PRINCE SULTAN UNIVERSITY
Department of Mathematical Sciences
MATH 211 – Business Calculus
Final Examination
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Maximum Time 150 Minutes

Q1. a. Study the continuity of the function $f(x)=\begin{cases}2x^2-1 & if \quad x\geq 1\\ -x^3+2 & if \quad x<1\end{cases}$ at $x = 1$.

b. Find the absolute maximum and absolute minimum of the function $f(t)=3t^5-5t^3$ on the interval [-3, 1].

c. Study the increasing, decreasing and the concavity and use them to sketch the graph of the function $f(x)=x^5-5x^4$.

d. Suppose the total revenue in dollars from the sale of q units of a certain commodity is $R(q)=-2q^2+68q-128$. At which level of sales is the average revenue equals the marginal revenue?

Q2. a. How much money should be invested today at 5 percent compounded continuously so that 10 years from now it will be worth \$10,000

b. A manufacturer can produce toasters at a cost of \$7 apiece and estimates that if they are sold for x dollars apiece, consumers will buy approximately $2,000e^{-0.2x}$ toasters per week. At what price should the toasters be sold in order to maximize profit?

c. Find the derivative of the following functions

١. $y=\dfrac{2x-4}{x^2-2}$

٢. $y=x^2e^{4x}$

٣. $y=\ln\left(\dfrac{x^2(2x-3)^4}{\sqrt{x-1}}\right)$

Q3. Evaluate the following integrals

a. $\displaystyle\int \frac{x\,dx}{\sqrt{x^2+1}}$

b. $\displaystyle\int_0^1 (x^3-3x^2+5)\,dx$

c. $\displaystyle\int \frac{2x-3x^4e^{2x}}{x^4}\,dx$

d. $\displaystyle\int\left(5e^2-\frac{3}{x^5}+\frac{5}{x}\right)dx$

Q4. a. Find the function whose tangent line has the slope $3x^2+1$ for each value of x and whose graph passes through (0, 2).

b. Determine the area of the region bounded by the curves $y=1+4x-x^2$ and $y=1+x^2$.

c. At a certain factory, the marginal cost is $3(q-4)^2$ dollars per unit when the level of production is q units.

١. What is the cost of producing 14 units if the overhead is \$436?

٢. Use the **marginal cost** to estimate the cost of producing the 14^{th} unit and compare it with the **actual cost** of producing the 14^{th} unit..

٣. By how much will the total cost increase if the level of production is raised from 6 units to 10 units?