2.1 Quadratic Functions:

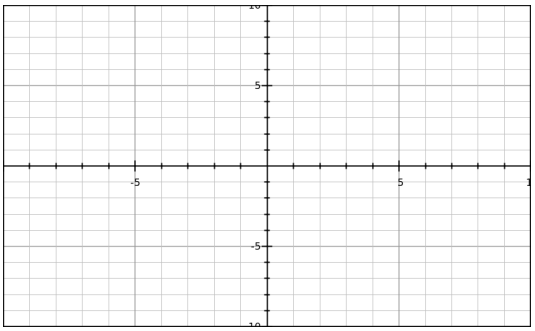
$$f(x) = ax^2 + bx + c$$

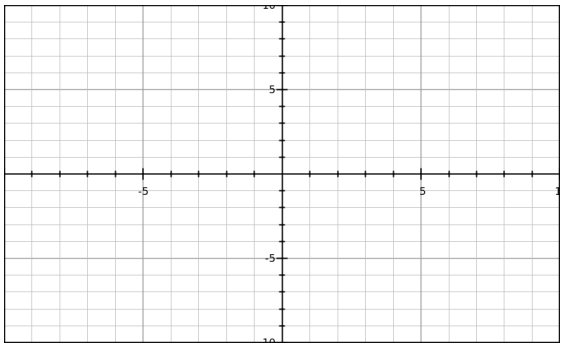
Polynomial of degree ____

Graph is a _____

Vertex is where graph _____

Graph is symmetric to a vertical line through the vertex called the _____





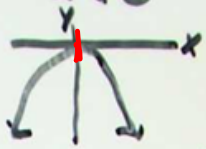
Characteristics of Basic Quadratics

Let $f(x) = ax^2$

If $a > 0$

Domain: All Real
Range: $y \geq 0$
Intercepts: $(0, 0)$
Decreasing: $x < 0$
Increasing: $x > 0$
axis: $x = 0$
rel. min. @ vertex $= 0$

If $a < 0$



Domain: All Real
Range: $y \leq 0$
Intercepts: $(0, 0)$
Decreasing: $x > 0$
Increasing: $x < 0$
axis: $x = 0$
rel. max @ vertex $= 0$

In general if $a > 0$, parabola opens up. If $a < 0$ then parabola opens down.

Finding the Vertex of a Parabola

Vertex form of a quadratic equation: $f(x) = a\,(x - h)^2 + k$

The vertex is at _____

Standard form of a quadratic equation: $f(x) = a\,x^2 + b\,x + c$

The x value of the vertex is at _____

Find the vertex of $f(x) = 4x^2 - 7x + 5$

Find the vertex of $f(x) = (x - 4)^2 + 2$

Intercepts: where the parabola crosses the *x* and *y* axis

To find the intercepts:

- x intercepts (called zeros of a function) : Let function = 0 and solve for x
- y intercepts: Plug 0 in for x and solve for y.

Find the intercepts of $f(x) = 6x^2 - 23x + 20$

Find the intercepts of $f(x) = 4x^2 - 7x + 5$

For the function,

find the following...

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

- vertex $x = \frac{1}{4}$

$f\left(\frac{1}{4}\right) = 2\left(\frac{1}{16}\right) - \frac{1}{4} - 3 = \frac{1}{8} - \frac{2}{8} - \frac{24}{8} = \frac{-25}{8}$ $\left(\frac{1}{4}, \frac{-25}{8}\right)$

- y-intercept

$y = -3$

- x-intercept

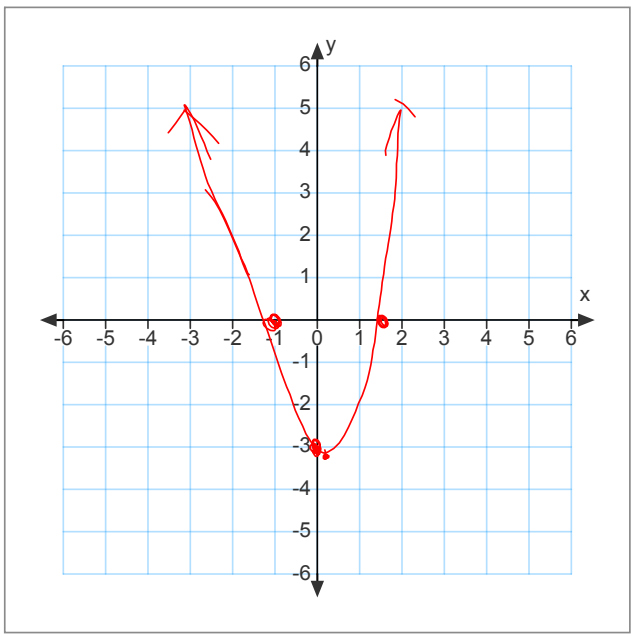
$0 = 2x^2 - x - 3$

$0 = (2x - 3)(x + 1)$

$2x - 3 = 0$ or $x + 1 = 0$

$x = \frac{3}{2}$ $x = -1$

- graph



Write the equation of a quadratic in vertex form that passes through the point (2, 23) and has a vertex at (-1, -4)

$y = a(x-h)^2 + k \quad \leftrightarrow$ vertex @ (h, k)

$y = a(x+1)^2 - 4$

$23 = a(2+1)^2 - 4$

$23 = a \cdot 9 - 4$

$23 = 9a - 4$

$\frac{27}{9} = \frac{9a}{9}$

$a = 3$

$\boxed{y = 3(x+1)^2 - 4}$

① $0 = (x+4)^2 - 3$

$x^2 + 8x + 16 - 3$

$0 = x^2 + 8x + 13$

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

or $3 = (x+4)^2$

$\pm\sqrt{3} = x+4$

$-4 \quad -4$

$\sqrt{3} - 4 = x$

$-\sqrt{3} - 4$