

Math (Sub./Gen.) Sc./Arts

Answer eight questions in all. Q.No. 1 is compulsory, which carries 20 marks.

Answer rest seven questions, selecting at least one from each Group and questions of each Group are equal value.

1. Choose the correct answer from the given option or fill up the blanks as required in the following questions :

(a) A relation R on a non-empty set is reflexive, symmetric and transitive, then R is called :

- (i) A partial order relation (ii) Universal relation
(iii) An equivalence relation (iv) None of these

LNMUonline.com

(b) $(A \cup B)'$ is equal to :

- (i) $A' \cap B'$ (ii) $A' \cup B'$ (iii) $(A \cap B)'$ (iv) None of these

(c) The relation "greater than or equal to" is not an equivalence relation is the set of real numbers. (True/False)

(d) $[a \times (B \cap C) = (A \times B) \cap (A \times C)]$ (True/False)

(e) $1 + \frac{1}{2} + \frac{1}{2^2} + \frac{1}{2^3} + \dots$ is :

- (i) Convergent (ii) Divergent (iii) Oscillatory (iv) None of these

(f) $\sum \frac{1}{n^p}$ is convergent if :

- (i) $p > 1$ (ii) $p < 1$ (iii) $p = 1$ (iv) $p \leq 1$

(g) The multiplicative group of four fourth root of unity is a cyclic group. (True/False)

(h) The equation of a plane in intercept form is :

(i) $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$ (ii) $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = -1$

(iii) $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 0$ (iv) $\frac{x}{b} + \frac{y}{a} + \frac{z}{c} = 1$

(i) A matrix A is skew-symmetric iff :

- (i) $A = -A$ (ii) $A' = -A$ (iii) $A' = A$ (iv) None of these

(j) If l, m and n are direction cosines of a straight line then:

- (i) $l^2 + m^2 + n^2 = 0$ (ii) $l^2 + m^2 + n^2 = 1$
(iii) $l^2 + m^2 + n^2 = -1$ (iv) None of these

Group-A

2. Prove that :

(a) $(A \cup B)' = A' \cap B'$

(b) $A \times (B \cup C) = (A \times B) \cup (A \times C)$

LNMUonline.com

3. Define an equivalence relation. Show that the relation of similarity in the set of all triangles lying in a plane is an equivalence relation.

4. (a) Show that the set of all integers forms an abelian group with respect to addition.

(b) Show that identity element in a group is unique.

5. Define a field. Show that the set of all real numbers forms a field with respect to usual addition and multiplication.

6.

Find the inverse of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 6 & 7 & 9 \end{bmatrix}$

LNMUonline.com

7. (a) Define symmetric and skew symmetric matrices.

LNMUonline.com

(b) Find the matrices A and B when $A + B = \begin{bmatrix} 1 & 0 & 2 \\ 2 & 2 & 2 \\ 1 & 1 & 3 \end{bmatrix}$ and $A - B = \begin{bmatrix} 1 & 4 & 4 \\ 4 & 2 & 0 \\ -1 & -1 & 2 \end{bmatrix}$

8. (a) Define a subspace of a vector space V over the field F.
(b) Prove that the intersection of two subspaces of a vector space is subspace.

Group-B

9. Define convergent and divergent sequence. Prove that a convergent sequence determines its limit uniquely.
10. (a) Examine the convergency and divergency of a geometric series.
(b) If an infinite series $\sum u_n$ is convergent then $\lim_{n \rightarrow \infty} u_n = 0$
11. State and prove D' Alembert's ratio test. LNMUonline.com

12. (a) Prove that a function which is finitely differentiable at a point is necessarily continuous at the point.
(b) Give an example of a function which is continuous at a point but not differentiable at that point.

Group-C

13. (a) Find the condition that the circles $x^2 + y^2 + 2g_1x + 2f_1y + c_1 = 0$ and $x^2 + y^2 + 2g_2x + 2f_2y + c_2 = 0$ should cut orthogonally.
(b) Find the value of K for which the circles $x^2 + y^2 + 5x + 3y + 7 = 0$ and $x^2 + y^2 - 8x + y + K = 0$ are orthogonal.
14. Find the equation of an ellipse in standard form.
15. (a) If l, m, n are direction cosines of a line, then prove that $l^2 + m^2 + n^2 = 1$.
(b) Find the direction cosines of a line that makes equal angles with the axes.
16. Obtain the equation of a plane intercept form.