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

Do Now: A landscaper is creating a rectangular flower bed such that the width is half the length. The area of the flower bed is 32 square feet. Using x to represent the width, write an equation that can be used to find the width of the flower bed.

a picture often helps understand the situation

x : width
$2x$: length

$A = bh$
$32 = 2x(x)$
$2x^2 = 32$

Let's take a closer look at the equation from the Do Now and solve. What is the width of the flower bed?

$$\frac{2x^2}{2} = \frac{32}{2}$$

$$\sqrt{x^2} = \pm\sqrt{16}$$

$x = +4, -4$

must reject -4 since distance can't be negative

width is 4 feet

Let's try some more examples.

1) Mary is six years older than her cousin Joan. The product of their ages is 135. Find their ages.

x : Joan's age
$x+6$: Mary's age

$$x(x+6) = 135$$
$$x^2 + 6x = 135$$
$$x^2 + 6x - 135 = 0$$
$$(x-9)(x+15) = 0$$

$x-9=0$	$x+15=0$
$x=9$	$x=-15$

reject (age can't be negative)

Joan's age : 9 years old
Mary's age : 15 years old

$(\text{first})^2 \qquad -17$

2) Find two consecutive *negative* integers such that the square of the first decreased by 17 equals 4 times the second.

$= \qquad 4(\text{second})$

x : 1st negative integer

x+1 : 2nd consecutive negative integer

$(x)^2 - 17 = 4(x+1)$ ← any expression with more than one term should be put in ( )

$x^2 - 17 = 4x + 4$

$x^2 - 4x - 17 = +4$

$x^2 - 4x - 21 = 0$

$(x-7)(x+3) = 0$

reject ~~$x-7=0$~~ $x=7$ | $x+3=0$ $x=-3$

1st integer : -3

2nd con. int. : -2

3) 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.

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

$A = (x^2+2x+2x+4)$

$A = (x^2+4x+4)$

2+x is equivalent to 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.

$6(x+2)(x+2) \longrightarrow 6(x+2)^2$

c. The total area available for the gardens is (150) square meters. Write and solve an equation to calculate the dimensions of each square garden.

or

$\frac{6}{6}(x+2)^2 = \frac{150}{6}$

$(x+2)^2 = 25$

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

$x+2 = \pm 5$

$x = -2 \pm 5$

$x = -2+5 \quad , \quad -2-5$

3 ← reject

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

$6(x^2+2x+2x+4) = 150$

$6(x^2+4x+4) = 150$

$6x^2 + 24x + 24 = 150$

$6x^2 + 24x - 126 = 0$

$6(x^2+4x-21) = 0$

$6(x+7)(x-3) = 0$

~~$x+7=0$~~ $x=-7$ | $x-3=0$ $x=3$

$x = 3$

each side is 5 meters

TAKE AWAY!

Quadratic Equations can help us solve problems. It's important to analyze the solution set to the equation and determine which solution(s) make sense in the context of the situation.