KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

2009/2010 ACADEMIC YEAR

FOR THE CERTIFICATE OF PRE- UNIVERSITY BIOLOGY

COURSE CODE: **PMATH 022**

COURSE TITLE: **BASIC CALCULUS**

STREAM: **PRE – S2**

DAY: **THURSDAY**

TIME: **2.00 – 4.00 P.M.**

DATE: **03/12/2009**

INSTRUCTIONS:

Attempt **Question One** and **any other two** questions.

PLEASE TURN OVER

QUESTION ONE (30 MARKS)

a) Using the first principle method, differentiate the following functions:
   i) y=3x+7 (3 mks)
   ii) y=15 (3 mks)

b) Suppose that f is a function for all real numbers t defined by:
   f(t)=3(2t-1)+2;
   Evaluate: i) f(x+1) (2 mks)
   ii) fff(1) (2 mks)

c) Given $f(x)=x^3-3x^2-4x$ and g(x)=x-1, find:
   i) $f(x)g(x)$ (2 mks)
   ii) $\frac{f(x)}{g(x)}$ (3 mks)

d) Given the equation of a line L_1 is 3y+6x+10=0, find the equation of the line perpendicular to L_1 passing through point (2,6). (3 mks)

e) Evaluate the following limits:
   i) $\lim_{x \to 2} \frac{x^2 - 7x + 10}{x - 2}$ (3 mks)
   ii) $\lim_{x \to 3} \frac{x^2 - 9}{x - 3}$ (3 mks)

f) Given $f(x) = \sqrt{x}$ and $g(x) = x + 2$, find:
   i) fog (2 mks)
   ii) gof (2 mks)
   iii) fof (2 mks)

QUESTION TWO (20 MARKS)

a) A closed tin in the shape of a cylinder is to have a capacity of 250Πmls. If the area of the metal used is to be a minimum, what should the radius of the tin be? (6 mks)

b) Find the area enclosed by the curve $y=x^2+5x+6$. (4 mks)

c) Determine whether the points A(1, -1), B(3,2) and C(8,10) are collinear, that is, lie on the same line. (3 mks)

d) Differentiate
   i) $y=2x^2+4x+15$ (2 mks)
   ii) $x = \sqrt{y} + 19$ (2 mks)
   iii) $f(x) = \sqrt{x^2 + 2x + 6}$ (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) 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) $y=\dfrac{2x+3}{2x-3}$ (3 mks)

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