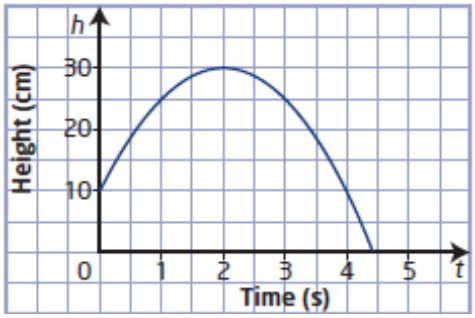
Section 3.2 Page 175 Question 7



a) The y-intercept of the graph represents the height of the rock that the siksik jumped from, 10 cm.

b) The vertex of the graph gives the maximum height of the siksik as 30 cm at a time of 2 s.

c) The x-intercept of the graph gives the time that the siksik was in the air, or approximately 4.4 s.

d) The domain is $\{t \mid 0 \leq t \leq 4.4, t \in \mathrm{R}\}$. The range is $\{h \mid 0 \leq h \leq 30, h \in \mathrm{R}\}$.

e) Answers may vary. Example: Unlikely: the siksik rarely stay in the air for more than 4 s.

Section 3.2 Page 175 Question 8

a) For a quadratic function with an axis of symmetry of $x = 0$ and a maximum value of 8, the parabola opens downward and the vertex is (0, 8). A parabola that opens downward with a vertex above the x-axis has two x-intercepts. Since the axis of symmetry is $x = 0$, one x-intercept will be negative and one positive.

b) For a quadratic function with a vertex at (3, 1), passing through the point (1, –3), the parabola opens downward. A parabola that opens downward with a vertex above the x-axis has two x-intercepts. Since the axis of symmetry is $x = 3$ and the x-intercept to the left of it is positive, then the x-intercept to the right will also be positive.

c) For a quadratic function with a range of $y \geq 1$, the parabola opens upward and its vertex is above the x-axis. So, there are no x-intercepts.

d) For a quadratic function with a y-intercept of 0 and an axis of symmetry of $x = –1$, the parabola could open upward with a vertex below the x-axis or open downward with a vertex above the x-axis. For either case, there are two x-intercepts. One x-intercept, to the right of the axis of symmetry ($x = –1$), is given as zero. So, the other x-intercept will be to the left, or less than –1, which is negative.

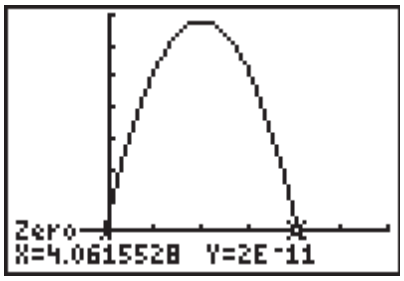
Section 3.2 Page 175 Question 9

a) The domain for $f(x) = -16x^2 + 64x + 4$ is $\{x \mid x \in \mathrm{R}\}$.
To determine the range, first find the coordinates of the vertex. Substitute $a = -16$ and $b = 64$ into $x = \dfrac{-b}{2a}$ to find the x-coordinate of the vertex.

$$x = \frac{-64}{2(-16)}$$

$x = 2$
Substitute $x = 2$ into $f(x) = -16x^2 + 64x + 4$ to find the y-coordinate of the vertex.
$f(2) = -16(2)^2 + 64(2) + 4$
$f(2) = 68$
The vertex is located at (2, 68).
Since $a < 0$, the parabola opens downward ans has a maximum. So, the range is $\{y \mid y \leq 68, y \in \mathrm{R}\}$.

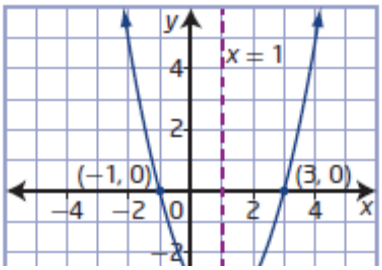
b) If this function represents the height of a football as a function of time, then neither height nor time can be negative. Graph $f(x) = -16x^2 + 64x + 4$ using a graphing calculator with window settings of x: [–2, 6, 1] and y: [–10, 70, 10]. Use the zero feature to determine the positive x-intercept is approximately 4.06. So, the domain is $\{x \mid 0 \leq x \leq 4.06, x \in \mathrm{R}\}$. The range is $\{y \mid 0 \leq y \leq 68, y \in \mathrm{R}\}$.



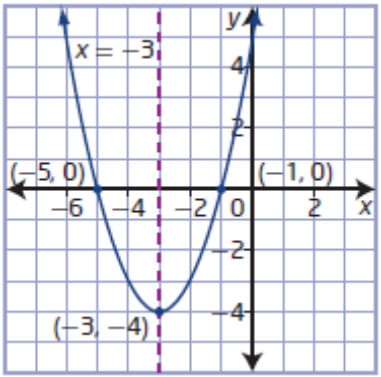
c) The domains and ranges are different in parts a) and b), because one represents the general case and the other represents a real-life scenario with constraints on the variables.

Section 3.2 Page 175 Question 10

a) Given x-intercepts at –1 and 3 and a range of $y \geq -4$, you know three points on the parabola. Two of the points are the x-intercepts at (–1, 0) and (3, 0). From the two x-intercepts and symmetry, the x-coordinate of the vertex is 1. From the range, the y-coordinate of the vertex is –4. Then, the third point on the parabola is (1, –4).

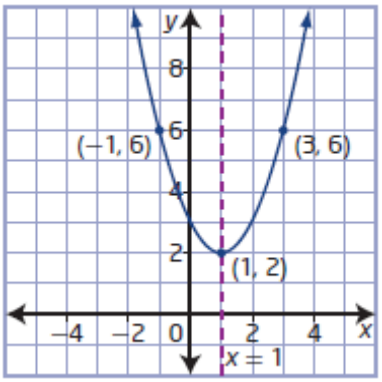


b) Given one x-intercept at –5 and vertex at (–3, –4), you know three points on the parabola. Two of the points are

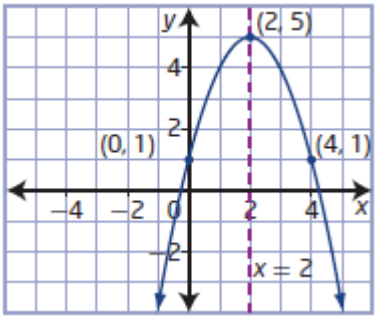


(–5, 0) and (–3, –4). Using symmetry, the third point is the other x-intercept at (–1, 0).

c) Given the axis of symmetry is $x = 1$, the minimum value of 2, and passing through (–1, 6), you know three points on the parabola. One point is given, (–1, 6). A second point is the vertex at (1, 2). Using symmetry, a third point on the parabola is (3, 6).



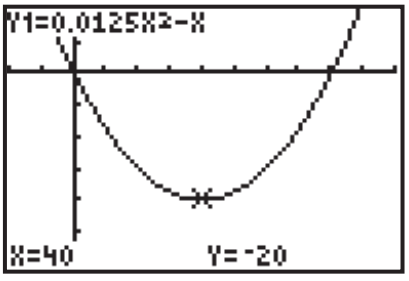
d) Given the vertex at (2, 5) and y-intercept of 1, you know three points on the parabola. Two of the points are (2, 5) and (0, 1). Using symmetry, the third point is (4, 1).



Section 3.2 Page 176 Question 11

a) Since the dish antenna is 80 cm across, the domain of $d(x) = 0.0125x^2 - x$ is $\{x \mid 0 \leq x \leq 80, x \in \mathrm{R}\}$.

b) Graph $d(x) = 0.0125x^2 - x$ using a graphing calculator with window settings of x: [–20, 100, 10] and y: [–30, 10, 5].



c) Use the minimum feature to determine the coordinates of the vertex are (40, –20). So, the maximum depth of the dish is 20 cm. This corresponds to the minimum value of the function, since the parabola opens upward.

d) The range of the function is $\{d \mid -20 \leq d \leq 0, d \in \mathrm{R}\}$.