

NEB-GRADE XII
2082 (2025)
Mathematics

{For the students whose first two digits of registration number starts from 80 (partial) and 81 (regular)}

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

Time: 3 hrs.

Full Marks: 75

Attempt **all** the questions.

Group 'A'

Question No. 1 to 11 (Multiple Choice Questions) will be provided after 30 minutes of starting examination. Rewrite its (MCQ) correct option (answer) in the same answer sheet.

Group 'B'

[8×5=40]

12. a) Write the expansion of $\log_e(1-x)$; $|x| < 1$. [1]
 b) Write the total number of permutations of a set having n elements. [1]
 c) State De-Moivre's theorem. [1]
 d) Write the sum of cubes of first n natural numbers. [1]
 e) Write the augmented matrix of the system of equation $3x+2y-1=0$ and $4x+y=3$. [1]
13. a) A committee is to be chosen from 'a' boys and 6 girls and is to consist 2 boys and 3 girls. If 120 committees are formed, what is the number of boys represented by 'a' ? [2]
 b) The square roots of any complex number are $(\sqrt{3}+i)$ and $(-\sqrt{3}-i)$. Write the complex number in polar form. [3]
14. a) In any triangle PQR, if $p \sin^2 \frac{R}{2} + r \sin^2 \frac{P}{2} = \frac{q}{2}$, prove that the sides are in A.P. [3]
 b) If $\vec{a} = 4\vec{i} - 3\vec{j} + 2\vec{k}$ and $\vec{b} = 3\vec{i} - 2\vec{j} + 4\vec{k}$ are two vectors, find the projection \vec{b} on \vec{a} [2]
15. a) Find the eccentricity of conic $3x^2 - 4y^2 - 6x = 0$. [2]
 b) Find the eccentricity of ellipse whose major axis is four times its minor axis and passes through the point (4, 2) [3]

Contd...

16. Consider the following data for supply (X) and the price (Y) of a commodity for last six years.

Year in B.S.	2075	2076	2077	2078	2079	2080
X	45	50	56	62	65	70
Y	65	70	75	80	90	100

- a) Find the correlation coefficient between X and Y. [2]
 b) Calculate the supply when the price of commodity is Rs. 150. [3]
17. a) Write the derivative of $\operatorname{cosech}^{-1}(x)$. [1]
 b) Define L-Hospital's rule. [1]
 c) Write the condition where the curve $y=f(x)$ has tangent parallel to y-axis. [1]
- d) Write the integral of $\int \frac{1}{x^2 - a^2} dx$ [1]
 e) Write the standard form of first order linear differential equation. [1]
18. a) Find the derivative of $\operatorname{coth}^{-1}(\sin 2x)$. [2]
 b) Integrate : $\int \frac{dx}{x^3 - x^2 - 2x}$. [3]
19. Using simplex method, maximize $P(x, y) = 10x + 3y$ subject to constraint $6x + 7y \leq 42$, $x + 3y \leq 42$, $x + 3y \leq 9$, $x \geq 0$, $y \geq 0$. [5]
 Or
 Two forces A and B acting parallel to the length and base of an inclined plane respectively, would each of them singly support a weight 'R' on the plane,
 prove that $\frac{1}{A^2} = \frac{1}{B^2} + \frac{1}{R^2}$. [5]

Group 'C'

[3×8=24]

20. a) If the middle term in the expansion $\left(\frac{a}{2} + 2\right)^8$ is 1120, find the value of a. [2]
 b) Using mathematical induction, prove that $1 + 7 + 13 + 19 + \dots + (6n-5) = n(3n-2)$ [3]
 c) Solve the following linear equations by using matrix method
 $7x - 2y = 18$, $3x + 7z = 33$, $x + y + z = 12$ [3]
21. a) The scalar product of two vectors and cross product of two vectors are interrelated. Explain. [3]
 b) If the cosines of two angles of a triangle are proportional to the opposite sides, show that it is an isosceles triangle. [2]

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(5) 0081(New course) set 'R'

c) Establish the condition that the line $ax + by + c = 0$ may be normal to the parabola $x^2 = 4ay$. [3]

22. a) Find the rate of change of volume of a sphere with respect to its surface area when radius is 7 cm. [2]

b) Integrate: $\int \frac{dx}{5 - 3 \cos x}$ [3]

c) Solve : $(1+x^2)dy - (1+y^2)dx = 0$ [3]

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