

Math-3A

Lesson 6-11

Modeling with Quadratic Equations

Area problems

Quantity	Unit of Measure
Height	Inches, feet, miles, etc.
Weight	Pounds, ounces, kilograms, grams
Temperature	Degrees F, Degrees C, Degrees K

Sometimes ratios of quantities become new quantities

Quantity	Ratio of:	Unit of Measure
Speed	Distance/time	Mile/hr, ft/sec, km/hr
“unit price”	Cost/weight	\$/lbm, \$/ounce
Efficiency	Distance/volume used	Miles/gallon, Km/liter

Vocabulary

Mathematical Modeling: representing a real-world phenomenon or quantity with an equation or inequality.

Formula: an equation that shows the relationship between two or more quantities.

Examples of formulas you've seen are:

$$A_{\text{circle}} = \pi r^2$$

$$V_{\text{box}} = L * w * h$$

$$A_{\text{rectangle}} = L * W$$

$$A = \frac{1}{2}(b_1 + b_2)h$$

Expressions from Phrases

What mathematical expression represents the following?

Three more than twice a number $2x + 3$

Five less than three times a number $3x - 5$

The width is 4 times the length. $w = 4L$

The area of a rectangle whose width is 4 times its length. $A = Lw$
 $A = L(4L)$

Write a mathematical expression that represent each statement:

1. The number of girls is three less than twice the number of boys. $g = 2b - 3$

2. The salary after a 4% increase $S_f = S_i + 0.04 * S_i$

3. Area of a rectangle whose length is 2 more than twice its width. $A = (2w + 2) * w$ $A = 2w^2 + 2w$

4. The area of a rectangle with the same size square cut out of each corner. $A = Lw - 4x^2$

Area of a Rectangle

The length of a rectangle is 4 more than 3 times its width.

The area of the rectangle is 200 square inches.

What is the length and width of the rectangle?

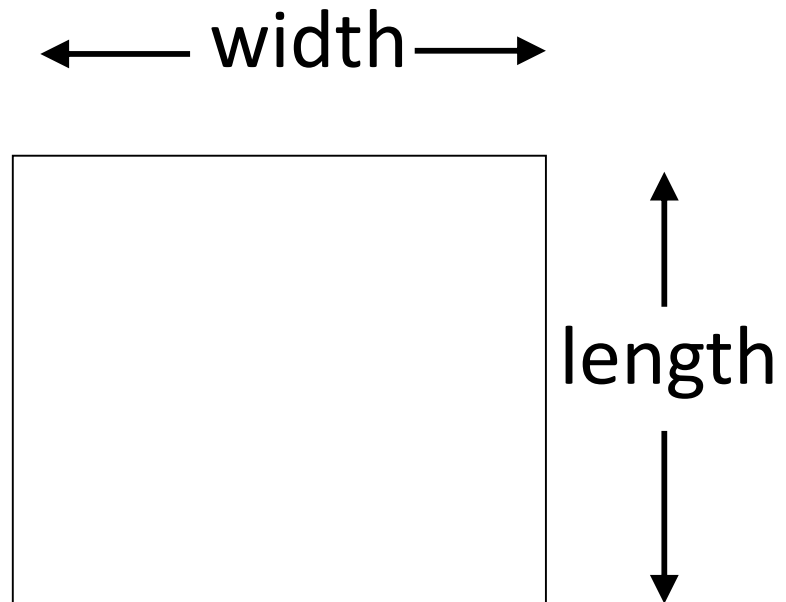
$$\text{Area} = L * W$$

$$L = 3W + 4 \quad A = 200$$

Using substitution:

$$200 = (3W + 4) * W$$

Solve by graphing.



Area of a Rectangle

$$\text{Area} = L * W$$

$$L = 3W + 4 \quad A = 200$$

Using substitution:

$$200 = (3W + 4) * W$$

Solve by graphing.

Get into “zero equals form”

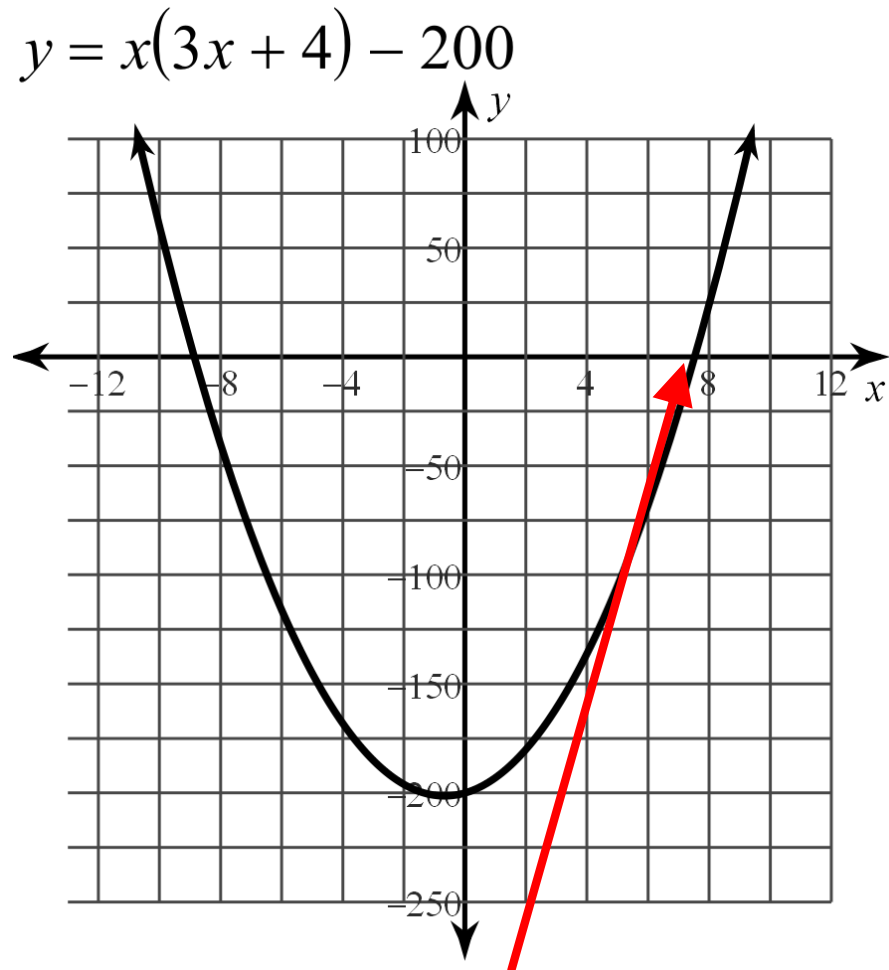
$$0 = W(3W + 4) - 200$$

Let ‘x’ = width

$$0 = x(3x + 4) - 200$$

$$y = x(3x + 4) - 200$$

Find the “zero” of the equation.



‘x’ = width = 7.53 inches

Area of a Rectangle

$$\text{Area} = L * W$$

$$L = 3W + 4 \quad A = 200$$

Using substitution:

$$200 = (3W + 4) * W$$

$$y = x(3x + 4) - 200$$

Using substitution:

$$L = 3W + 4$$

$$L = 3(7.53) + 4$$

$$L = 26.59 \text{ inches}$$

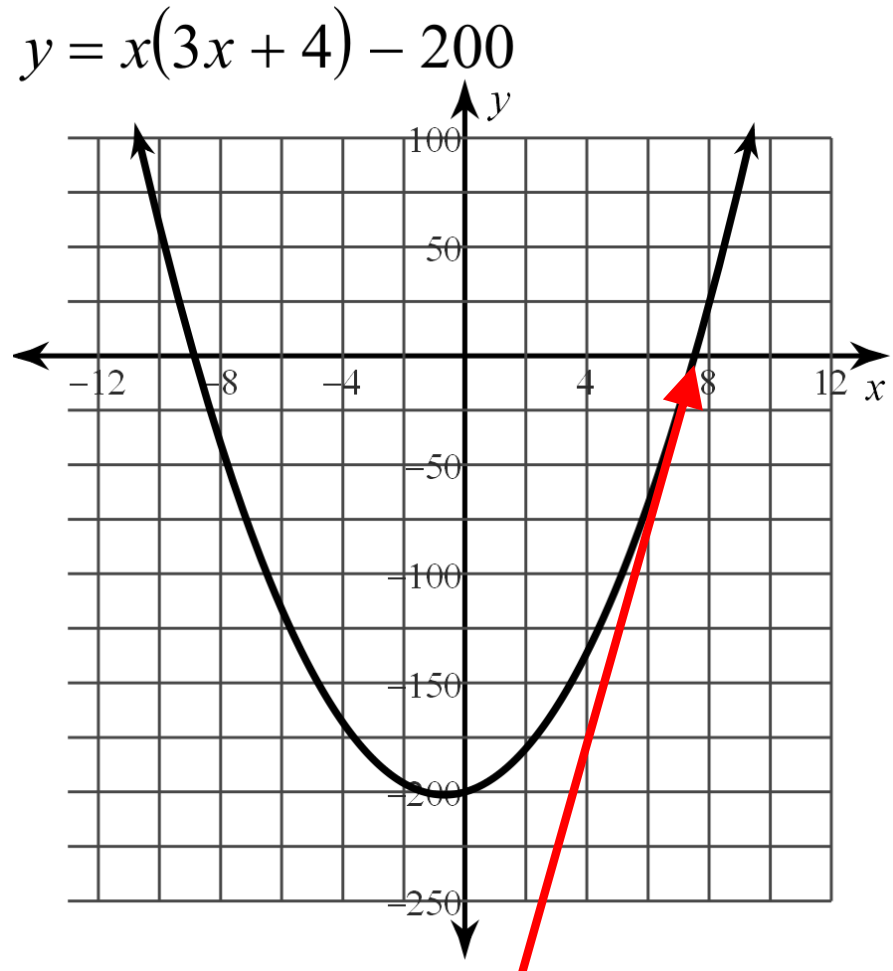
Check:

$$200 = L * W$$

Check:

$$200 = (26.59)(7.53)$$

Find the “zero” of the equation.



‘x’ = width = 7.53 inches

Area of a Rectangle

The length of a rectangle is 7 less than 4 times its width.

The area of the rectangle is 6600 square inches.

What is the length and width of the rectangle?

$$\text{Area} = \underline{\hspace{2cm}} * \underline{\hspace{2cm}}$$

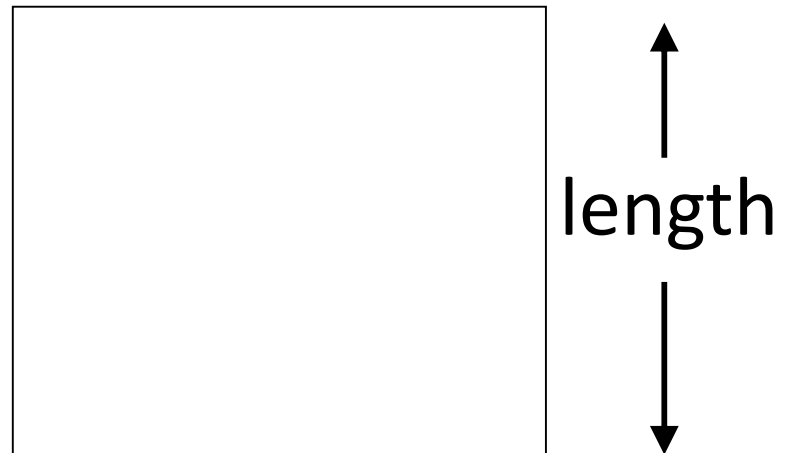
$$L = \underline{\hspace{2cm}} \quad A = \underline{\hspace{2cm}}$$

← width →

Using substitution:

$$\underline{\hspace{2cm}} = (\underline{\hspace{2cm}}) * \underline{\hspace{2cm}}$$

Solve by graphing.

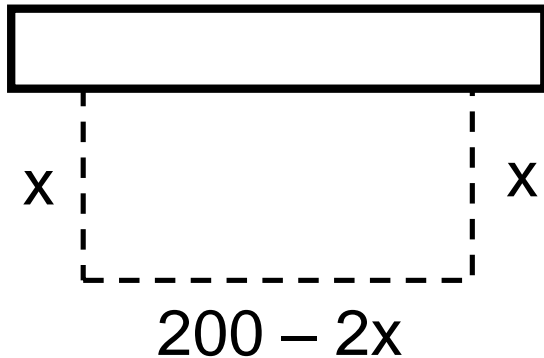


Area of a Rectangle

200 feet of fence is used to build a rectangular horse corral.

One side of the corral is next to a large barn and does not need to be fence.

a) Draw a top-view picture of the corral and barn.



b) Label the length of each side of a fenced corral using only one variable.

c) Using the rectangle area formula, write an equation that has only one variable.

$$A(x) = x(200 - 2x)$$

d) What are the x-intercepts?

$$A(x) = x(200 - 2x)$$

$(0, 0)$ and $(100, 0)$

e) What is the vertex?

$(50, f(50)) \rightarrow (50, 5000)$

f) Hand-draw a graph of the equation with the axes correctly labeled.

g) Graph the equation on your calculator, and find the vertex using “2nd” + “calc” + “maximum”

$(50, 5000)$

