Algebra 1 9.1

$y = x^2$

Analyze characteristics of graphs of quadratic functions

Graph quadratic functions

quadratic

standard form $y = ax^2 + bx + c$

parabola

axis of symmetry

vertex

maximum

minimum

table of values

$y = 2x^2 + 7x - 5$

$a = 2 \quad b = 7 \quad c = -5$

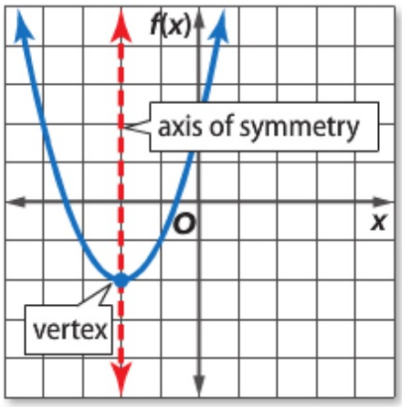
A.O.S. $\rightarrow x = \frac{-b}{2a}$

Vertex (x, y)

KeyConcept Quadratic Functions

Parent Function:	$f(x) = x^2$
Standard Form:	$f(x) = ax^2 + bx + c$
Type of Graph:	parabola
Axis of Symmetry:	$x = -\frac{b}{2a}$
y-intercept:	c

$y = 0 + 0 + c$



GuidedPractice

1. Use a table of values to graph $y = 1x^2 + 3$. State the domain and range.

$$x = \frac{-0}{2 \cdot 1} = \frac{0}{2} = 0$$

x	x^2+3	
0	0+3	3
1	1+3	4
2	4+3	7
3	9+3	12

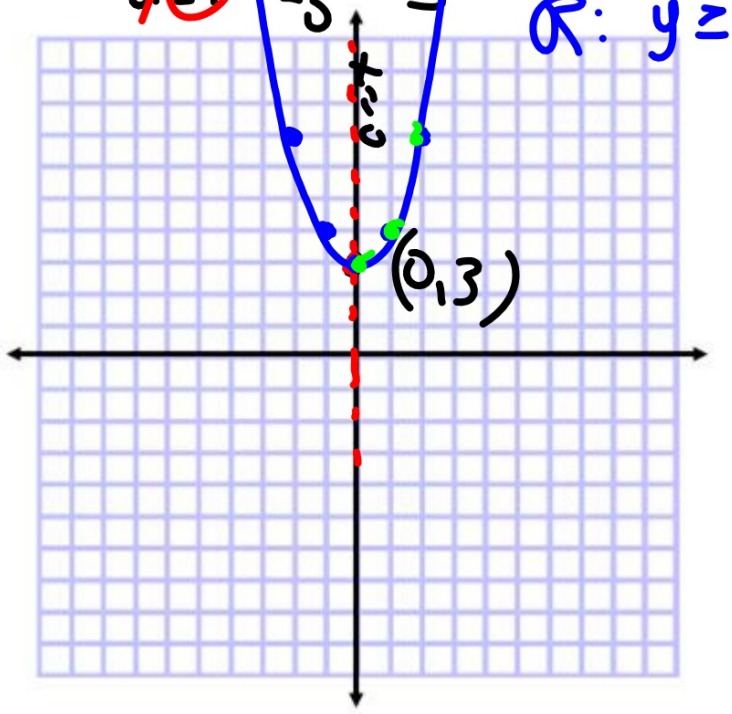
$1x^2 + 3$

$a = 1$ $b = 0$ $c = 3$

x y

D: ARN

R: $y \geq 3$



Example 1 Graph a Parabola

$x = \frac{-b}{2a}$

Use a table of values to graph $y = 3x^2 + 6x + -4$. State the domain and range.

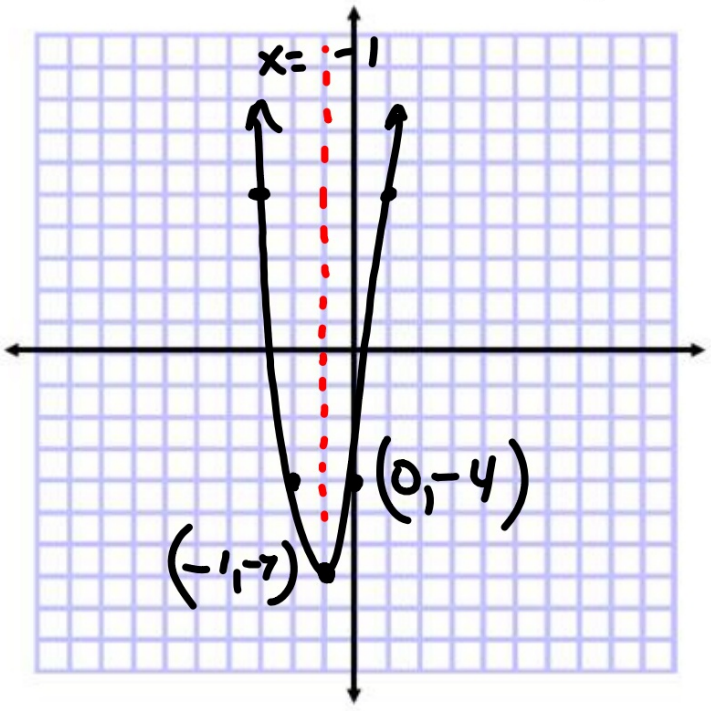
$a=3$ $b=6$ $c=-4$

$x = \frac{-b}{2a} = \frac{-6}{6} = -1$

D: ALL

R: $y \geq -7$

	$3x^2+6x+-4$	
-1	$3\cdot1+6\cdot-1+-4$ $3+-6+-4$	-7
1	$3\cdot1+6\cdot1+-4$	5
2	$3\cdot4+6\cdot2+-4$ $12+12+-4$	20



x-coord: -b/2a

Example 2 Identify Characteristics from Graphs

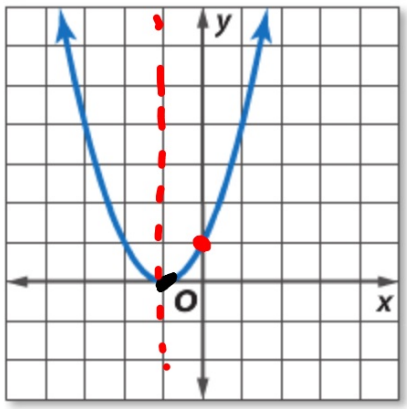
Find the vertex, the equation of the axis of symmetry, and the y-intercept of each graph.

V (-1, 0)

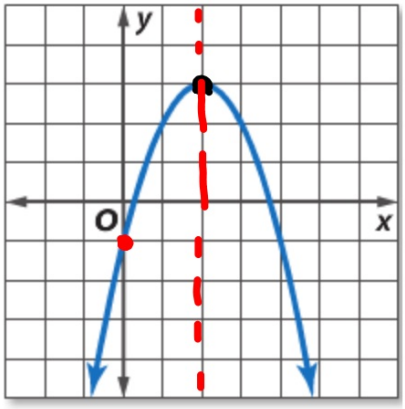
AOS x = −1

y int (0, 1)

a.



b.



vertex
axis of symmetry
y-intercept

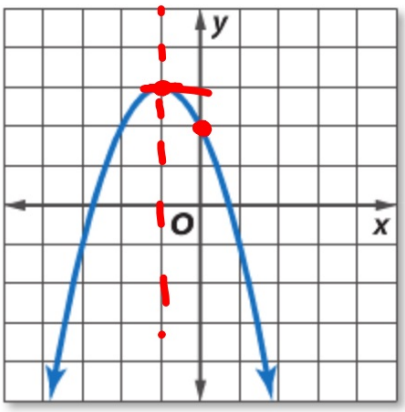
v (2, 3)

AOS x = 2

Y int (0, -1)

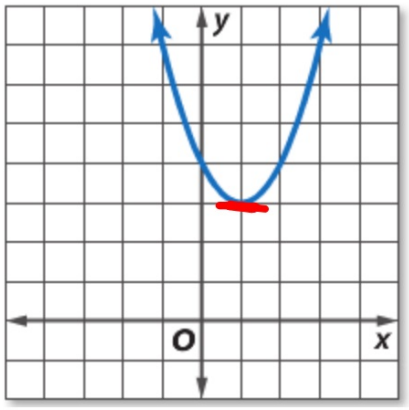
Guided Practice

2A.



vertex (-1, 3)
axis of symmetry $x = -1$
y-intercept (0, 2)
domain ARN
range $y \leq 3$

2B.



min.

-b/2a

Example 3 Identify Characteristics from Functions

Find the vertex, the equation of the axis of symmetry, and the y-intercept of each function.

a. $y = 2x^2 + 4x - 3$

V (−1, −5)

AOS $x = -1$

$\frac{-4}{2 \cdot 2}$ $\frac{-4}{4} = -1$

y int (0, −3)

x	$2 \cdot 1 + -4 + -3$
−1	−5

-b/2a

b. $y = -x^2 + 6x + 4$

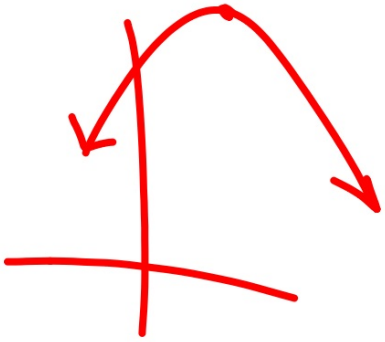
$\frac{-6}{2 \cdot -1} = \frac{-6}{-2} = 3$

V (3, 13)

AOS $x = 3$

yint (0, 4)

3	$-9 + 18 + 4$	13



GuidedPractice

3A. $y = -3x^2 + 6x - 5$

3B. $y = 2x^2 + 2x + 2$

Vertex

KeyConcept Maximum and Minimum Values

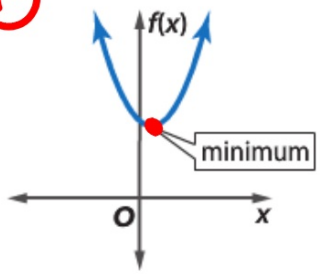
Words

The graph of $f(x) = ax^2 + bx + c$, where $a \neq 0$:

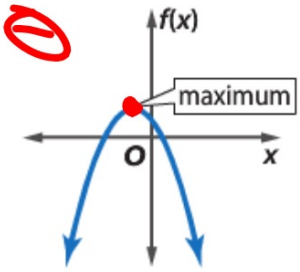
- opens upward and has a minimum value when $a > 0$, and
- opens downward and has a maximum value when $a < 0$.
- The range of a quadratic function is all real numbers greater than or equal to the minimum, or all real numbers less than or equal to the maximum.

Examples

a is positive.



a is negative.



....vertex

Example 4 Maximum and Minimum Values

Consider $f(x) = -2x^2 - 4x + 6$.

a. Determine whether the function has a *maximum* or *minimum* value.

$x = \frac{4}{2 \cdot -2} = \frac{4}{-4} = -1$

b. State the maximum or minimum value of the function.

$-1 \mid -2 + 4 + 6 \mid 8$ $\quad V(-1, 8)$

c. State the domain and range of the function.