Prince Sultan University

Department of Mathematical Sciences

Major III Exam

Semester II, 2005 Spring (042)

22nd May, 2005

MATH 111 – CALCULUS I

Time Allowed : 120 minutes
Maximum Points: 100 points

Name of the student : _____

ID number : _____

Section : _____

For All The Students:

- **Answer all the questions.**
- **This exam consists of *a total of 7 pages and 12 questions.***
- **Show your working in the space provided for each question.**
- **Show all the key steps of your work.**
- **Scientific, non-programmable calculators are allowed.**

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

Q.1: **Find the local linear approximation of** $f(x)=\sqrt{1-x}$ **at** $x_{\circ}=0$ **(6 points)**

Q.2: **Let** $y=x^2$**. Find** dy **and** Δy **at** $x=2$ **with** $dx=\Delta x=1$**.** **(8 points)**
Then sketch dy **and** Δy **on the same coordinate plane.**

Q.3: **Determine all intervals where the following function is increasing or decreasing**. **(8 points)**

$$f(x)=x^5+\frac{5}{2}x^4-\frac{40}{3}x^3+5$$

Q.4: **If $f(x) = ax^3 + bx^2 + cx + d$. Determine the values of $a, b, c,$ and d such that f has a local maximum at the point $(0,1)$ and a local minimum at the point $(2,4)$** **(8 points)**

Q.5: **Locate the critical points, and classify them as stationary points or points of non differentiability.** **(8 points)**

$$f(x) = x^{\frac{1}{3}}(x+4)$$

Q.6: **For the function $f(x) = 12 + 6x^2 - x^4$, find** **(8 points)**

a) the intervals on which f is concave up.

b) the intervals on which f is concave down.

c) The x-coordinates of the inflection points.

Q.7: **A ladder 10 m tall is leaning against a vertical wall.** **(8 points)**
The ladder is sliding down the wall at a rate of 1 m/s. At what rate is the ladder sliding away from the wall when the base of the ladder is 4m from the wall?

Q.8: **A man starts at a point A and runs east at a rate of $200ft/\min$.** **(8 points)**
One minute later, another man starts at A and runs north at a rate of $150ft/\min$.
At what rate is the distance between them changing 1 minute after the second man starts?

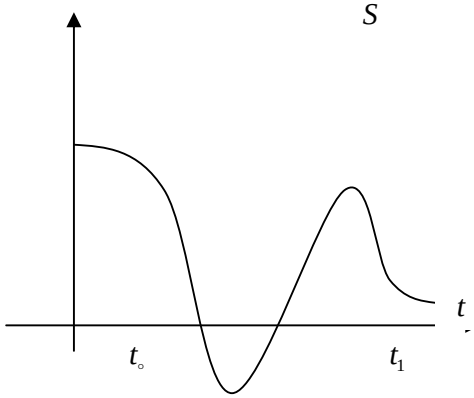
Q.9: **Graph the following polynomial and label the coordinates of the stationary points and the inflection points.** **(8 points)**

$$f(x) = x^4 + 2x^3 - 1$$

Q.10: **Graph the following rational function and label the coordinates of the extrema points and the inflection points. Show the horizontal and vertical asymptote.** **(10 points)**

$$f(x) = x^3 + \frac{3}{x}$$

Q.11: **The position function of a particle moving along a horizontal x-axis is shown In the following figure. (*Explain your answer*)** **(8 points)**



a) **Is the particle moving left or right at time $t_\circ$?**

b) **Is the acceleration positive or negative at time $t_\circ$?**

c) **Is the particle speeding up or slowing down at time $t_\circ$?**

d) **Is the particle speeding up or slowing down at time t_1 ?**

Q.12 **: The position function of a particle is moving along a coordinate line is given by $s(t) = t^4 - 4t^3 + 10$, $t \geq 0$ where s is in meters(m) and t is in seconds(s).** **(12 points)**

a) Find the velocity and acceleration functions

b) Find the position, velocity, and acceleration when $t = 2$ s

c) At what time is the particle stopped?

d) When is the particle speeding up? Slowing down?

e) Analyze the motion of the particle for $t \geq 0$. Give a schematic picture of the motion.