Prince Sultan University

Department of Mathematical Sciences

Major II Exam

Semester I, 2014 FALL (151)

December 02, 2015

MATH 211 – Business Calculus

Time Allowed : 90 minutes
Maximum Points: 100 points

Name of the student:_____

ID number :_____

Section : _____

Important Instructions:

1. You may use a scientific calculator that does not have programming or graphing capabilities.
2. You may NOT borrow a calculator from anyone.
3. You may NOT use notes or any textbook.
4. There should be NO talking during the examination.
5. Your exam will be taken immediately if your mobile phone is seen or heard
6. Looking around or making an attempt to cheat will result in your exam being cancelled
7. This examination has 12 problems, some with several parts and a total of 6 pages. Make sure your paper has all these problems.

Question	Maximum score	Your Score
Q.1 , Q.2	22	
Q.3 , Q.4 , Q.5	19	
Q.6 , Q.7	19	
Q.8 , Q.9	22	
Q.10 , Q.11 , Q.12	18	
Total	**100**	

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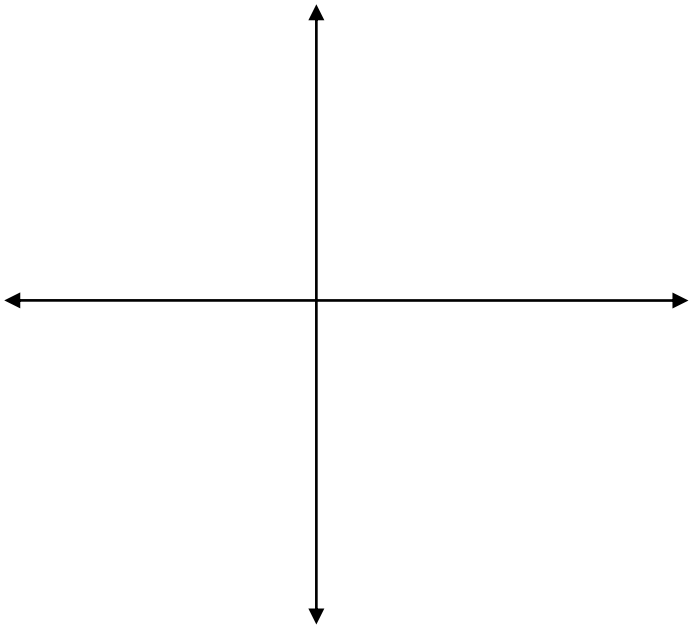
Q.1(15 points) : Given $f(x) = -x^4 + 4x^3 + 5$

a) Find all the **critical points** of the function and classify them as **relative maximum or minimum**.
b) Find the intervals of **increase** and **decrease**, if any.
c) Find the intervals of **concavity** and **the inflection points**, if any.
d) **Sketch the graph** of f showing all features.



Q.2 (7 points): Use the **second derivative test** to find the **relative maxima or relative minima**, if any of $f(x) = \dfrac{x^2}{x+1}$

Q.3 (8 points): Find the **absolute maximum and minimum** of $f(x) = -2x^3 + 3x^2 + 12x - 5$ on the interval $0 \le x \le 3$

Q.4 (6 points): The cost of producing x units of a certain commodity is $C(x) = 3x^2 + 4x + 4$ dollars. If the price is $p(x) = (52 - x)$ dollars per unit, determine the level of production that **maximizes profit**.

Q.5 (5 points): A company determines that if x thousand dollars are spent on advertising a certain product, then $S(x)$ units of product will be sold, where $S(x) = -2x^3 + 27x^2 + 132x + 207 \quad ; \ 0 \le x \le 17$.
How much should be spent on advertising to **maximize sales**?

Q.6 (10 points): The price $p(q)$ at which q units of a certain commodity can be sold is given by $p(q) = 37 - 2q$. The total cost $C(q)$ of producing the q units is $C(q) = 3q^2 + 5q + 75$.

a) Find the **marginal revenue** and the **marginal cost**.
b) Find the **average cost.**
c) Find the level of production, q at which average **cost is minimized**.

Q.7 (9 points): **Solve** the equation.

a) $\log_5(x+1) = 2$

b) $3\ln x - \frac{1}{2}\ln x^4 = 9$

c) $5 = 7 - 3e^{-2x}$

Q.8 (16 points): Find the **derivative:** **(Simplify your answer)**

a) $f(x)=\dfrac{x}{e^{x^2}}$

b) $f\,(x)=e^{-5x}\,\ln\sqrt{x}$

c) $y=\ln\left(2x^3-1\right)^4$

d) $y=\dfrac{e^{2x}\left(2x-1\right)^6}{\left(x^3+5\right)^2(4-7x)}$

Q.9 (6 points): Find the **equation of the tangent line** to $f\,(x)=(x+1)e^{-2x}$ at $x=0$

Q.10 (4 points): How much money should be invested today at 5% compounded quarterly so that 10 years from now it is worth $\$25,000$?

Q.11 (4 points): How long will it take $2,000 to grow to $10,000 if interest is 7% compounded continuously? (Round your answer to nearest whole year)

Q.12 (10 points): The demand, $q = D(p)$ of a particular commodity is given by $D(p) = \sqrt{400 - 0.01p^2}$ where p is the price at which q units can be sold.

a) Find the elasticity of demand
b) Find the elasticity of demand at $p = \$50$
c) Determine the values of p for which the demand is elastic, inelastic, and of unit elasticity.