

Sec. 9.1 Quadratic Graphs and Their Properties

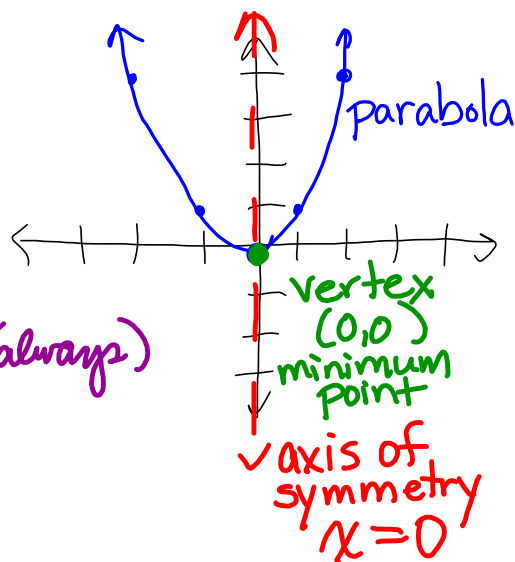
Quadratic function: $y = ax^2 + bx + c$
Standard Form

Parent: (simplest): $y = x^2$

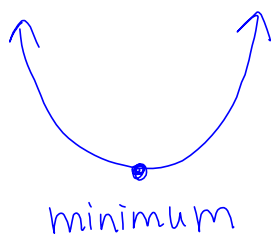
x	y
-2	4
-1	1
0	0
1	1
2	4

Domain: \mathbb{R} (always)

Range: $y \geq 0$

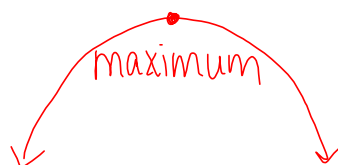


If $a > 0$ graph opens up

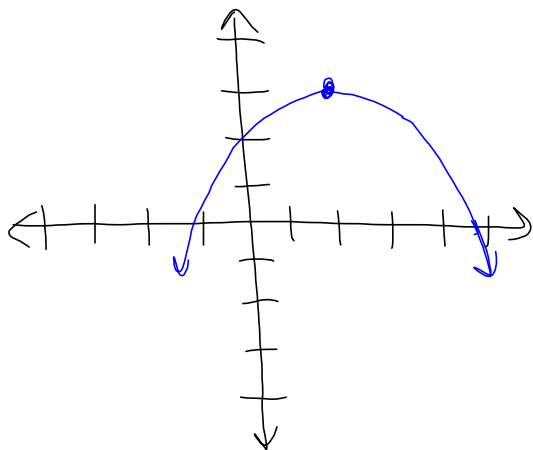


$$y = [a]x^2$$

If $a < 0$ graph opens down



Problem 1: Find the vertex. Is it a maximum or a minimum?



vertex: $(2, 3)$

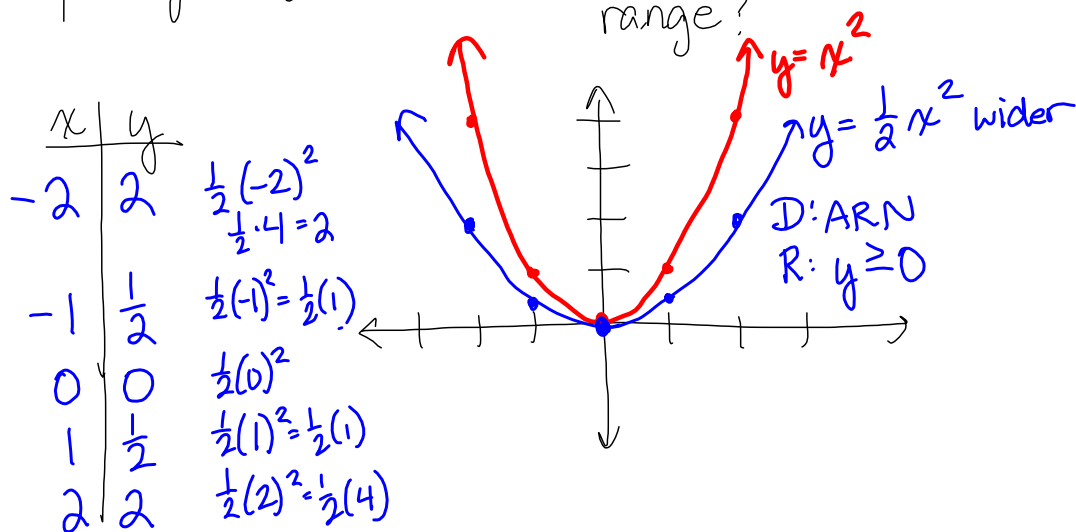
maximum

Domain: \mathbb{R}

Range: $y \leq 3$

Problem 2:

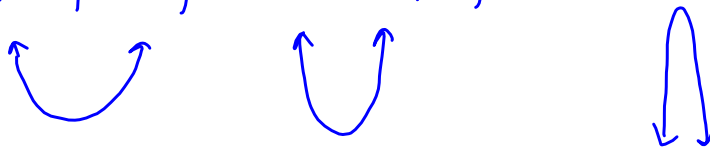
Graph $y = \frac{1}{2}x^2$. What are the domain and range?



Problem 3: Write in order, from widest to narrowest, the graphs of:

$f(x) = -4x^2$, $f(x) = \frac{1}{4}x^2$, $f(x) = x^2$

$f(x) = \frac{1}{4}x^2$, $f(x) = x^2$, $f(x) = -4x^2$



Problem 4: How is the graph of $y = 2x^2 + 3$ different from the graph of $y = 2x^2$

x	$2x^2$	$2x^2 + 3$
-2	8	11
-1	2	5
0	0	3
1	2	5
2	8	11

It is shifted up 3 units

(vertically translated)

$y = 2x^2 - 5$
shift down 5 units
(vertical translation)

Problem 5: An acorn drops from a tree branch 20 ft above the ground.

$h = -16t^2 + 20$, $h =$ height of acorn
 $t =$ number of seconds
 $0 = -16t^2 + 20$
 $+16t^2 + 16t^2$
 $\frac{16t^2}{16} = \frac{20}{16}$
 $t = \frac{\sqrt{5}}{2} \approx 1.1 \text{ sec.}$

Graph: What time does the acorn hit the ground?



*slightly after
1 second*

t	h
0	20
1	4
$\frac{1}{2}$	16

$-16(1)^2 + 20$
 $-16 \cdot 1$
 $-16 + 20$
 $-16\left(\frac{1}{2}\right)^2 + 20$
 $\frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$
 $-16\left(\frac{1}{4}\right) + 20$
 $-4 + 20$