



MACHAKOS UNIVERSITY

University Examinations 2018/2019

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS, STATISTICS AND ACTUARIAL SCIENCE

FOURTH YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE IN MATHEMATICS

BACHELOR OF EDUCATION

SMA 200: CALCULUS II

DATE: 25/9/2019

TIME: 2:00 – 4:00 PM

INSTRUCTIONS

Attempt question *one (compulsory)* and any other *two questions*.

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Consider the region bounded by the equations $y = \sin x$ and $y = 0$ from the line $x = 0$ to $x = \pi$. Calculate the centroid (center of mass) of the region (3 marks)
- b) A particle carrying a positive electrical charge $+q$ is released at a distance d from an immovable positive charge $+Q$. calculate amount of work done on the particle as its distance increases to $2d$. (4 marks)
- c) Calculate the area bounded by the curve $y = \frac{1}{\sqrt{x}}$, x -axis and the line $x = 1$ (4 marks)
- d) Evaluate the improper integral $\int_{-\infty}^{\infty} \frac{1}{1+x^2} dx$ (4 marks)
- e) Determine
- i.) $\int x e^x dx$ (5 marks)
- ii.) $\int \frac{x+1}{\sqrt{x^2-x+1}} dx$ (5 marks)

QUESTION TWO (20 MARKS)

- a) Consider the integral $\int x^m (\log x)^n dx$
- Obtain its reduction formula (6 marks)
 - Use the formula obtained in (i) above to evaluate $\int x^4 (\log x)^3 dx$ (4 marks)
- b) Determine the approximate value for $\int_0^1 e^{-x^2} dx$ using trapezoidal rule by taking 10 equal intervals. (10 marks)

QUESTION THREE (20 MARKS)

- a) Work out the volume of the solid obtained by revolving the cardioide $r = a (1 + \cos \theta)$ about the initial line. (9 marks)
- b) Determine the distance travelled in a straight line by a particle in 6 sec given that the velocity v in m/s is connected with the time as follows. Sketch the time velocity graph. (11 marks)

t	0	1	2	3	4	5	6
v	10	12	15	16	11	5	3

QUESTION FOUR (20 MARKS)

Evaluate;

- $\int \frac{x^4}{x^3 - 2x^2 - 7x - 4} dx$ (5 marks)
- $\int x \sec^2 x dx$ (5 marks)
- $\int x^2 \ln x dx$ (5 marks)
- $\int \sin^3 x dx$ (5 marks)

QUESTION FIVE (20 MARKS)

a.) Evaluate;

i.) $\int_0^{\pi} x \sin^6 x \cos^4 x dx$ (3 marks)

ii.) $\int_0^{\frac{\pi}{4}} \log(1 + \tan \theta) d\theta$ (6 marks)

- b.) Compute $\int_0^1 \frac{\tan^{-1} x}{x^{\frac{3}{2}}} dx$ using Simpson's rule with 10 equal intervals. (11 marks)