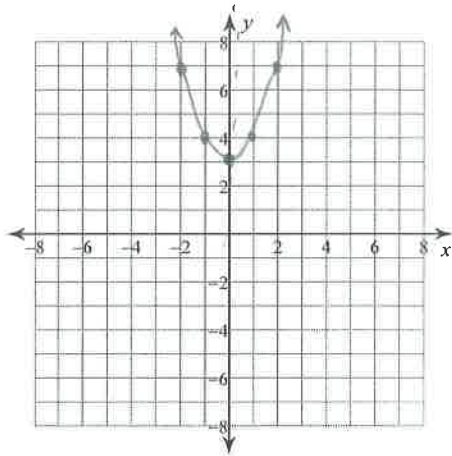


Parabolas

Identify the vertex, axis of symmetry, y-intercept, and x-intercepts of each. Then sketch the graph.

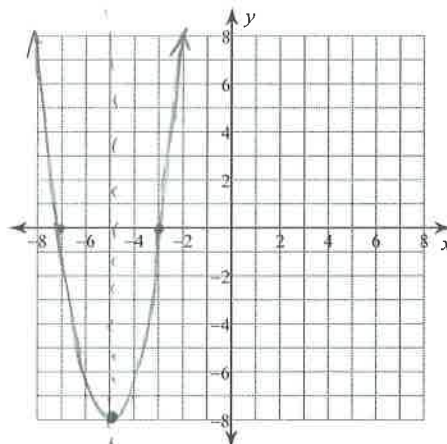
1) $f(x) = x^2 + 3$



AOS: $-\frac{b}{2a} = \frac{0}{2(1)} = x=0$
 vertex: $0^2 + 3 = (0, 3)$
 y-intercept $(0, 3)$

x-intercepts:
 $x^2 + 3 = 0$
 $x^2 = -3$
 $x = \pm\sqrt{-3}$ (no real)

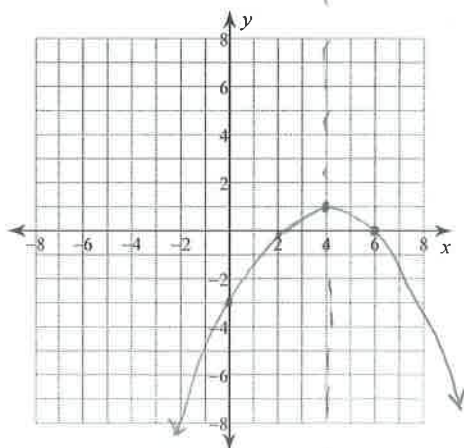
2) $f(x) = 2(x + 5)^2 - 8$



AOS: $x = -5$
 vertex: $(-5, -8)$
 y-intercept: $2(0+5)^2 - 8$
 $(0, 42)$

x-intercepts:
 $2(x+5)^2 - 8 = 0$
 $2(x+5)^2 = 8$
 $(x+5)^2 = 4$
 $x+5 = \pm 2$
 $x = -5 \pm 2$

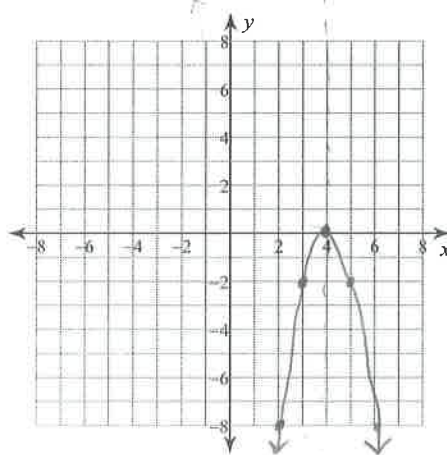
3) $f(x) = -\frac{1}{4}(x - 4)^2 + 1$



AOS: $x = 4$
 vertex: $(4, 1)$
 y-intercept: $-\frac{1}{4}(0-4)^2 + 1$
 $(0, -3)$

x-intercepts:
 $-\frac{1}{4}(x-4)^2 + 1 = 0$
 $-\frac{1}{4}(x-4)^2 = -1$
 $(x-4)^2 = 4$
 $x-4 = \pm 2$
 $x = 4 \pm 2$
 $(6, 0)(2, 0)$

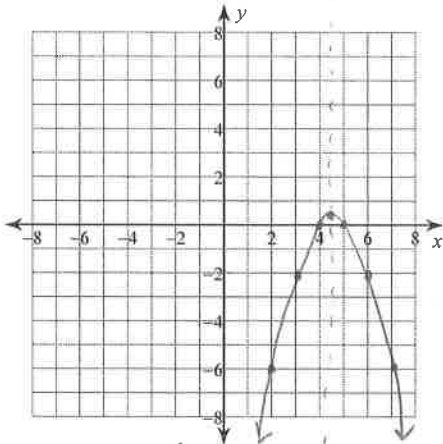
4) $f(x) = -2(x - 4)^2$



AOS: $x = 4$
 vertex: $(4, 0)$
 y-intercept: $-2(0-4)^2$
 $(0, -32)$

x-intercepts:
 $-2(x-4)^2 = 0$
 $(x-4)^2 = 0$
 $x-4 = 0$
 $x = 4$

$$5) f(x) = -\left(x - \frac{9}{2}\right)^2 + \frac{1}{4}$$



axis: $x = \frac{9}{2}$

vertex: $(\frac{9}{2}, \frac{1}{4})$

y-intercept: $-(0 - \frac{9}{2})^2 + \frac{1}{4}$
 $(0, -20)$

x-intercepts:

$$-(x - \frac{9}{2})^2 + \frac{1}{4} = 0$$

$$-(x - \frac{9}{2})^2 = -\frac{1}{4}$$

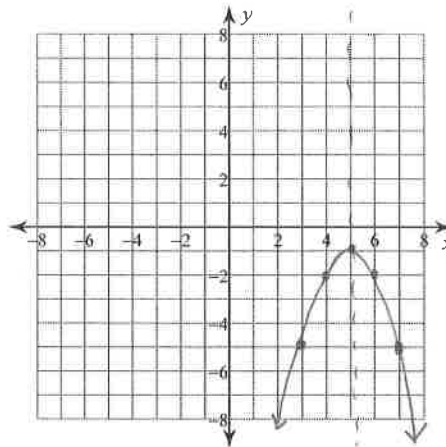
$$(x - \frac{9}{2})^2 = \frac{1}{4}$$

$$x - \frac{9}{2} = \pm \frac{1}{2}$$

$$x = \frac{9}{2} \pm \frac{1}{2}$$

$$(5, 0)(4, 0)$$

$$6) f(x) = -(x - 5)^2 - 1$$



axis: $x = 5$

vertex: $(5, -1)$

y-intercept: $-(0 - 5)^2 - 1$
 $(0, -26)$

x-intercepts:

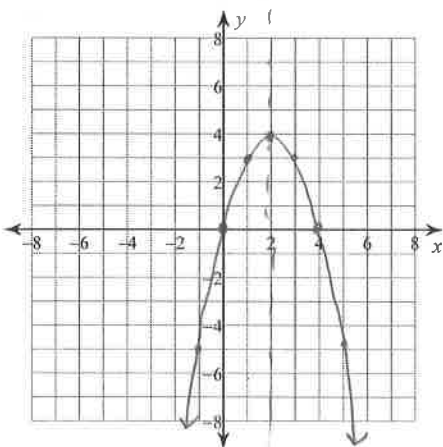
$$-(x - 5)^2 - 1 = 0$$

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

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

no real

$$7) f(x) = -(x - 2)^2 + 4$$



axis: $x = 2$

vertex: $(2, 4)$

y-intercept: $-(0 - 2)^2 + 4$
 $(0, 0)$

x-intercepts:

$$-(x - 2)^2 + 4 = 0$$

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

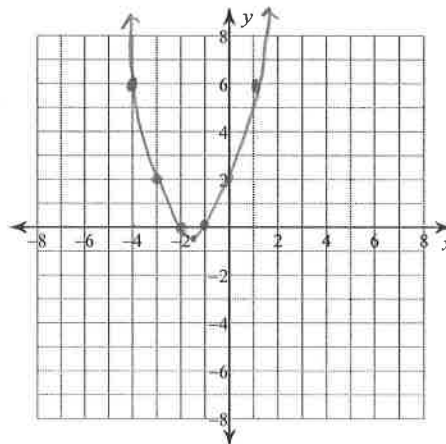
$$(x - 2)^2 = 4$$

$$x - 2 = \pm 2$$

$$x = 2 \pm 2$$

$$(4, 0)(0, 0)$$

$$8) f(x) = \left(x + \frac{3}{2}\right)^2 - \frac{1}{4}$$



axis: $x = -\frac{3}{2}$

vertex: $(-\frac{3}{2}, -\frac{1}{4})$

y-intercept: $(0 + \frac{3}{2})^2 - \frac{1}{4}$
 $(0, 2)$

x-intercepts:

$$(x + \frac{3}{2})^2 - \frac{1}{4} = 0$$

$$(x + \frac{3}{2})^2 = \frac{1}{4}$$

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

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

$$(-1, 0)(-2, 0)$$

Use the information provided to write the vertex form equation of each parabola. Then identify the vertex, axis of symmetry, y-intercept, and x-intercepts of each.

$$9) y = -\frac{3}{4}x^2 - 6x - 20$$

$$y = -\frac{3}{4}(x^2 + 8x + 16 - 16) - 20$$

$$y = -\frac{3}{4}(x+4)^2 + 12 - 20$$

$$y = -\frac{3}{4}(x+4)^2 - 8$$

axis: $x = -4$

vertex: $(-4, -8)$

y-intercept: $(0, -20)$

no real x-intercepts

$$10) y = -\frac{1}{3}x^2 - \frac{4}{3}x + \frac{23}{3}$$

$$y = -\frac{1}{3}(x^2 + 4x + 4 - 4) + \frac{23}{3}$$

$$y = -\frac{1}{3}(x+2)^2 - \frac{4}{3} + \frac{23}{3}$$

$$y = -\frac{1}{3}(x+2)^2 + 9$$

axis: $x = -2$

vertex: $(-2, 9)$

y-intercept: $(0, \frac{23}{3})$

x-intercepts:

$$-\frac{1}{3}(x+2)^2 + 9 = 0$$

$$-\frac{1}{3}(x+2)^2 = -9$$

$$(x+2)^2 = 27$$

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

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

$$(-2+3\sqrt{3}, 0) (-2-3\sqrt{3}, 0)$$

$$11) y = \frac{1}{3}x^2 + 6x + 28$$

$$y = \frac{1}{3}(x^2 + 18x + 81 - 81) + 28$$

$$y = \frac{1}{3}(x+9)^2 - 27 + 28$$

$$y = \frac{1}{3}(x+9)^2 + 1$$

axis: $x = -9$

vertex: $(-9, 1)$

y-intercept: $(0, 28)$

x-intercepts:

no real

$$12) y = -\frac{1}{14}x^2 + \frac{4}{7}x - \frac{57}{7}$$

$$y = -\frac{1}{14}(x^2 - 8x + 16 - 16) - \frac{57}{7}$$

$$y = -\frac{1}{14}(x-4)^2 + \frac{8}{7} - \frac{57}{7}$$

$$y = -\frac{1}{14}(x-4)^2 - 7$$

axis: $x = 4$

vertex: $(4, -7)$

y-intercept: $(0, -\frac{57}{7})$

no real

$$13) y = 2(2x^2 + 40x + 205)$$

$$y = 4(x^2 + 20x + 100 - 100) + 410$$

$$y = 4(x+10)^2 + 400 + 410$$

$$y = 4(x+10)^2 + 10$$

x-intercepts:

no real

axis: $x = -10$

vertex: $(-10, 10)$

y-intercept: $(0, 410)$

$$14) y = -2x(x+10)$$

$$y = -2(x^2 + 10x + 25 - 25)$$

$$y = -2(x+5)^2 + 50$$

axis: $x = -5$

vertex: $(-5, 50)$

y-intercept: $(0, 0)$

x-intercepts:

$$-2(x+5)^2 = -50$$

$$(x+5)^2 = 25$$

$$x+5 = \pm 5$$

$$x = 5 \pm 5$$

$$(10, 0) (0, 0)$$

$$15) -2x^2 + 8x + y - 17 = 0$$

$$y = 2x^2 - 8x + 17$$

$$y = 2(x^2 - 4x + 4 - 4) + 17$$

$$y = 2(x-2)^2 + 8 + 17$$

$$y = 2(x-2)^2 + 9$$

x-intercepts:
no real

$$\text{AOS: } x = 2$$

$$\text{Vertex: } (2, -9)$$

$$\text{y-intercept: } (0, 17)$$

$$17) y + 3 = (x + 3)^2$$

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

$$\text{AOS: } x = -3$$

$$\text{Vertex: } (-3, -3)$$

$$\text{y-intercept: } (0 + 3)^2 - 3$$

$$(0, 6)$$

x-intercepts:

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

$$x + 3 = \pm\sqrt{3}$$

$$x = -3 \pm \sqrt{3}$$

$$(-3 + \sqrt{3}, 0) (-3 - \sqrt{3}, 0)$$

$$16) -2x^2 - 24x + y - 63 = 0$$

$$y = 2x^2 + 24x + 63$$

$$y = 2(x^2 + 12x + 36 - 36) + 63$$

$$y = 2(x + 6)^2 - 72 + 63$$

$$y = 2(x + 6)^2 - 9$$

x-intercepts:

$$2(x + 6)^2 - 9 = 0$$

$$2(x + 6)^2 = 9$$

$$(x + 6)^2 = \frac{9}{2}$$

$$x + 6 = \pm \frac{3\sqrt{2}}{2}$$

$$x = -6 \pm \frac{3\sqrt{2}}{2}$$

$$\left(-6 + \frac{3\sqrt{2}}{2}, 0\right) \left(-6 - \frac{3\sqrt{2}}{2}, 0\right)$$

$$\text{AOS: } x = -6$$

$$\text{Vertex: } (-6, -9)$$

$$\text{y-intercept: } (0, 63)$$

$$18) -\frac{1}{4}(y - 10) = (x - 3)^2$$

$$y - 10 = -4(x - 3)^2$$

$$y = -4(x - 3)^2 + 10$$

$$\text{AOS: } x = 3$$

$$\text{Vertex: } (3, 10)$$

$$\text{y-intercept: } -4(0 - 3)^2 + 10$$

$$(0, -26)$$

x-intercepts:

$$-4(x - 3)^2 = -10$$

$$(x - 3)^2 = \frac{5}{2}$$

$$x - 3 = \pm \frac{\sqrt{10}}{2}$$

$$x = 3 \pm \frac{\sqrt{10}}{2}$$

$$\left(3 + \frac{\sqrt{10}}{2}, 0\right) \left(3 - \frac{\sqrt{10}}{2}, 0\right)$$

$$19) \frac{1}{13}(y + 9) = (x + 3)^2$$

$$y + 9 = 13(x + 3)^2$$

$$y = 13(x + 3)^2 - 9$$

$$\text{AOS: } x = -3$$

$$\text{Vertex: } (-3, -9)$$

$$\text{y-intercept: } 13(0 + 3)^2 - 9$$

$$(0, 108)$$

x-intercepts:

$$13(x + 3)^2 - 9 = 0$$

$$13(x + 3)^2 = 9$$

$$(x + 3)^2 = \frac{9}{13}$$

$$x + 3 = \pm \frac{3\sqrt{13}}{13}$$

$$x = -3 \pm \frac{3\sqrt{13}}{13}$$

$$\left(-3 + \frac{3\sqrt{13}}{13}, 0\right)$$

$$\left(-3 - \frac{3\sqrt{13}}{13}, 0\right)$$

$$20) 20x = 51 - y + 2x^2$$

$$y = 2x^2 - 20x + 51$$

$$y = 2(x^2 - 10x + 25 - 25) + 51$$

$$y = 2(x - 5)^2 - 50 + 51$$

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

$$\text{AOS: } x = 5$$

$$\text{Vertex: } (5, 1)$$

$$\text{y-intercept: } (0, 51)$$

x-intercepts:

no real