw a diagram and find the length of the original of the side of the original square.

14. Solve for x :

Use your EQUATIONS ACTION BANK paper, or plain notebook paper.
SHOW and EXPLAIN ALL STEPS!!

a) $3(x - 4) = 15$

Solutions: $x = 9$

c) $5(2x - 3) - 4x = 8$

$x = 23/6$

b) $-2(x - 2) = 11$

$x = -7/2$

d) $\frac{2}{3}x = 9$

$x = 27/2$