

Sub.Code:007

NATIONAL SCHOOL OF SCIENCES, NIST
Lainchour, Kathmandu

First Term Examination - 2079

Grade: XI

Subject: Mathematics (Set-A)

Full Marks: 75

Time: 3 hrs.

Group 'B' [8 × 5 = 40]

12. Define tautology. If p and q are two statements then prove that the given statement is tautology

$$\sim (p \wedge q) \iff (\sim p \vee \sim q). \quad [1+4]$$

13. i. Prove that, if $A \subseteq B$, then $\bar{B} \subseteq \bar{A}$. [2+3]

ii. Prove that: $A - (B - C) = (A - B) \cup (A \cap C)$

14. Calculate the coefficient of skewness for the following distribution and hence, comment on the types of the frequency distribution
 [4+1]

Marks	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60
No. of students	5	12	20	11	2

15. If the equations $x^2 + ax + b = 0$ and $x^2 + bx + a = 0$ have a common root, prove that $a + b + 1 = 0$ or $a = b$. [5]

6. Two dice thrown simultaneously. Find the probability of getting
 [1+1+1+1+1]

- an even number as the sum.
- the sum as prime number.
- a total of at least 10.
- a doublet of even number.
- multiple of 2 on one dice and a multiple of 3 on the other dice.

17. Define a continuity of a function at a point. A function $f(x)$ is defined as [1 + 3 + 1]

$$f(x) = \begin{cases} x^2 - 5 & \text{for } x < 4 \\ 8 & \text{for } x = 4 \\ 2x + 3 & \text{for } x > 4 \end{cases}$$

Show that function is discontinuous at $x = 4$. How can you make it continuous at $x = 4$?

18. i. Prove that: $\lim_{x \rightarrow 0} \frac{a^x - 1}{x} = \log_e a$ where $a > 0$. [3+2]

ii. Evaluate: $\lim_{x \rightarrow 0} \frac{x^{2x} - 1}{x^{2x+1}}$.

19. i. Find the value of 'a' if $\lim_{x \rightarrow 0} \frac{x^a - a^x}{x - a} = \lim_{x \rightarrow 3} (4 + x)$. [2+3]

ii. Evaluate: $\lim_{x \rightarrow \infty} (\sqrt{x+3} - \sqrt{x})$

Group 'C' [3 × 8 = 24]

20. i. If a is any positive real number and $x \in \mathbb{R}$ prove that [5+3]
 $|x| \leq a \iff -a \leq x \leq a$.

ii. Solve: $|5 - x| \geq 2$ and represent a solution in real line.

21. i. Find the angle between the lines $y - \sqrt{3}x - 5 = 0$ and $\sqrt{3}y - x + 6 = 0$. [2+4+2]

ii. Prove that the length of perpendicular from $P(x_1, y_1)$ on the line $ax + by + c = 0$ is given by $|\frac{ax_1 + by_1 + c}{\sqrt{a^2 + b^2}}|$.

iii. Find the distance between the parallel lines $3x + 4y - 5 = 0$ and $3x + 4y + 7 = 0$.

22. i. Geometrically, prove that: $\lim_{\theta \rightarrow 0} \frac{\sin \theta}{\theta} = 1$ where θ is measured in radian. [5+1+2]

ii. Using above theorem, prove that: $\lim_{\theta \rightarrow 0} \theta \cot \theta = 1$.

iii. Evaluate: $\lim_{\theta \rightarrow \frac{\pi}{6}} \frac{\cot^2 \theta - 3}{\csc \theta - 2}$.