

NEB-GRADE XII

2083 (2026)

Mathematics

(For the students whose first two digits of registration number starts from 80, 81 and 82)

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'

[11×1=11]

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) State the principle of mathematical induction. [1]
 b) Write the general term of $(x + a)^n$. [1]
 c) When does given linear equations become inconsistent? [1]
 d) State Demoivre's theorem for positive integral power. [1]
 e) Write any one property of combination. [1]
13. a) How many word can be formed from the letter of the word "DAUGHTER" so that vowels always come together? [2]
 b) Find the cube roots of: $-\frac{1}{2} + \frac{\sqrt{3}}{2}i$ [3]
14. a) Find the solution of triangle given by $a = 2$, $b = \sqrt{6}$ and $A = 45^\circ$ [2]
 b) Two vectors $\vec{a} = 2\vec{i} - 3\vec{j} + 4\vec{k}$ and $\vec{b} = -\vec{i} + 5\vec{j} + 2\vec{k}$ are given.
 Is the area of parallelogram formed by $\vec{a}$ and $\vec{b}$, a whole number?
 Find it by calculation. [3]
15. a) Find the equation of tangent to the curve $y^2 = 4ax$ at (t_1, t_2) . [2]
 b) Find the equation of hyperbola with focus at $(-7, 0)$ and eccentricity $= \frac{7}{4}$ [3]

Contd...

16. The height in inches (X) and weight in kg (Y) of 7 students are given below:

Height (X)	60	61	62	63	64	65	66
Weight (Y)	62	63	61	64	66	67	64

Find the correlation coefficient between X and Y and also find regression coefficient of X on Y. [3+2]

17. a) If a particle moves in a path given by $S = f(t)$, write the velocity. [1]
 b) Write the derivative of $\sinh^{-1}x$ with respect to x . [1]
 c) Write the integral of $\int \cosh x \, dx$. [1]
 d) Write the integral of $\int \frac{dx}{x^2 - a^2}$ [1]
 e) Write the order of $\frac{d^2y}{2x^2} + y \frac{dy}{dx} = 5x$ [1]

- 18 a) Using L. Hospital's rule, find the limit of $\lim_{x \rightarrow 0} \left(\frac{x - \sin x}{x^2} \right)$ [2]

b) Solve: $\sqrt[3]{\frac{dy}{dx} + \frac{1}{x}y} = x$. [3]

19. Use simplex method to solve maximize $Z = 8x + 36y$ subject to constraints

$$2x + 6y \leq 30, \quad x + 6y \leq 18, \quad x, y \geq 0 \quad [5]$$

OR

- a) A mass of 10 kg is acted on by a constant force which in 5 seconds, produced a velocity of 20m per second. Find the force if the mass was initially rest. [2]
 b) A particle of mass 5 kg slides down the inclination of the plane. If smooth inclined plane to the horizontal is 30° . Find the acceleration of the particle and reaction between the particle and the plane. [3]

Contd...

Group 'C'

[3×8=24]

20. a) A Committee of 5 members is to be formed from 6 boys and 4 girls. In how many ways can this be done so as to include at most three girls. [3]
b) Prove that $1 + 3 + 5 + \dots + (2n-1) = n^2$ using principle of mathematical induction. [3]
c) The total cost of 2 pen and 3 book is Rs. 1,100 and the total cost of 4 pen and 1 book in Rs. 700. Find the cost of a pen and a book using Cramer's rule. [2]
21. a) Prove that : $(c + a - b) \left(\cot \frac{C}{2} + \cot \frac{A}{2} \right) = 2bc \cot \frac{B}{2}$ [3]
b) Find vertex, focus, and equation of directrix of conic $9x^2 + 4y^2 = 36$. [3]
c) Find the angle between $\vec{a} = \vec{i} + 2\vec{j} - \vec{k}$ and $\vec{b} = \vec{i} - \vec{j} + \vec{k}$ [2]
22. a) A container is made up of a hollow inverted right circular cone whose height is 24 cm and the radius at the top is 16 cm. Water is flowing in the container at the rate of 8 cm³/sec and find rate of change of depth of water when depth is 12 cm. [3]
- b) Integrate : $\int \frac{y^2 + 1}{(y^2 + 49)(y^2 + 4)} dy$ [3]
- c) Solve : $xdy + ydx = \sqrt{x^2 + a^2} dx$ [2]