KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

2010/2011 ACADEMIC YEAR

FOR THE CERTIFICATE OF PRE-UNIVERSITY MATHEMATICS

COURSE CODE: PMATH 022

COURSE TITLE: BASIC CALCULUS

STREAM: SEMESTER TWO

DAY: TUESDAY

TIME: 2.00 – 4.00 P.M.

DATE: 07/12/2010

INSTRUCTIONS:

1. Attempt question **ONE** and any other **TWO** questions.
2. Show your **workings** clearly.

PLEASE TURN OVER

QUESTION ONE (30MKS)

(a) Define function and give an illustration of a function operating like a machine so as to give an image (y) **(5mks)**

(b) Using the first principle technique find the derivatives of each of the following at a specified point.

(i) $y = 4x + 7$ at (10,4) **(4mks)**

(ii) $y = 2x^2 + x + 1$ at (2,6) **(4mks)**

(iii) $y = \frac{1}{x^2}$ at (-2,3) **(4mks)**

(c) What do you understand by the following terms?

(i) Real valued function **(2mks)**

(ii) Gradient function **(2mks)**

(iii) Normal and tangent functions **(2mks)**

(d) (i) Evaluate $\int_{-1}^{1} (2x^2 + 4x + 1)dx$ **(3mks)**

(ii) $\frac{d}{dx}\sqrt{(x^2 + 4x + 7)}$ **(2mks)**

(iii) Evaluate $\lim_{x \to 0} \frac{x^2 + x}{x}$ **(2mks)**

QUESTION TWO

a) Define a function and give an illustration of function operating like a machine. **(3 mks)**

b) Using the definition of a limit, show that:

i) $\lim_{x \to 10} (3x + 5) = 35$ **(4 mks)**

ii) $\lim_{x \to 0} x^9 = 0$ **(4 mks)**

c) Differentiate:

i) $y = (3x - 1)(x^2 - 4)$ **(3 mks)**

ii) $y = \frac{2x + 3}{2x - 3}$ **(3 mks)**

d) Evaluate $\int_{-1}^{2} (x^2 + 4x)dx$ **(3 mks)**

QUESTION THREE (20 MARKS)

a) What do you understand by the following terms:
   i) continuous function **(2 mks)**
   ii) "hole" **(2 mks)**
   iii) limit of a function **(2 mks)**

b) Describe the following function:

$$f(x) = \begin{cases} x^3 + 2 & if \quad x < 2 \\ x^2 + 6 & if \quad x > 2 \\ 10 & if \quad x = 2 \\ \dfrac{1}{x^2 - 2} & if \quad x < 2 \end{cases}$$ **(3 mks)**

c) Differentiate and hence find the gradient at a specific point indicated.
   i) $y = (2x^2 + x + 1)(x^2 + 2)$ at (0,1) **(4 mks)**
   ii) $y = (3x^2 + 4)^{10}(x + 4)$ at (0,16) **(4 mks)**
   iii) $y = \dfrac{\sqrt{x^2 + 6x + 1}}{x + 1}$ at (1, -3) **(3 mks)**

QUESTION FOUR (20 MARKS)

a) Find the tangent and normal line to the curve $f(x)=2x^3+2x+4$ at a point (1,2) **(5 mks)**

b) An object moves along a line in such a way that its position at time t is $S(t)=t^3-6t^2+9t+5$
   i. Find the acceleration and velocity statement and hence evaluate acceleration and velocity at time t=2 seconds. **(4 mks)**
   ii. When is the object stationary? **(3 mks)**

c) Given $y=2x^2-6x$,
   i. Find the critical points. **(2 mks)**
   ii. Using the second derivative method, find the local extrema. **(3 mks)**

d) $\int_{-1}^{3}(3x^2 + x + 1)dx$ **(3 mks)**

QUESTION FIVE (20 MARKS)

(a) A real valued function is defined by f(t) = 2(3t-1)+4 evaluate the value of the function at the input of the following values.

(i) O **(2mks)**

(ii) f(1) **(2mks)**

(iii) x+2 **(3mks)**

(iv) ff(1) **(3mks)**

(b) Given f(x) = x^3, g(x) = x + 1, h(x) = 2

Evaluate;

(i) f(x) 3g(x) **(2mks)**

(ii) f(x) + g(x) **(2mks)**

(iii) $\frac{f(x)}{g(x)}$ **(2mks)**

(iv) fog **(2mks)**

(v) fogoh **(2mks)**