

**KABARAK**



**UNIVERSITY**

**UNIVERSITY EXAMINATIONS**

**2010/2011 ACADEMIC YEAR**

**FOR THE DEGREE OF BACHELOR OF ECONOMICS AND  
MATHEMATICS**

**COURSE CODE: MATH 113**

**COURSE TITLE: CALCULUS I**

**STREAM: Y1S1**

**DAY: WEDNESDAY**

**TIME: 2.00 – 4.00 P.M.**

**DATE: 14/12/2010**

---

**INSTRUCTIONS:**

- Attempt question **ONE** and any other **TWO** Questions

**PLEASE TURNOVER**

**QUESTION ONE (30MKS)**

- (a) (i) Using the first principle technique derive  $\log_a x$  **(3 mks)**
- (ii) Given  $y = uv$  deduce the product Rule. **(3mks)**
- (b) (i) Find  $\lim_{x \rightarrow \infty} \frac{2x^2 - 2}{3x^2 - 3x + 2}$  **(3mks)**
- (ii) Find  $\lim_{x \rightarrow 0} \frac{\sin x - \cos 3x}{x^2}$  **(3mks)**
- (c) Use first principles to find the derivative of
- (i)  $f(x) = 6x$  **(3mks)**
- (ii)  $y = e^{2x}$  **(3mks)**
- (d) Show that  $\lim_{x \rightarrow a} x^2 = a^2$  **(3mks)**
- (e) Find the equation of the line which passes through the point (5, 3) and is parallel to the tangent to the curve,  $y = x^2$  at the point (3, 9) **(3mks)**
- (f) Differentiate the following functions:
- (i)  $y = (x^2 - 5)(x - x^3)$  at  $x = 1$  **(3mks)**
- (ii)  $y = \frac{3x^2 - 5}{1 - x^3}$  **(3mks)**

**QUESTION TWO (20MKS)**

- (a) Differentiate the following:
- (i)  $y = 5x^3 - 4x^2 + 12x - 8$  **(1mks)**
- (ii)  $y = \sin^3 2x$  **(5mks)**
- (b) Find  $\frac{dy}{dx}$  when  $x = 1$  of  $y = \frac{u}{u+1}$  and  $u = 3x^2 - 1$  **(8mks)**
- (c) Find the composite function  $f(g(x))$  where  $f(u) = u^2 + 3u + 1$  and  $g(x) = x + 1$  **(4mks)**
- (d) Find the equation of the curve given the gradient is  $4x - 2$  at a point (1, 2) **(2mks)**

**QUESTION THREE (20MKS)**

(a) Find  $\frac{dy}{dx}$  and  $\frac{d^2y}{dx^2}$  if  $x^2y + 2y^3 + 4x = 0$  at a point (1, 1) **(15mks)**

(b) Show that the rational function  $f(x) = \frac{x+1}{(x-2)^2}$  is continuous at  $x = 3$  **(5mks)**

**QUESTION FOUR (20MKS)**

(a) Use the first principles to find the derivative of:

$y = \sin x$  **(8mks)**

(b) For the function defined by  $y = 2x^3 - 15x^2 + 24x + 19$ , find the stationary points and distinguish between them. **(6mks)**

(c) Differentiate the function.  $y = \frac{\sin x}{\cos x}$  **(6mks)**

**QUESTION FIVE (20MKS)**

(a) Differentiate the following:

(i)  $y = \ln^2(x^2 + 2x + 1)^2$  **(3mks)**

(ii)  $y = \sin^3 2x$  **(3mks)**

(b) Find  $\frac{dy}{dx}$  when  $x = 1$  of  $y = \frac{u}{u+1}$  and  $u = 3x^2 - 1$  **(8mks)**

(c) Find the equation of the curve given the gradient is  $4x - 2$  and the curve passes through point (1, 2) **(4mks)**

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