



Zowah Khan

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Department of Electrical and Computer Engineering
Terminal Exam, Fall 2023

Class: BEE, EEE, BCE

Subject: Calculus and Analytic Geometry

Instructors: Dr. Tanvir Akbar, Dr. Manshoor Ahmed
Dr. Muhammad Qasim, Ms. Itrat Rubab

Date: 04 January, 2024

Time Allowed: 3 hours

Marks: 50

Instructions: -

- i. Answer all questions.
- ii. All questions carry equal marks.
- iii. Make sure the question numbers in your answer book align with those on the question paper.

Q.1:

Find the values of the constants k and m , if possible, that will make the function $f(x)$ continuous everywhere.

$$f(x) = \begin{cases} x^2 + 5, & x > 2 \\ m(x+1) + k & -1 < x \leq 2 \\ 2x^3 + x + 7 & x \leq -1 \end{cases}$$

Q.2:

Show that $y = x \sin x$ is a solution of the equation $y'' + y = 2 \cos x$.

Q.3:

A spherical balloon is to be deflated so that its radius decreases at a constant rate of 15 cm/min. At what rate must air be removed when the radius is 9 cm? (Volume V of a sphere of radius r is $V = \frac{4}{3}\pi r^3$).

Q.4:

For the given function

$$f(x) = 5 + 12x - x^3$$

Find: (a) the intervals on which f is increasing, (b) the intervals on which f is decreasing, (c) the open intervals on which f is concave up, (d) the open intervals on which f is concave down, and (e) the x -coordinates of all inflection points.

Q.5:

The boundary of a field is a right triangle with a straight stream along its hypotenuse and with fences along its other two sides. Find the dimensions of the field with maximum area that can be enclosed using 1000 ft of fence.

Q.6:

Evaluate the integrals using appropriate substitutions.

a. $\int e^{\sin x} \cos x \, dx$

b. $\int \frac{t}{1+t^4} \, dt$

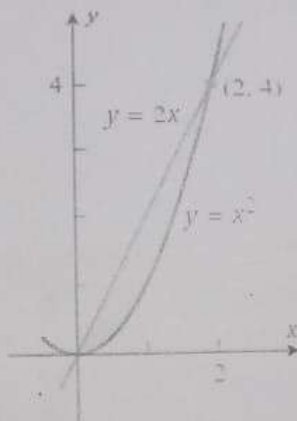
Q.7:

Evaluate the integral

$$\int_{-1}^2 |2x - 3| \, dx$$

Q. 8:

Find the area of the shaded region.



Q. 9:

Use cylindrical shells to find the volume of the solid generated when the region enclosed by the given curves is revolved about the y -axis.

$$y = \frac{1}{x}, y = 0, x = 1, x = 3$$

Q. 10:

Find the cube roots of $1 + i$.