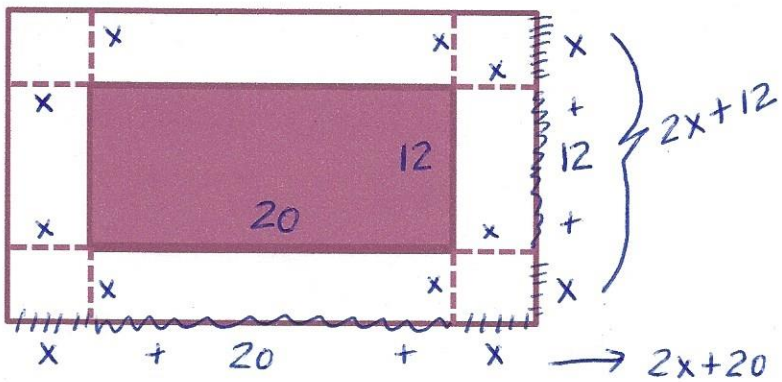
Algebra RH

Essential Question: How can quadratic equations help us solve more complicated area word 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.



   b. What is the area of the small rectangle?

$A = L \cdot W \qquad A = 20 \cdot 12 \qquad A = 240\ ft^2$

   c. Represent the dimensions of the large rectangle algebraically.

   length: $2x + 20$

   width: $2x + 12$

   d. What is the area of the large rectangle?

$A = (2x + 20)(2x + 12)$

$A = 4x^2 + 24x + 40x + 240$

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

   e. Write an equation that represents the area of the large rectangle. Solve the equation.

small rectangle + border

240 + 68

308

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

$4x^2 + 64x - 68 = 0$

$x^2 + 16x - 17 = 0$

$(x + 17)(x - 1) = 0$

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

   f. What does the value of the variable represent?

The width of the border is 1 foot.

2. An elementary school is designing a set of square garden plots so that each grade can grow its own vegetables. The minimum size for a plot recommended for vegetable gardening is at least 2 meters on each side. The school principal has decided to make the vegetable gardens bigger by adding an additional **x** meters to each side.

a. Write an expression to represent the area of one garden.

$(x+2)(x+2)$

b. There are 6 grades in the school including pre-kindergarten and kindergarten. Write an expression to represent the total area of all 6 gardens.

$6(x+2)^2$

c. The total area available for the gardens is 150 square meters. Calculate the dimensions of each square garden.

$6(x+2)^2 = 150$

$(x+2)^2 = 25$

$\sqrt{(x+2)^2} = \pm\sqrt{25}$

$x+2 = \pm 5$

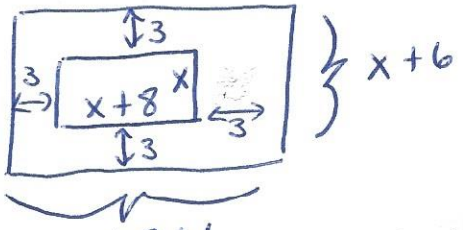
$x = -2 \pm 5$

$-2+5$ (3)

$-2-5$ ~~(-7)~~ reject

Dimensions of garden are 5 meter by 5 meter

3. The length of a garden is 8 feet longer than it is wide. A walkway 3 feet wide will surround the entire garden. If the total area of only the walkway is 288 feet^2, what are the dimensions of the garden?



$(x+6)(x+14) = (x+8)(x) + 288$

$x^2 + 20x + 84 = x^2 + 8x + 288$

$20x + 84 = 8x + 288$

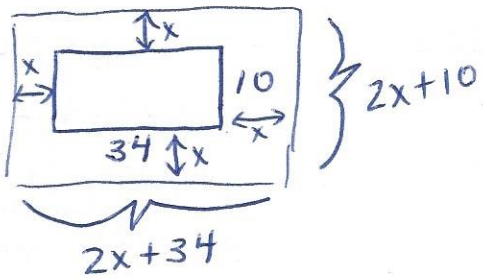
$12x + 84 = 288$

$12x = 204$

$x = 17$

Garden is 17 ft by 25 ft.

4. 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)

$A = l \cdot w$

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

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

$4x^2 + 88x - 300 = 0$

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

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

reject $x+25=0$ | $x-3=0$

$x=-25$ | $x=3$

The width of the border is 3 feet.