

Section 3.5 Notes:

Find the Maximum or Minimum of a Quadratic Function:

Write a Quadratic Function in Standard Form:

Graph a Quadratic Function using the Vertex and Maximum or Minimum:

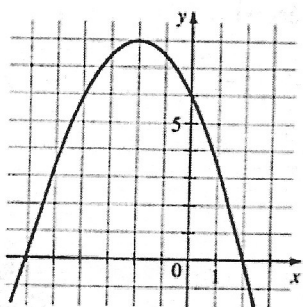
**Find the Maximum and Minimum:**

1-4 ■ The graph of a quadratic function  $f$  is given.

(a) Find the coordinates of the vertex.

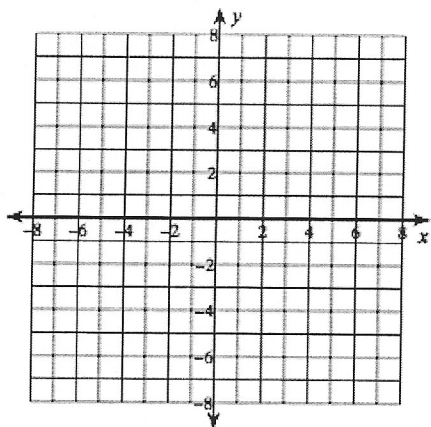
(b) Find the maximum or minimum value of  $f$ .

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

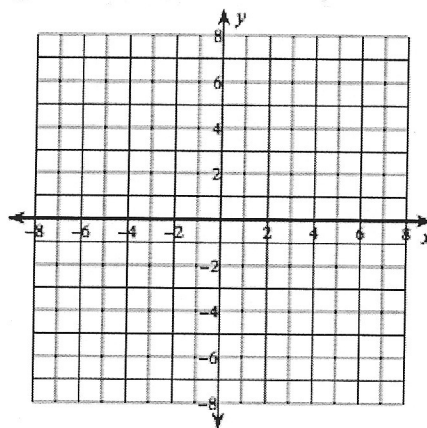


5-18 ■ Sketch the graph of the given parabola and state the coordinates of its vertex and its intercepts.

11.  $y = -x^2 + 6x + 4$



15.  $y = 2x^2 - 20x + 57$



**Write a Quadratic Function in Standard Form:**

A Quadratic Function:

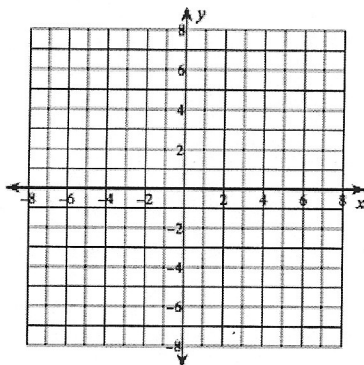
Can be expressed in Standard Form: (By completing the Square)

**Graph a Quadratic Function using the Vertex and Maximum or Minimum:**

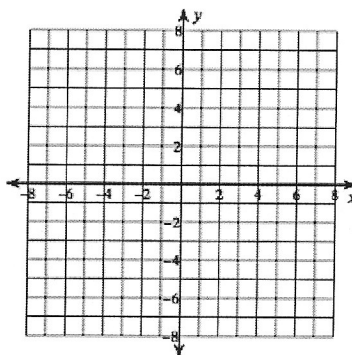
19–28 ■ A quadratic function is given.

- (a) Express the quadratic function in standard form.
- (b) Sketch its graph.
- (c) Find its maximum or minimum value.

22.  $f(x) = x^2 - 8x + 8$



26.  $g(x) = 2x^2 + 8x + 11$



29–38 ■ Find the maximum or minimum value of the function.

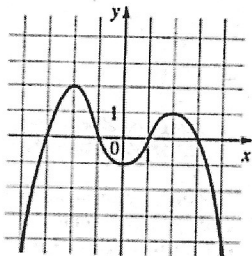
31.  $f(t) = 100 - 49t - 7t^2$

41–42 ■ Find the domain and range of the function.

42.  $f(x) = x^2 - 2x - 3$

45–48 ■ Find all local maximum and minimum values of the function whose graph is shown.

46.



57. **Height of a Ball** If a ball is thrown directly upward with a velocity of 40 ft/s, its height (in feet) after  $t$  seconds is given by  $y = 40t - 16t^2$ . What is the maximum height attained by the ball?

If  $a < 0$ , then the maximum value is  $f\left(-\frac{b}{2a}\right)$

Section 3.5 Notes:

Find the Maximum or Minimum of a Quadratic Function:

Write a Quadratic Function in Standard Form:

Graph a Quadratic Function using the Vertex and Maximum or Minimum:

Find the Maximum and Minimum:

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

$$x = -\frac{b}{2a}$$

if  $a > 0$  then min val is  $f(-\frac{b}{2a})$

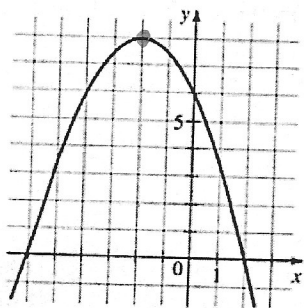
if  $a < 0$   $f(-\frac{b}{2a})$  max val.

1-4 ■ The graph of a quadratic function  $f$  is given.

(a) Find the coordinates of the vertex.

(b) Find the maximum or minimum value of  $f$ .

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



$$\frac{2}{2(-1/2)} = \frac{2}{-1} = -2$$

$a < 0$

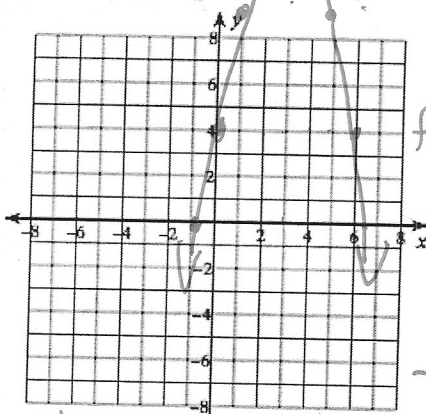
$(-2, 8) \text{ max}$

$$f(-2) = -\frac{1}{2}(-2)^2 - 2(-2) + 6$$

$$-2 + 4 + 6 = 8$$

5-18 ■ Sketch the graph of the given parabola and state the coordinates of its vertex and its intercepts.

11.  $y = -x^2 + 6x + 4$



$a < 0$   
max  
 $\frac{-6}{2(-1)} = 3$

$$f(3) = -(3)^2 + 6(3) + 4 = 13$$

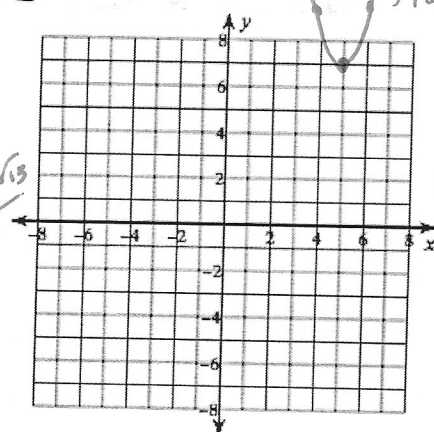
$$f(1) = -1^2 + 6(1) + 4 = 9$$

$$\frac{-6 \pm \sqrt{36 - 4(-1)(4)}}{2(-1)} = \frac{-6 \pm 2\sqrt{13}}{-2}$$

$$\frac{-6 \pm \sqrt{6^2 - 4(-1)(4)}}{2(-1)}$$

$v(3, 9)$  y-int  $(0, 4)$  x-int  $(3 \pm \sqrt{13})$

15.  $y = 2x^2 - 20x + 57$



$a > 0$   $\frac{20}{2(2)} = 5$

$$f(5) = 2(5)^2 - 20(5) + 57 = 7$$

$(5, 7)$   
no x-int  
y-int  $(0, 57)$

Write a Quadratic Function in Standard Form:

A Quadratic Function:

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

Can be expressed in Standard Form: (By completing the Square)

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

**Graph a Quadratic Function using the Vertex and Maximum or Minimum:**

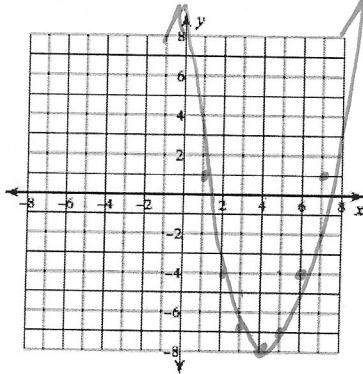
19-28 ■ A quadratic function is given.

(a) Express the quadratic function in standard form.

(b) Sketch its graph.

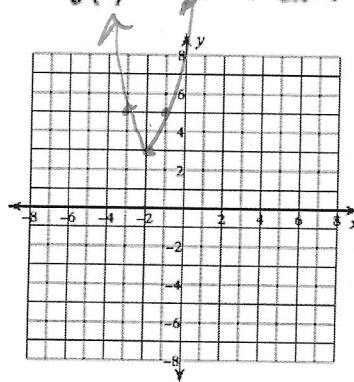
(c) Find its maximum or minimum value.

22.  $f(x) = x^2 - 8x + 8$   $(x^2 - 8x + 16) + 8 - 16$



$(x-4)^2 - 8$   
min(4, -8)

$2(x^2 + 4x + 4) + 11 - 8$   
26.  $g(x) = 2x^2 + 8x + 11$   $2(x+2)^2 + 3$



min(-2, 3)

29-38 ■ Find the maximum or minimum value of the function.

31.  $f(t) = 100 - 49t - 7t^2$   $\frac{49}{2(-7)} = -\frac{7}{2}$   $f(\frac{7}{2}) = -7(\frac{7}{2})^2 - 49(\frac{7}{2}) + 100$

$(3.5, 185.75)$

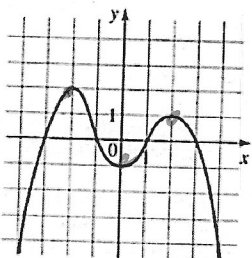
41-42 ■ Find the domain and range of the function.

42.  $f(x) = x^2 - 2x - 3$   $\frac{2}{2(1)} = 1$   $f(1) = 1^2 - 2(1) - 3 = -4$  (1, -4) min

D:  $(-\infty, \infty)$   
R:  $[-4, \infty)$

45-48 ■ Find all local maximum and minimum values of the function whose graph is shown.

46.



Relative max (-2, 2)  
Local max (2, 1)  
Relative min (0, -1)

57. **Height of a Ball** If a ball is thrown directly upward with a velocity of 40 ft/s, its height (in feet) after  $t$  seconds is given by  $y = 40t - 16t^2$ . What is the maximum height attained by the ball?

$f(t) = -16t^2 + 40t$

If  $a < 0$ , then the maximum value is  $f(-\frac{b}{2a})$

$f(1.25) = 40(1.25) - 16(1.25)^2 = 25$

$\frac{-40}{2(-16)} = 1.25$