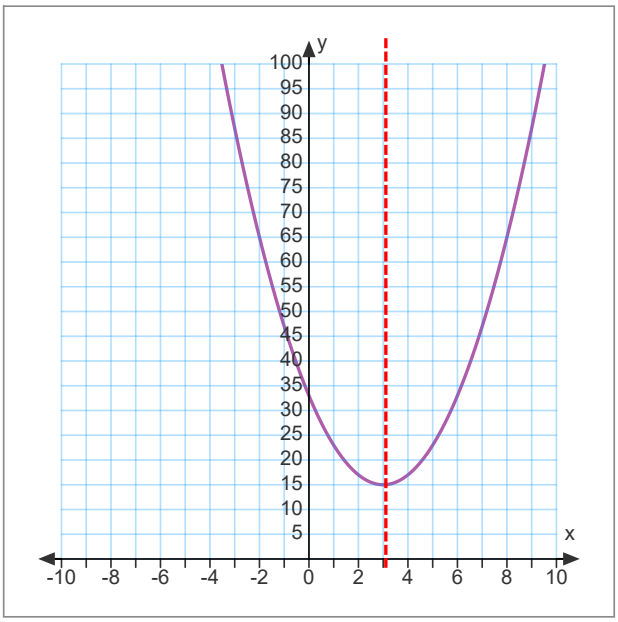
$$f(x) = 2(x-3)^2 + 15$$



a determines how the parabola opens: up (+), down (−), wide, thin.

$|a|<1$ $|a|>1$

h & k determine the vertex of the parabola.

$$V(h,k)$$

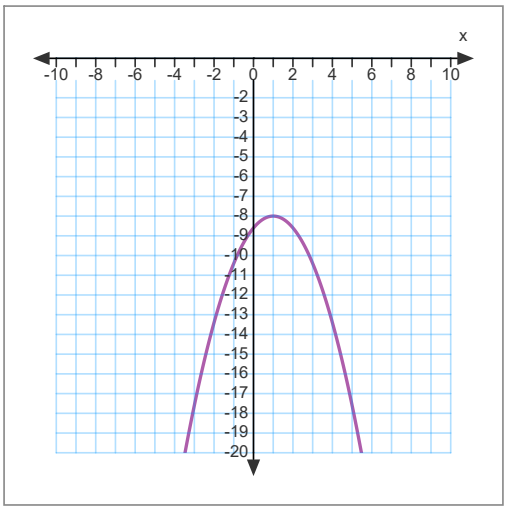
Axis of symmetry: the vertical line passing through the vertex. Its equation is $x = h$.

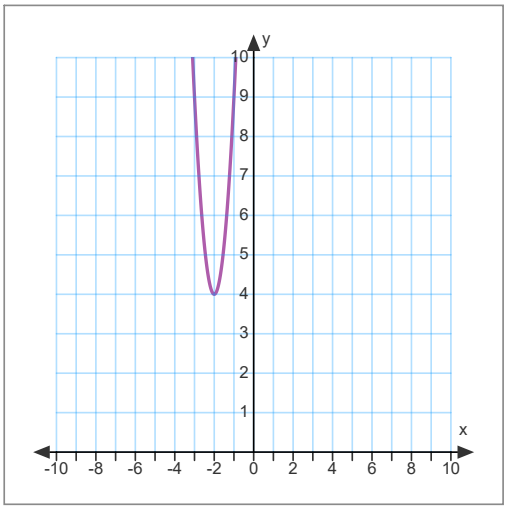
$x = 3$

Example: Using the parameters, describe the graph of each quadratic function.

a) $f(x) = -\frac{3}{5}(x-1)^2 - 8$

b)



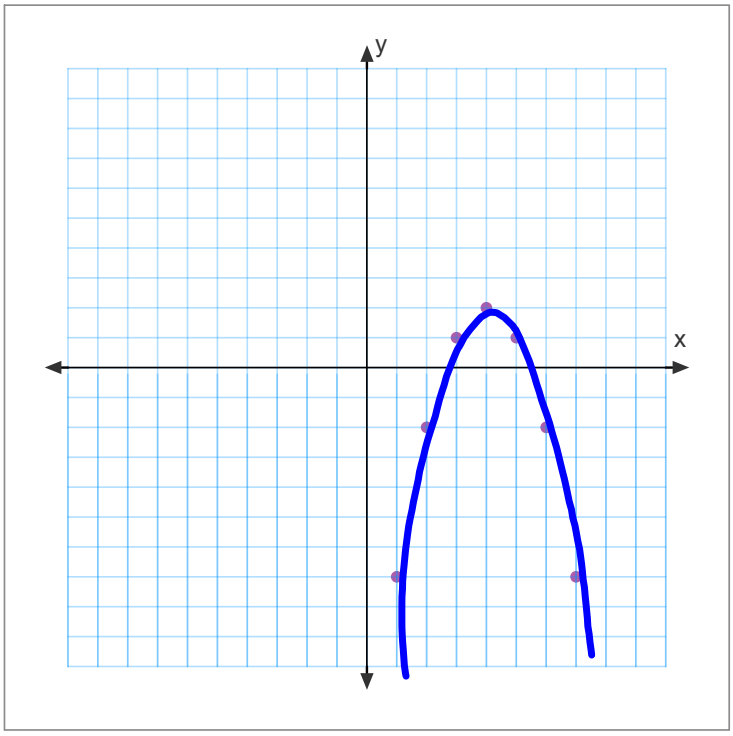


Graphing a Second-Degree Function

Example: $y = -(x-4)^2 + 2$

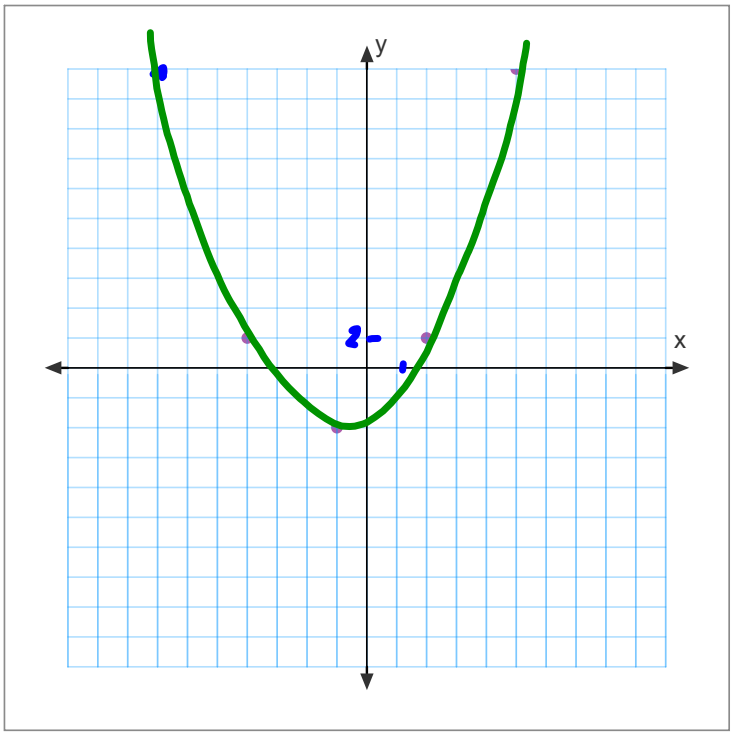
(1, -7)

x	y
2	-2
3	1
vertex 4	2
5	1
6	-2
7	-7



Example: Graph the function $f(x)=\frac{2}{3}(x+1)^2-4$.

x	y
-10	50
-7	20
-4	2
−1	−4
2	2
5	20
8	50



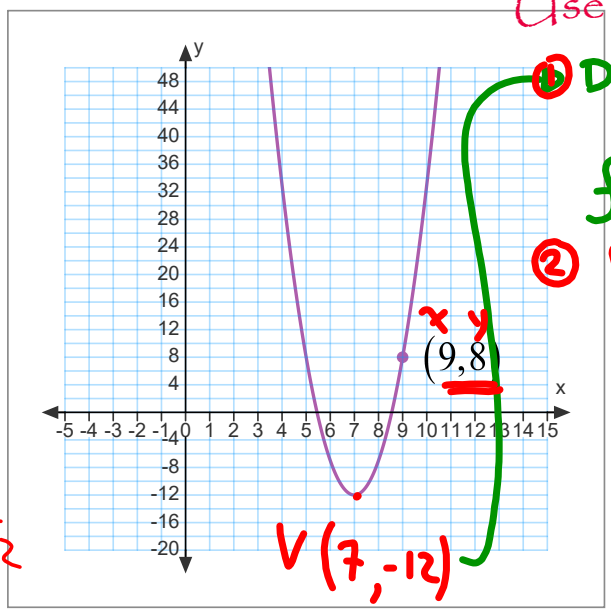
Finding the Rule of a Second-degree Function

- Given the vertex and a point

(h, k)

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

Example:



① Determine (h, k) from vertex

$f(x)=a(x-7)^2-12$

② Fill in x, y from the point

$8=a(9-7)^2-12$

↑ isolate a

$8=a(2)^2-12$

$8=4a-12$

$+12 \quad +12$

$\frac{20}{4}=\frac{4a}{4}$

$5=a$

$f(x)=5(x-7)^2-12$

Example: What is the equation of the second-degree function whose vertex is $(11,24)$ and passes through the point $(6,42)$?

(h k for the vertex; x y for the point)

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

$$f(x)=a(x-11)^2+24$$

$$42=a(6-11)^2+24$$

$$42=a(-5)^2+24$$

$$42=25a+24$$

$$18=25a \longrightarrow a=\frac{18}{25}=0.72$$

$$f(x)=\frac{18}{25}(x-11)^2+24 \quad \text{or} \quad f(x)=0.72(x-11)^2+24$$

Example: What is the equation of the second-degree function whose vertex is $V(-10,-2)$ and whose y-intercept is -12?

The given point is $P(0,-12)$.

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

$$f(x)=a(x+10)^2-2$$

$$-12=a(0+10)^2-2$$

$$-12=100a-2$$

$$-10=100a$$

$$\frac{-10}{100}=-\frac{1}{10}=-0.1=a$$

$$f(x)=-\frac{1}{10}(x+10)^2-2$$

Example: A second-degree function has the following properties:

Ran: $]-\infty, 7]$

Zeros: $\{-1, 9\}$

Axis of symmetry: $x = 4$

Determine the equation of this function.