



MACHAKOS UNIVERSITY

University Examinations for 2020/2021

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

SECOND YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (MATHEMATICS AND COMPUTER SCIENCE)

SCO 210: INTEGRAL CALCULUS

DATE: 17/8/2021

TIME: 2:00 – 4:00 PM

INSTRUCTIONS: Answer Question One and Any Other Two Questions

QUESTION ONE (COMPULSORY) (30 MARKS)

a) Evaluate

$$\int (2x^5 + 3e^x + 4x + 5) dx$$

(5 marks)

b) Evaluate

$$\int \frac{\sin \varphi}{2 + \cos \varphi} d\varphi$$

(5 marks)

c) Integrate the following functions with respect to x

$$y = \frac{dx}{4 + 9x^2}$$

(5 marks)

d) Find the integrals of the following function with respect to x $\int \left(\frac{2x^3 + 5x^2 + 8x + 9}{x} \right)$ (5 marks)

e) Evaluate the following integral $\int (\tan x)^{10} \sec^2 x dx$ (4 marks)

f) Evaluate the following definite integrals

$$\int_0^\pi \sin 5x \cos 6x dx$$

(3 marks)

g) Find the area enclosed by the curve $y = x^3 - 4x$ and the x-axis (3 marks)

QUESTION TWO (20 MARKS)

Evaluate the following definite integrals

i) $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \sqrt{\sec^2 x - 1} dx$ (4 marks)

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

iii) $\int_0^\pi \cos^5 x dx$ (4 marks)

iv) $\int_0^2 \frac{x^3 - 2x^2 + 1}{x^2 - x} dx$ (4 marks)

v) $\int_0^2 x^4 \sqrt{x^5 + 5} dx$ (4 marks)

QUESTION THREE (20 MARKS)

- a) Find the area bounded by the $x = 9 - y^2$ and the y-axis (5 marks)
- b) Find the volume of the solid generated by the region $y = x^2 + 1$, x-axis and the lines $x = -1$ and $x = 1$, rotated 360° about the x-axis. (5 marks)
- c) The region bounded by the y-axis, $y = x^3$, $y = 1$ and $y = 8$ is rotated 360° about the y-axis. Find the volume of the resulting solid. (5 marks)
- d) Find the volume generated by revolving the region bounded by $y = \sqrt{x}$, the lines $x = 1$ and $x = 4$ about the line $y = 1$ (5 marks)

QUESTION FOUR (20 MARKS)

- a) Integrate the following function with respect to x $\int \cos 4\phi d\phi$ (5 marks)
- b) It took 20 seconds for a thermometer to rise from 10°F to 212°F when it was taken from a freezer and placed in boiling water. Show that somewhere along the way the mercury was rising at exactly 10.1°F/sec (5 marks)
- c) Given that $y = f(x) = x^3 - 7x + 6$
Find the intercepts (5 marks)
- d) Evaluate the following integral
 $\int e^{x^5} x^4 dx$ (5 marks)

QUESTION FIVE (20 MARKS)

Using appropriate integration techniques evaluate

i) $\int x^2 e^x dx$ (5 marks)

ii) $\int \cos^4 x dx$ (5 marks)

iii) $\int x^3 \ln x dx$ (5 marks)

iv) $\int x^4 (7 - x^5)^3 dx$ (5 marks)