Prince Sultan University

Math 211
Major Exam 1
First Semester, Term 171
Sunday, November 5, 2017
Time allowed: 90 minutes

Student Name:_____

Student ID #: _____

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. Talking during the examination is NOT allowed.
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 13 problems, some with several parts. Make sure your paper has all these problems.

Problems	Max points	Student's Points
1-3	18	
4-6	24	
7-10	20	
11-13	18	
Total	**80**	
Total	**20**	

Q1) [4 pts] Find the domain of the function $f(x)=\sqrt{-x^2+x+6}$

Q2) [6 pts] Market research indicates that manufacturers will supply *x* printers to the marketplace when the price is $p=S(x)=12x+280$ dollars per unit and that the same number of printers will be demanded (bought) by consumers when the price is $p=D(x)=-2x+560$. At what level of production *x* **and** unit price *p* is market equilibrium achieved?

Q3) [8 pts] A manufacturer produces jackets at a cost of $12 apiece. He estimates that if the jackets are sold for *x* dollars apiece, consumers will buy a quantity of 1220 – 6*x* each month.

a) Find the Cost $C(x)$, Revenue $R(x)$ and Profit $P(x)$ as a function of *x*.

b) Graph the Profit function $P(x)$ (show the vertex and *x*-intercepts) **and** determine the optimal selling price that maximizes the profit, and find the maximum profit.

c) How many jackets will be sold each month at the optimal price?

Q4) [6 pts] A gourmet burger seller can sell burgers for $9 apiece. The sellers total cost consists of a fixed overhead of $2250 per month plus production costs of $6.25 per burger. How many burgers must he sell to make a profit of $280 in one month?

Q5) [6 pts] Find the equation of the line in the **general form** which passes through $(1,5)$ and is perpendicular to a line which has an *x*-intercept of -3 and *y*-intercept of 5

Q6) [12 points] Find the following limits:

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

$$\lim_{x\to\infty}\frac{12x^3+x^2+2x}{-3x^3-4x^2-2}$$

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

Q7) [4 pts] Find the value of *c* that makes the function continuous everywhere

$$f(x)=\begin{cases} cx-3 & \text{if } x<2 \\ 3-x+2x^2 & \text{if } x\geq 2 \end{cases}$$

Q8) [8 pts] Use the **<u>definition of the derivative from first principles</u>** to find the first derivative of

$$f(x)=\frac{1}{\sqrt{x+2}}$$

Q9) [4 pts] Find the *x*-coordinates of the horizontal tangent lines of $f(x)=(x+1)(x^2-x-2)$.

Q10) [4 pts] Find the equation of the tangent line to $y=\left(\frac{x+1}{x-1}\right)^3$ at the point where x =3.

Q11) [6 pts] Differentiate the following functions

a) $f(x)=\frac{2}{3}\sqrt{x}+\frac{2}{\sqrt[3]{x}}+\frac{3}{2}\sqrt{x^3}$

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

Q12) [6 pts] Find the second derivative of $f\left(x\right)=\frac{3-2x}{\left(2x-5\right)^2}$

Q13) [6 pts] An importer of coffee determines that local customers will buy $D\left(p\right)=\frac{4374}{p^2}$ pounds of coffee per week when the price is *p* dollars per pound. He also determines that *t* weeks from now, the price will be $p\left(t\right)=0.02t^2+0.1t+6$ dollars per pound. At what rate will the demand for coffee be changing with respect to time 10 weeks from now?