Graphing Parabolas

<u>Standard Form</u>

$y = ax^2 + bx + c$

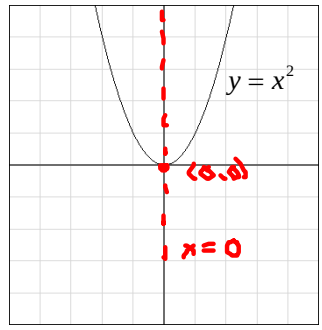
vertex: $x = -\dfrac{b}{2a}$

$y = f(x)$

axis of symmetry: $x = -\dfrac{b}{2a}$

x-intercept: set y equal to zero and solve for x

y-intercept: set x equal to zero and solve for y



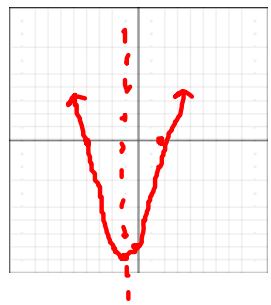
1. Find the vertex, axis of symmetry and intercepts of each function. Sketch the graph of each parabola.

a) $y = x^2 + 2x - 8$ $\quad a=1 \quad b=2 \quad c=-8$

$x = -\dfrac{b}{2a} = \dfrac{-2}{2(1)} = \dfrac{-2}{2} = -1$

$y = (-1)^2 + 2(-1) - 8 = 1 - 2 - 8 = -9$

vertex $(-1, -9)$



axis of symmetry $\quad x = -\dfrac{b}{2a} = -1$

<u>x-int</u> $\quad$ set $y=0$

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

$1 \cdot 8$

$\boxed{2 \cdot 4}$

$0 = (x-2)(x+4)$

$x - 2 = 0 \qquad x + 4 = 0$

$+2 \quad +2 \qquad -4 \quad -4$

$x = 2 \qquad x = -4$

$(2,0)\ (-4,0)$

<u>y-int</u> $\quad$ set $x=0$

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

$y = -8$

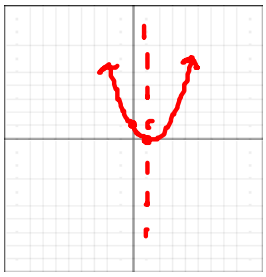
$(0,-8)$

b) $y = x^2 - 2x + 1$ $\quad a = 1 \quad b = -2 \quad c = 1$

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

$y = (1)^2 - 2(1) + 1 = 1 - 2 + 1 = 0$

vertex $(1, 0)$



axis of symmetry $x = \frac{-b}{2a} = x = 1$

x-int set $y = 0$

$0 = x^2 - 2x + 1$

$\boxed{1 \cdot 1}$

$0 = (x - 1)(x - 1)$

$x - 1 = 0 \quad x - 1 = 0$

$+1 \quad +1$

$x = 1 \quad (1, 0)$

y-int set $x = 0$

$y = 0^2 - 2(0) + 1$

$y = 0 - 0 + 1$

$y = 1$

$(0, 1)$

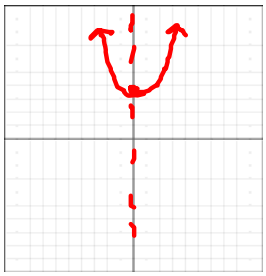
c) $y = x^2 + 4$ $\quad a = 1 \quad b = 0 \quad c = 4$

$x = \frac{-b}{2a} = \frac{-(0)}{2(1)} = \frac{0}{2} = 0$

$y = (0)^2 + 4 = 0 + 4 = 4$

vertex $(0, 4)$

axis of symmetry $x = \frac{-b}{2a} = 0$



x-int set $y = 0$

$0 = x^2 + 4$

Does not factor

No x-int

y-int set $x = 0$

$y = (0)^2 + 4 = 4$

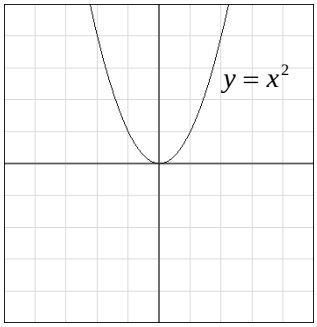
$(0, 4)$

Vertex Form

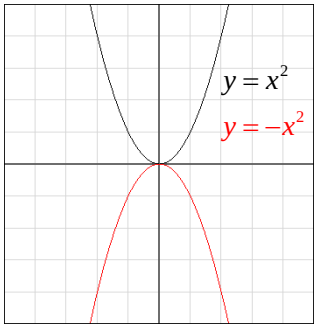
$y = a(x-h)^2 + k$

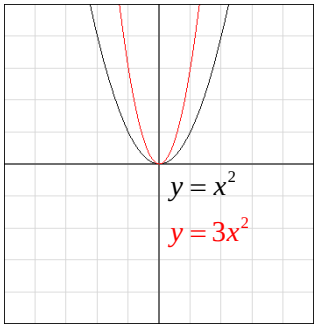
vertex: (h,k)

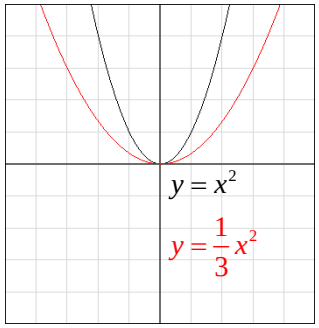
axis of symmetry: $x = h$

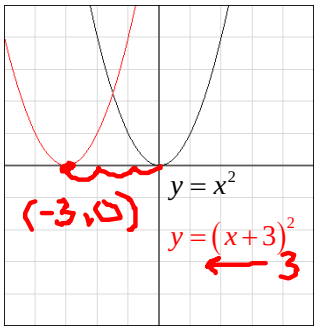


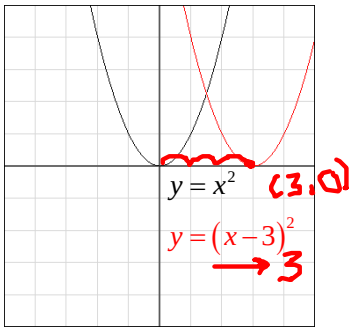
Transformations of $y = x^2$

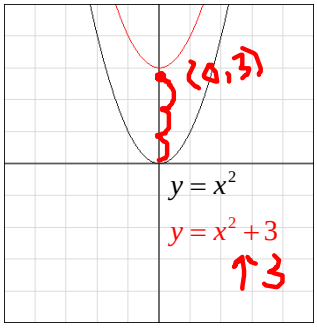


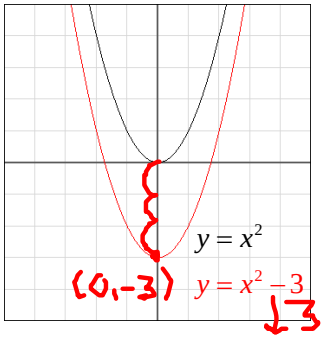












2. Find the vertex and axis of symmetry of each function. Sketch the graph of each parabola.

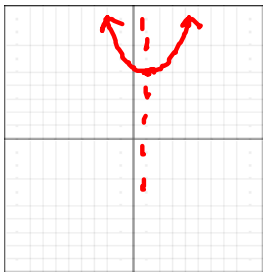
a) $y=(x-1)^2+5$ $\uparrow 5$

$\rightarrow 1$

vertex $(1, 5)$

axis of symm. $x=1$

$a=1$



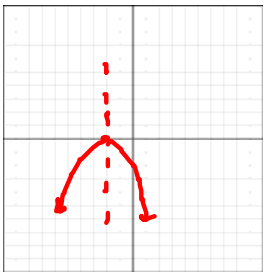
b) $y=-(x+2)^2$

$\leftarrow 2$

vertex $(-2, 0)$

axis of symm. $x=-2$

$a=-1$



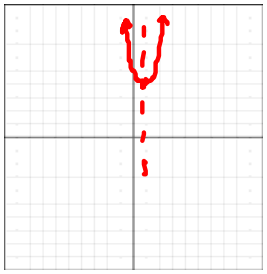
c) $y=3(x-1)^2+4$

$\rightarrow 1$ $\uparrow 4$

vertex $(1, 4)$

axis of symm. $x=1$

$a=3$



d) $y=-\frac{1}{2}x^2+1$ $\uparrow 1$

a

vertex $(0, 1)$

axis of symm. $x=0$

$a=-\frac{1}{2}$