TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR:

BACHELOR OF TECHNOLOGY AND RENEWABLEL ENERGY & BACHELOR OF TECHNOLOGY AND APPLIED PHYSICS

AMA 4109: CALCULUS FOR TECHNOLOGISTS 1

END OF SEMESTER EXAMINATION

SERIES:APRIL 2016

TIME:2HOURS

DATE: Pick DateMay2016

Instructions to Candidates
You should have the following for this examination
-*Answer Booklet, examination pass and student ID*
This paper consists of **FIVE** questions. Attempt question ONE (Compulsory) and any other TWO questions.
Do not write on the question paper.

QUESTION ONE (COMPULSORY 30MKS)

a) Find the derivative of $y = 2x^3 + 3$ by the first principles (6 marks)

b).Find $\frac{dy}{dx}$ if $y^2 = x^2 + \sin xy$ (6 marks)

c). Evaluate the following limits

i) $\lim_{x \to o} \frac{\sqrt{x+3} - \sqrt{3}}{x}$ (4 marks)

ii) $\lim\limits_{x \to -2} \frac{x+2}{x^2+x-2}$ (3 Marks)

d).Find the first derivative of the following function

$y = \cos 3x \ln x$ (3 marks)

e).Determine the co-ordinates of the maximum and minimum values of the graph $y = \frac{x^3}{3} + \frac{x^2}{2} - 6x + \frac{5}{3}$ and distinguish between them. Sketch the graph. (8 marks)

QUESTION TWO (20MKS)

a).An object at the end of a vertical spring is stretched 4cm beyond its rest position and released to move in simple harmonic motion from t=0. Its position at time t is $S = f(t) = 4cost.$ Find its velocity and acceleration. (4 marks).

b).Define $f(2)$ in a way that extends $f(x) = \frac{x^2+x-6}{x^2-4}$ to be continuous at $x = 2$

(3 Marks)

c). $\lim\limits_{x \to 1} \frac{x^3-1}{x-1}$. Evaluate (3 Marks)

d).Differentiate $y = x^2 \tan x$ (3 Marks).

e).Determine the asymptotes to the curve $y = \frac{(x-1)(x+4)}{(x-2)(x-3)}$ (7marks)

QUESTION THREE (20MKS)

a) Find $\frac{dy}{dx}$ in the following

i) $y = \sqrt{3x^2 + 4x - 1}$ (3 marks)

ii) $x^3 \sec(xy) = \ln y$ (4 marks)

iii). $x^2 y = e^{\sin 5x}$ (4marks)

iv). $y = \log_e(x^2 - 6x + 8)$, at x=1 (4marks)

b). Determine the area of the largest piece of rectangular ground that can be enclosed by 100m of fencing, if part of the existing straight wall is used as one side (5 marks).

QUESTION FOUR (20MKS)

a).Find the equation of the tangent to the curve given by $y = t^3 + 1$ and $x = t + 2$ at the point (1,0) (6 marks)

b).Using first principle,Show that $\frac{d(\sin x)}{dx} = \cos x$ (6 marks)

c).Find $\frac{dy}{dx}$ for the following functions

i) $y = (3x^2 - \sin 2x)^2$ (4 marks)

ii) $y = \sqrt{\ln e^{2x}}$ (4 marks)

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QUESTION FIVE (20MKS)

a) Find $\frac{d^2y}{dx^2}$ for the following

$x = t^3$, $y = 3t^2 + 5$ (4 Marks)

b) A projectile is fired straight upwards with a velocity of 400m/s. its distance above the ground t- seconds after being fired is given by $S(t) = -16t^2 + 400t$. Find

(i) The time after which the projectile hits the ground. (3 Marks)

(ii) The velocity at which the projectile hits the ground (3 Marks)

(iii) The maximum altitude achieved by the projectile (4 Marks)

(iv) The acceleration at any time t (1 Marks)

c).A ladder 20m long is leaned against a vertical wall. If the bottom of the ladder slides away from the wall at the rate of 2m/s. How fast is the ladder sliding down when the top of the ladder is 12m above the ground? (5marks)