

# Graphs of Quadratic Functions

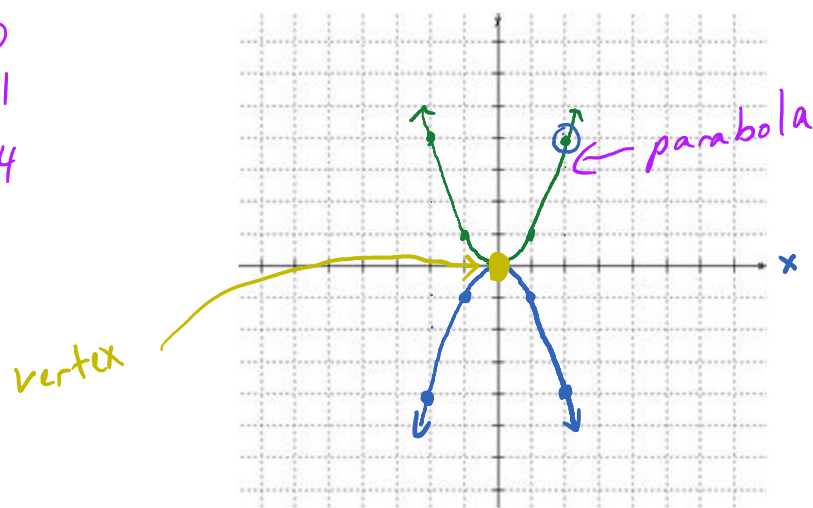
## Goals:

$f(x) = ax^2 + bx + c = a(x-h)^2 + k$ ,  
 where  $(h, k)$  is the vertex.

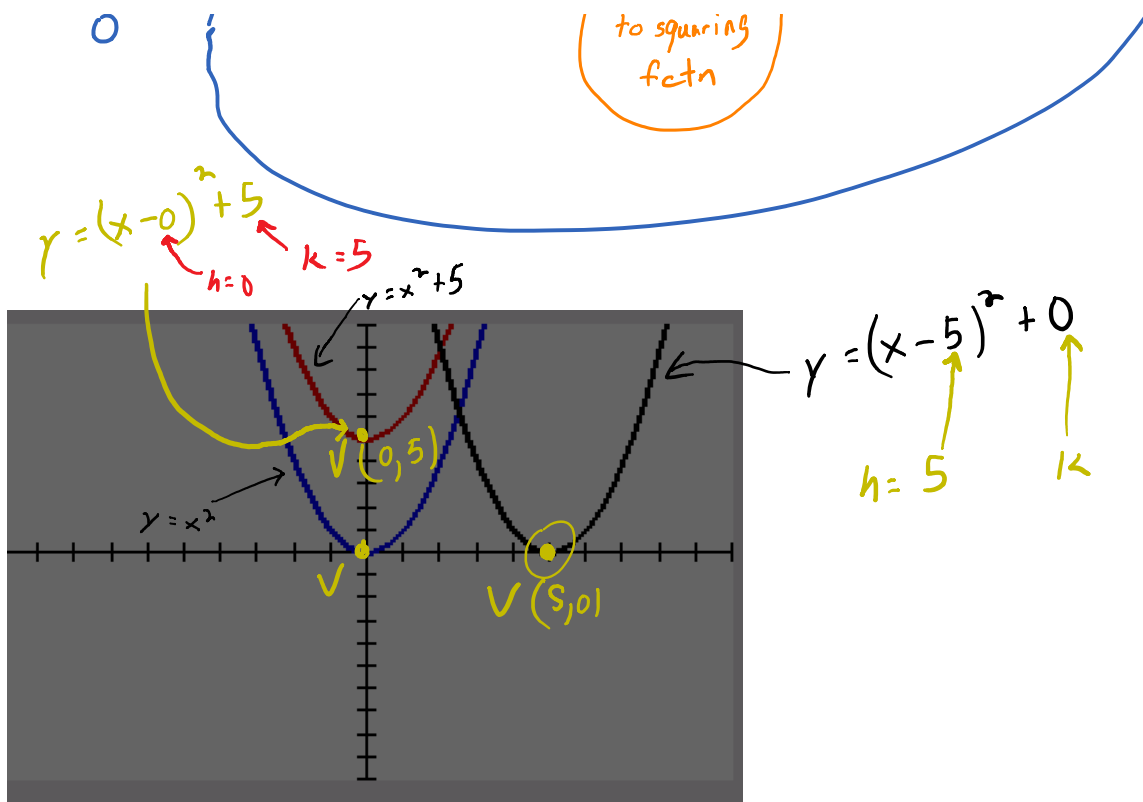
1. To graph a quadratic function using the standard form of its equation.
2. To find the vertex and axis of symmetry of a quadratic function.
3. To find the domain, range, and maximum or minimum value of a quadratic function.
4. To write the equation of a quadratic function in standard form.

(ex) Graph  $y = x^2$  and  $y = -x^2$   
 $y = x^2$  is a squaring function.

x	$y = x^2$	$y = -x^2$
-2	4	-4
-1	1	-1
0	0	0
1	1	-1
2	4	-4

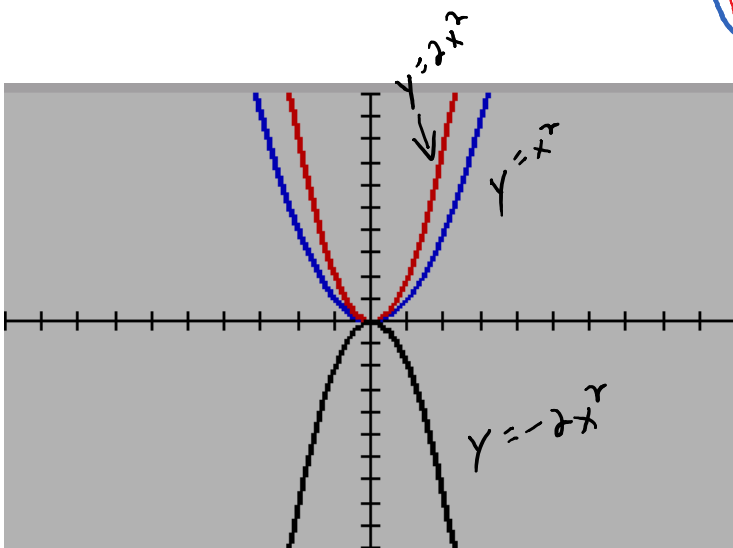
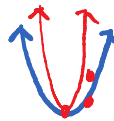


(ex) Compare the graphs of  $y = x^2$ ,  $y = x^2 + 5$ , and  $y = (x - 5)^2$ .  
 -  $y = x^2 + 5$ : add 5 to squaring fctn  
 -  $y = (x - 5)^2$ : right 5



⊗ compare  $y = x^2$ ,  $y = 2x^2$  and  $y = -2x^2$

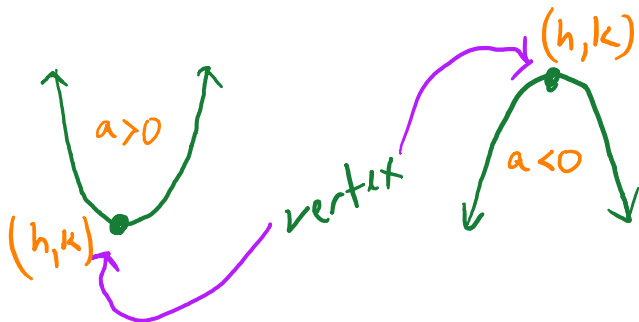
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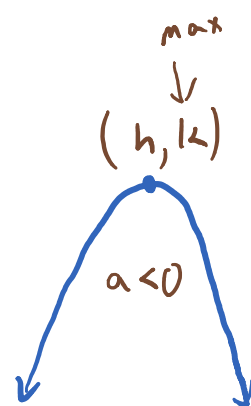
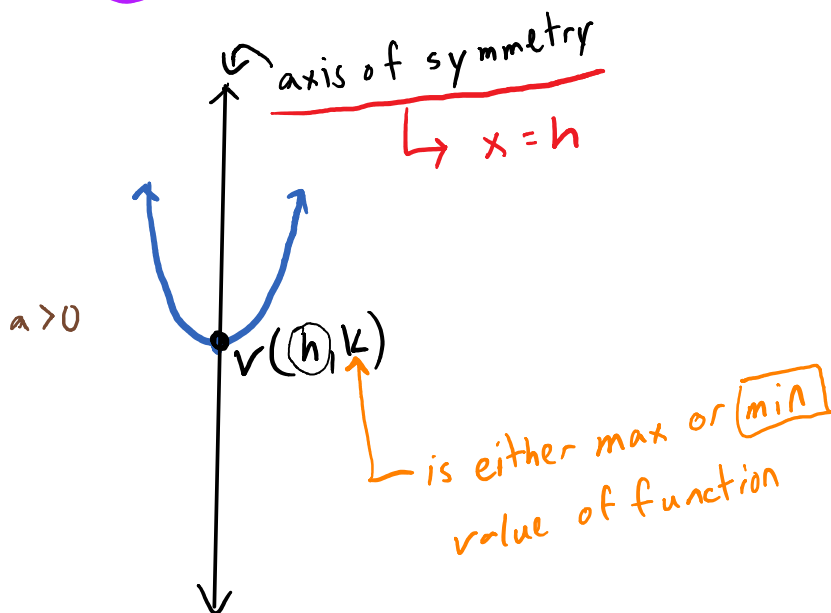
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Standard Form (or Vertex Form) of a Quadratic Function

$$y = a(x-h)^2 + k, \quad (h, k) \text{ is vertex}$$



Shape is a parabola



## Domain and Range of a Q.F.

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

plug in anything



plug in anything



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

$$R: \underbrace{[k, \infty)}_{a > 0} \text{ or } \underbrace{(-\infty, k]}_{a < 0}$$

ex) Graph

$$a) f(x) = 2(x-3)^2 - 1$$

The equation is enclosed in a red box. The  $x$  and  $-3$  in the binomial are circled in green. The  $-1$  is underlined in red. Red arrows point from the labels  $h$  and  $k$  to the  $-3$  and  $-1$  respectively.

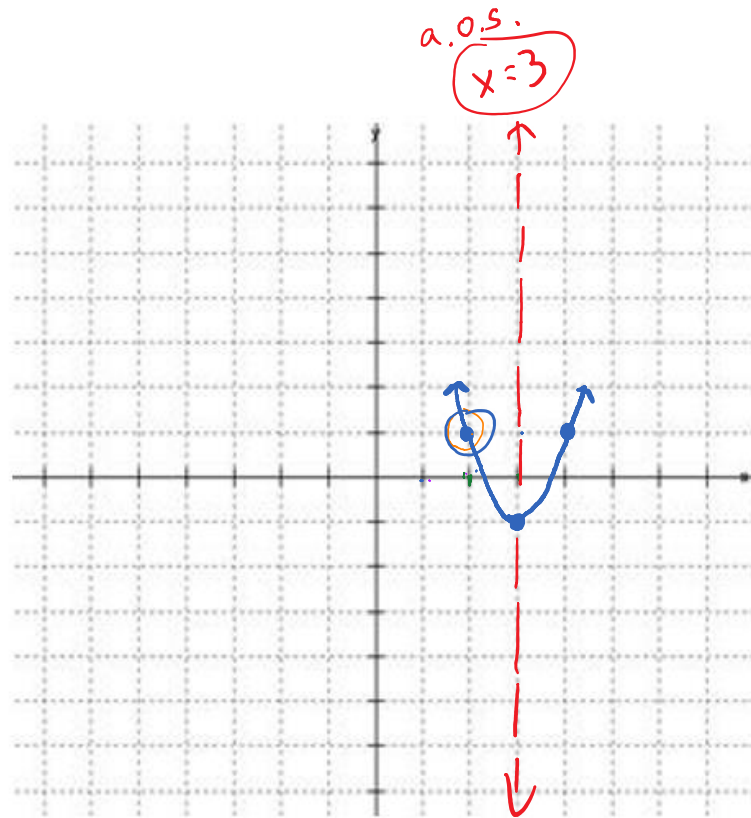
$$V(3, -1)$$

$$a = 2 > 0$$

x	y=f(x)
2	1
4	1

$$f(2) = 2(-1)^2 - 1 = 1$$

4 | 1 sym pt.



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

$$R: [-1, \infty)$$

min: -1

$$b) g(x) = \underbrace{1x^2 + 2x + 5}$$

want

$$\rightarrow g(x) = a(x-h)^2 + k$$

1        0        1

b)  $g(x) = x^2 + 2x + 5$  →  $g(x) = a(x-h) + K$   
vertex form!

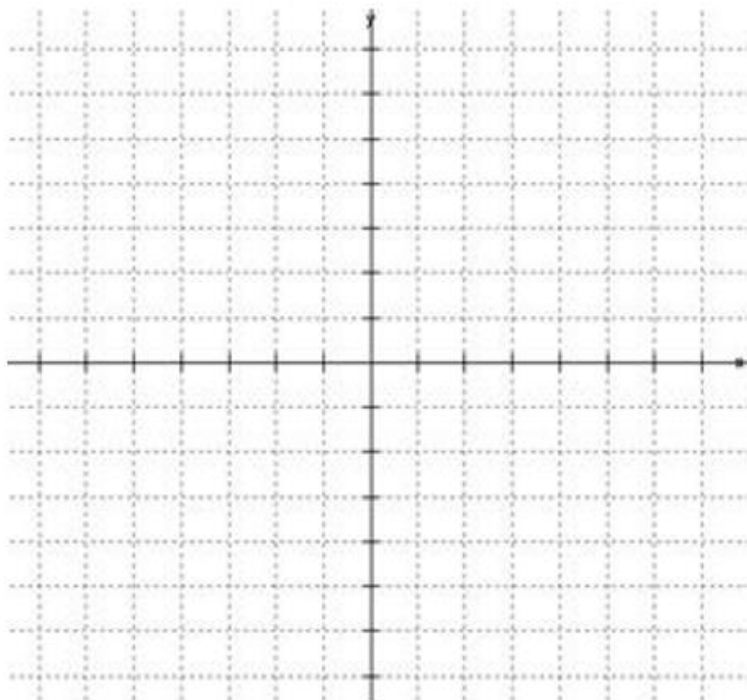
complete  $\square$

$$g(x) = (x^2 + 2x + 1) + 5 - 1$$

$$g(x) = (x + 1)^2 + 4$$

$V(-1, 4)$

a.o.s.:  $x = -1$



c)  $f(x) = 2x^2 - 16x + 23$

Complete  $\square$  factor out 2

$$f(x) = 2(x^2 - 8x + 16) + 23 - 32$$

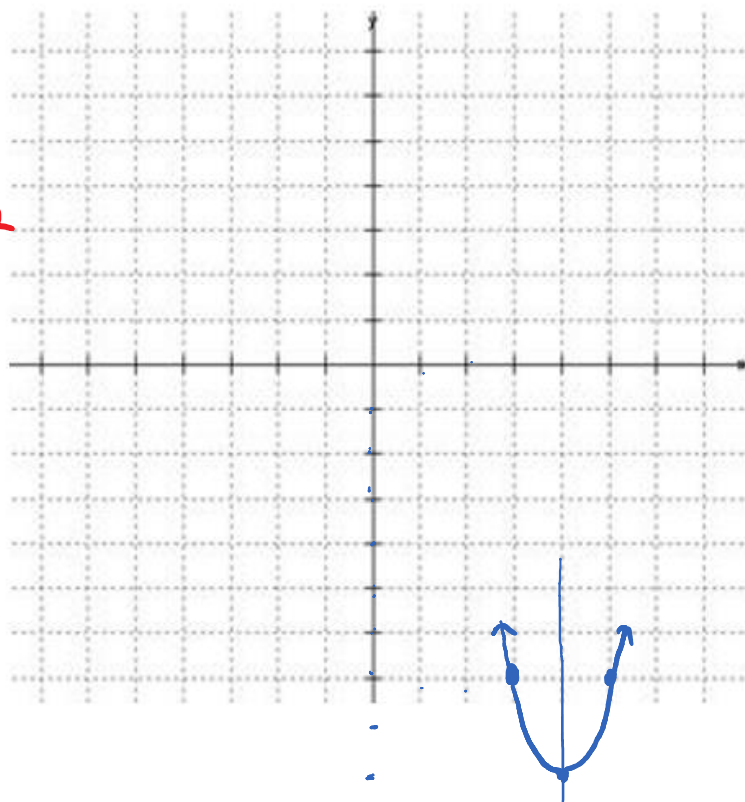
$\uparrow$   
 $\frac{-(-8)}{2}$

$$f(x) = 2(x - 4)^2 - 9$$

$V(4, -9)$

a.o.s.:  $x = 4$

$x$	$y$	
3	-7	2 - 9
5	-7	



o | ' .



$$d) \quad r(x) = -3x^2 - 5x + 1$$

