



STUDENT CENTRE K M  
Email: studentcentre@yahoo .com

**KENYATTA UNIVERSITY**  
**UNIVERSITY EXAMINATIONS 2010/2011**  
**INSTITUTE OF OPEN LEARNING**  
**EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION**  
**SMA 200: CALCULUS II**

**DATE: MONDAY, 31<sup>ST</sup> JANUARY 2011**

**TIME: 11.00 A.M. - 1.00 P.M.**

**INSTRUCTIONS: Answer question ONE and any other TWO questions.**

1. (a) Determine the integrals of

(i)  $\frac{3x^2 + 2x + 1}{x^3 + x^2 + x - 1}$  (2 marks)

(ii)  $\sqrt{1 - 25x^2}$  (4 marks)

(b) Evaluate the definite integrals

(i)  $\int_1^2 x^2 \ln x \, dx$  (4 marks)

(ii)  $\int_0^1 \sin 5x \sin 7x \, dx$  (4 marks)

(c) Find the area of the region bounded by the line  $y = -x$  and the parabola  $y = 10 - x^2$ . (4 marks)

(d) Find the volume of the solid generated by revolving the plane region bounded by the curve  $x = y^2$  and the line  $x = 2$  about the  $x$ -axis (4 marks)

(e) Find the length of the smooth arc

$y = \frac{1}{2}(e^x + e^{-x})$  from  $x = 0$  to  $x = 1$  (4 marks)

- (f) Find the area of the surface generated by rotating the curve  $y = x^2, 0 \leq y \leq 1$  about the  $y$ -axis. (4 marks)
2. (a) Evaluate the approximate value of  $\int_1^2 \frac{\ln x}{1+x} dx$  using
- (i) Trapezoidal rule
- (ii) Simpson's rule with  $n = 10$  correct to five decimal places. (10 marks)
- (b) (i) In using Simpson's rule with  $n = 10$ , estimate the error made in the approximation of  $\int_1^2 \ln x dx$  (5 marks)
- (ii) How large should  $n$  be to guarantee that the Simpson's rule approximation to  $\int_1^2 \ln x dx$  is accurate to within 0.0001? (5 marks)
3. (a) Resolve into partial fractions  $\frac{x^3}{x^2 + x - 20}$  (4 marks)
- Hence evaluate  $\int_0^1 \frac{x^3}{x^2 + x - 20} dx$
- (b) (i) Show that  $\tan^n x = \tan^{n-2} x (\sec^2 x - 1)$  (2 marks)
- (ii) If  $I_n = \int \tan^n x dx$ , prove that
- $$I_n = \frac{2^{\frac{n-2}{2}}}{n-1} + \left(\frac{n-2}{n-1}\right) I_{n-2}, n \geq 2 \text{ and hence evaluate } I_4 \quad (12 \text{ marks})$$
4. (a) Find the area of the region bounded by the line  $y = -\frac{1}{2}x$  and the parabola  $y^2 = 9 - x$  (6 marks)
- (b) Find the length of arc of the curve  $x = \frac{1}{6}y^3 + \frac{1}{2y}$  between  $y = 1$  and  $y = 2$  (8 marks)

- (c) Use trigonometric substitution to evaluate

$$\int \frac{\sqrt{x^2 - 36}}{x} dx \quad (6 \text{ marks})$$

5. (a) Find the area of the surface generated by rotating the hypocycloid  
 $x = a \cos^3 \theta$ ,  $y = a \sin^3 \theta$  about the  $x$ -axis. (8 marks)

- (b) The area enclosed by  $y = x^2$  and  $y^2 = x$  is rotated about the  
 $x$  axis. Find the volume generated. (6 marks)

- (c) Evaluate the integral  
 $\int_{-\infty}^{\infty} \frac{dx}{5 + 2x + x^2}$  if it converges. (6 marks)

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