Week 5 Worksheet

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1. Find the derivatives of the following functions:

   (a) $f(x) = x^3 - 11x^2 + 7x + 9$.

   (b) $g(x) = -100\sqrt{x} - 11x^{2/3}$.

   (c) $h(x) = \frac{8}{x^5} - \frac{8}{x^4} + \frac{6}{x} + \sqrt{7}$.

   (d) $k(x) = (8x^2 - 4x)^2$.

2. On the way to section, a GSI walks east down University Ave. While walking, he moves at about a constant rate, but stops 3 times at intersections. After getting to campus, he continues to walk without stopping, but slows down on the way up the hill to Evans. He waits for packets to print, and then turns around and sprints west towards Barker.

   Let $f(t)$ represent the GSI's distance from his starting location. Sketch possible graphs of both f and f'.

3. It turns out that a company's cost and revenue for producting x items is modeled by

$$C(x) = \frac{2}{x} \qquad R(x) = 2x - \frac{x^2}{5000}$$

   (a) Find functions for marginal cost and marginal revenue.

   (b) Use your answer to the previous part to find a function for marginal profit.

   (c) For what value of x is marginal profit 0? When is marginal profit positive? When is it negative? (You may use a calculator for this, or otherwise reason about approximate values.)

   (d) How many products should the company produce?

4. Suppose the position of an object moving along a straight line is given by $s(t) = t^3 - 2t + 1$. What is the velocity when $t = 2$? What is the acceleration when $t = 2$?

5. The typical velocity v (in centimeters per second) of a marine organism of length l (in centimeters) is given by $v = 2.69 \cdot l^{1.86}$. Find the rate of change of velocity with respect to length at $l = 1.25$. What are the units of this quantity?