PRINCE SULTAN UNIVERSITY
Department of Mathematical Sciences
MATH 211 – Business Calculus
Midterm Examination
July 2004

Maximum Time 90 Minutes

Student Name: _____

ID: _____ **Section:** _____

Q1. (6 Points) Consider the functions $f(x) = 2x^2 - 3$ and $g(x) = 3x - 2$. Find the value of the following:

a) $f(g(2)) =$

b) $g \circ f(x) =$

Q2. (10 Points) Suppose the total cost in riyals of manufacturing q units of a certain commodity is given by the function $C(q) = q^3 - 30q^2 + 400q + 500$.

a) Compute the cost of manufacturing 10 units.

b) Compute the cost of manufacturing the 10^{th} unit.

Q3. (6 Points) Find the equation of the line passes through the points (2, -1) and (3, 4).

Q4. (10 Points) A certain car rental agency charges $ 25 plus 60 cents per mile. A second agency charges $30 plus 30 cents per mile. Which agency offers the better deal?

Q5. (8 Points) Find the indicated limit if exists.

a) $\lim_{x \to 3} \frac{x - 3}{x^2 + 9}$

b) $\lim_{x \to 4} \frac{x - 4}{\sqrt{x} - 2}$

Q6. (8 Points) Given the function $f(x) = \begin{cases} 2x + 5 & if \quad x \geq 4 \\ 5x - 7 & if \quad x < 4 \end{cases}$. Check whether the function *f(x)* is continuous at $x = 4$.

Q7. (12 Points) Find the derivative of the following functions

a) $f(x) = \frac{2x + 3}{5x - 1}$

b) $g(x) = \left(3x^3 - 5x + 1\right)^4$

c) $y = 3x^4 - \frac{4}{x^3} + \sqrt{x}$

Q8. (10 Points) The gross domestic product (GDP) of a certain country was $N(t) = t^2 + 5t + 102$ billion dollars t years after 1995.

a) At what rate was the GDS changing with respect to time in 2003?

b) At what percentage of change was the GDP changing with respect to time in 2003?

Q9. (10 Points) A manufacturer of digital cameras estimates that when x hundred cameras are produced, the total cost will be $C(x) = \frac{1}{8}x^2 + 3x + 98$ dollars, and all x cameras will be sold when the price is $p(x) = \frac{1}{3}(75 - x)$ dollars per camera.

a) Find the marginal cost and the marginal revenue.

b) Use the marginal cost to estimate the cost of producing the ninth unit and compare it with the actual cost.

Q10. (5 Points) Find the slope of the tangent line to the curve $y = 2x^3 - 5x + 1$ at x = 3.

Q11. (15 Points) Consider the function $f(x) = x^5 - 5x^4$.

a) Find the critical points and determine their nature.

b) Find the intervals of increasing and decreasing.

c) Find the intervals of concave up and down and the inflection points (if any.

d) Sketch the graph of the function.