



**TECHNICAL UNIVERSITY OF MOMBASA**  
**Faculty of Applied & Health**  
**Sciences**

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR:

**BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING**

**BACHELOR OF SCIENCE IN BUILDING & CIVIL ENGINEERING**

**BACHELOR OF SCIENCE ELECTRICAL & ELECTRONIC ENGINEERING**

**BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY**

SMA 2173/AMA 4202: CALCULUS II

**END OF SEMESTER EXAMINATION**

SERIES: DECEMBER 2013

**TIME ALLOWED: 2 HOURS**

**Instructions to Candidates:**

You should have the following for this examination

- *Mathematical tables*
- *Scientific Calculator*

This paper consist of **FIVE** questions

Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are as shown

This paper consists of **THREE** printed pages

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**Question One (Compulsory)**

a) Find the derivative of the following:

$$y = \coth \sec x$$

(i)

**(4 marks)**

(ii)  $y = \tanh^{-1} 2x$  (4 marks)

b) Show that  $\tanh^2 x + \operatorname{sech}^2 x = 1$  (4 marks)

c) Evaluate:

(i)  $\int \frac{\sin \sqrt{x+1}}{\sqrt{x+1}} dx$  (5 marks)

(ii)  $\int \sec^3 x dx$  (5 marks)

d) Express  $2x^2 - 6x + 4$  in the form  $a(u^2 \pm A^2)$  where a and A are real constants, hence find

$\int \frac{2 dx}{2x^2 - 6x + 4}$  (5 marks)

e) Find the area of the region enclosed by the x-axis and one arc of the curve:  $y = \sin x$  (3 marks)

**Question Two**

$y = 9 \cosh \frac{x}{9}$

a) Find the length of the curve between  $x = 1$  and  $x = 2$  (6 marks)

b) (i) Find the partial fraction for:

$\frac{8x^2 - 2x + 15}{(x^2 + 3)(x - 1)}$  (5 marks)

(ii) Use the results in (b) (i) above to evaluate:

$\int \frac{8x^2 - 2x + 15}{(x^2 + 3)(x - 1)} dx$  (4 marks)

$y = 4e^{x/4}$ ,

c) The area enclosed by the curve the x-axis and ordinates  $x = -1$  and  $x = 3$  is rotated through  $360^\circ$  about the x-axis. Determine the volume generated (5 marks)

**Question Three**

$$y = 3t^2, \quad x = 3t - t^3$$

- a) Find the surface area generated when the arc of the curve between  $t = 0$  and  $t = 1$  rotates about x axis through  $2\pi$  radians. **(8 marks)**

$$1.6 \cosh x + 4.6 \sinh x = 7.89$$

- b) Solve for x in correct to 4 decimal places **(6 marks)**

$$\int_3^4 \frac{x^3 - 2x^2 - 4x - 4}{x^2 + x - 2} dx$$

- c) correct to 3 decimal places **(6 marks)**

#### Question Four

$$x^2 y^3 - x^4 - y^5 - 2xy = -17$$

- a) Differentiate the function and determine its gradient at (2, 1) **(4 marks)**

$$\sinh x = -\frac{3}{4}$$

- b) Given that:  
Find  $\cosh x$  **(3 marks)**

$$\int_{-\pi/2}^{\pi/2} \sqrt{1 - \sin^2 t} dt$$

- c) Evaluate **(4 marks)**

$$y = x^3 + 2x - 5x - 6$$

- d) Sketch the graph between  $x = -3$  and  $x = 2$  and determine the area enclosed by the curve and the x-axis **(6 marks)**

$$x \frac{dy}{dx} = y + 1$$

- e) Evaluate: **(3 marks)**

#### Question Five

$$\int_1^3 \frac{3}{\sqrt{x}} dx$$

- a) Calculate the error in approximating by Simpson's rule using  $n = 6$  **(9 marks)**

- b) Evaluate:

$$\int_0^{\pi} \sin 5x \cos 3x dx$$

- (5 marks)**

$$\coth^{-1} x = \frac{1}{2} \ln \frac{1+x}{x-1}$$

- c) Show that hence solve  $\coth^{-1} 2.1$  **(6 marks)**