Math 1410: Worksheet 3

September 3, 2021

Name: _____

1. The trajectory of an object launched directly upward can be modeled using quadratic functions, under the assumption that air resistance is negligible. The general case looks like

$$y(t) = -\frac{g}{2}t^2 + vt + h,$$

where $y(t)$ is the height at time t, g is the acceleration due to gravity, v is the initial velocity of the object, and h is the initial height of the object. At the earth's surface, $g \approx 10\ m/s^2$, so $g/2 \approx 5\ m/s^2$. (Here, m is meters and s is seconds).

   (a) Suppose a ball is thrown upward from ground level with an initial speed of 20 m/s. When will the ball hit the ground?

   (b) Suppose a ball is held at rest and then dropped off the top of a 180 m skyscraper. How long will it take for the ball to reach the ground?

   (c) Suppose that instead of merely dropping the ball from the skyscraper, it is thrown directly downward with a speed of 10 m/s. How long will it take for the ball to reach the ground?

   (d) What if instead the ball is thrown upward with a speed of 10 m/s. How long will it take for the ball to reach the ground?

2. Consider the quadratic function $f(x) = 3x^2 - 6x - 9$.

   (a) Calculate the x- and y-intercepts of f, and the vertex of f.

   (b) Determine the following information about f: its domain, its range, where it is increasing, where it is decreasing, and whether it is concave up or concave down.

   (c) Sketch a graph of f, marking on the graph the intercepts and vertex.