



MULTIMEDIA UNIVERSITY OF KENYA

FACULTY OF COMPUTING AND INFORMATION TECHNOLOGY

UNIVERSITY EXAMINATIONS 2021/2022

THIRD YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF
BACHELOR OF SCIENCE IN COMPUTER TECHNOLOGY AND INFORMATION
TECHNOLOGY

SMA 2102: CALCULUS II

DATE: 12TH AUGUST 2021

TIME: 2 HOURS

INSTRUCTIONS:

ANSWER YOUR QUESTIONS IN ANSWER BOOKLET PROVIDED

ANSWER QUESTION ONE [COMPULSORY] AND ANY OTHER TWO QUESTIONS

QUESTION ONE 30 MARKS.

a). Use the de Moivre's formula to derive the following identities;

(i). $\cos 3\theta = \cos^3 \theta - 3\cos \theta \sin^2 \theta$,

(ii). $\sin 3\theta = 3\cos^2 \theta \sin \theta - \sin^3 \theta$,

[6 marks]

b). By factorizing $z^4 - 4z^2 + 3$ into two quadratic factors, show that if z lies on the circle

$|z| = 2$, then $\left| \frac{1}{z^4 - 4z^2 + 3} \right| \leq \frac{1}{3}$.

[4 marks]

(c). If u is a differentiable function of x , show that;

$$(i). \frac{d}{dx} (\sinh^{-1} u) = \frac{1}{1-u^2} \frac{du}{dx}$$

$$(ii). \frac{d}{dx} (\tanh^{-1} u) = \frac{1}{1-u^2} \frac{du}{dx} (u^2 < 1),$$

(d). Evaluate the following integrals;

$$(i). \int \sec x dx,$$

$$(ii). \int \frac{dx}{5+4\sin x}$$

$$(e). \text{Given } y = \frac{1}{3}x^3 + \frac{1}{2}x^2 - 6x + 8,$$

find;

(i). the maximum and minimum values y ,

(ii). the intervals on which y is increasing and decreasing. Hence sketch the graph of y .

$$(f). \text{Evaluate } \int_0^6 \frac{dx}{1+x}, \text{ using}$$

(i) Trapezoidal rule, (ii) Simpson's a third rule, (iii) Simpson's three eighths rule

QUESTION TWO [20 MARKS]

Evaluate the following;

$$(i). \int \sin^2 x \cos^3 x dx [4 \text{ marks}]$$

$$(ii). \int \tan^5 x dx$$

$$(iii). \int \frac{(x+1)dx}{x^3+x^2-6x} [4 \text{ marks}]$$

$$(iv). \int \frac{(3x+5)dx}{x^3-x^2-x+1}$$

[6 marks]

QUESTION THREE [20 MARKS].

(a). Solve the following differential equations by method of separation of variables;

$$(i). \frac{dy}{dx} = 1 + x^2 \quad [2 \text{ marks}],$$

$$(ii). \frac{dy}{dx} = 1 + y^2 \quad [4 \text{ marks}],$$

$$(iii). \frac{dy}{dx} = \cot x \tan y \quad [4 \text{ marks}],$$

$$(iv). \frac{dy}{dx} = 1 + x + y + xy, \quad [6 \text{ marks}].$$

(b). Solve the differential equation.

$$\frac{dy}{dx} = \frac{xy}{x^2 + y^2}$$

[4 marks].

QUESTION FOUR [20 MARKS].

(a). Find the area bounded by the parabolas $y = 6x - x^2$ and $y = x^2 - 2x$. [6 marks]

(b). Find the volume generated by revolving the area bounded by the parabola $y^2 = 8x$ and its latus rectum about the latus rectum (i.e $x=2$). [6 marks]

(c). Verify that

$$2 < \lim_{n \rightarrow \infty} \left(1 + \frac{1}{n}\right)^n < 3$$

[8 marks]

QUESTION FIVE [20 MARKS].

Evaluate the integral

$$\int_4^{5.2} \log_a x dx, \text{ using}$$

[6 marks]

(i). Trapezoidal rule,

(ii).Simpson's one third rule

(iii).Simpson's three eighths rule



MULTIMEDIA UNIVERSITY OF KENYA
FACULTY OF COMPUTING AND INFORMATION TECHNOLOGY
UNIVERSITY EXAMINATIONS 2017/2018
SECOND YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF
BACHELOR OF SCIENCE IN COMPUTER SCIENCE/INFORMATION TECHNOLOGY

CCS 2216: INTEGRAL CALCULUS

DATE: THURSDAY 8TH FEBRUARY, 2018

TIME: 2 HOURS

INSTRUCTIONS:

ANSWER YOUR QUESTIONS IN ANSWER BOOKLET PROVIDED

ANSWER QUESTION ONE [COMPULSORY] AND ANY OTHER TWO QUESTIONS

QUESTION ONE (THIRTY MARKS)

a) Evaluate the following integrals using the correct technique

i. $\int_0^3 2x \sin x^2 dx$

(3 marks)

ii. $\int \frac{6}{(x+1)(x-2)} dx$

(4 marks)

iii. $\int \tan^{-1} x dx$

(4 marks)

iv. $\int (x-1)\sqrt{x} dx$

(4 marks)

v. $\int \cos(2x-1) dx$

(4 marks)

vi. $\int \frac{1}{\sqrt{4-x^2}} dx$

(4 marks)

b) Find the displacement of an object from $t=2$ to $t=3$, if the velocity of the object at time t is given by

$$v = \frac{t^2+1}{(t^3+3t)^2}$$

(3 marks)

c) Find the area bounded by the graph of $x = y^2$ and $x = 2 - y^2$

(4 marks)

QUESTION TWO (TWENTY MARKS)

a) Evaluate:- i. $\int \frac{x}{\sqrt{3-2x+x^2}} dx$ ii. $\int x^3(x^4+5)^2 dx$ iii. $\int_0^{\pi/3} 2\sec^2 x dx$ (10 marks)

b) Find the volume of the solid resulting from revolving the region bounded by the curve $y = 4 - x^2$

and the line $y=1$ from $x=0$ to $\sqrt{3}$ about the y -axis

(6 marks)

c) The acceleration at time t of a particle moving along the x -axis is given by $a(t) = 20t^3 + 6$. At time $t=0$ the velocity of the particle is zero and the position of the particle is 7. What is the position of the particle at time t ?

(4 marks)

QUESTION THREE (TWENTY MARKS)

- a) Show that $\int \frac{dx}{x^2-36} = \frac{1}{12} \ln \left| \frac{x-6}{x+6} \right| + C$ (4marks)
- b) Find the length of the parabolic arc $y^2 = -4x$ from $(0,0)$ to $(-4,4)$ (4marks)
- c) Find the area under the curve $f(x) = \sin x$ on the interval $[0, \pi]$ (2marks)
- d) Evaluate i. $\int \frac{x^2-1}{x(x^2+1)} dx$ ii. $\int \cot 2x dx$ iii. $\int_0^1 (x^2 + \sqrt{x}) dx$ (10 marks)

QUESTION FOUR (TWENTY MARKS)

- a) Evaluate the integral i. $\int \frac{x^2}{(x+1)^2} dx$ ii. $\int_{-2}^0 (e^x - 1) dx$ iii. $\int \log_5 x dx$ (9 marks)
- b) Compute the area of the surface obtained by rotating the curve round the x axis $y = x^3$ $0 \leq x \leq 2$ (5 marks)
- c) Compute $\int_0^2 (x^2 - 2x) dx$ using trapezoidal rule with 10 subdivisions (6 marks)

QUESTION FIVE (TWENTY MARKS)

- a) The function f is given by $f(x) = 3x^2 + 1$ what is the average value of f on a closed interval $[1,3]$ (4 marks)
- b) Find the area of the region in the first quadrant between the graph of $y = x\sqrt{4-x^2}$ and x-axis (4 marks)
- c) Compute $\int_0^2 \sqrt{(x^2+1)} dx$ using Simpson's rule with 4 subdivisions (6 marks)
- d) Find the arc length of the parabola $y^2 = x^3$ between $[1,1]$ and $[4,8]$ (6 mark)



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FACULTY OF COMPUTING AND INFORMATION TECHNOLOGY
UNIVERSITY EXAMINATIONS 2017/2018
THIRD YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF
BACHELOR OF SCIENCE IN COMPUTER SCIENCE/ SOFTWARE ENGINEERING

SMA 2102: CALCULUS II

THURSDAY 8TH FEBRUARY, 2018

INSTRUCTIONS:

TIME: 2 HOURS

ANSWER YOUR QUESTIONS IN ANSWER BOOKLET PROVIDED
ANSWER QUESTION ONE [COMPULSORY] AND ANY OTHER TWO QUESTIONS

QUESTION ONE (THIRTY MARKS)

Differentiate the implicit function $x + \sqrt{xy} = y^2$

(3marks)

Evaluate the following integrals using the correct technique

- $\int \frac{6}{(x+2)(x-3)} dx$ (4marks)
- $\int_0^{\pi} \sin 2x dx$ (3marks)
- $\int \arctan x dx$ (4marks)
- $\int x^2 e^{x^3} dx$ (3marks)

For which value of b does the curve $y = x^2 + bx + 1$ have a horizontal tangent at $x=3$ (2marks)

Find the general solutions of the following differential equations:

- $\frac{dx}{dt} = t\sqrt{1-x^2}$ (3marks)
- $\cos^2 x \frac{dy}{dx} = (y+3)$ (3marks)

Find the area between the curves $y = \sqrt{x}$ and $y = x^3$

(5 marks)

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QUESTION TWO (TWENTY MARKS)

- a) Find i. $\int e^x \cos x \, dx$ ii. $\int_0^{\sqrt{3}} \frac{dx}{1+x^2}$ iii. $\int \log_3 x$ (9 marks)
- b) Determine the volume of the solid obtained by rotating the region bounded by $y = x^2 - 4x - 5$ $x = 1$, $x = 4$ and the x -axis (4 marks)
- c) Evaluate $\int e^{-\frac{x^2}{3}} dx$, correct to 4sf using mid-ordinate rule with 6 intervals (7 marks)

QUESTION THREE (TWENTY MARKS)

- a) Sketch the curves and find the area of the region they bound $y = x^2$ and $y = 2x$ (7 marks)
- b) Use trapezoidal rule with $n=4$ to calculate an approximate value for the integral $\int_0^1 \sqrt{1-x^3} \, dx$ (7 marks)
- c) Solve the following initial value problem $\frac{y'}{\cos(x^2)} = 2xe^{-y} = 0$ $y(0)=1$ (6 marks)

QUESTION FOUR (TWENTY MARKS)

- a) Use Simpson's rule with $n=4$ to calculate an approximate value for the integral $\int_0^2 \frac{dx}{1+x^4}$ (5 marks)
- b) Find the curve which satisfies the equation $xy' = (1+x^2) \frac{dy}{dx}$ and passes through the point $(0,1)$ (4 marks)
- c) Compute the area of the surface obtained by rotating the curve round the x axis $y = x^3$ $0 \leq x \leq 2$ (5 marks)
- d) Given $z_1 = 1 + i$ and $z_2 = 2 + \sqrt{3}i$ find where ~~is~~ $z = \sqrt{-1}$
i. $z_1 z_2$ ii. $\frac{z_1}{z_2}$ iii. $\overline{z_1 + z_2}$ (6 marks)

QUESTION FIVE (TWENTY MARKS)

- a) Show that $\int \frac{dx}{x^2-9} = \frac{1}{3} \ln \left| \frac{x-3}{x+3} \right| + C$ (4 marks)
- b) Find the derivatives of i. $\sinh 2x$ ii. $\coth x$ iii. $\tanh 3x$ (6 marks)
- c) Find the arc length of the semi cubical parabola $y^2 = x^3$ between $(1,1)$ and $(4,8)$ (5 marks)
- d) Solve the following equation $4xy \frac{dy}{dx} = y^2 - 1$ (5 marks)

MULTIMEDIA UNIVERSITY OF KENYA
FACULTY OF COMPUTING AND INFORMATION TECHNOLOGY
UNIVERSITY EXAMINATIONS 2017/2018
FIRST YEAR SECOND SEMESTER SUPPLEMENTARY/SPECIAL
EXAMINATION FOR
THE DEGREE OF BACHELOR OF SCIENCE COMMERCE /BACHELOR OF
BUSINESS INFORMATION TECHNOLOGY

CCS 2216: INTEGRAL CALCULUS

DATE: WEDNESDAY 18TH OCTOBER 2017

TIME: 2 HOURS

INSTRUCTIONS:

ANSWER YOUR QUESTIONS IN ANSWER BOOKLET PROVIDED.

ANSWER QUESTION ONE [COMPULSORY] AND ANY OTHER TWO QUESTIONS.

QUESTION ONE (THIRTY MARKS) (COMPULSORY)

- i. Integrate $\int_1^3 5x\sqrt{(2x^2 + 7)}dx$ (4 marks)
- ii. Find $\int \cos^5 \theta d\theta$ (4 marks)
- iii. Evaluate $\int x^2 \sin x dx$ (4 marks)
- iv. Determine the area between the curve $y = 4 - x^2$ and the $y = x^2 - 2x$ (4 marks)
- v. Use trapezoidal rule to evaluate $\int_1^2 \frac{2}{\sqrt{x}} dx$ using 8 interval, give the answer to 3 significant figures (6 marks)
- vi. Evaluate $\int_2^3 \frac{x^3 - 2x^2 - 4x - 4}{x^2 + x - 2} dx$ correct to 4 significant figures (8 marks)

QUESTION TWO (TWENTY MARKS)

- i. Evaluate $\int_0^2 4 \cos 3t$ (4 marks)
- ii. Find $\int \frac{3+6x+4x^2-2x^3}{x^2(x^2+3)} dx$ (7 marks)
- iii. Given the curves $y = x^2$ and $y^2 = 8x$;
- Determine the co-ordinates of the point of intersection of the curves (3 marks)
 - Sketch the curves on the same axes (3 marks)
 - Calculate the area enclosed by the two curves (3 marks)
 - The enclosed area above is rotated 360° about x-axis, determine the volume of the solid (3 marks)

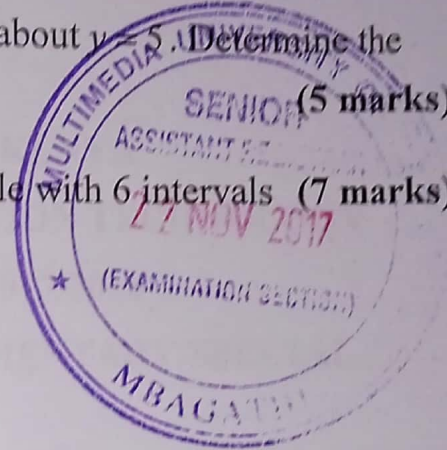
QUESTION THREE (TWENTY MARKS)

- i. Show that $\int \tan \theta d\theta = \ln(\sec \theta) + c$ (4 marks)
- ii. Evaluate $\int_0^{\pi} \sin^2 x \cos^3 x dx$ (6 marks)
- iii. Evaluate $\int_0^{\pi} \frac{1}{1 + \sin x} dx$ with 8 intervals giving your answer to 3 decimal places using:
- Trapezoidal rule (4 marks)
 - Mid-ordinate rule (3 marks)
 - Simpson's rule (3 marks)

QUESTION FIVE (TWENTY MARKS)

- i. Find $\int x \ln x dx$ (4 marks)
- ii. The acceleration am/s^2 of a moving particle is given by $a = 2t - 3$ where t is time in seconds. Determine:
- An expression for the velocity Vm/s of the particle given that the initial velocity is $5m/s$ (2 marks)
 - The total distance moved by the particle in the first three seconds of motion (2 marks)

- iii. The area of the segment cut off by $y = x^2 + 1$ is rotated about $y = 5$. Determine the volume generated (5 marks)
- iv. Evaluate $\int e^{\frac{x^2}{3}} dx$, correct to 4sf using mid-ordinate rule with 6 intervals (7 marks)



SMA 2012: CALCULUS II

WEDNESDAY 18TH OCTOBER

TIME: 2 HOURS

INSTRUCTIONS:

ANSWER YOUR QUESTIONS IN ANSWER BOOKLET PROVIDED
ANSWER QUESTION ONE [COMPULSORY] AND ANY OTHER TWO QUESTIONS

QUESTION ONE (THIRTY MARKS)

Give the definition of horizontal and vertical asymptotes.

Find the asymptotes of the function

$$y = \frac{1}{x^2 - 1} \text{ and graph it.}$$

Find the equation of the tangent line to the curve

$$x = \frac{1}{t} + t^2, \quad y = t^2 - t + 1 \text{ at the point } (2, 1).$$

Solve the differential equation

$$\frac{dy}{dx} = 4 \frac{\sqrt{(1+y^2)^3}}{y} \text{ given that } y(0) = -3$$

Find the area bounded by the curve $y = x^2 + 5$ and the line $y = 8 - 2x$

Evaluate the integral



(2 marks)

(4 marks)

(3 marks)

(5 marks)

$$\int (x^3 + x)^5 (3x^2 + 1) dx$$

(3 marks)

- f) Find the volume of the solid generated by the curve $y = \sqrt{x}$; $0 \leq x \leq 4$ when revolved about the y-axis. (3 marks)

- g) Approximate $\int_0^1 \sqrt{1-x^2} dx$ with $n=10$ using Simpson's rule.

What is the error involved when you compare with the exact answer? (6 marks)

QUESTION TWO (TWENTY MARKS)

- a) Obtain the reduction formula that expresses the integral $\int \cos^n x dx$. (4 marks)

Use the formula to evaluate $\int \cos^5 x dx$. (2 marks)

- b) Evaluate $\int 3^{\sin x} \cos x dx$ (4 marks)

- c) State the second fundamental Theorem of integral calculus.

Calculate $\frac{dy}{dx}$ if $y = \int_{x^2}^0 \cos t dt$ (2,3 marks)

- d) Evaluate the integral $\int \frac{dx}{x(x^2+1)}$ (5 marks)

QUESTION THREE (TWENTY MARKS)

- a) Find the distance travelled by the particle $P(x, y)$ between $t = 4$ and $t = 9$ if the position at time t is given by

$$x = \frac{t^2}{2}; \quad y = \frac{1}{3}(2t+1)^{3/2}$$

(4 marks)

- b) The line segment $x = \sin^2 t$, $y = \cos^2 t$; $0 \leq t \leq \frac{\pi}{2}$ is revolved about the y-axis to generate a cone. Find its surface area. (5 marks)

- c) Use the trapezoidal rule with $n = 5$ to estimate the value of the integral

$$\int_2^5 \frac{x^2 - 3x + 2}{x - 2} dx$$

Compare the answer with the exact. (6 marks)

- d) Evaluate the integral $\int_{\frac{\pi}{3}}^{\frac{\pi}{2}} \frac{\sin^2 x}{\sqrt{1 - \cos x}} dx$ (5 marks)

QUESTION FOUR (TWENTY MARKS)

Evaluate the following integrals:

a) $\int \frac{x-1}{\sqrt{1-9x^2}} dx$

(5 marks)

b) $\int \frac{x^2-2}{x+1} dx$

(5 marks)

c) $\int \sqrt{1-\cos 2x} dx$

(5 marks)

d) $\int \frac{x}{\sqrt{x^2+4x+13}} dx$

(5 marks)

QUESTION FIVE (TWENTY MARKS)

Evaluate the following integrals:

a) $\int x \sec^{-1} x dx$

(4 marks)

b) $\int \tan^4 x dx$

(3 marks)

c) $\int_0^{\ln 2} \frac{e^x}{1+e^{2x}} dx$

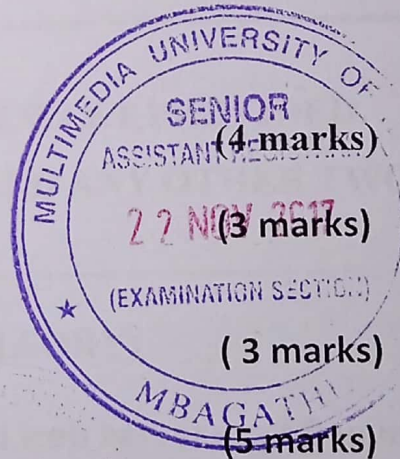
(3 marks)

d) $\int e^{ax} \sin bx dx$

(5 marks)

e) $\int \frac{dx}{\sin x - \cos x + 1}$

(5 marks)



THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE/BACHELOR
OF SCIENCE IN INFORMATION TECHNOLOGY/BACHELOR OF SCIENCE IN
COMPUTER SCIENCE

SMA 2102 : CALCULUS II

DATE: 18TH SEPTEMBER 2019

TIME: 2 HOURS

INSTRUCTIONS:

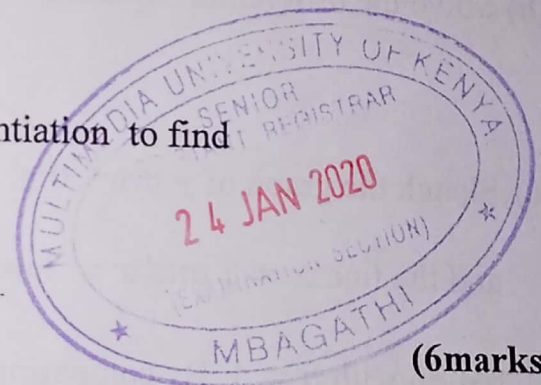
ANSWER YOUR QUESTIONS IN ANSWER BOOKLET PROVIDED.
ANSWER QUESTION ONE [COMPULSORY] AND ANY OTHER TWO QUESTIONS.

QUESTION THREE (THIRTY MARKS)

(a) Given $y^2 = x^3 + 10x$, use the implicit differentiation to find

(i) $\frac{dy}{dx}$

(ii) $\frac{d^2y}{dx^2}$



(6marks)

(b) Evaluate the following using DeMoivre's theorem

$$\frac{(\cos 3\theta + i \sin 3\theta)^4 (\cos 2\theta - i \sin 2\theta)^5}{(\cos 4\theta + i \sin 4\theta)^6 (\cos 2\theta - i \sin 2\theta)^{10}}$$

(6marks)

(c) Evaluate $\int \sin^3 x \, dx$

(6marks)

(d) Evaluate $\int \sec^2 x \, dx$

(4marks)

(e) Evaluate $\int \frac{x^2-3x-3}{(x+1)(x^2+x+1)} dx$ (8ma

QUESTION TWO (20 MARKS)

(a) Evaluate $\int x \cosh x dx$ (4ma

(b) Work out $\int_{-2}^2 3x^2 \sqrt{(x^3+1)} dx$ (6mar

(c) Evaluate $\int \cos^5 x dx$ (5mar

QUESTION THREE (20 MARKS)

(a) Evaluate $\int \frac{6x^2+7x-25}{(x-3)(x+2)(x-2)} dx$ (13mar

(b) Determine $\int_0^1 2x^2 e^{3x} dx$ (7mar

QUESTION FOUR (20 MARKS)

(a) Evaluate $\int \tan^5 x \sec^3 x dx$ (5marks)

(b) Solve the differential equation $x \frac{dy}{dx} + \cot y = 0$, given that $y = \frac{\pi}{4}$ when $x = \sqrt{2}$ (5marks)

(c) Sketch the graph of $y = x^2$, $0 \leq x \leq 3$ and clearly indicate the region bounded by the curve and the lines $x = 1$ and $x = 2$. using trapezoidal rule, estimate the area of the indicated region with $n = 4$. By comparing the estimate with the actual value of $\int_1^2 x^2 dx$, calculate the percentage error. (10 marks)

QUESTION FIVE (20 MARKS)

(a) Using both the mid-ordinate rule and Simpson's rule with 4 intervals, evaluate $\int_1^3 \frac{2}{\sqrt{x}} dx$, correct to 3 decimal places. By working out the actual value of the integral, compare and comment on the accuracy of the two rules. (14marks)

(b) Evaluate $\int \sin^6 x dx$ (6marks)

