

# Graphing quadratics

Rewriting Quadratic functions

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

Intercept form:  $f(x) = a(x - q)(x - p)$

Vertex form:  $f(x) = a(x - h)^2 + k$

Ex.1 standard to vertex: complete the square

$$\boxed{A} \quad y = x^2 + 8x + 1$$

$$(4)^2 + y - 1 = x^2 + 8x + (4)^2$$

$$\begin{array}{r} 15 + y \\ -15 \end{array} = \begin{array}{r} (x + 4)^2 \\ -15 \end{array}$$

$$\boxed{y = (x + 4)^2 - 15}$$

$$\boxed{B} \quad y = \frac{-2x^2 - 16x - 32}{-2}$$

$$-\frac{y}{2} = x^2 + 8x + 16$$

$$\overset{-16}{(4)^2} - \overset{-16}{16} - \frac{y}{2} = x^2 + 8x + (4)^2$$

$$-\cancel{2} \left( -\frac{y}{2} \right) = \left( (x+4)^2 \right) - 2$$

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

Ex.2 vertex to standard form: expand

$$\boxed{A} \quad f(x) = 2(x-3)^2 + 7$$

$$f(x) = 2(x-3)(x-3) + 7$$

$$f(x) = 2(x^2 - 3x - 3x + 9) + 7$$

$$f(x) = 2(x^2 - 6x + 9) + 7$$

$$f(x) = 2x^2 - 12x + 18 + 7$$

$$\boxed{f(x) = 2x^2 - 12x + 25}$$

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

Ex.3 standard to intercept form: factor

$$a=1 \quad b=-4 \quad c=-21$$
$$\boxed{A) f(x) = x^2 - 4x - 21}$$

$$\boxed{f(x) = (x+3)(x-7)}$$

a.c  
-21  
1·21  
3·7

Ex.4 intercept to standard: multiply

$$\boxed{A) f(x) = (x+1)(x-9)}$$

$$f(x) = x^2 - 9x + x - 9$$

$$\boxed{f(x) = x^2 - 8x - 9}$$

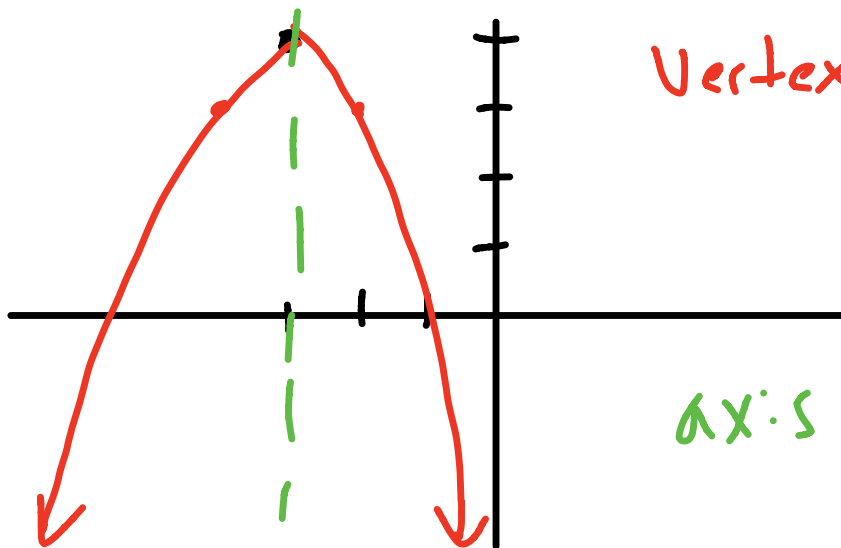
## Graphing in Vertex Form

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

1. Find the vertex.  $(h, k)$
2. Find the axis of symmetry.  $x = h$
3. Put the vertex in a t-table
4. Sketch the graph using the end behavior from  $a$ . When  $a$  is positive, the graph will go up. When  $a$  is negative the graph will go down.

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

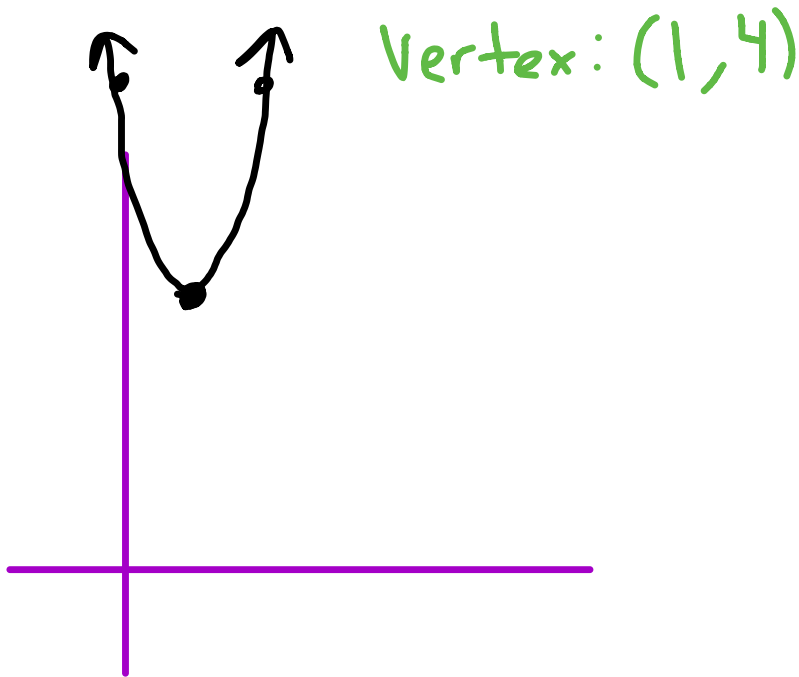
$a = -1$     $h = -3$     $k = 4$



Vertex  $(h, k)$   
 $(-3, 4)$

Axis Symmetry  
 $x = -3$

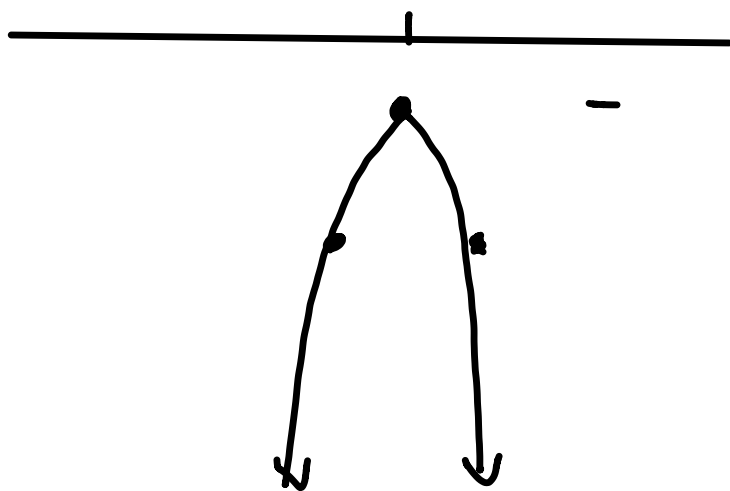
Ex.2  $y = 3(x-1)^2 + 4$



x	y
-1	16
0	7
1	4
2	7
3	16

Ex.3  $y = -2(x+3)^2 - 1$

Vertex: (-3, -1)



x	y
-5	-9
-4	-3
-3	-1
-2	-3
-1	-9

# Graphing given standard form

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

1. Find the vertex  $\left(-\frac{b}{2a}, \right)$
2. Axis of symmetry  $x = -\frac{b}{2a}$
3. Create a t-table to find more values
4. Graph the values

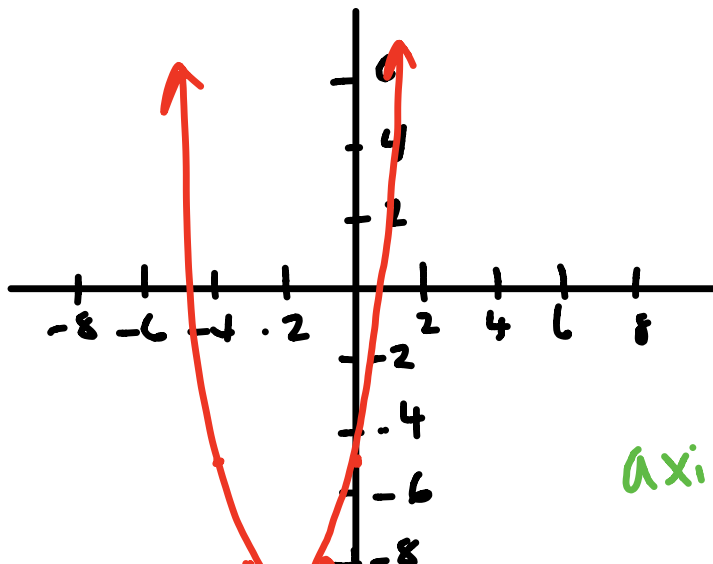
Ex.1

$$y = x^2 + 4x - 5$$

$$a=1 \quad b=4 \quad c=-5$$

$$\text{Vertex: } \frac{-b}{2a} = \frac{-4}{2(1)} = -2$$

x	y
0	-5
-1	0
-2	-9
-3	-8
-4	-5



axis of symmetry:  
 $x = -2$

$$I-16$$

Ex.2

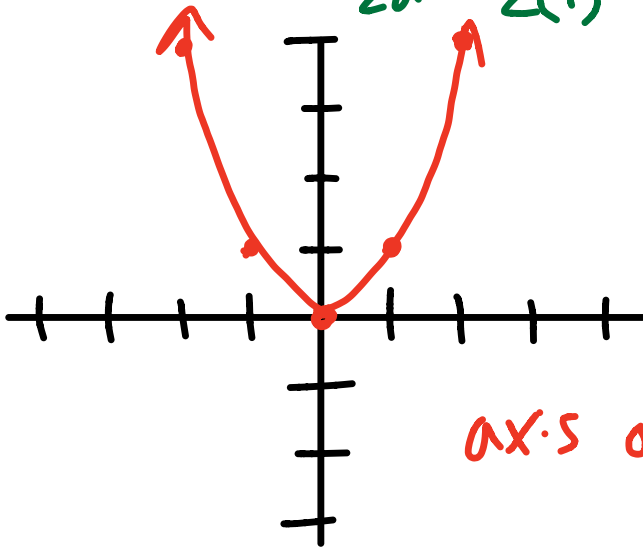
$$y = x^2$$

$$a = 1$$

$$b = 0$$

$$c = 0$$

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



x	y
2	4
1	1
0	0
-1	1
-2	4

axis of symmetry  
 $x = 0$

# Graphing in Intercept Form

$$y = a(x-p)(x-q)$$

1. Find the intercepts, p and q.
2. Find the vertex  $(\frac{p+q}{2}, \quad)$
3. Connect vertex to intercepts.

Ex.1  $y = -(x+2)(x-4)$

$$x+2=0$$

$$x-4=0$$

$$x = -2$$

$$x = 4$$

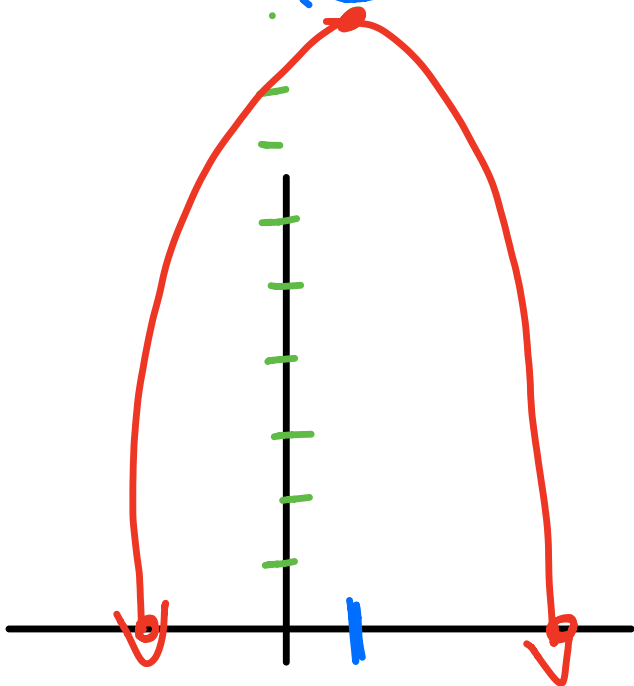
$$\frac{-2+4}{2} = \frac{2}{2} = 1$$

x	y
1	9

$$y = -(1+2)(1-4)$$

$$y = -(3)(-3)$$

$$y = 9$$



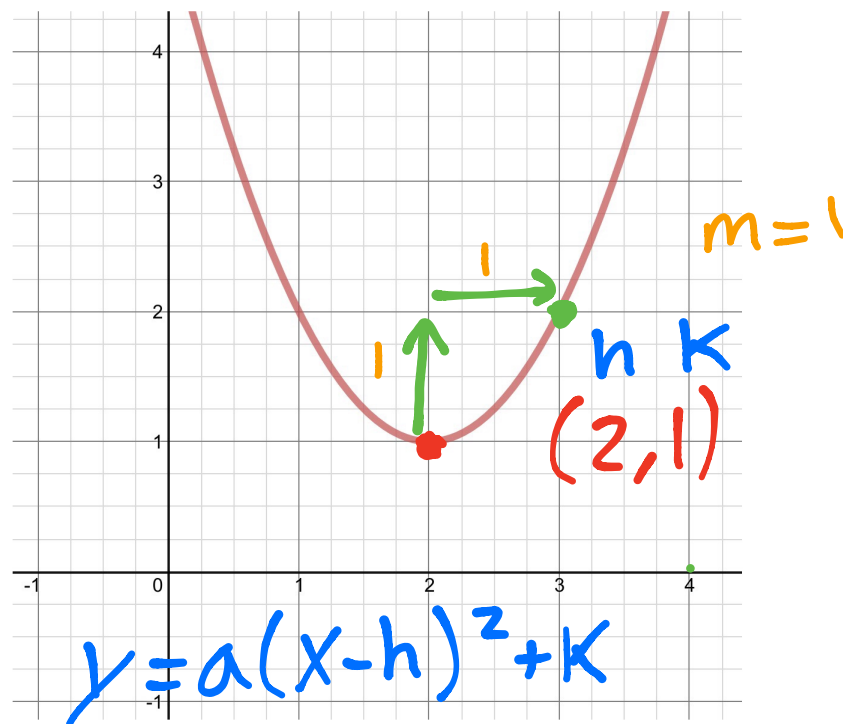


# Writing equations from a graph

1. Find the vertex  $(h, k)$
2. Find 'a' by finding the slope from the vertex right one Unit.
3. Plug h, k, and a into vertex form.

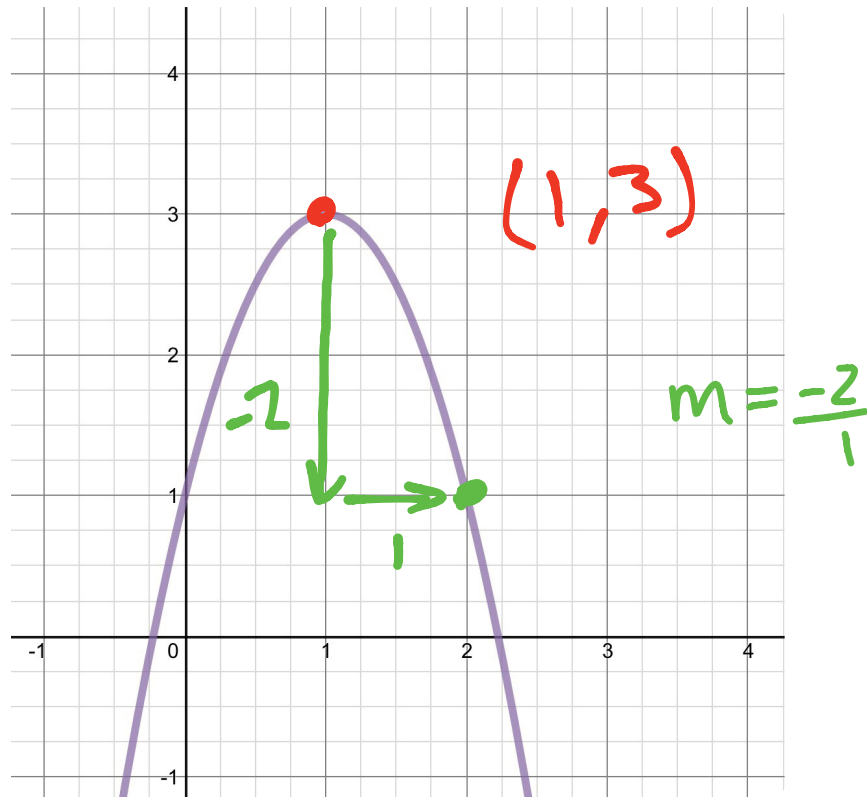
$$f(x) = a(x-h)^2 + k$$

Ex.1 write the Equation for the graph.



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

## Ex.2

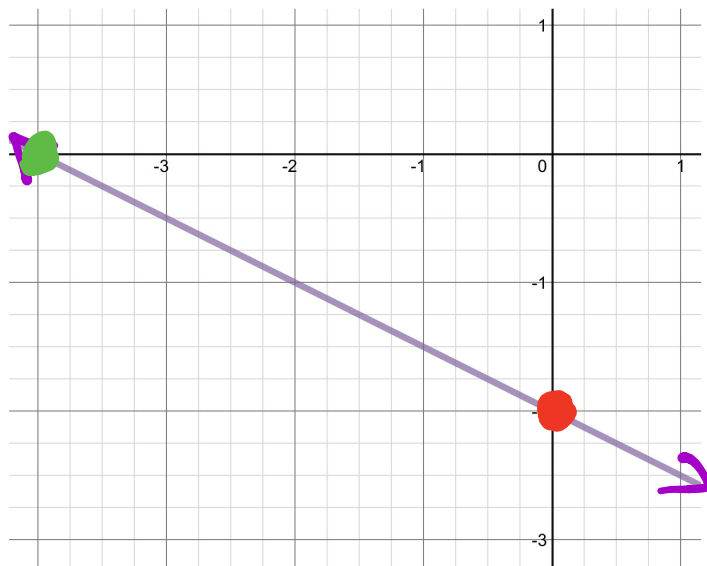


$$y = a(x-h)^2 + k$$
$$\boxed{y = -2(x-1)^2 + 3}$$

# Characteristics of functions

- Domain- all possible "x" values.
- Range- all possible "y" values.
- Axis of symmetry- is a line that divides a graph into two symmetrical parts.
- Interval of increase -Domain where the graph is increasing.
- Interval of decrease- Domain where the graph is decreasing.
- Zeros- "x" intercepts.

Ex.1



Increase: none

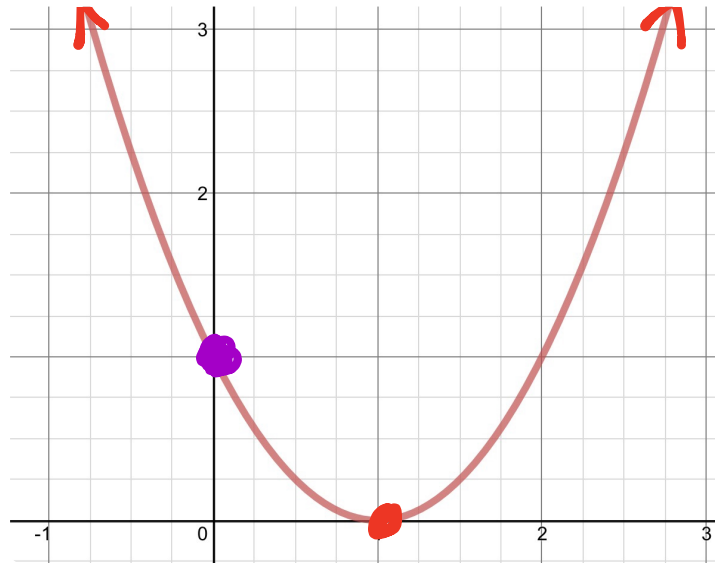
Domain:  
 $(-\infty, \infty)$

Range:  
 $(-\infty, \infty)$

Intercepts:  
 $(0, -2)$   
 $(-4, 0)$

Decrease:  
 $(-\infty, \infty)$

Ex. 2



Domain:  
 $(-\infty, \infty)$

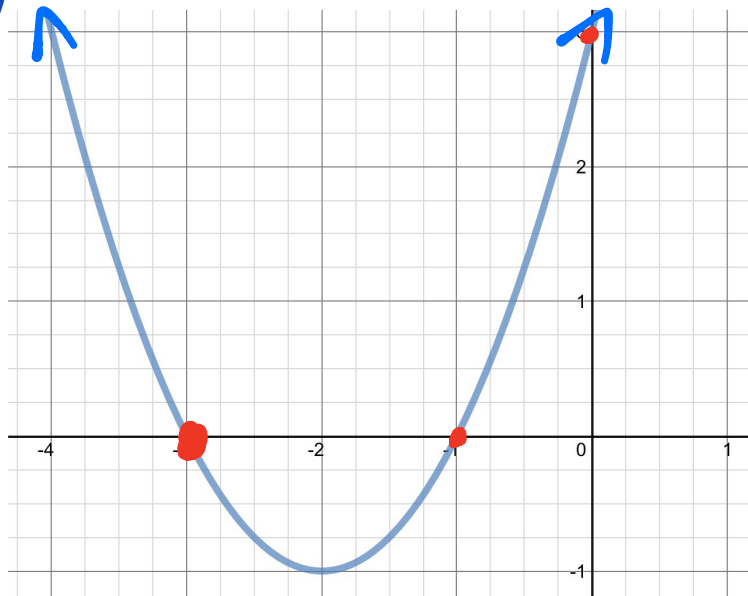
Range:  
 $[0, \infty)$

Intercepts:  
 $(0, 1)$   
 $(1, 0)$

Increase:  
 $(1, \infty)$

Decrease:  
 $(-\infty, 1)$

Ex. 3



Domain:  
 $(-\infty, \infty)$

Range:  
 $[-1, \infty)$

Intercepts:  
 $(-3, 0)$   
 $(-1, 0)$   
 $(0, 3)$

Increase:  
 $(-2, \infty)$

Decrease:  
 $(-\infty, -2)$