

April 4, 2018
Sect. 8-1
Parabola Parts and Graphs
Vertex
Up/Down
Axis of Symmetry
Y-int
Inc./Dec.
Max/Min

Properties of a Parabola

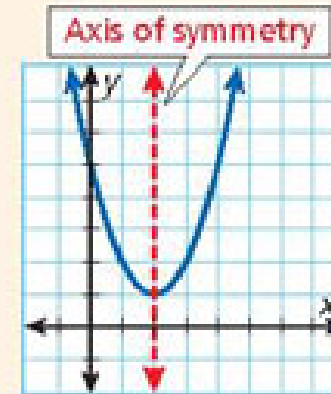
For $f(x) = ax^2 + bx + c$, where a , b , and c are real numbers and $a \neq 0$, the parabola has these properties:

The parabola **opens** upward if $a > 0$ and downward if $a < 0$.

The **axis of symmetry** is the vertical line $x = -\frac{b}{2a}$.

The **vertex** is the point $\left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right)$.

The **y-intercept** is c .



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

V_y : plus V_x back in
Simplify

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

$$a=1 \quad b=-4 \quad c=6$$

Find Vertex

$$V_x = \frac{-b}{2a} = \frac{4}{2(1)} = \frac{4}{2} = 2$$

$$V_y: (2)^2 - 4(2) + 6$$
$$4 - 8 + 6$$
$$2$$

$$V: (2, 2)$$

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

$$a = +1$$

$$V: (2, 2)$$

Open Up/Down Up

AoS $x = 2$

y-int: $(0, 6)$

$$f(x) = -4x^2 - 12x - 3$$

$$a = -4 \quad b = -12 \quad c = -3$$

Find Vertex

$$V_x: \frac{-b}{2a} = \frac{12}{2(-4)} = \frac{12}{-8} = -\frac{3}{2} \quad (-1.5, 6)$$

$$V_y: -4(-1.5)^2 - 12(-1.5) - 3$$

$$-4(2.25) + 18 - 3$$

$$-9 + 18 - 3$$

$$6$$

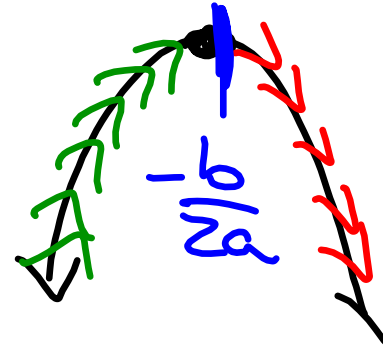
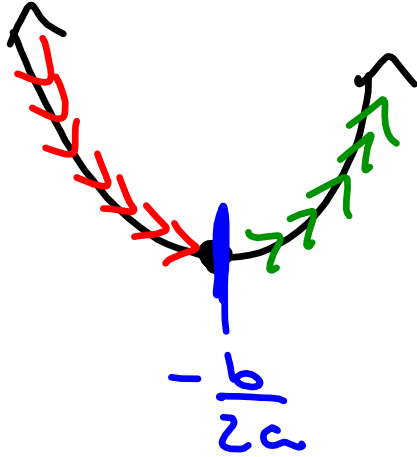
$$f(x) = -4x^2 - 12x - 3 \quad V: (-1.5, 6)$$

Open Up/Down Down

AoS $x = -1.5$

y-int: $(0, -3)$

Increasing / Decreasing



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

$a = +1$

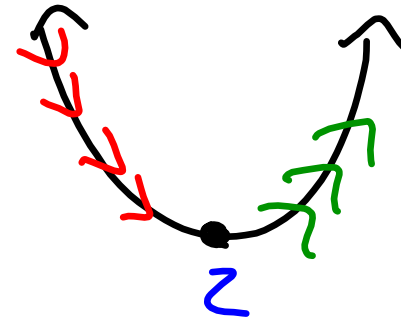
$$V: (2, 2)$$

Open Up/Down

Up

Dec: $x < 2$

Inc: $x > 2$



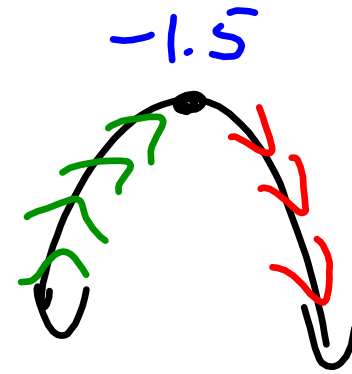
$$f(x) = -4x^2 - 12x - 3$$

$$V: (-1.5, 6)$$

Open Up/Down Down

$$\text{Inc. : } x < -1.5$$

$$\text{Dec : } x > -1.5$$



Max/Min
Need two things

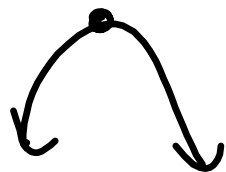
1. Vertex

2. Does parabola open up/down

then:



opens up \Rightarrow vertex is minimum



opens down \Rightarrow vertex is maximum

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

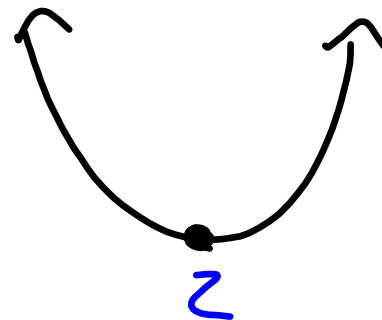
$$a = +1$$

$$V: (2, 2)$$

Open Up/Down

Up

Min of 2



$$f(x) = -4x^2 - 12x - 3$$

$$V: (-1.5, 6)$$

Open Up/Down Down

Max of 6

