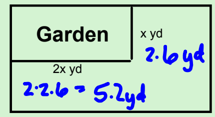
## Section 9 - 3
## Solving Quadratic Equations

Students will be able to solve quadratic equations by graphing and using square roots.

**The diagram shows a plan for your new garden. You want to use only 1.5 yd$^3$ of topsoil and plan to spread a layer 4 in thick. What are the dimensions of the largest garden you can build?**




Work with a neighbor to try to find a solution.
Keys: 1.5 is the volume (lwh), and the depth is given as in not yds.

$$\frac{4\text{in}}{12\text{in}} = \frac{1/3}{3/1} = \frac{1}{3}\cdot\frac{1}{3} = 1/9 \text{ yds}$$

$$1.5 = 2x \cdot x \cdot 1/9$$

$$1.5 = 2/9\, x^2$$

$$\frac{9}{2}\cdot 1.5 = \frac{9}{2}\cdot\frac{2}{9}x^2$$

$$6.75 = x^2 \qquad \sqrt{6.75} = \sqrt{x^2}$$

$$x = 2.6$$

lution Video:

In the last problem, we were modeling the solution with a quadratic equation, because we knew it was equal to 1.5 and we ended up with an $x^2$.

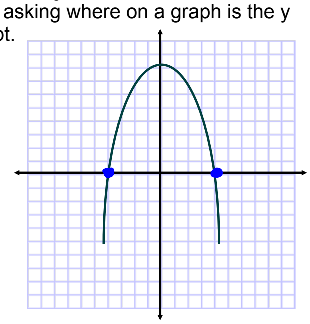
-Quadratic equations can be solved using a variety of methods, including graphing and finding square roots.

> One way is to graph the related quadratic function, $ax^2 + bx + c = 0$.
> The solution of the equation are the x-intercepts of the function.

**Graphing:** When solving $ax^2 + bx + c = 0$, we are looking for the values of x that we can plug in and get a 0. This value of 0 is in the place of y, so it is actually asking where on a graph is the y value 0. This is the x-intercept.

Example:

x-intercepts:
x = -4
x = 4



Note: there are 2 solutions

The solutions of the equation and the x - intercepts of the graph are often called the roots of the equation or zeros of the function.

Solve by graphing:

$x^2 - 16 = 0$

$x = -4$

$x = 4$

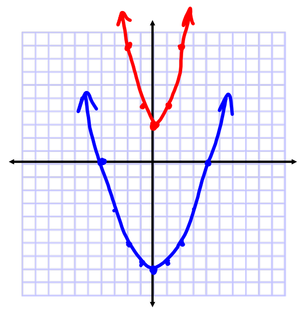
| x | y |
|---|---|
| -2 | -12 |
| -1 | -15 |
| 0 | -16 |
| 1 | -15 |
| 2 | -12 |
| 3 | -7 |
| 4 | 0 |

$3x^2 + 6 = 0$

No Solution

does NOT cross x-axis

| x | y |
|---|---|
| -2 | 18 |
| -1 | 9 |
| 0 | 6 |
| 1 | 9 |
| 2 | 18 |



We said that we could also solve quadratic equations by taking the square root. This means use order of operations to get the $x^2$ alone, then undo to square by doing the opposite, square rooting.

Example: Solve:

$m^2 - 36 = 0$

$\quad +36 \; +36$

$m^2 = 36$

$(6)^2 = 36$

$(-6)^2 = 36$

$\sqrt{m^2} = \pm\sqrt{36}$

$\boxed{m = \pm 6}$

$3x^2 + 15 = 0$

$\quad -15 \; -15$

$\frac{3x^2}{3} = \frac{-15}{3}$

$x^2 = -5$

$\sqrt{x^2} = \pm\sqrt{-5}$

cannot take the square root of a negative #

$\boxed{\text{No Solution}}$

Solve:

$4x^2 + 44 = 80$

$\quad -44 \; -44$

$\frac{4x^2}{4} = \frac{36}{4}$

$x^2 = 9$

$\sqrt{x^2} = \pm\sqrt{9}$

$\boxed{x = \pm 3}$

**The length of a rectangular prism is 3 times the width. The height of the prism is 5 in. If the volume of the prism is 80 $in^3$ what is the length of the prism?**

$V = l \cdot w \cdot h$

$l = 3w$

$w = w$

$h = 5$

$80 = 3w \cdot w \cdot 5$

$\frac{80}{15} = \frac{15w^2}{15}$

$w^2 = 5.\bar{3}$

$\sqrt{w^2} = \pm\sqrt{5.3}$

$w = \pm 2.31$

width cannot be negative so

$w = 2.31$ in $l = 3w = 3(2.31) = 6.93$in

deo

Solve:

$x^2 + 7 = 0$

$-7 \quad -7$

$x^2 = -7$

$\sqrt{x^2} = \pm\sqrt{-7}$

$\boxed{\text{No Solution}}$

cannot take sq root of a negative #

$x^2 + 15 = 15$

$-15 \quad -15$

$x^2 = 0$

$\sqrt{x^2} = \pm\sqrt{0}$

$\boxed{x = 0}$

# 9-3 Homework

Pg. 564 - 565
#8 - 28 (4th), 32 - 40 evens,
44 - 50 evens

QUIZ TOMORROW