



TECHNICAL UNIVERSITY OF MOMBASA  
**Faculty of Engineering &  
Technology**

DEPARTMENT OF BUILDING & CIVIL ENGINEERING  
**DIPLOMA IN BUILDING & CIVIL ENGINEERING (DBCE 13J)**

AMA 2102: ENGINEERING MATHEMATICS

**SPECIAL/SUPPLEMENTARY EXAMINATION**  
**SERIES: OCTOBER/NOVEMBER 2013**  
**TIME ALLOWED: 2 HOURS**

**Instructions to Candidates:**

You should have the following for this examination

- *Answer Booklet*
- *Mathematical tables/Calculator*

This paper consists of **FIVE** questions.  
 Answer any **THREE** questions  
 Maximum marks for each part of a question are as shown  
 This paper consists of **THREE** printed pages  
**Question One**

a) Find first derivative  $\frac{dy}{dx}$  for  $\tan x$  from first principles **(8 marks)**

b) Determine  $\frac{dy}{dx}$  for the following:

$$y = \frac{e^2 x \cot x}{(x^4 + 5) \cos x}$$

(i)

$$x^2 \sin y + x^2 \cos x = 5x$$

(ii)

**(9 ½ marks)**

c) Find  $\frac{dy}{dx}$  at  $t = \frac{\pi}{3}$ , given  $y = t \sin x$ ,  $x = 4t + \cos x$  **(4 ½ marks)**

**Question Two**

a) Using the three rules of differentiation find  $\frac{dy}{dx}$  for,

$$y = \frac{\sinh x}{e^{4x} \cos x}$$

**(6 marks)**

b) Use logarithms to find first derivative for:

$$y^3 = \frac{\sinh x}{e^{4x} \cos x}$$

**(7 marks)**

c) A closed cylindrical tank of capacity 1m<sup>3</sup> is to be fabricated. Find dimensions if the tank is to have minimum surface area **(7 marks)**

**Question Three**

a) (i) Find  $\frac{dy}{dx}$  for  $4y = \cos^{-1}\left(1 - \frac{1}{x}\right)$

(ii) Determine  $\frac{d^2y}{dt^2}$  given  $y = \frac{\cos t}{te^t}$

**(11 marks)**

$$x^3 - yx = ey$$

- b) Find the radius of curvature for the function; at the point (2, 0) **(9 marks)**

**Question Four**

- a) Find first derivative for:

$$y = \cosh^{-1}\left(1 + \frac{1}{x^2}\right)$$

**(3 marks)**

$$x^3 y = x \cos y$$

- b) Find the equation of the normal to at point (1, 3) **(8 marks)**

- c) Determine volume for a cylinder of maximum volume that can be cut from a cone of base radius 9cm and perpendicular height 12cm. **(9 marks)**

**Question Five**

- a) Find second derivative for:

$$yx^2 - \frac{x}{y} = 5$$

**(6 marks)**

$$t = \frac{\pi}{3} \quad y = \cos t \quad x = -\sin t$$

- b) Find the co-ordinates for centre of curvature at the point given

**(7 marks)**

- c) The cost in dollar for fabricating steel door frame for a store taking t days is expressed as:

$$c = \frac{2t^3}{3} - \frac{5t^2}{2} + t + 3$$

- Determine the days it will take to fabric at minimum or maximum cost **(7 marks)**