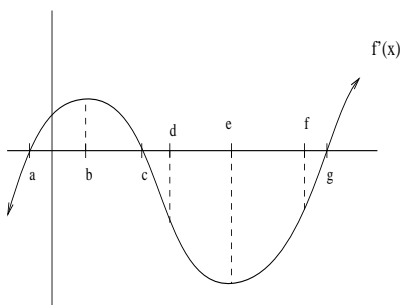


Directions: You may work with other students, but make sure you write up the answers by yourself and in your own words. Your work should be neat and easy to follow. If you use your calculator to do something, tell me what you did.

1. Answer the following questions based on the graph below. Notice that the graph is of the derivative, not the original function.

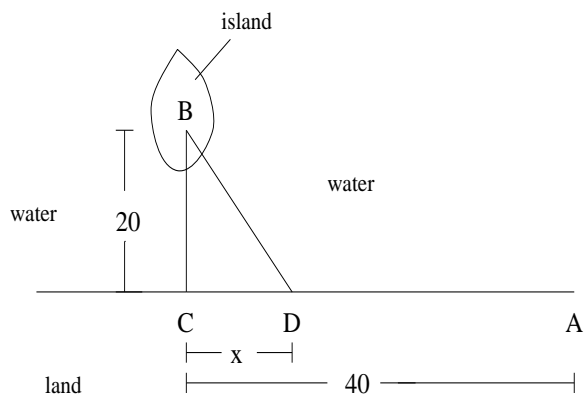


- a. Where is f is concave up? b. Where is $f'' = 0$?
- c. Where is f is decreasing? d. Where is f' is concave down?
2. An efficiency study conducted for Elektra Electronics Company showed that the number of Space Commander walkie-talkies assembled by the average worker t hours after starting work at 8 A.M. is given by

$$N(t) = -t^3 + 6t^2 + 15t, \quad 0 \leq t \leq 4.$$

At what time during the morning shift is the average worker performing at peak efficiency?

3. A freshwater pipeline is to be laid from point A on a straight shoreline to point B on an island 40 miles down off the coast (see figure). The pipeline may run completely under the water directly from point A to point B, or it may be run along the shoreline to point C and then under the water to point B, or it may be run along the shoreline to some intermediate point D and then under the water to point B. Let x represent the distance from point C to point D. If the pipeline costs \$200 per mile on land and \$500 per mile under the water, find the distance x from point C that will minimize the cost of laying the pipeline.



4. The cost, $C = f(w)$, in dollars of buying a chemical is a function of the weight bought, w , in pounds.

a. In the statement $f(12) = 5$, what are the units of the 5? _____ What are the units of the 12? _____ Write a sentence interpreting the statement $f(12) = 5$.

b. Do you expect the derivative f' to be positive or negative? Why?

c. In the statement $f'(12) = 0.1$, what are the units of the 12? _____ What are the units of the 0.1? _____ Write a sentence interpreting the statement $f'(12) = 0.1$.

5. The profit function $\Pi(p)$ in dollars for a manufactured item is given by

$$\Pi(p) = \frac{3a^2(p-b)(k-p)}{tpk},$$

where a and b are positive constants, p is the price at which the item is sold, k is the marginal cost to produce each item, and t is the freight charge per mile for delivery of the product. Assuming that the marginal cost and the freight charge are fixed, find the price in dollars that maximizes profit.