Worksheet-Week #6

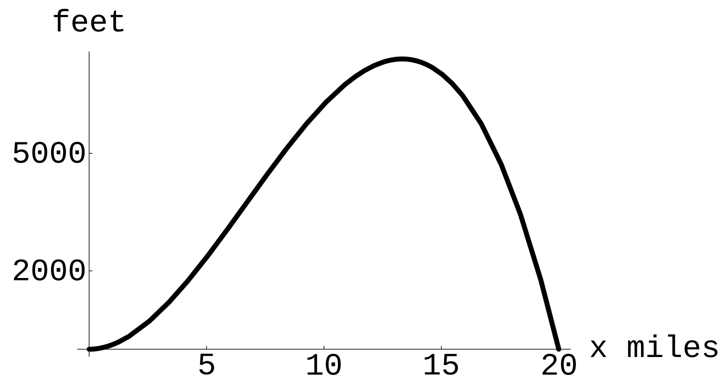
The Hiker and the Submarine Math 124

Introduction

This worksheets introduces the problem of find maximum and minimum values of functions using techniques of calculus.

1. You are planning a 20 mile hike in the Cascades. The guidebook provides you with a chart, plotting elevation above the trailhead (in feet) as a function of the distance hiked (in miles). This plot is shown and is modeled by the function

$$e(x) = 125x^2 - 6.25x^3.$$



(a) Using the graph of $e(x)$, explain in words how the tangent lines to the graph relate to the difficulty of the hike.

(b) What can you say about the slope of the tangent line at the point of highest elevation on the graph?

(c) Find the instantaneous rate of change of elevation as a function of $x =$ (distance hiked). Include units in your answer.

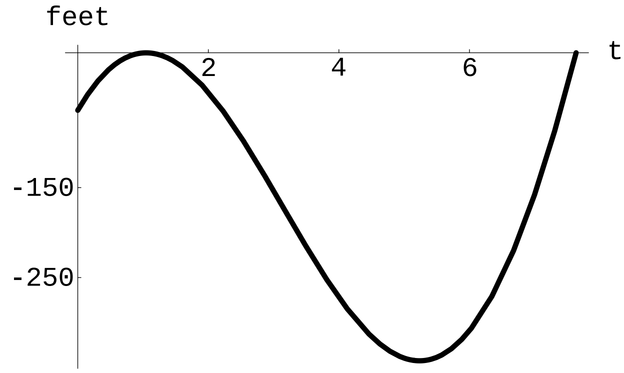
(d) Determine how far the hiker will have traveled when he reaches the highest point on the trail.

(e) What is the elevation of the highest point on the trail? Give your answer accurate to the nearest whole foot.

2. A submarine executes a diving drill. Starting from 64 feet below sea level, the submarine surfaces, then dives several hundred feet before resurfacing. The altitude of the submarine in feet is given by the function

$$a(t) = 500\cos\left(\frac{t}{2}\right) + 125t - 564,$$

where t represents the number of minutes that have passed since the beginning of the drill. The graph of a is plotted at right.



(a) What can you say about the tangent line to the graph at the lowest point on the dive?

(b) After how many minutes will the submarine reach the lowest point? Round your answer to two decimal places.

(c) What is the greatest depth the submarine will reach on this dive? Round your answer to the nearest foot.

(d) What is the greatest rate at which the submarine's depth will increase during the dive? Include units in your answer.