National University of Computer & Emerging Sciences, Karachi

Fall-2023 FAST School of Computing

MT-1003 Calculus and Analytical Geometry

Assignment #2

Q1: Consider the quadratic function $f(x) = Ax^2 + Bx + C, where\ A \neq 0$. Show that the number c is always the midpoint of the given interval [a, b] (conclusion of the mean value theorem)

Q2: Show that the function $f(t) = 2t + e^{-2t}$ satisfies the hypotheses of the

Mean-Value Theorem over the interval $[-2,3]$ and find all values of c in the interval $(-2,3)$

at which the tangent line to the graph of $f(t)$ is parallel to the secant line joining the points$(-2, f(-2))\ and\ (3, f(3))$.

Q3: A study on optimizing revenue function $\boldsymbol{R}$ from a website is,

$$\boldsymbol{R(x) = (x-1)^2 e^{3x}}$$

where **x** measures the proportion of the total bandwidth requested by a customer.

Find intervals in which the $\boldsymbol{R(x)}$ is decreasing, increasing, concave up and concave down

Q4:The total profit P (in thousands of dollars) from the sale of x hundred thousand automobile tires is approximated by

$$\boldsymbol{p(x) = -x^3 + 9x^2 + 120x - 400,\ \ x \geq 5}$$

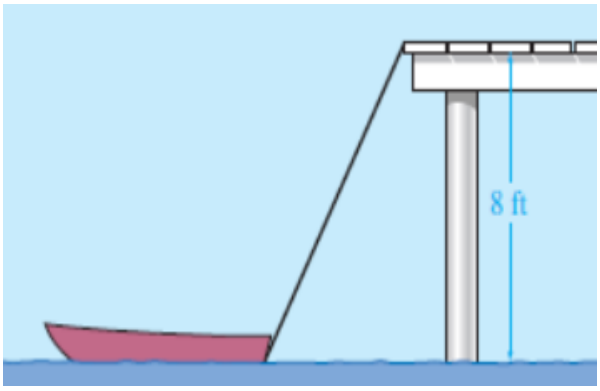
Find the number of hundred thousands of tires that must be sold to maximize profit. Find the maximum profit.

Q5: A train is traveling at 0.8 km/min along a long straight track, moving in the direction shown in Figure.

A movie camera, 0.5 km away from the track, is focused on the train.

I. Express z, the distance between the camera and the train, as a function of x.
II. How fast is the distance from the camera to the train changing when the train is 1 km from the camera? Give units.
III. How fast is the camera rotating (in radians/min) at the moment when the train is 1 km from the camera?

Q6: A pulley is on the edge of a dock, 8 ft above the water level. (See the figure below.) A rope is being used to pull in a boat. The rope is attached to the boat at water level. The rope is being pulled in at the rate of 1 ft per second. Find the rate at which the boat is approaching the dock at the instant the boat is 8 ft from the dock.



Ex# 7.1 Q 20 to 30.