KISII UNIVERSITY

UNIVERSITY EXAMINATIONS

MATH 211: CALCULUS II

STREAM: BED SCIENCE Y2S1 **TIME: 2 HOURS**

DAY: **DATE:**

INSTRUCTIONS

1. Do not write anything on this question paper.

2. This paper consist of 3 printed pages.

2. Answer Question **ONE(COMPULSORY)** and any other **TWO** questions.

QUESTION ONE (30 MARKS)

a. Evaluate the following integrals;

i) $\int \frac{3x}{(4x^2-1)^5}dx$ (5mks)

ii) $\int \frac{2e^t}{\sqrt{e^t+4}}dt$ (5mks)

iii) $\int_2^3 \frac{x^3-2x^2-4x-4}{x^2+x-2}dx$ (5mks)

b. Show that $\int \frac{1}{\sqrt{a^2-x^2}}dx = \sin^{-1}\frac{x}{a}$. Hence find $\int_0^4 \frac{1}{\sqrt{16-x^2}}dx$ (5mks)

c. Evaluate the value of $\int_1^2 (3x^2 e^{\frac{1}{2}})\, dx$ (5mks)

d. The displacement S metres of a particle at time t sec is given by $S = 2t^3 - 5t^2 + 4t - 3$. Show that the average velocity is attained twice on the interval t = 0sec and t =2sec. Find also average velocity reached. (5mks)

QUESTION TWO (20MARKS)

a. Given that z = xcosy-ycosx. Show that $\frac{\delta^2 z}{\delta x^2} + \frac{\delta^2 z}{\delta y^2} + 2 = 0$ (4mks)

b. Given that z = $\sin^2\theta\cos3\theta$. Show that $\frac{\delta^2 z}{\delta \theta^2} + \frac{\delta^2 z}{\delta \theta^2} + 13z = 0$ (4mks)

c. The pressure,p and volume, v of a gas are related by $pv^{1.2} = c$. Find the approximate percentage chang in c when pressure increases by 2.2% and volume decreases by 0.86%. (6mks)

d. If z = f(x, y) such that z = $e^{\frac{y}{2}}$ in(2x+3y). Find rate of change in z when x = 1cm and y = 2cm given that x is increasing at 5cm/s and y is decreasing at 4cm/s. (6mks)

QUESTION THREE (20MKS)

a. Evaluate $\int 3sec^2\, xtanx$ dx. Hence find $\int_0^{\frac{\pi}{12}} sec^2\, xtanx$ dx (6mks)

b. Determine the integrals in each case;

i) $\int \frac{x}{x^2+a^2}$ dx (4mks)

ii) $\int sin^2\, tcos^2 t$ dt (4mks)

iii) $\int \frac{3+6x+4x^2-2x^3}{x^2(x^2+3)}$ dx (6mks)

QUESTION FOUR (20MKS)

a. State the Rolles theorem. (2mks)

b. Find the value of x for which Rolle's theorem is satisfied for the fumction f(x) = $\sqrt{x-1}$ for the interval x =1 and x=3 (6mks)

c. Use Rolle's theorem to show that $x^5 + 4x = 1$ has exactly one solution. (4mks)

d. Test whether the function f(x) = $x^{2/3}$ satisfy the mean value theorem for the interval x= -8 and x = 8.   (2mks)

e. Show that $\int_{\sqrt{3}/2}^{3/2} \frac{1}{3+4x^2}\, dx = \frac{\pi\sqrt{3}}{72}$ (6mks)

QUESTION FIVE (20MKS)

a. State the Taylors theorem   (2mks)

b. Use Taylors theorem to expand sin$(\frac{\pi}{6} + h)$ in ascending powers of h as far as the term in h^4. Hence estimate the value of sin$(\frac{\pi}{6} + h)$ given that sin$\pi/6$ = 0.5   (6mks)

c. Use Taylor's theorem to approximate the value of $\frac{1}{(2.03)^3}$ to 3 d.p.   (6mks)

d. Expand $e^{(2a+e)}$ upto e^2 by using Taylors theorem. Hence estimate $e^{3.072}$ correct to 2 d.p. given that e^3 = 20.086.   (6mks)

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