

KABARAK



UNIVERSITY

EXAMINATIONS

2008/2009 ACADEMIC YEAR

**FOR THE DEGREE OF BACHELOR OF EDUCATION
SCIENCE**

COURSE CODE: MATH 113

COURSE TITLE: CALCULUS I

STREAM: SESSION I

DAY: TUESDAY

TIME: 2.00 – 4.00 P.M.

DATE: 11/08/2009

INSTRUCTIONS:

Attempt question **ONE** and any other **TWO** questions.

PLEASE TURN OVER

QUESTION ONE (30MKS)

- (a) (i) Find $\lim_{x \rightarrow 1} \frac{x^2 - 1}{x^2 - 3x + 2}$ (3mks)
- (ii) Find $\lim_{x \rightarrow 0} \frac{\sin x - \cos 3x}{x^2}$ (3mks)
- (b) Use first principles to find the derivative of
- (i) $f(x) = 2x$ (3mks)
- (ii) $f(x) = \frac{1}{x}$ (3mks)
- (c) Show that $\lim_{x \rightarrow a} x^2 = a^2$ (3mks)
- (d) Find the equation of the line which passes through a point (5,3) and is parallel to the tangent to the curve. $y = x^2$ at the point (3,9) (3mks)
- (e) Show that the polynomial $P(x) = 3x^3 - x + 5$ is continuous at $x = 1$. (3mks)
- (f) Differentiate the following functions:
- (i) $y = (x^2 - 5)(x - x^3)$ (3mks)
- (ii) $y = \frac{3x^2 - 5}{1 - x^3}$ (4mks)
- (iii) $y = \ln(5x^2 - 2x + 1)$ (2mks)

QUESTION TWO (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 THREE (20MKS)

- (a) A particle moves along a straight line in such a way that its distance from a fixed point o on the line after t seconds is S meters, where $S = \frac{1}{6}t^4$. Find;
- (i) Its velocity after 3 seconds and after 4 seconds (3mks)
- (ii) Its acceleration after 2 seconds and after 4 seconds (3mks)

(b) Find the equation of the normal to the curve $y = x^2 + 3x$ at the point where $x = 1$ **(6mks)**

(c) Find $\frac{dy}{dx}$, given that $y = \frac{\tan^2 x e^{2x}}{x^2}$ **(5mks)**

(d) Evaluate $\lim_{x \rightarrow \infty} \left(1 + \frac{4}{x}\right)^{2+x}$ **(3mks)**

QUESTION FOUR (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 FIVE (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)**