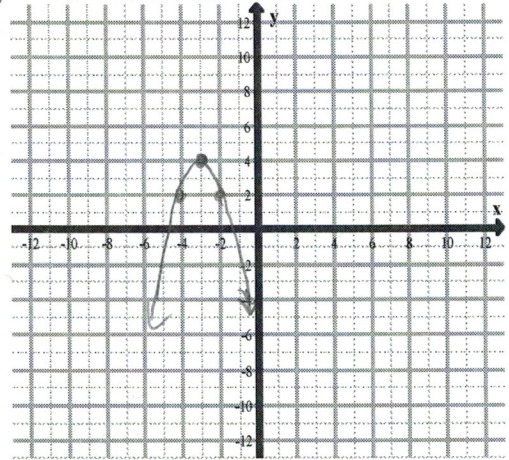


4.3 Practice Problems

1. Graph the quadratic function using transformations. $f(x) = -2x^2 - 12x - 14$

$$\begin{aligned} f(x) &= -2(x^2 + 6x) - 14 \\ &= -2(x^2 + 6x + 9) - 14 + 18 \\ &= -2(x + 3)^2 + 4 \end{aligned}$$



2. a. Graph $f(x) = 3x^2 - 12x + 7$ by determining whether the graph opens up or down and by finding its vertex, axis of symmetry, y-intercept, and x-intercepts, if any.

$a = 3 > 0$ opens up

$$h = \frac{-b}{2a} = \frac{-(-12)}{2(3)} = \frac{12}{6} = 2$$

$$k = f(2) = 3(2)^2 - 12(2) + 7 = -12 + 7 = -5$$

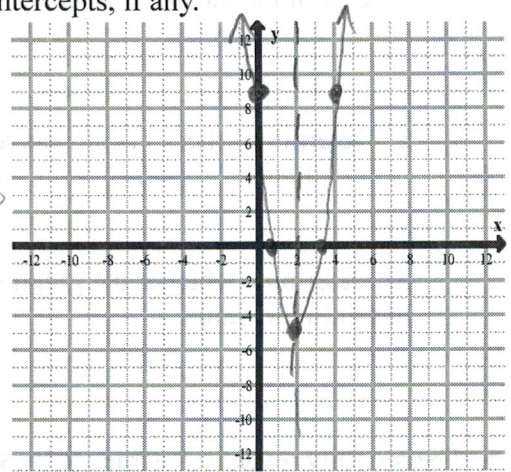
$(2, -5)$ - vertex

$x = 2$ axis of symmetry

$(0, 7)$ y-int

$$x = \frac{12 \pm \sqrt{144 - 4(3)(7)}}{2(3)}$$

$$= \frac{12 \pm \sqrt{60}}{6} = \frac{12 \pm 2\sqrt{15}}{6} = \frac{6 \pm \sqrt{15}}{3}$$



$$\begin{aligned} \frac{6 + \sqrt{15}}{3} &\approx 3.29 \\ \frac{6 - \sqrt{15}}{3} &\approx 0.71 \end{aligned}$$

- b. Determine the domain and range of f .

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

Range: $[-5, \infty)$

- c. Determine where f is increasing and where it is decreasing.

Dec: $(-\infty, 2)$

INC: $(2, \infty)$

- d. Determine whether the graph has a maximum or minimum value. Then find the maximum or minimum value.

min of -5 at $x = 2$

3. a. Graph $f(x) = -4x^2 - 8x - 9$ by determining whether the graph opens up or down and by finding its vertex, axis of symmetry, y-intercept, and x-intercepts, if any.

$a = -4 < 0$ opens down

$$h = \frac{-b}{2a} = \frac{-(-8)}{2(-4)} = \frac{8}{-8} = -1$$

$$k = f(-1) = -4(-1)^2 - 8(-1) - 9 = -5$$

vertex $(-1, -5)$

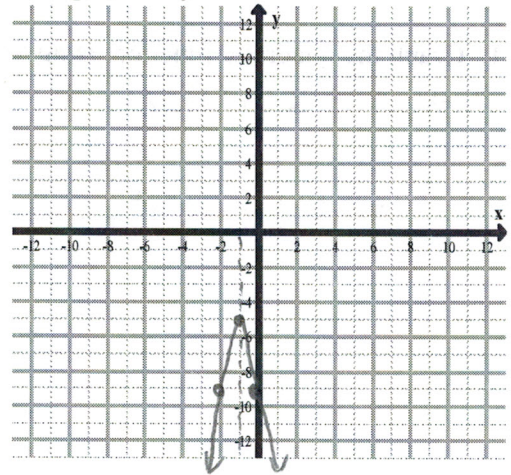
axis of symmetry $x = -1$

y-int $x = 0$ $f(0) = -4(0)^2 - 8(0) - 9 = -9$
 $(0, -9)$

x-int $y = 0$
 $0 = -4x^2 - 8x - 9$

$$x = \frac{-(-8) \pm \sqrt{(-8)^2 - 4(-4)(-9)}}{2(-4)}$$

$$= \frac{8 \pm \sqrt{64 - 144}}{-8} = \frac{8 \pm \sqrt{-80}}{-8} \leftarrow \text{no x-int}$$



- b. Determine the domain and range of f .

Domain $(-\infty, \infty)$

Range $(-\infty, -5]$

- c. Determine where f is increasing and where it is decreasing.

INC: $(-\infty, -1)$

DEC: $(-1, \infty)$

- d. Determine whether the graph has a maximum or minimum value. Then find the maximum or minimum value.

max of -5 at $x = -1$

4. The monthly revenue R achieved by selling x baseball gloves is figured to be $R(x) = 80x - 0.5x^2$. The monthly cost C of selling x baseball gloves is $C(x) = 20x + 1000$.

a. How many baseball gloves must the company sell to maximize revenue? What is the maximum revenue? (Round to the nearest integer as needed)

b. Profit is given as $P(x) = R(x) - C(x)$. What is the profit function?

c. How many baseball gloves must the company sell to maximize profit? What is the maximum profit?

$$a) h = \frac{-b}{2a} = \frac{-80}{2(-0.5)} = 80$$

$$k = R(80) = 80(80) - 0.5(80)^2 \\ = 6400 - 0.5(6400) \\ = 6400 - 3200 \\ = 3200$$

80 gloves
max revenue 3200

$$b) P(x) = R(x) - C(x) \\ = 80x - 0.5x^2 - 20x - 1000 \\ = -0.5x^2 + 60x - 1000$$

$$c) h = \frac{-b}{2a} = \frac{-60}{2(-0.5)} = 60$$

$$k = P(60) = -0.5(60)^2 + 60(60) - 1000 \\ = -0.5(3600) + 3600 - 1000 \\ = -1800 + 3600 - 1000 \\ = 1800 - 1000 \\ = 800$$

60 gloves
max profit \$800