

MATHEMATICS

MAT03

09/07/2024

8.30 AM-11.30 AM

Names:

Index number:

SUBJECT: MATHEMATICS

**OPTION : ASSOCIATE NURSING PROGRAM
(ANP)**

DURATION: 3 HOURS

S6 QUESTIONS and ANSWERS BOOKLET

**ADVANCED LEVEL NATIONAL EXAMINATIONS,
2024-2025**

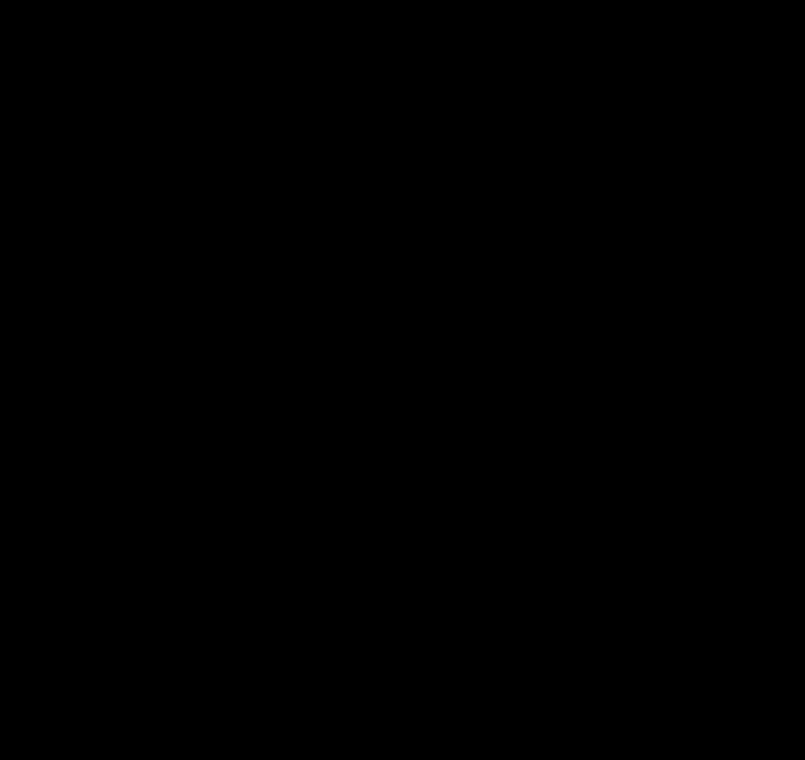
Instructions to candidates:

- 1) Write your names and index number on the answer booklet as written on your registration form.
- 2) **DO NOT** open this question paper until you are told to do so.
- 3) This paper consists of **two** sections: **A** and **B**.
Section A: Attempt **all** questions. **(55 marks)**
Section B: Attempt only **three** questions. **(45 marks)**
- 4) **Geometrical instruments and silent non-programmable calculators may be used where it is necessary.**
- 5) Use only a **blue** or **black** pen.

FOR EXAMINER'S USE ONLY

Questions	Marks	Questions	Marks
1		16	
2		17	
3		18	
4		19	
5		20	
6		21	
7		22	
8		23	
9		24	
10		25	
11		26	
12		27	
13		28	
14		29	
15		30	

TOTAL MARKS...../ 100



Section A: Attempt all questions (55 marks).

For all multiple choice questions, circle the letter corresponding to the correct answer

- 1) State whether each of the following statements is **True** or **False**: **(3 marks)**
- a) The intersection between a set of irrational numbers and rational numbers is a set of real number.
- b) The solution of this equation $2x-1=0$ in $\mathbf{Z}$, is $S = \left\{\frac{1}{2}\right\}$.
- c) For all x real numbers, $|x-4| \in \mathbb{R}^+$.

- 2) Which among the given answers is the solution of the equation $|2x-5|=|x-4|$? **(3 marks)**

- a) $S = \{1, 3\}$
- b) $S = \{1, -3\}$
- c) $S = \{-1, 3\}$
- d) $S = \{-1, -3\}$

3) The equation $x^2 - 5x + m = 0$ admits a double roots, which answer corresponds to the value of a parameter m and its solutions? **(3 marks)**

a) $m = 6, x_1 = 2 \text{ and } x_2 = 3$

b) $m = 6, x_1 = -2 \text{ and } x_2 = 3$

c) $m = \frac{25}{4}, x_1 = x_2 = 3$

d) $m = \frac{25}{4}, x_1 = x_2 = \frac{5}{2}$

4) Which one among the given solutions is the derivative of y if $y = 3e^x + 2\ln 3x$?

(2 marks)

a) $6e^x + \frac{2}{3x}$

b) $6e^x + \frac{2}{x}$

c) $3e^x + \frac{2}{x}$

d) $3e^x + \frac{2}{3}$

5) Consider the following complex numbers: $z_1 = 1 + 3i$ and $z_2 = -25 + i$, then

evaluate $z_1 \times z_2$ and $\frac{z_1}{z_2}$, which one among the following answers is obtained?

(4 marks)

a) $z_1 \times z_2 = -28 - 74i$ and $\frac{z_1}{z_2} = \frac{11}{5} + \frac{38}{5}i$

b) $z_1 \times z_2 = -28 - 74i$ and $\frac{z_1}{z_2} = \frac{-11}{5} + \frac{38}{5}i$

c) $z_1 \times z_2 = 28 - 74i$ and $\frac{z_1}{z_2} = \frac{11}{5} + \frac{38}{5}i$

d) $z_1 \times z_2 = -28 + 74i$ and $\frac{z_1}{z_2} = \frac{-11}{5} + \frac{38}{5}i$

6) The mean of the numbers 12, 18, 21, c , 13 is 17. Answers given below are values of c and variances. Choose one answer with correct value of c and variance. **(5 marks)**

a) $c = 20$, and $\sigma^2 = 14.8$

b) $c = 21$, and $\sigma^2 = 14.5$

c) $c = 21$, and $\sigma^2 = 14.8$

d) $c = 21$, and $\sigma^2 = 14.9$

7) Which answer corresponds to the simplified form of : $\frac{\sin x}{1 + \cos x} + \frac{1 + \cos x}{\sin x}$

(4 marks)

a) $\frac{2}{\sin x}$

b) $\frac{2}{\cos x}$

c) $\frac{-2}{\sin x}$

d) $\frac{-2}{\cos x}$

8) One of the answers below is the solution of the trigonometric equation.

$$3 \sin x + \sqrt{3} \cos x = 3 \text{ for } 0^0 \leq x \leq 2\pi . \text{ Which one?}$$

(4 marks)

a) $S = \left\{ \frac{\pi}{6} + 2k\pi, \forall k \in \mathbf{Z} \right\}$

b) $S = \left\{ \frac{\pi}{2} + 2k\pi, \forall k \in \mathbf{Z} \right\}$

c) $S = \left\{ \frac{\pi}{6} + 2k\pi, \frac{\pi}{2} + 2k\pi, \forall k \in \mathbf{Z} \right\}$

d) $S = \left\{ \frac{\pi}{6} + k\pi, \frac{\pi}{2} + k\pi, \forall k \in \mathbf{Z} \right\}$

9) The 25th of an arithmetic progression (sequence) whose 9th term is -6 and common difference $\frac{5}{4}$ corresponds to which solution among these below?

(3 marks)

a) *The 25th term is 14*

b) *The 25th term is 13*

c) *The 25th term is 16*

d) *The 25th term is 15*

- 10) Which one of the given answers is the slope of the line tangent to the graph of $y = \log_2(4x+1)$, at $x = 1$? **(4 marks)**

a) $Slope = \frac{4 \ln 2}{5}$

b) $Slope = \frac{5}{4 \ln 2}$

c) $Slope = \frac{4}{5 \ln 2}$

d) $Slope = \frac{5 \ln 2}{4}$

- 11) Which one among the given solutions is the area of the parallelogram spanned by the vectors $\vec{a} = (3, -3, 1)$ and $\vec{b} = (4, 9, 2)$? **(4 marks)**

a) $Area = 5\sqrt{70} m^2$

b) $Area = 70\sqrt{5} m^2$

c) $Area = 1750 m^2$

d) $Area = 56 m^2$

12) Given two matrices $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 0 & -8 \\ 6 & 5 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 0 & 5 \\ 1 & 10 & 4 \end{bmatrix}$. Which answer

corresponds to $A + 2B$

(4 marks)

a) $A + 2B = \begin{bmatrix} 3 & 6 & 9 \\ 6 & 0 & 2 \\ 8 & 25 & 12 \end{bmatrix}$

b) $A + 2B = \begin{bmatrix} 3 & 8 & 6 \\ 6 & 2 & 0 \\ 9 & 12 & 25 \end{bmatrix}$

c) $A + 2B = \begin{bmatrix} 9 & 6 & 3 \\ 2 & 0 & 6 \\ 12 & 25 & 8 \end{bmatrix}$

d) $A + 2B = \begin{bmatrix} 6 & 3 & 9 \\ 0 & 6 & 2 \\ 25 & 8 & 12 \end{bmatrix}$

13) Which one among the following answers is the value of $\lim_{x \rightarrow 5} \left(\frac{\log x - \log 5}{x - 5} \right)$? **(3 marks)**

- a) $\frac{0}{0}$
- b) ∞
- c) $\frac{1}{5}$
- d) 1

14) Which answer among the following is the solution of $\int \left(\frac{5x-1}{x} \right) dx$? **(4 marks)**

- a) $5x + \frac{1}{x^2} + c$
- b) $5x - \ln x + c$
- c) $\frac{5x^2 - x}{\frac{x^2}{2}} + c$
- d) $\frac{5x^2}{2} + \frac{1}{x^2} + c$

15) Given $y = 2xe^{-3x}$ show that $\frac{d^2y}{dx^2} + 6\frac{dy}{dx} + 9y = 0$

(5 marks)

Section B: Attempt any three (3) questions (45 marks)

16) a) Let E and F be events of an experiment such that

$P(E) = \frac{3}{10}, P(F) = \frac{1}{2}$ and $P(F \setminus E) = \frac{2}{5}$, find then the following probabilities:

i) $P(E \cap F)$ **(2 marks)**

ii) $P(E \setminus F)$ **(3 marks)**

iii) $P(E \cup F)$ **(3 marks)**

b) For the following set of bivariate data given in the table below:

x	0	1	2	3	4
y	2	3	5	4	6

Determine the equation of the regression line of y on x **(7 marks)**

17) Given the function $f(x) = \frac{x+3}{x-2}$

a) Find domain of definition and boundary limits **(3 marks)**

b) Find asymptotes to the curve **(3 marks)**

c) Compute the first derivative and study its sign **(2 marks)**

d) Compute the second derivatives and study its sign **(2 marks)**

e) Calculate its integral on interval $[0, 2]$ **(5 marks)**

18) Solve the following system of linear equations using Cramer's method.

(15 marks)

$$\begin{cases} x + y + z = 6 \\ 2x + y - z = 1 \\ 3x + 2y + z = 10 \end{cases}$$

19) a) Write in the trigonometric and algebraic forms the complex number $(-\sqrt{3} + i)^{10}$

(6 marks)

b) If $7\sin^2 x + 3\cos^2 x = 4$, then show that $\tan x = \frac{1}{\sqrt{3}}$ **(9 marks)**

20) It is well known that if three events A, B, and C, are considered, and that A and C are independent, then B and C are also independent, meaning that events A and B are disjoint. Knowing that:

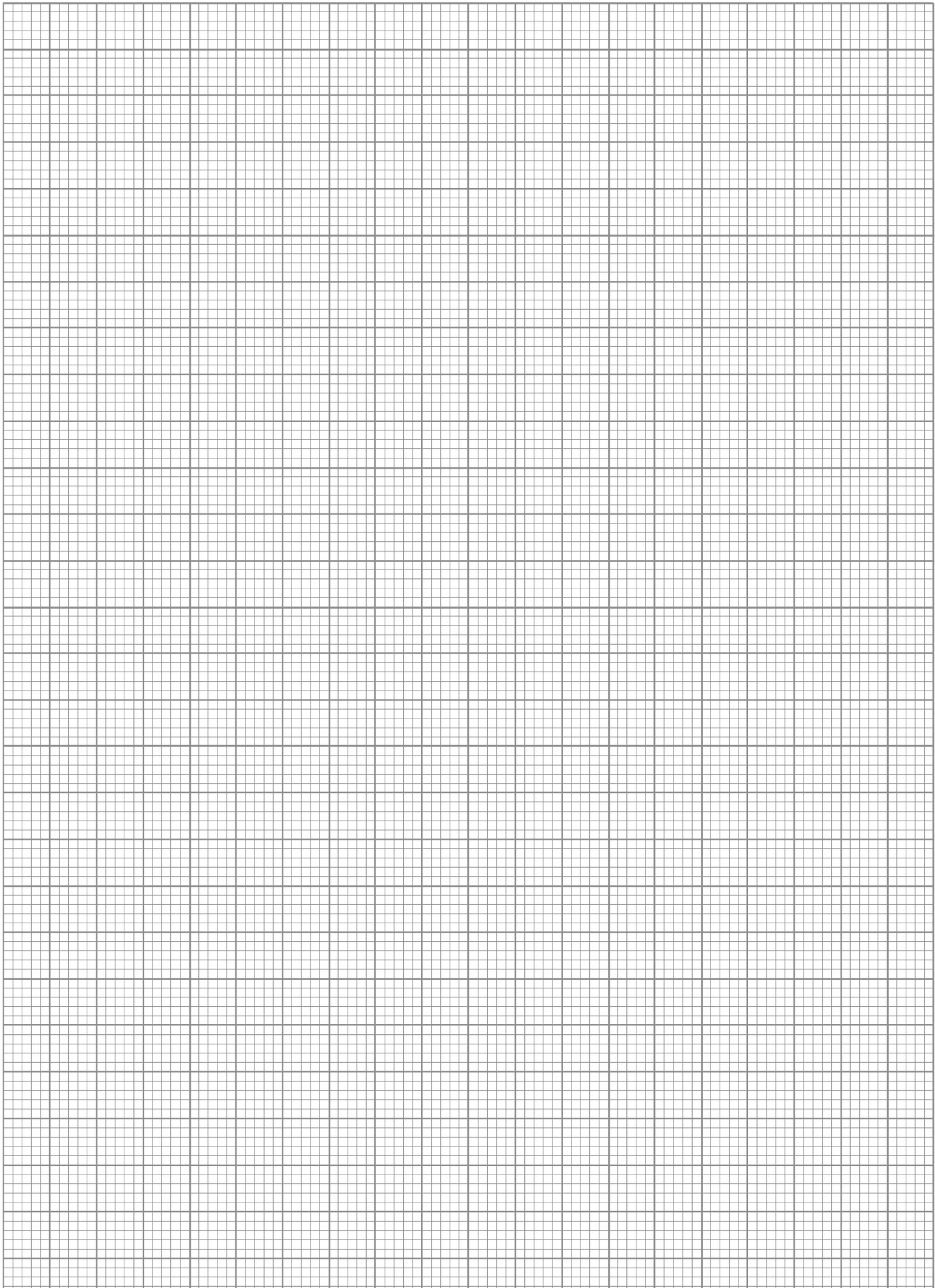
$$P(A \cup C) = \frac{2}{3}, P(B \cup C) = \frac{3}{4},$$

$$P(A \cup B \cup C) = \frac{11}{12}$$

Work out:

- a) The value of $P(A)$ **(5 marks)**
- b) The value of $P(B)$ **(5 marks)**
- c) The value of $P(C)$ **(5 marks)**

Space in which to answer the three chosen questions from section B



-END-