

1. Find $f'(x)$. Do not simplify.

(a) $f(x) = (x^2 - 5)\sqrt{3x + 10}$.

(b) $f(x) = \sqrt{x + \cos(x^2)}$.

2. Let G , g , and h be functions, with $G = g \circ h$. Suppose h is given by $h(x) = x^2 - 3x$. Suppose further that $G'(1) = 4$. Find $G'(2)$.

3. Find an equation for the line tangent to the curve $y = (\cos(x))^2$ at the point where $x = \frac{\pi}{6}$. Leave your answer in exact form (in terms of π and square roots).

4. Find the slope of the line tangent to the curve $y^3 - 2xy^2 + x^4 = 1$ at the point $(1, 2)$.

5. After 25 years of unrelieved boredom, the Viking lander on Mars picks up a small rock and hurls it directly upward. The rock's height h (in meters) at time t (in seconds) is given by

$$h(t) = 40t - 5t^2.$$

- (a) What is the rock's velocity and direction of travel six seconds after it is thrown?

- (b) What is the maximum height reached by the rock?

6. The number-crunchers at the Shrink-to-Fit Sock Shop estimate that their company makes a profit P (in dollars) given by

$$P(x) = 2x - 0.002x^2 - 300$$

when they manufacture x pair of socks per month. Suppose that the current production level at Shrink-to-Fit is 600 pair of socks per month.

- (a) What is the current monthly profit and the marginal profit? Be sure to include appropriate units.

- (b) What action should the company take to increase its profits? Be as specific as possible.

7. A lighthouse stands on an island three miles away from a perfectly straight, north-south shoreline. The lighthouse beacon makes one complete rotation every five seconds. How fast is the image from the lighthouse beam moving along the shore when it is three miles north of the point on the shore closest to the lighthouse? Remember to include units.