3.2 Quadratic functions

- $\boxed{f(x) = ax^2 + bx + c}$

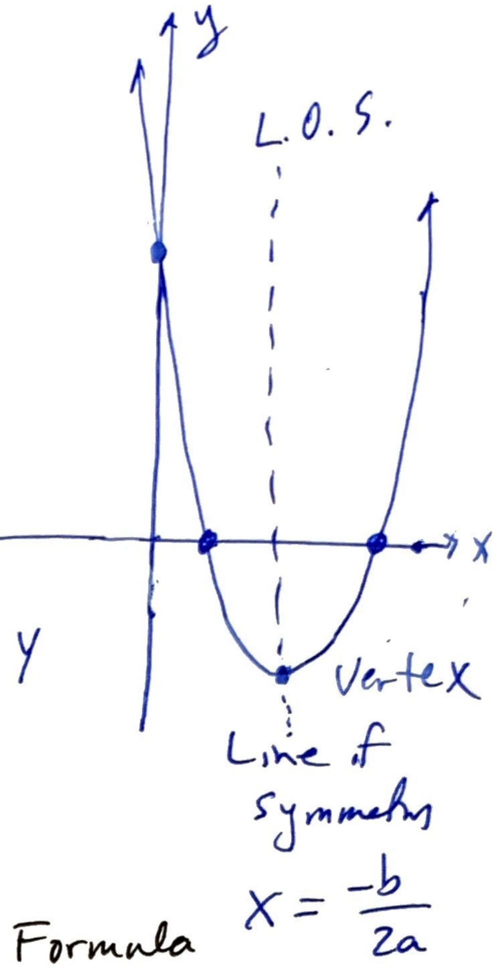
- Graph: Replace $f(x)$ w/ y

  $y = ax^2 + bx + c$

- zeros (x-int.): Replace y w/ 0

  $0 = ax^2 + bx + c$

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



- Line of Sym: front $\frac{1}{2}$ of Quad. Formula

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

- vertex: $f(x_{l.o.s.})$

  $(x, y) = \left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right)$

- y-int: $x = 0$

  $y = f(0)$

EX Tell me all about $f(x) = x^2 + 2x - 8$, graph

- zeros

$$0 = x^2 + 2x - 8 \quad \begin{cases} a = 1 \\ b = 2 \\ c = -8 \end{cases}$$

$$x = \frac{-(2) \pm \sqrt{2^2 - 4(1)(-8)}}{2 \cdot 1}$$

$$x = \frac{-2 \pm \sqrt{4+32}}{2}$$

$$x = -1 \pm \frac{1}{2}\sqrt{36}$$

$$x = -1 \pm \frac{6}{2}$$

$$x = -1 \pm 3$$

$$x = -1+3, -1-3$$

$$\boxed{x_1 = -4, \ x_2 = 2}$$

- Line of Sym

$$\boxed{x = -1}$$

- vertex : $x = -1$

$$y = f(-1) = (-1)^2 + 2(-1) - 8$$

$$y = 1 - 2 - 8$$

$$y = -9$$

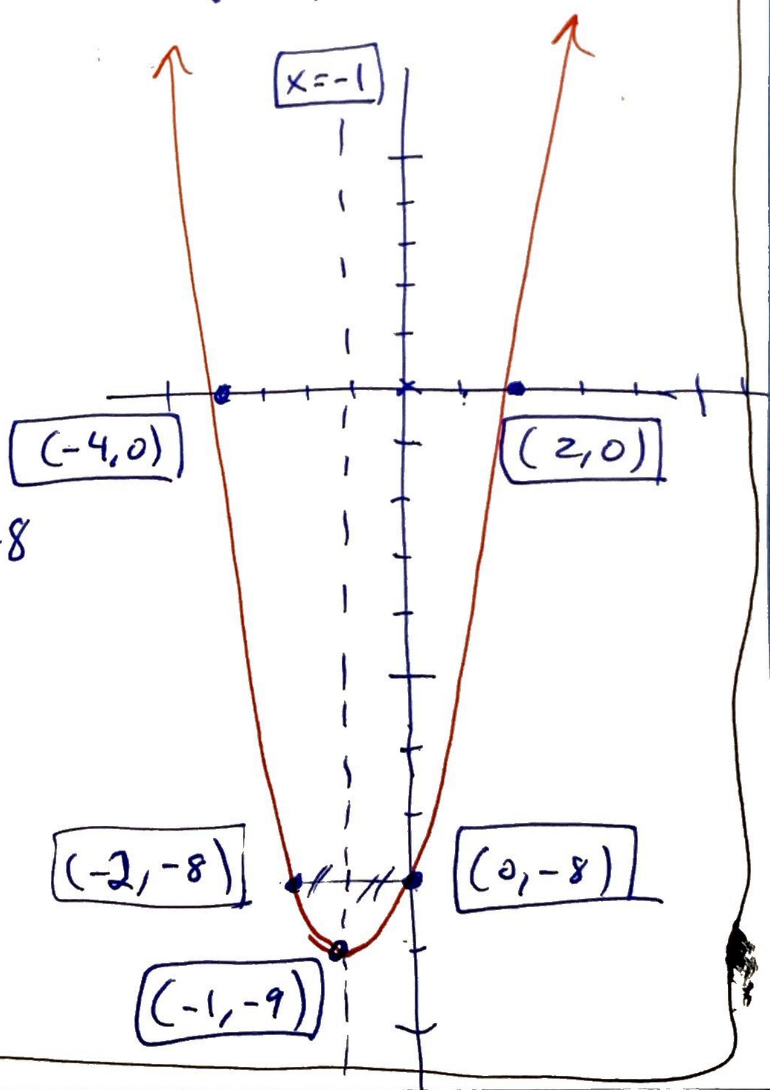
$$\boxed{(x, y) = (-1, -9)}$$

- y-int

$$f(0) = 0^2 + 2(0) - 8$$

$$\boxed{y = -8}$$

- graph

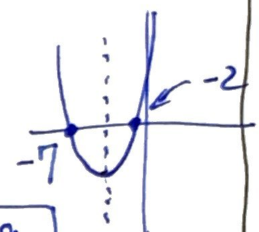


* L.O. Sym. given zeros.

If we are given the two zeros of $f(x)$ we average their values to get the Line of sym.

Ex A quadratic function has zeros at $x = -7$ and $x = -2$. What is that functions Line of sym.?

$$\boxed{X_{L.O.S.} = \frac{X_1 + X_2}{2}}$$



here $\quad X_{LOS} = \dfrac{(-7)+(-2)}{2} = \boxed{-\dfrac{9}{2}}$

* Factoring $f(x)$ yeild zeros

To locate zeros of $f(x)$ we set $y=0$

$$0 = f(x)$$

If $f(x)$ factors into $(x+a)(x+b)$

then $\quad \boxed{\begin{array}{c} 0 = (x+a)(x+b) \\ x = -a \quad \text{or} \quad x = -b \end{array}}$

Ex what are the zeros of $f(x) = x^2 - 5x$

$0 = x^2 - 5x$

$0 = x(x-5) \quad \boxed{x=0} \quad \text{or} \quad \boxed{x=5}$

BTW $\quad L.O.S = \frac{0+5}{2} = \frac{5}{2}$

⊛ Building a quadratic function given some information

Ex vertex of a parabola is $(-2,-1)$ and it passes through $(x,y)=(-4,3)$

Q: what is the quad. function

Std. Form $\boxed{f(x) = a(x-h)^2+k}$ vertex $=$ $\boxed{(h,k)}$

Gen. Form $\boxed{f(x)=ax^2+bx+c}$

- Lets use the std. form.

$\boxed{\text{Vertex} = (h,k)}$ in the std. form

$$\Rightarrow f(x) = a(x-(-2))^2+(-1)$$

- Form: $\boxed{f(x) = a(x+2)^2-1}$
- Point: $3 = a(-4+2)^2-1$
- Solve: $3 = a(-2)^2-1$

$$3 = a\cdot 4-1$$
$$4 = a\cdot 4$$
$$\boxed{a=1}$$

- Final: $\boxed{f(x) = 1\cdot(x+2)^2-1}$

Std. Form: $f(x) = (x+2)^2-1$ "vertex form"

Gen form: $\boxed{f(x) = x^2+4x+3}$