



The Times Secondary School

Dillibazar, Kathmandu

Second unit Test – 2076

Grade: XI

Set A

Full Marks: 100

Stream: Science

Pass Marks: 40

Subject: Basic Mathematics.

Time : 3hrs

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate the full marks.

Attempt all the questions.

Group 'A' [5x3x2 = 30]

- 1. (a) Prove that: A ⊆ B ⇒ A ∩ B = A.
(b) If A = [-1,3] and B = [2,4], compute (A- B)
(c) Write |x + 2| < 4 without using modulus sign.
2. (a) Rewrite -1 ≤ x ≤ 5 using absolute value sign.
(b) For any x and y in R, Prove that |x- y| ≤ |x| + |y|.
(c) If a, b, c are in G.P. prove that: 1/a+b, 1/2b, 1/b+c are in A.P.
3. (a) If H be the harmonic mean between a and b, Prove that :
1/(H-a) + 1/(H-b) = 1/a + 1/b.
(b) If A = (2 3 / 5 -2), show that: A^-1 = 1/19 .A
(c) Without expanding the determinants, prove that:
|1 7 8 / 4 -3 4 / -5 10 2| = |8 4 2 / 1 4 -5 / 7 -3 10|
4. (a) Prove that :(1 + i)^4 . (1 + 1/i)^4 = 16.
(b) If z = 1 + 2i and w = 2 - i ,verify that : z-bar w-bar = z . w-bar.
(c) Find the length of y- intercept made by the circle
x^2 + y^2 - 8x + y - 20 = 0.
5. (a) Find the equation of the circle which touches the x-axis at (4, 0)
and passes through the point (1,1).
(b) Evaluate: lim x -> pi/4 sec^2 x - 2 / tan x - 1.
(c) Evaluate: lim x -> infinity (x - sqrt(x^2 + x)).

Group 'B' [5x2x4 = 40]

- 6.(a) In a group of students, 12 read Mathematics, 15 read statistics,11 read physics, 4 read Mathematics only, 7 read statistics only, 3 read statistics and physics only and 1 read mathematics and statistics only.

- (i) How many read all three subjects?
(ii) How many read mathematics and physics only?
(iii) How many read physics only?
(iv) How many students are there all together?
(b) Solve the inequality(x^2-2x-3)≥0 and show in a number line.
7 (a)The A.M. between two numbers exceeds their G.M. by 2 and the G.M. exceeds the H.M by 1.6.Find the numbers.
(b) Show that : |(b+c)^2 a^2 a^2 / b^2 (c+a)^2 b^2 / c^2 c^2 (a+b)^2| = 2abc(a+b+c)^3
8 (a) If P = (2 1 / 4 -1), show that :(A -3I).(A+2I)=0
(b) If Z and W are complex numbers, Prove that: |z| + |w| ≥ |z + w|
9. (a) Find the equation to the circle which touches the positive y-axis at a distance of 4 from the origin and cuts off an intercept 6 from the axis of x.
(b) If a line y-x=2 is the equation of a chord of the circle x^2+y^2+2x=0, find the equation of the circle of which this chord is a diameter.
10. (a) Evaluate: lim x -> 1 (x - sqrt(2-x^2)) / (2x - sqrt(2+2x^2)).
(b) Evaluate: lim x -> theta (xcos theta - theta cos x) / (x - theta).

Group 'C' [6x5 = 30]

- 11.State and prove De' Morgan laws.
12.Define absolute value of real numbers and let x ∈ R and a > 0.
Then |x| ≤ a ⇔ - a ≤ x ≤ a.
13.The A.M., G.M and H.M. between any two unequal positive numbers satisfy the relations:
(a) (G.M.)^2 = A.M. × G.M.
(b) A.M. > G.M. > H.M.
14.If A = (0 1 2 / 1 2 3 / 3 1 1), verify that A.(adj.A) = (adj.A)A.
15.Define the limit of the function. Prove Geometrically lim theta -> 0 sin theta / theta = 1.

The End



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Attempt all the questions.

Group 'A' [5×3×2 = 30]

1. (a) Prove that: $A \subseteq B \Rightarrow \bar{B} \subseteq \bar{A}$
 (b) If $A = [-2,3]$ and $B = [1,4]$, compute $(A \cup B)$.
 (c) Write $|2x - 1| \leq 5$ without using modulus sign.
2. (a) Rewrite $-4 \leq x \leq 7$ using absolute value sign.
 (b) For any x and y in \mathbb{R} , Prove that $|x + y| \leq |x| + |y|$.
 (c) If $x + y, 2y, y + z$ are in H.P. prove that: x, y, z are in G.P.
3. (a) If G be the Geometric mean between a and b , Prove that: $\frac{1}{G^2 - a^2} + \frac{1}{G^2 - b^2} = \frac{1}{G^2}$
 (b) If $A = \begin{pmatrix} 1 & -2 & 3 \\ -1 & 2 & 1 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & 3 \\ 3 & 1 \\ 1 & 2 \end{pmatrix}$ Find the matrix $AB - 3I$ where I is the unit matrix of order 2.
 (c) Without expanding the determinants, prove that:

$$\begin{vmatrix} 51 & 61 & 71 \\ 5 & 6 & 7 \\ 1 & 1 & 1 \end{vmatrix} = 0.$$
4. (a) Prove that: $\frac{\bar{z}}{|z|^2}$ is the multiplicative inverse of z .
 (b) Simplify: $\frac{1}{i} - \frac{1}{i^2} + \frac{1}{i^3} - \frac{1}{i^4}$.
 (c) Find the length of x -intercept made by the circle $x^2 + y^2 - 8x + y - 20 = 0$.
5. (a) Find the equation of the circle which touches the x -axis at $(3, 0)$ and passes through the point $(1, 2)$.
 (b) Evaluate: $\lim_{x \rightarrow a} \left(\frac{x^{\frac{2}{3}} - a^{\frac{2}{3}}}{x - a} \right)$
 (c) Evaluate: $\lim_{x \rightarrow \infty} (\sqrt{3x} - \sqrt{x - 5})$.

Group 'B' [5×2×4 = 40]

6. (a) In a survey of 500 television viewers, 285 watch football, 195 watch hockey, 115 watch basketball, 45 watch football and basketball, 70 watch football and hockey, 50 watch hockey and basketball. 50 do not watch any of the three games. How many watch all three games? How many watch exactly one of the three games?
 (b) Solve the inequality $|2x + 1| \geq 3$ and show in a number line.
- 7(a) Prove that $b^2 > ac$ or $b^2 < ac$, according as a, b, c are in A.P or H.P
 (b) Show that:

$$\begin{vmatrix} b+c & c+a & a+b \\ q+r & r+p & p+q \\ y+z & z+x & x+y \end{vmatrix} = 2 \begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix}.$$
- 8(a) If $P = \begin{pmatrix} 1 & 2 \\ 3 & 1 \end{pmatrix}$, show that: $A^2 - 2A - 5 = 0$
 (b) If z_1 and z_2 are complex numbers, Prove that: $|z_1| - |z_2| \leq |z_1 - z_2|$
9. (a) Find the equation of the circle with radius 4, centre on the line $23x + 4y = 32$ and touching the line $3x + 4y = 12$.
 (b) If a line $x - y = -2$ is the equation of a chord of the circle $x^2 + y^2 + 2x = 0$, find the equation of the circle of which this chord is a diameter.
10. (a) Evaluate: $\lim_{x \rightarrow 1} \left(\frac{x - \sqrt{2 - x^2}}{2x - \sqrt{2 + 2x^2}} \right)$.
 (b) Evaluate: $\lim_{x \rightarrow \theta} \left(\frac{x \sin \theta - \theta \sin x}{x - \theta} \right)$.

Group 'C' [6×5 = 30]

11. Define symmetric difference between two sets. Prove that: $A \Delta B = (A \cup B) - (A \cap B)$.
12. Define absolute value of real numbers and let $y \in \mathbb{R}$ and $c > 0$. Then $|y| \leq c \Leftrightarrow -c \leq y \leq c$.
13. The arithmetic mean between two positive numbers a and b where $a > b$ is twice their geometric mean. Prove that: $a:b = (2 + \sqrt{3}) : (2 - \sqrt{3})$
14. If $B = \begin{pmatrix} 2 & -3 & 0 \\ 3 & 3 & 0 \\ 0 & 0 & 1 \end{pmatrix}$, verify that $B \cdot (\text{adj} B) = (\text{adj} B) \cdot B$
15. What are indeterminate form? Prove geometrically $\lim_{\beta \rightarrow 0} \frac{\sin \beta}{\beta} = 1$.

The End