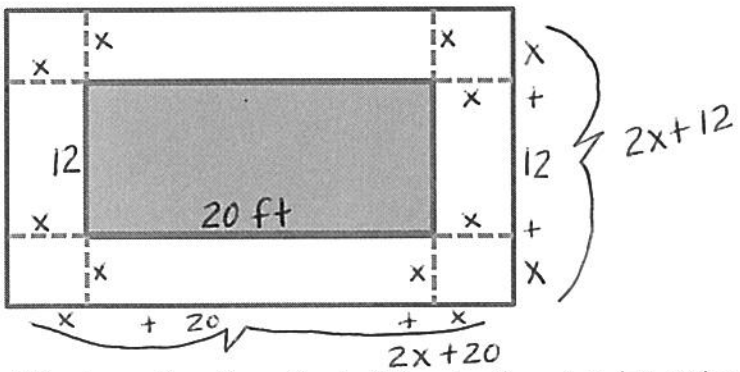
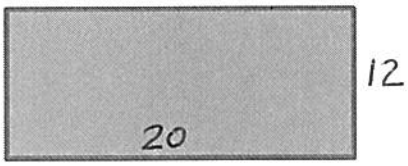
Essential Question: How can quadratic equations help us solve more complicated problems?

1. The Smiths have decided to put a paved border of uniform width around their swimming pool. The pool is a rectangular shape that measures 12 feet by 20 feet. The area of the border is 68 ft^2 and the width of the border is x feet.

a. Label the diagram to represent the scenario presented above.

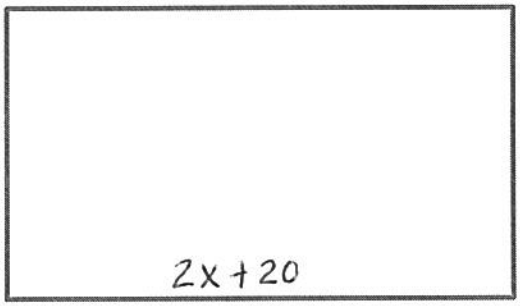


b. What are the dimensions of the small rectangle? What is the area of the small rectangle?



$A = \ell \cdot w$
$A = 12 \cdot 20$
$A = 240 \text{ feet}^2$

c. What are the dimensions of the large rectangle? What is the area of the large rectangle?



$A = \ell \cdot w$
$A = (2x+20)(2x+12)$
$A = 4x^2 + 24x + 40x + 240$
$A = 4x^2 + 64x + 240$

Area = rectangle + border = 240 + 68 = 308

d. Write an equation that represents the area of the large rectangle. Solve the equation. What does the value of the variable represent?

$4x^2 + 64x + 240 = 308$

$\frac{4x^2}{4} + \frac{64x}{4} - \frac{68}{4} = \frac{0}{4}$

$x^2 + 16x - 17 = 0$
$(x+17)(x-1) = 0$

$x+17=0$	$x-1=0$
reject $x=-17$	$x=1$

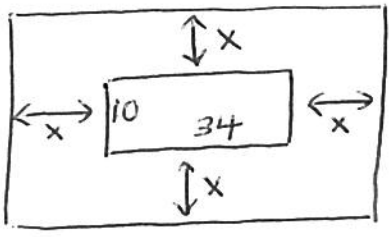
x = width of the border

x = 1 foot width around the pool

2. A museum is displaying Egyptian artifacts in a 34 by 10 foot rectangular area. To protect the artifacts, a roped-off border has been created around the display. The combined area of the display and the border totals 640 square feet. Find the width of the border.

(Assume width is the same all around the display)

a. Draw a diagram to represent the scenario. Let x represent the width of the border.



b. Represent the dimensions of the large rectangle algebraically.

length: $2x + 34$

width: $2x + 10$

c. Write an equation that represents the combined area of the display and the surrounding border. Solve the equation to find the value of x.

$A = \ell \cdot w$

$(2x+34)(2x+10) = 640$

$4x^2 + 20x + 68x + 340 = 640$

$4x^2 + 88x + 340 = 640$

$\frac{4x^2}{4} + \frac{88x}{4} - \frac{300}{4} = \frac{0}{4}$

$x^2 + 22x - 75 = 0$

$(x+25)(x-3) = 0$

$x+25=0 \quad | \quad x-3=0$

$x = -25 \quad x = 3$

reject

$x = 3$

The width of the border is 3 feet.

TAKE AWAY!

When solving problems that involve geometric shapes, it's helpful to draw and label a diagram. The diagram can help us make sense of the situation and assist us in creating an equation that can be used to solve the problem.