# Chapter 2.1 Practice Problems

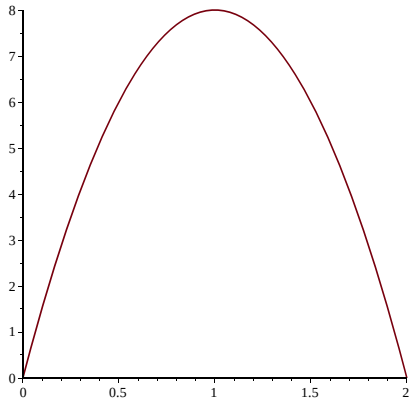
EXPECTED SKILLS:

- Be able to compute the average rate of change of a function over an interval; i.e., be able to find the slope of the secant line through two points on the graph of a function.
- Be comfortable using a limit to compute the instantaneous rate of change of a function (for arbitrary and specific values); i.e., know how to find the slope of the tangent line to a function.

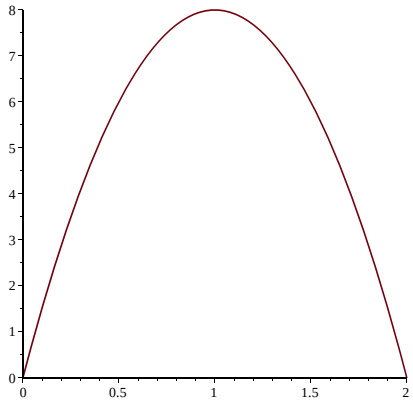
PRACTICE PROBLEMS:

1. Find the average rate of change of the given function on the given interval.
   (a) $f(x) = x^2$ on $[0, 2]$
   (b) $f(x) = x^3 - 3x + 5$ on $[-2, 2]$
   (c) $f(x) = \dfrac{1}{x}$ on $[1, 2]$
2. Find the instantaneous rate of change of the given function at the given point.
   (a) $f(x) = x^2 - 1$ at $x = 3$
   (b) $f(x) = x^3$ at $x = 2$
   (c) $f(x) = \sqrt{x}$ at $x = 9$
   (d) $f(x) = \dfrac{1}{x^2}$ at $x = 1$
3. A ball is thrown straight up in the air (from the ground) and its position in feet above the ground after $t$ seconds is given by: $f(t) = -8t^2 + 16t$. Answer the following questions about the path of the ball.
   (a) At what time $t$ does the ball hit the ground?
   (b) What is the average velocity of the ball from $t = 0$ to $t = 1$?
   (c) What is the instantaneous velocity of the ball at $t = 1$ second?

(d) Below is the graph of $f(t)$. Sketch the secant line whose slope is the average velocity of the ball on $[0, 1]$.




(e) Below is the graph of $f(t)$. Sketch the tangent line whose slope is the instantaneous velocity of the ball at $t = 1$ second.




4. If a rock is thrown upward on the moon with an initial velocity of 3.244 (m/s), its height (in meters) after $t$ seconds is given by $H(t) = -0.811t^2 + 3.244t$.

   (a) Find the velocity of the rock at $t = a$ seconds.

   (b) Find the velocity of the rock at $t = 1$ second.

   (c) When will the rock hit the surface of the moon?

   (d) Compute the velocity of the rock at the moment when it hits the surface of the moon.