

King Fahd University of Petroleum and Minerals
Department of Mathematics and Statistics
Math 132 – Applied Calculus
Semester – 071

Exam I

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Ser No: _____ Student No.: _____. Name: _____

*Show all your work; No credits for answers without justification.
Write neatly and legibly. You may loose points for messy work.*

Problem 1 (25 points): Consider the function $f(x) = \frac{x e^{-x}}{x-1}$.

- (1) If exists, find $\lim_{x \rightarrow 0} f(x)$.
- (2) If exists, find $\lim_{x \rightarrow 1^-} f(x)$.
- (3) If exists, find $\lim_{x \rightarrow \infty} f(x)$.
- (4) Find all values of x at which $f(x)$ is discontinuous.
- (5) Find all vertical asymptotes, if any.
- (6) Find all horizontal asymptotes, if any.

Problem 2 (25 points):

- (a) Use the definition of the derivative to find $f'(1)$ where $f(x) = 1 - x^2$.
- (b) Find the slope of the tangent line to the curve $f(x) = \left(\frac{x^3 - 2x^2 - 1}{x^2 + x + 1} \right)^5$ at $x = 0$.
- (c) Find the equation of the line tangent to the curve $2x^2y - xy^2 = 3$ at $(-1, 1)$.

Problem 3 (25 points):

- (1) If $y = (1 + u^3)^2$ and $u = e^{2x}$, find $\frac{dy}{dx}$ at $x = 0$.
- (2) A manufacturer determines that m employees will produce a total of q units of a product per day, where $q = m(50 - m)$. If the demand equation is given by $p = -0.01q + 9$ where the price p is in dollars. Find the marginal revenue and the marginal revenue product when $m = 10$.
- (3) If $y = x^3 5^x$, find $\frac{d^2y}{dx^2}$.

Problem 4 (25 points):

- (1) If $y = \log_3 \sqrt{\frac{3^x}{x^4 + 1}}$, find $\frac{dy}{dx}$ and simplify completely.
- (2) If $y = (1 + x)^x$, find $y'(1)$.
- (3) In the United States (1922-1942), the consumption function is estimated by $C = 0.672I + 113.1$ Find the marginal propensity to consume and the marginal propensity to save.