3. vertex: $(1, -1)$

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

7. The point $(1, 0)$ is on the graph and $g(1) = 0$. $g(x) = x^2 - 2x + 1$

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

$x = \frac{-b}{2a} = \frac{2}{-2} = -1$

$f(-1) = -(-1)^2 - 2(-1) + 8$
$= -1 + 2 + 8 = 9$

The vertex is at $(-1, 9)$.

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

vertex: $(-2, -1)$

x-intercepts:

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

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

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

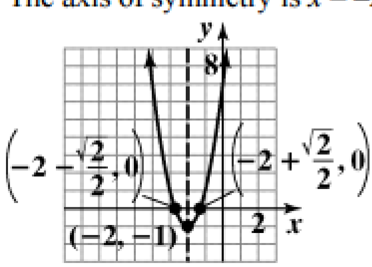
$x + 2 = \pm\frac{1}{\sqrt{2}}$

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

y-intercept:

$f(0) = 2(0+2)^2 - 1 = 7$

The axis of symmetry is $x = -2$.



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

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

range: $[-1, \infty)$

37. $f(x) = 2x - x^2 - 2$

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

$f(x) = -\left(x^2 - 2x + 1\right) - 2 + 1$

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

vertex: $(1, -1)$

x-intercepts:

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

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

$x - 1 = \pm i$

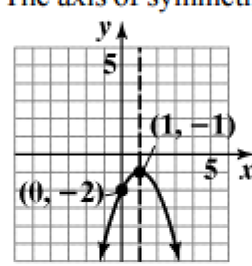
$x = 1 \pm i$

No x-intercepts.

y-intercept:

$f(0) = 2(0) - (0)^2 - 2 = -2$

The axis of symmetry is $x = 1$.



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

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

range: $(-\infty, -1]$

57. **a.** $y = -0.01x^2 + 0.7x + 6.1$
$a = -0.01,\ b = 0.7,\ c = 6.1$

x-coordinate of vertex

$$= \frac{-b}{2a} = \frac{-0.7}{2(-0.01)} = 35$$

y-coordinate of vertex

$$y = -0.01x^2 + 0.7x + 6.1$$
$$y = -0.01(35)^2 + 0.7(35) + 6.1 = 18.35$$

The maximum height of the shot is about 18.35 feet. This occurs 35 feet from its point of release.

b. The ball will reach the maximum horizontal distance when its height returns to 0.

$$y = -0.01x^2 + 0.7x + 6.1$$
$$0 = -0.01x^2 + 0.7x + 6.1$$
$$a = -0.01,\ b = 0.7,\ c = 6.1$$
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
$$x = \frac{-0.7 \pm \sqrt{0.7^2 - 4(-0.01)(6.1)}}{2(-0.01)}$$
$$x \approx 77.8 \text{ or } x \approx -7.8$$

The maximum horizontal distance is 77.8 feet.

c. The initial height can be found at $x = 0$.

$$y = -0.01x^2 + 0.7x + 6.1$$
$$y = -0.01(0)^2 + 0.7(0) + 6.1 = 6.1$$

The shot was released at a height of 6.1 feet.