Prince Sultan University

MATH 211

First Major Exam

First Semester 2007/2008, Term 071

Saturday, 3rd November 2007

Dr. Aiman Mukheimer

Time Allowed: 90 minutes

i. **Name: _____ _____ _____**

(First) (Middle) (Last)

1.

2. ID Number: _____

b. Serial No.: _____

Important Instructions:

- You may use CASIO scientific calculator that does not have programming or graphing capabilities.
- You may **NOT borrow** a calculator from anyone.
- There should be **NO talking** during the examination.
- Your exam will be taken **immediately** without any warning if your mobile is seen or heard
- You must show all your work beside the problem. Be organized.
- You may use the back of the pages for extra space, but be sure to indicate that on the page with the problem.
- This examination has **14** problems, some with several parts. Make sure that your paper has all these problems

2. Problems	Max points	Student's Points
1,2,3,4	25	
5,6,7	20	
8,9,10,11	30	
12,13,14	25	
Total	100	

Q1. (6 points) What is the domain of the function: $f(t) = \dfrac{t+2}{\sqrt{4-t^2}}$

Q2. (6 points) At a certain factory, the total cost of manufacturing q units during the daily production run is $C(q) = q^2 + 2q + 297$ dollars. On a typical workday, $q(t) = 17t$ units are manufactured during the first t hours of a production run. How many dollars are spent during the first 4 hours of production?

Q3. (7 points) Temperature measured in degrees Fahrenheit is a linear function of temperature measured in degrees Celsius. Use the fact that the 0^{O} Celsius is equal to 32^{O} Fahrenheit and 100^{O} Celsius is equal to 212^{O} Fahrenheit to write an equation for this linear function. Use your function you obtained to convert 15^{O} Celsius to Fahrenheit.

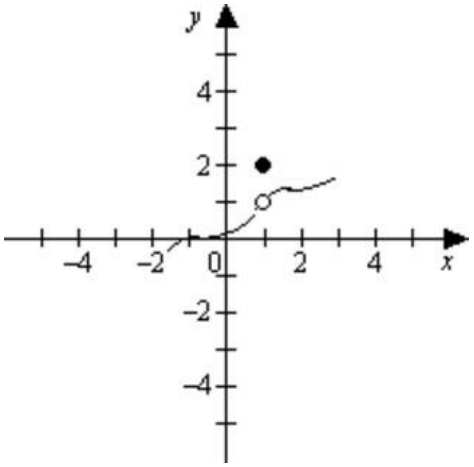
Q4. (6 points) A cylindrical can is to have 36π cubic inches. The cost of the material used for the top and bottom of the can is 4 cents per square inch, and the cost of the material used for the curved side is 3 cents per square inch. Express the cost in cents of constructing the can as a function of its radius.

Q5. (8 points) Find the following indicated limit if it exist:

3. $\lim_{x \to -2} \dfrac{x^2 - x - 6}{x^2 + 3x + 2}$

4. $\lim_{x \to 9} \dfrac{\sqrt{x} - 3}{x - 9}$

Q6. (6points) If $f(x)$ is graphed below, find the following indicated if it exist:



1. $\lim_{x \to 1} f(x) =$
2. $\lim_{x \to -1} f(x) =$
3. $f(1) =$

Q7. (6points) Find the values of the constant A such that the function $f(x)$ continuous for all x.

$$f(x) = \begin{cases} \dfrac{x^2 - 1}{x + 1} & if \quad x < -1 \\ Ax^2 + x - 3 & if \quad x \geq -1 \end{cases}$$

Q8. (8points) Find the equation of the tangent line to the curve $f(x) = x - \dfrac{1}{x^2}$ at the point where $x =$ 1.

Q9. (6points) A manufacture of videocassettes determines that when x hundred units are produced, the profit will be $P(x) = 4000(15 - x)(x - 2)$ dollars.

1. Find $P'(x)$.

Determine where $P'(x) = 0$. What is the significance of the level of production x where this occurs?

Q10. (8 points) A spherical balloon is being filled with air in such a way that its radius is increasing at the constant rate of 2 cm/sec. At what rate is the volume of the balloon increasing at the instant when its surface has area 4π cm^2 ? (Note: A sphere of radius *r* has volume $V = \frac{4}{3}\pi r^3$ and surface area $S = 4\pi r^2$.)

Q11. (8 points) The gross national product (GNP) of a certain country is $N(t) = t^2 + 3t + 121$ billion dollars where *t* is the number of years after 1990. At what percentage rate will the GNP be changing with respect to time in 1995?

Q12. (6 points) Let $f(x) = \left(\frac{x}{x^2 - 1} + \frac{4 - x}{x^2 + 1} \right)^3$, find $f'(x)$

Q13. (6 points) It is estimated that *t* years from now, the population of a certain suburban community will be $p(t) = 50 - \frac{7}{2t + 1}$ thousand people. At what rate, in people/year will the population be growing 3 years from now?

Q14. (13 points) A manufacture estimates that when x units of a particular commodity are produced, the total cost will be $C(x) = \frac{2}{7}x^2 + 65$ dollars, and furthermore, that all x units will be sold when the price is $p(x) = \frac{12+2x}{3+x}$ dollars per unit.

1. Find the marginal cost and the marginal revenue.

2. Use the marginal cost to estimate the cost of producing the fifth unit.

What is the actual cost of producing the fifth unit?