

Word Problems:

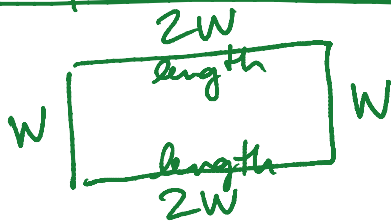
Linear and Quadratic Equations  
in One Variable

Added step with word problems:  
we must write out the  
equations to be solved  
by translating from words  
into math symbols.

## Examples:

1) You have 99 ft. of fencing, and you would like to fence in a long rectangular playground that is twice as long as it is wide. If you want to use up all the fencing, how wide should the playground be?

Draw a picture (if possible):



Define the variables:

- Total amount of fencing is 99 ft  
= the perimeter of the playground
- Width of the rectangle is what I want to find, so I give it a variable name W
- Length should be twice the width  
so length = 2W

Use a formula I know, or create one to relate all the variables:

Formula for perimeter of a rectangle:

$$P = 2 \cdot L + 2 \cdot W$$

So plugging in our variables gives:

$$\boxed{99 = 2 \cdot (2W) + 2 \cdot W \quad \text{Solve for } W.}$$

Solving we get:

$$99 = 2(2W) + 2W$$

$$99 = 4W + 2W$$

$$\frac{99}{6} = \frac{6W}{6}$$

$$16.5 \text{ ft} = W$$

not reasonable!

ex: 165 ft

I only have 99 ft!

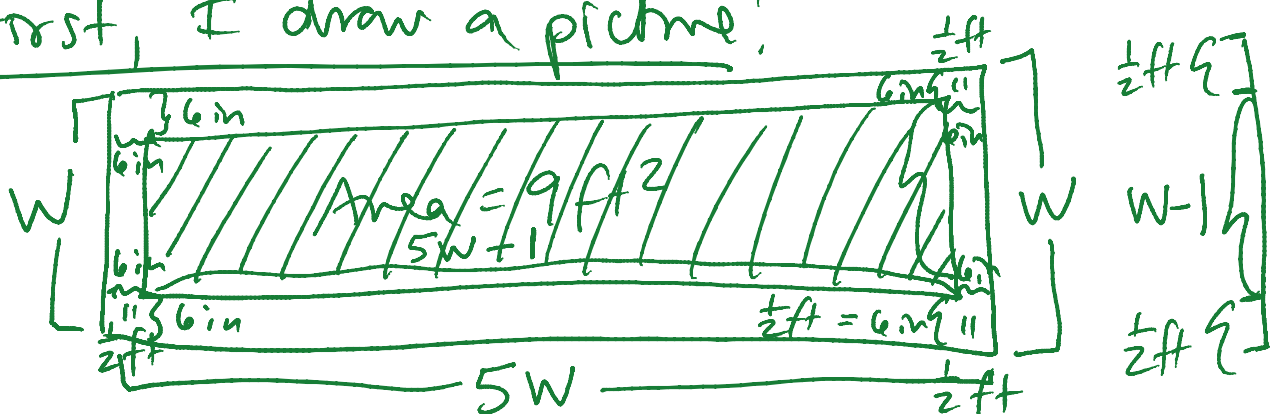
1.65 ft

clearly too small!

Note! With word problems,  
once we get our answer, we should:  
- include the units (ft, sec, \$, etc)  
- check our answer for reasonableness

2) I want to make a blackboard on the wall of my room with a 6 in border all around it. I'd like the whole length of the blackboard (including the border) to be five times the total width (including the border). The can of Blackboard paint that I have (which can be used to paint the area inside the border) says that it will cover  $9 \text{ ft}^2$  of wall space. What is the biggest width I can choose for my blackboard without buying more paint?

First, I draw a picture!



Now I define my variables:

- Area of the inside =  $9 \text{ ft}^2$  ←

- Width (w/frame) =  $\underline{W}$  → Looking for this

- Length (w/frame) =  $5W$

- width (w/o frame) =  $W - 1 \text{ (ft)}$

- length (w/o frame) =  $5W - 1 \text{ (ft)}$

Find a formula: Area = length x width

$$9 = (W - 1)(5W - 1) \quad \text{Solve for } W.$$

$$9 = (W-1)(5W-1) \text{ solve for } W$$

$$\Rightarrow 9 = 5W^2 - 6W + 1$$

$$\Rightarrow 0 = 5W^2 - 6W - 8$$

$$\Rightarrow 0 = (5W^2 - 10W) + (4W - 8)$$

$$\Rightarrow 0 = 5W(W-2) + 4(W-2)$$

$$\Rightarrow 0 = (5W+4)(W-2)$$

$$\Rightarrow 5W+4=0 \quad \text{or} \quad W-2=0$$

$$\Rightarrow \frac{5W}{5} = \frac{-4}{5}$$

$$\Rightarrow \boxed{W = -\frac{4}{5}} \text{ or}$$

$$\boxed{W = 2}$$

~~$\frac{-4}{5}$  ft~~ or  $\boxed{2 \text{ ft}}$  as the width of my blackboard

3) The bookstore marks up textbooks 40% over the price that the publisher charges them to buy the book. If your math book cost you \$101.50, what did the publisher originally charge the bookstore for the book?

Define the variables:

- percentage increase =  $40\% = 0.4$
- looking for original price =  $P$
- final price = \$101.50

Formula/Equation

$$\text{original price} + (\text{original price}) \cdot (\text{percentage increase}) = \text{final price}$$

$$(1 + \text{percentage increase})(\text{original price}) = \text{final price}$$

$$P + 0.40P = \$101.50$$

$$\frac{1.4P}{1.4} = \frac{\$101.50}{1.4}$$

$$P = \$72.50$$