Section 4.1 – Practice Problems

Determine whether the graph of each quadratic opens upwards or downwards, why?

1. $y = \frac{1}{3}x^2 + 2$ upwards $\frac{1}{3}$ is positive

2. $y = -2x^2 + 3$ downwards -2 is negative

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

4. $y = 2 - 3x^2 \rightarrow y = -3x^2 + 2$ downwards coefficient is negative

5. $y + 2x - x^2 = 0$ $y = x^2 - 2x$ upwards ; positive coefficient

6. $x^2 + 2x + y = 0$ $y = -x^2 - 2x$ downwards ; negative leading coefficient

Graph the quadratic function. Plot at least 4 points other than vertex.

7. $y = x^2 - 4$

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

Vertex: (0, -4)

Max/Min: Min

Axis of Symmetry: $x = 0$

Domain: $\mathbb{R}$

Range: $y \geq -4$

8. $y = -x^2 + 4$

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

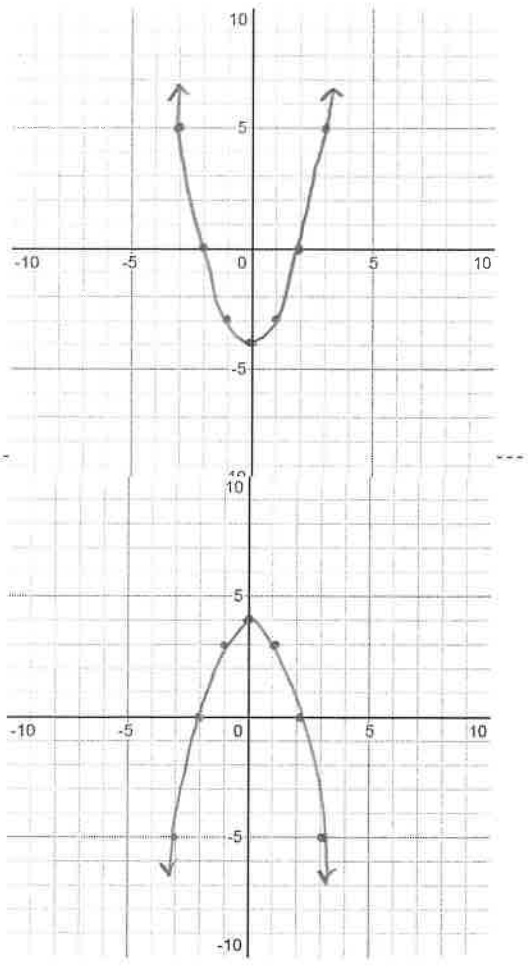
Vertex: (0, 4)

Max/Min: Max

Axis of Symmetry: $x = 0$

Domain: $\mathbb{R}$

Range: $y \leq 4$



9. $y = x^2 - x$

x	y
0	0
1	0
-1	2
2	2
-2	6
3	6
-3	12
4	12

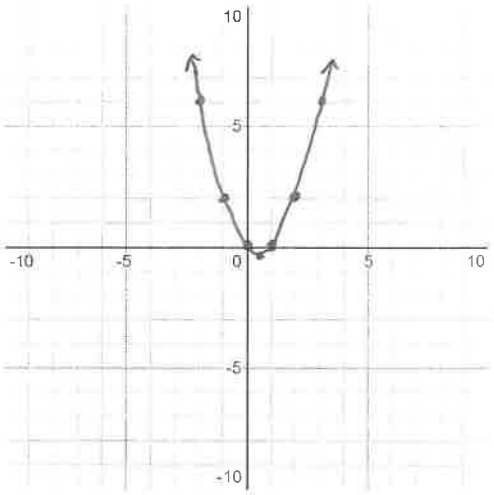
Vertex: $(\frac{1}{2}, -\frac{1}{4})$

Max/Min: Min

Axis of Symmetry: $x = \frac{1}{2}$

Domain: $\mathbb{R}$

Range: $y \geq -\frac{1}{4}$



10. $y = -x^2 + x$

x	y
0	0
1	0
-1	-2
2	-2
$\frac{1}{2}$	$\frac{1}{4}$
-2	-6
3	-6

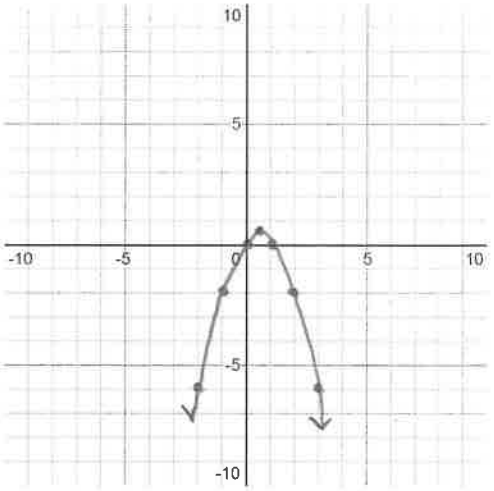
Vertex: $(\frac{1}{2}, \frac{1}{4})$

Max/Min: Max

Axis of Symmetry: $x = \frac{1}{2}$

Domain: $\mathbb{R}$

Range: $y \leq \frac{1}{4}$



11. $y = \frac{1}{2}x^2 - 6$

x	y
0	-6
2	-4
-2	-4
4	2
-4	2
6	12
-6	12

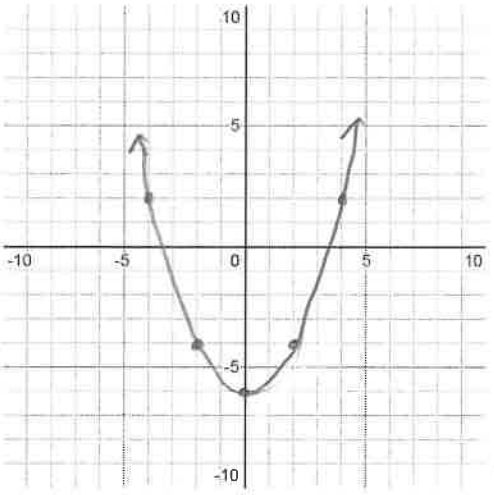
Vertex: $(0, -6)$

Max/Min: Min

Axis of Symmetry: $x = 0$

Domain: $\mathbb{R}$

Range: $y \geq -6$



12. $y = -2x^2 + 6$

x	y
0	6
1	4
-1	4
2	-2
-2	-2
3	-12
-3	-12

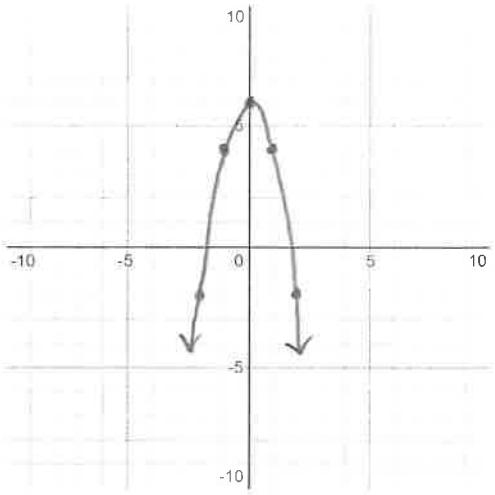
Vertex: (0,6)

Max/Min: Max

Axis of Symmetry: $x = 0$

Domain: $\mathbb{R}$

Range: $y \leq 6$



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

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

Vertex: (1,4)

Max/Min: Max

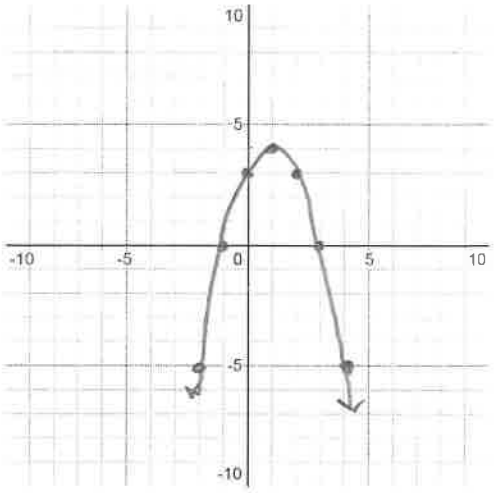
Axis of Symmetry: $x = 1$

Domain: $\mathbb{R}$

Range: $y \leq 4$

$y-intercet$: (0,3)

$x-intercept$: (-1,0) (3,0)



14. $y = \frac{1}{4}(x+2)^2$

x	y
-2	0
0	
-4	
-6	
2	
-8	
4	

Vertex: (-2,0)

Max/Min: Min

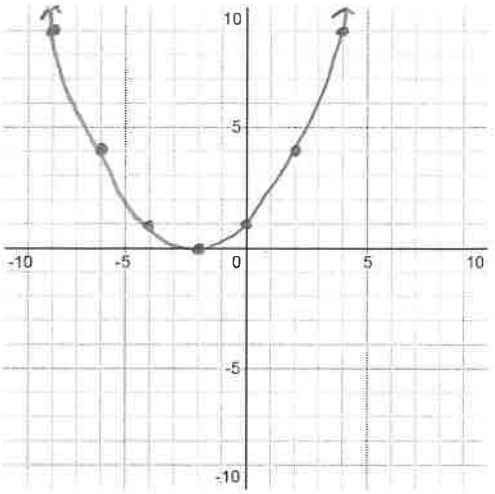
Axis of Symmetry: $x = -2$

Domain: $\mathbb{R}$

Range: $y \geq 0$

$y-intercet$: (0,1)

$x-intercept$: (-2,0)



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

x	y
-1	3
0	1
-2	1
-3	-5
1	-5
-4	-15
2	-15

Vertex: (-1, 3)

Max/Min: Max

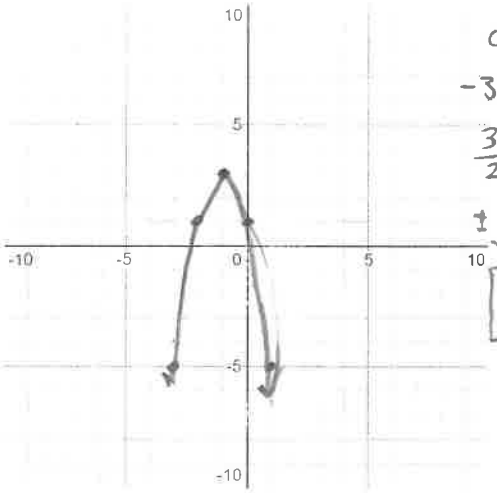
Axis of Symmetry: $x = -1$

Domain: $\mathbb{R}$

Range: $y \leq 3$

$y-intercept$: (0, 1)

$x-intercept$: omit



$0 = -2(x+1)^2 + 3$

$-3 = -2(x+1)^2$

$\frac{3}{2} = (x+1)^2$

$\pm\sqrt{\frac{3}{2}} = x+1$

$-1 \pm \sqrt{\frac{3}{2}} = x$

16. $y = \frac{3}{2}(x+2)^2 - 6$

x	y
-2	-6
-4	0
0	0
-6	18
2	18
6	90
-10	90

Vertex: (-2, -6)

Max/Min: Min

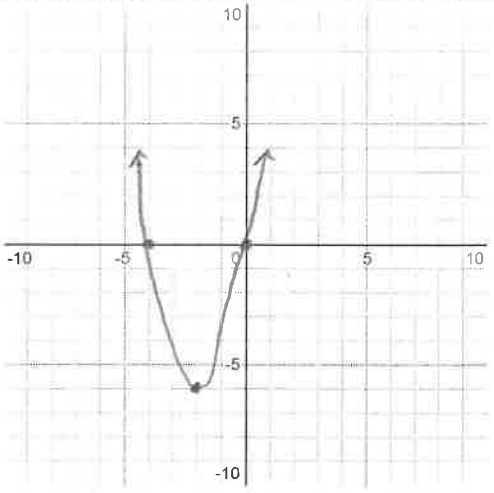
Axis of Symmetry: $x = -2$

Domain: $\mathbb{R}$

Range: $y \geq -6$

$y-intercept$: (0, 0)

$x-intercept$: (0, 0); (-4, 0)



17. $y = -\frac{3}{2}(x-1)^2 + 6$

x	y
1	6
-1	0
3	0
5	-18
-3	-18
0	9/2

Vertex: (1, 6)

Max/Min: Max

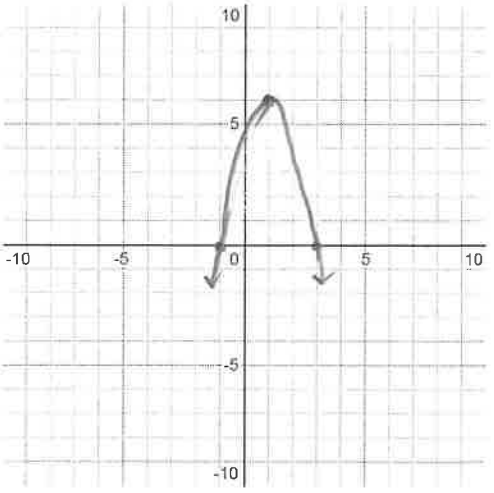
Axis of Symmetry: $x = 1$

Domain: $\mathbb{R}$

Range: $y \leq 6$

$y-intercept$: (0, 9/2)

$x-intercept$: (-1, 0) (3, 0)



Find the number of $x-intercepts$ for the following functions, explain why.

18. $f(x) = -2(x-1)^2 + 1$

2 intercepts
shifted up 1
opens downward

19. $f(x) = -2(x-1)^2 - 1$

zero intercepts
shifted down 1
opens down

20. $f(x) = -2(x-1)^2$

1 intercept
vertex is on x-axis
no vertical shift

21. $f(x) = 2(x+1)^2 + 1$

zero intercepts
shifted up 1 and
opens upward

22. $f(x) = 3x^2 - 1$

2 intercepts
shifted down
opens up

23. $f(x) = -3x^2 - 1$

0 intercepts
shifted down
opens down

24. Write the equation of a quadratic function $h(x)$ that has the same shape as:
$f(x) = -\frac{1}{2}(x+1)^2 - 3$ and the same vertex as $g(x) = 2(x+2)^2 + 1$

shape → $-\frac{1}{2}$ vertex → $(-2, 1)$

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

25. Write the equation of a quadratic function $h(x)$ that has the same shape as:
$f(x) = \frac{2}{3}(x-1)^2 + 2$ and the same vertex as $g(x) = -(x+3)^2 - 4$

shape → $\frac{2}{3}$ vertex → $(-3, -4)$

$$h(x) = \frac{2}{3}(x+3)^2 - 4$$