

Name : _____

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1. Find the following derivatives:

$$(a) \frac{d}{dx} \left(x^3 + \frac{1}{x} \right) =$$

$$(b) \frac{d}{dx} \left(\frac{2}{\sqrt{x}} - e^x + 5 \ln x \right) =$$

$$(c) \frac{d}{dx} \ln(e^{x^2} + 1) =$$

$$(d) \frac{d}{dx} (x^2 + \sqrt{x})^8 =$$

$$(e) \frac{d}{dx} ((2x + 1)^2 (x^3 + 4)^5) =$$

$$(f) \frac{d}{dx} \left(\frac{e^t}{e^t + 1} \right) =$$

(g) $\frac{d}{dx}(e^{3x} \ln(2x+1)) =$

(h) $\frac{d}{dx} \sqrt{\frac{x}{\ln x}} =$

2. Find the following integrals:

(a) $\int (5x^4 + 2x - 1) dx$

(b) $\int \left(x^{1/3} + \frac{1}{x} \right) dx$

(c) $\int x e^{x^2} dx$

(d) $\int \frac{4x}{(2x^2 + 5)^4} dx$

(e) $\int \frac{e^{\frac{1}{x}}}{x^2} dx$

(f) $\int_0^3 e^{-2x} dx$

(g) $\int_1^5 x\sqrt{x-1} dx$

(h) $\int_1^e \frac{\ln x}{x} dx$

3. (a) Find the interval(s) where $f(x) = \frac{1}{3}x^3 - x^2 - 3x + 1$ is increasing and the interval(s) on which it is decreasing.

- (b) Find the interval(s) where $f(x) = \frac{x+1}{x-1}$ is concave upward and the interval(s) on which it is concave downward.

- (c) Find the absolute maximum and the absolute minimum of

$$f(x) = 5 - (x - 3)^{2/3}$$

on the interval $[2, 11]$.

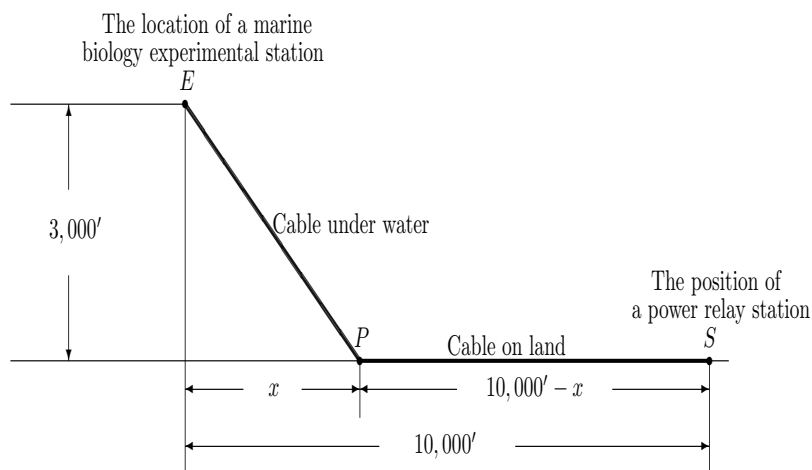


Figure 1: The diagram

- (d) In the diagram above, S represents the position of a power relay station located on a straight coast, and E shows the location of a marine biology experimental station on an island. A cable is to be laid connecting the relay station with the experimental station. If the cost of running the cable on land is \$3.00/running foot and the cost of running the cable under water is \$5.00/running foot, locate the point P that will result in a minimum cost (solve for x .)

4. (a) A man is expected to have an income stream at the rate $R(t) = 100000$ dollars per year in the next 5 years. What is the present value of the income stream if the interest rate is 5% per year compounded continuously ?

- (b) A company manufactures a toaster oven. Management has determined that the daily marginal cost function associated with producing these toaster ovens is given by

$$C'(x) = 0.0003x^2 - 0.12x + 20,$$

where $C'(x)$ is measured in dollar/unit and x denotes the number of units produced. Management has also determined that the daily fixed cost incurred in the production is \$800. Find the total cost incurred in the producing the first 400 units of these toaster ovens per day.

- (c) The velocity of a car (in feet/second) t sec after starting from rest is given by the function $f(t) = 2\sqrt{t}$ ($0 \leq t \leq 30$). Find the car's position $S(t)$, assuming $S(0) = 0$. $\left(\frac{dS}{dt} = f(t)\right)$

- (d) Find the the area of the region completely enclosed by the graphs of the given functios $f = 2x + 1$ and $g = x^2 - 2$.