



SCHOOL OF COMPUTING AND ENGINEERING SCIENCES (SCES)
BACHELOR OF SCIENCE IN COMPUTER NETWORK AND SECURITY
BACHELOR OF BUSINESS INFORMATION AND TECHNOLOGY
END OF SEMESTER EXAMINATION
CNS 1204: CALCULUS II
BBIT 2104: INTEGRAL CALCULUS

DATE: 11 March, 2026

Time: 08:30-10:30

Instructions

1. This examination consists of **FIVE** questions.
2. Answer **Question ONE (COMPULSORY)** and any other **TWO** questions.

QUESTION ONE (30 MARKS)

a) Integrate the following

i) $\int_0^9 2\sqrt{x-4} \, dx.$ (3 marks)

ii) $\int \frac{2x}{7-5x^2} \, dx.$ (3 marks)

b) The Goldplus company determines that the marginal cost for their Aiibe 64 GB flash drive given by the differential rate equation

$$C'(x) = -0.02x + 6$$

Where x is the number of flash drives produced and C is the cost in dollars.

i) Determine the general solution of the cost function $C(x)$. (2 marks)

ii) Find the particular cost function $C(x)$, knowing that the cost of producing 10 Aiibe 64GB flash drive is \$400. Also determine the cost of 50 Aiibe 64GB flash drive.

(5 marks)

c) Determine the area under the parabola $y = x^2 - 2x + 2$ above the x -axis and between $x=0$ and $x=1$, using;

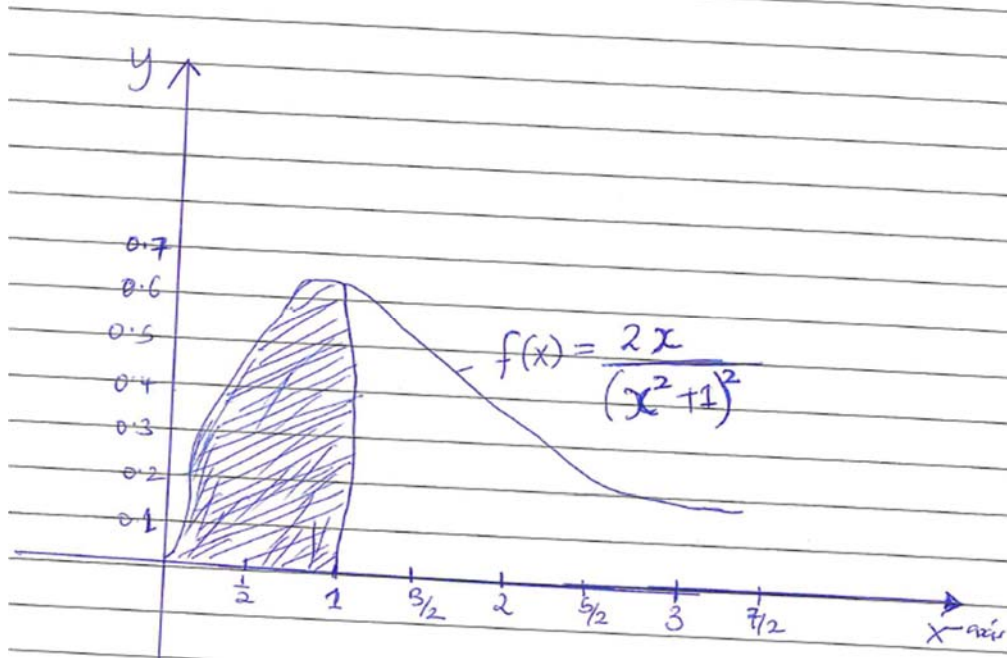
i) Trapezoidal rule with $n=4$. (4 marks)

ii) Simpson's rule $n=4$. (3 marks)

- d) Determine the particular solution for the following initial value problem

$$\frac{dy}{dx} = xy - 3x, \quad y(0) = 4. \quad (5 \text{ marks})$$

- e) Determine the exact area of the shaded region in the figure below (5 marks)



QUESTION TWO (20 MARKS)

- a) Media consultants for the new local magazine have projected that the number of subscriptions will grow during the first five years at a rate given by

$$S'(t) = \frac{1000}{(1+0.3t)^3}, \quad 0 \leq t \leq 60$$

Where t is the number of months since the magazine's first issue and $S'(t)$ is the rate of change in the number of subscriptions measured in subscriptions/month.

- (i) Evaluate $S'(12)$. (2 marks)
 - (ii) Evaluate and interpret $\int_0^6 S'(t) dt$. (4 marks)
 - (iii) Obtain the subscription function $S(t)$, given $S(0) = 5000$. (4 marks)
- b) Integrate the following
- (i) $\int \sec 3x \tan 3x dx$. (3 marks)
 - (ii) $\int_0^{\frac{\pi}{2}} \sin^2 x \cos x dx$. (4 marks)
- c) Determine the area between the x-axis and $f(x) = x^2 - 7x + 6$ on $[2, 6]$. (3 marks)

QUESTION THREE (20 MARKS)

- a) Find the integral of
- $\int x^2 e^{0.2x} dx.$ (4 marks)
 - $\int \frac{1}{x(x-3)} dx.$ (4 marks)
- b) The current (year 2025) population of earth is 7.8 billion people, and the yearly birth and death rates are $\beta = 0.024$ and $\delta = 0.012$ respectively. Assuming that the birth and death rates remains constant, find the population of the earth the earth in the year 2076. (6 marks)
- c) Use the midpoint rule with $n = 4$ to estimate $\int_0^2 x^2 + 1 dx.$ (6 marks)

QUESTION FOUR (20 MARKS)

- a) A manager at the black box microprocessor manufacturing company finds through data gathered in research that the marginal cost function for a certain type of automobile computer chip made at the facility is given by

$$C'(x) = 6x\sqrt{x^2 + 11}$$

Where x represents the number of auto computer chips produced each hour and $C'(x)$ represents the marginal cost. The manager also knows that it cost \$1932 to manufacture 5 chips.

- Recover the cost function $C(x)$ (6 marks)
 - Find the fixed costs (2 marks)
- b) Given that $x = 5$ when $y = 0$, solve the following Initial Value Problem (IVP)
- $$e^y \frac{dy}{dx} = (2x - 4) \quad (6 \text{ marks})$$
- c) Evaluate the following integral
- $\int_1^4 \frac{2x+1}{(x^2+x-1)} dx$ (3 marks)
 - $\int (x^2 - x)^4 (2x - 1) dx$ (3 marks)

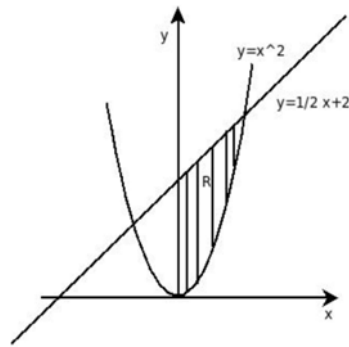
QUESTION FIVE (20 MARKS)

- a) The marginal profit $P'(x)$ for producing x units of an electrical appliance is given by the linear function

$$P'(x) = 80 + 0.03x$$

Where $P'(x)$ is in dollars per unit. Knowing that $p = 0$ when $x = 0$, recover the profit function (5 marks)

- b) Find the area of the region R under the line $y = \frac{1}{2}x + 2$, above the parabola $y = x^2$ and between the y-axis and $x = 1$ (5 marks)



c) Find the Taylor series for $f(x) = \sin x$ about $x = 0$. (6 marks)

d) Evaluate the following antiderivative.
 $\int x \ln x \, dx$. (4 marks)