NEB-GRADE XII

2083 (2026)

Mathematics

(New Course)

(For the regular 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.

Attempt **all** the questions.

Group 'A' [11×1=11]

Rewrite the correct option of each question in your same answer sheet.

1. Which one of the following is Euler's formula?
   A) $re^{-i\theta}$ B) re^{θ} C) $re^{i\theta}$ D) $re^{-\theta}$

2. What is the sum of the squares of the first n natural numbers?
   A) $\frac{n(n+1)(2n-1)}{6}$ B) $\frac{n(n+1)(2n+1)}{6}$
   C) $\frac{n(n+1)(2n+3)}{6}$ D) $\frac{n(n+1)(3n+1)}{6}$

3. Which one of the following is the value of
   $(b + c)\cos A + (c + a)\cos B + (a + b)\cos C$?
   A) a – b – c B) a – b + c C) a + b – c D) a + b + c

4. Which one of the following is the equation of tangent to the circle $x^2 + y^2 = 4$ at a point (2, 0) ?
   A) x - 2 = 0 B) x + 2 = 0 C) y + 2 = 0 D) y - 2 = 0

5. The angle between two diagonals of a cube is
   A) $\cos^{-1}(0)$ B) $\cos^{-1}\left(\frac{1}{\sqrt{2}}\right)$ C) $\cos^{-1}\left(\frac{1}{2}\right)$ D) $\cos^{-1}\left(\frac{1}{3}\right)$

6. For two events A and B, $P(A\cap B) = \frac{1}{4}$ and $P(B) = \frac{5}{8}$, then P(A/B) is equal to
   A) $\frac{1}{3}$ B) $\frac{2}{3}$ C) $\frac{2}{5}$ D) $\frac{3}{5}$

7. Which of the following is the derivatives of $\coth^{-1} x$?
   A) $\frac{-1}{x^2-1}(x>1)$ B) $\frac{1}{\sqrt{1+x^2}}$ C) $\frac{1}{\sqrt{x^2-1}}(x>1)$ D) $\frac{-1}{1-x^2}(x<1)$

Contd...

8. What is the inclination with the x-axis of the tangent of $x^2 + y^2 = 16$ at (0,4)?
   A) 0^0 B) 45^0 C) 60^0 D) 90^0

9. Which of the following is the value of $\int \frac{dx}{25-x^2}$?
   A) $\frac{1}{10}\log\left(\frac{5+x}{5-x}\right)+C$ B) $\frac{1}{10}\log\left(\frac{5-x}{x+5}\right)+C$
   C) $\sin^{-1}\frac{x}{5}+C$ D) $\frac{1}{5}\sin^{-1}\frac{x}{5}+C$

10. Which one of the following is variable separable form of the differential equation $e^{x-y}\,dx + e^{y-x}\,dy = 0$?
   A) $e^x\,dx = e^y\,dy$ B) $\frac{e^x}{x}dx = \frac{e^y}{y}dy$
   C) $e^{2x}\,dx = -e^{2y}\,dy$ D) $e^{2x}\,dx = e^{2y}\,dy$

11. Using Gauss Elimination method for solving a system of linear equations in three variables, the corresponding augmented matrix reduces to the form $\begin{pmatrix} a_1 & b_1 & c_1 : d_1 \\ 0 & b_2 & c_2 : d_1 \\ 0 & 0 & 0 : 0 \end{pmatrix}$ at the end of forward elimination process. Then the system has
   A) no solution B) unique solution
   C) two solution D) infinitely many solution

OR

If O is the circum-centre of the triangle ABC and forces P,Q , R acting at O along OA , OB , OC are in equilibrium , which of the following rule is applied for calculation ?
A) sine-law B) cosine-law C) projection law D) tangent law

Group 'B' [8×5=40]

12. a) Write the total number of combination of n things taken r at a time. [1]
    b) Write the general term in the expansion of $(a - x)^n$. [1]
    c) State the De-Moivre's theorem for positive integer *n*. [1]
    d) Write the sum of first 'k' even natural numbers. [1]
    e) Write the condition for existence of A^{-1} for any square matrix A. [1]

13. a) Find the number of arrangement of the letters of the word " SCHOOL", so that all the vowels are always together? [2]

Contd...

b) Prove that: $1+\frac{1+2}{2!}+\frac{1+2+3}{3!}+\frac{1+2+3+4}{4!}+\ldots\ldots\ldots\ldots=\frac{3e}{2}$ [3]

14.a) Prove that : $4\left(bc\cos^2\frac{A}{2}+ca\cos^2\frac{B}{2}+ab\cos^2\frac{C}{2}\right)=(a+b+c)^2$ [3]

b) Find the unit vector which is perpendicular to both $2\vec{i}-\vec{j}+\vec{k}$ *and* $3\vec{i}+4\vec{j}-\vec{k}$. [2]

15.a) Find the eccentricity and the coordinates of foci of the hyperbola

$$\frac{x^2}{64}-\frac{y^2}{36}=1$$ [2]

b) Find the equation of ellipse whose foci are (±4, 0) and the length of latus rectum is 8. [3]

16. a) Calculate Karl Pearson's correlation coefficient for the data. [3]

X	13	16	18	20	25	28
Y	15	19	21	23	24	26

b) Find the regression line of Y on X when $\bar{x}=20, \bar{y}=25$ *and* $b_{yx}=0.4$. Also estimate the value of Y when X = 30. [2]

17.a) Write the slope of tangent to the curve $y = f(x)$ *at* (x_1, y_1). [1]

b) Write the formula of $\int\sqrt{a^2-x^2}\,dx$. [1]

c) Write the integral of $\int Sech^2 x\,dx$. [1]

d) Write the integration of $\int\frac{dx}{(x+a)(x+b)}$. [1]

e) A differential equation is in the form $\frac{dy}{dx}=f\left(\frac{y}{x}\right)$. Name the differential equation . [1]

18.a) Find the derivative of $(\sinh x)^{\tanh x}$ [2]

b) Integrate : $\int\frac{dx}{4-5\cosh x}$ [3]

19. Using simplex method, maximize
z = 2x + 3y subject to x + 2y ≤ 10, 2x + y≤14, x, y ≥ 0. [5]

OR

a) Sand allowed to fall vertically at a steady rate hits a horizontal floor with a speed of 0.05 ms^{-1}. If the force exerted on the floor is 0.005N, find the mass of sand falling per second. [2]

b) From a point on the ground at a distance p from the foot of a vertical wall, a ball is thrown at an angle of 45° which just clears the top of the wall

Contd...

afterwards strikes the ground at a distance 'q' on the other side. Prove that the height of the wall is $\frac{pq}{p+q}$. [3]

Group 'C' **[3×8=24]**

20. a) Find the term independent of x in the expansion of $\left(2x+\frac{1}{x}\right)^8$. [2]

b) Using principle of induction prove that the sum of first n positive odd numbers is n^2. [3]

c) Solve by using Cramer's rule: [3]
x - 2y -z +7=0 , 2x + y + z = 0, 3x -5y +8z = 13

21. a) If C= 30° , B = 45° and c = $6\sqrt{2}$, solve the triangle . [2]

b) In any triangle ABC , prove by vector method that
$b^2 = c^2 + a^2 - 2ac\,CosB$ [3]

c) Apply the rule of quadratic equation to find the condition that the line $y = mx + c$ may be tangent to the parabola $y^2 = 4ax$ [3]

22. a) Evaluate : $\lim_{x\to3}\frac{x^3-27}{x^4-81}$ [2]

b) Give an example of homogeneous differential equation of first order and first degree and solve it. [3]

c) The concept of anti- derivative is necessary for solving a differential equation. Justify this statement with example. [3]

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