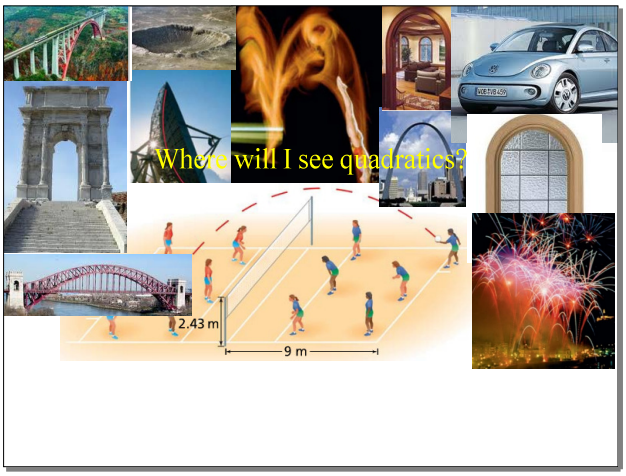


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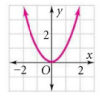
## Ch 10 Quadratic Equations/Graphs

**Definition** Standard Form of a Quadratic Function

A **quadratic function** is a function that can be written in the form $y = ax^2 + bx + c$, where $a \neq 0$. This form is called the **standard form of a quadratic function.** **Examples** $y = 5x^2$ $y = x^2 + 7$ $y = x^2 - x - 3$

The graph of a quadratic function is a U-shaped curve called a **parabola.** The graph of $y = x^2$, shown at the right, is a parabola.



You can fold a parabola so that the two sides match exactly. This property is called *symmetry*. The fold or line that divides the parabola into two matching halves is called the **axis of symmetry.**

The highest or lowest point of a parabola is its **vertex,** which is on the axis of symmetry.

If $a > 0$ in $y = ax^2 + bx + c$ ↓ the parabola opens upward. ↓ The vertex is the **minimum** point or lowest point of the parabola.

If $a < 0$ in $y = ax^2 + bx + c$ ↓ the parabola opens downward. ↓ The vertex is the **maximum** point or highest point of the parabola.

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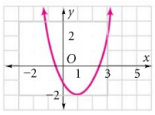
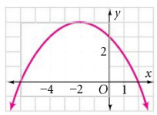
**1 EXAMPLE** Identifying a Vertex

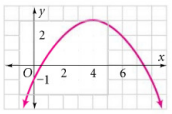
Identify the vertex of each graph. Tell whether it is a minimum or maximum.

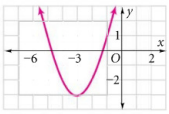
a. 

b. 

The vertex is $(1, -2)$. It is a minimum. The vertex is $(-2, 4)$. It is a maximum.

1 Identify the vertex of each graph. Tell whether it is a minimum or maximum.

a. 

b. 

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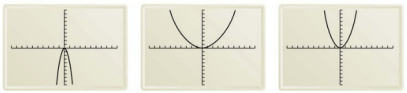
**3 EXAMPLE** Comparing Widths of Parabolas

Use the graphs below. Order the quadratic functions $f(x) = -4x^2$, $f(x) = \frac{1}{4}x^2$, and $f(x) = x^2$ from widest to narrowest graph.

$y = -4x^2$ $y = \frac{1}{4}x^2$ $y = x^2$

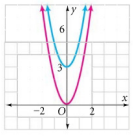


**4 EXAMPLE** Graphing $y = ax^2 + c$

**Multiple Choice** How is the graph of $y = 2x^2 + 3$ different from the graph of $y = 2x^2$?

(A) It is shifted 3 units up. (B) It is shifted 3 units down.
(C) It is shifted 3 units to the right. (D) It is shifted 3 units to the left.

| x | $y = 2x^2$ | $y = 2x^2 + 3$ |
|---|---|---|
| −2 | 8 | 11 |
| −1 | 2 | 5 |
| 0 | 0 | 3 |
| −1 | 2 | 5 |
| −2 | 8 | 11 |



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## Ch 10.3 Solving Quadratic Equations in $y = ax^2 + c$

a- tells how wide the graph will be
c- moves the graph up and down

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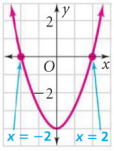
**EXAMPLE** Solving by Graphing

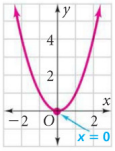
Solve each equation by graphing the related function.

**a.** $x^2 - 4 = 0$
Graph $y = x^2 - 4$.



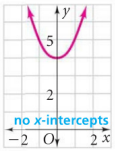

There are two solutions, ±2.

**b.** $x^2 = 0$
Graph $y = x^2$.




There is one solution, 0.

**c.** $x^2 + 4 = 0$
Graph $y = x^2 + 4$.




There is no solution.

To graph make a table of values and let x = -1, 0, 1, etc.

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Ex1) Sketch the graph and determine the number of solutions.

a) $x^2-1=0$

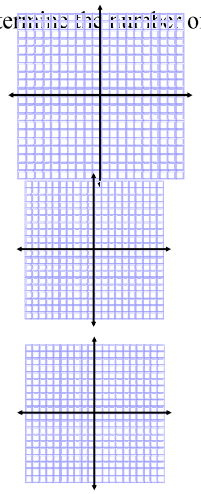
| x | y |
|---|---|

b) $2x^2 + 4 = 0$

| x | y |
|---|---|

c) $\frac{1}{4}x^2 + 1 = 0$

| x | y |
|---|---|



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Ex2) Solving quadratics:
1. set the variable$^2$= 0
2. $\sqrt{}$ square root both sides
* these are the x-intercepts if graphing.

a) $x^2 - 25 = 0$

b) $3x^2+ 12 = 12$

c) $2x^2 + 32 = 0$

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If x = + number, then 2 solutions
if x = 0, one solution
if x = - number, no solution.

Try#1. sketch a graph of $2x^2 + 2 = 0$, then determine how many solutions.

Try #2. Solve $2x^2 - 2 = 0$

Try #3. Solve $3x^2 = -27$

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