Math 95--Quadratic Word Problems--page 1

There are times when you will be working quadratic word problems, but you may not know the problem is quadratic until after you've removed parentheses and observed that you have a power of 2 in the equation. Because of the power of 2, you will solve using factoring. Many times, those quadratic equations are related to geometry problems. When a problem is based on a shape, I draw the shape. Using direct translation, I label the drawing. Then I use the drawing to figure out the formula that's needed. For quadratic equations, you usually use area formulas or the Pythagorean formula. After you set up your formula, you solve.

a: A rectangular flower bed has a length which is 3 feet more than the width. The area is 40 square feet. Find the length and width.

Draw the rectangle.

Label x = width. Label x + 3 = length. The area formula for a rectangle is $lw = A$. Replace l with the phrase (x + 3), replace w with (x), replace area with 40.

Formula:	$lw = A$			
The equation reads:	$(x + 3)(x) = 40$			
Distribute:	$x^2 + 3x = 40$			Quadratic so use factoring!
Rearrange:	$x^2 + 3x - 40 = 0$			
Factor:	$(x + 8)(x - 5) = 0$			
Set to zero:	$x + 8 = 0$	or	$x - 5 = 0$	
Solve:	$x = -8$	or	$x = 5$	Only x = 5 is logical so…
Answer:	**x = width = 5 ft**			
	x + 3 = length = 5 + 3 = 8 ft			

b: You may not remember what the Pythagorean formula says. The formula itself is $a^2 + b^2 = c^2$, where a and b represent the legs of a right triangle and c represents the hypotenuse of a right triangle. I usually use this formula: $leg^2 + leg^2 = hyp^2$. Before we do a semi-complicated example, let's do a fairly easy one.

The legs of a right triangle are 6 inches and 8 inches. Find the hypotenuse.

Draw the triangle and label the legs. c = hypotenuse

Write the formula:	$leg^2 + leg^2 = hyp^2$			
Substitute:	$6^2 + 8^2 = c^2$			
Simplify:	$36 + 64 = c^2$			
	$100 = c^2$			Quadratic so use factoring!
Rearrange:	$0 = c^2 - 100$			
Factor:	$0 = (c + 10)(c - 10)$			
Set to zero:	$c + 10 = 0$	or	$c - 10 = 0$	
Solve:	$c = -10$	or	$c = 10$	Only c = 10 is logical so…
Answer:	**c = hypotenuse = 10 inches**			

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c: A 39 foot ladder is resting against a building. The top of the ladder reaches a height of 36 feet. Find how far the ladder is from the bottom of the building.

Draw the triangle.

x = width of bottom of ladder from building– a leg
36 = height of top of ladder from the ground– a leg
39 = hypotenuse

Write the formula:	$leg^2 + leg^2 = hyp^2$	
Substitute:	$(x)^2 + (36)^2 = (39)^2$	
Simplify and solve:	$x^2 + 1296 = 1521$	
	$x^2 = 225$	Quadratic so use factoring!
	$x^2 - 225 = 0$	
	$(x + 15)(x - 15) = 0$	
	$x + 15 = 0$ or $x - 15 = 0$	
	$x = -15$ or $x = 15$	Only x = 15 is logical so…
Answer:	**x= width of bottom of ladder from building = 15 feet**	

The only way to get good at these is to practice. So try the following!

Set up and solve. I recommend that you draw the shape, label anything you know, choose an appropriate formula, and fill in the formula using the drawing you made.

1. A closet, rectangular in shape, has a length which is 5 feet more than the width. The area is 36 square feet. Find the dimensions.

2. A family decides to add a room onto their house. The room has a length which is 4 feet more than the width. The area is 60 square feet. Find the dimensions.

3. A television screen has a diagonal of 30 inches. The bottom of the screen measures 24 inches. What is the height of the screen?

4. A ladder is resting against a wall. The top of the ladder touches the wall at a height of 24 feet. The bottom of the ladder is 10 feet from the wall. How long is the ladder?

5. A wire stretches from the top of a pole 20 feet high to a stake in the ground which is 15 feet from the foot of the pole. Find the length of the wire.

Answer Key.

1.	width = x; length = x+ 5;	$(x+ 5)(x) = 36$;	width is 4 ft, length is 9 ft
2.	width = x; length = x+ 4;	$(x+ 4)(x) = 60$;	width is 6 ft, length is 10 ft
3.	leg = x;	$24^2 + x^2 = 30^2$;	height is 18 inches
4.	hypotenuse = x;	$24^2 + 10^2 = x^2$;	ladder is 26 ft
5.	hypotenuse = x;	$20^2 + 15^2 = x^2$;	wire is 25 ft