Sub.Code : 0081 (New course) Set 'B'

NEB-GRADE XII

2083 (2026)

Mathematics

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

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 represents Σn^3 ?

A) $\frac{n(n+1)}{2}$ B) $\frac{n^2(n+1)}{4}$

C) $\frac{n^2(n+1)(n+2)}{4}$ D) $\frac{n^2(n+1)^2}{4}$

2. Which one is the highest Common Factor (HCF) of n!, (n+1)!, and (n+2)! ?

A) (n+2)! B) (n+1)! C) n! D) n

3. Which one of the following is equation of circle which touches x-axis and whose centre is at (3,4) ?

A) $x^2 + y^2 + 6x + 8y + 9 = 0$ B) $x^2 + y^2 - 6x - 8y + 9 = 0$

C) $x^2 + y^2 + 6x + 8y + 16 = 0$ D) $x^2 + y^2 - 6x - 8y + 16 = 0$

4. In any triangle ABC, a= 3, b= 4 and c= 5, then which is equal to $Sin\frac{A}{2}$?

A) $\frac{3}{\sqrt{10}}$ B) $\frac{1}{\sqrt{10}}$ C) $\frac{1}{10}$ D) $\frac{3}{10}$

5. If $\vec{a}$ *and* $\vec{b}$ be two vectors then the projection of the vector $\vec{a}$ on $\vec{b}$ is :

A) $\frac{\vec{a}.\vec{b}}{|\vec{b}|}$ B) $\frac{\vec{a}.\vec{b}}{|\vec{a}|}$ C) $\vec{a}.\vec{b}$ D) $\frac{\vec{a}.\vec{b}}{|\vec{a}||\vec{b}|}$

6. A and B are dependent events. $P(A)=\frac{1}{2}, P(B)=\frac{1}{3}$ *and* $P(A\cap B)=\frac{1}{5}$, which one of the following is P(A/B) ?

A) $\frac{1}{6}$ B) $\frac{2}{5}$ C) $\frac{3}{5}$ D) $\frac{19}{30}$

7. Which one is the derivative of $log\left(cosh\frac{x}{a}\right)$?

A) $\frac{1}{a}tanh\frac{x}{a}$ B) $tanh\frac{x}{a}$ C) $\frac{1}{a}sech\frac{x}{a}$ D) $\frac{1}{a}coth\frac{x}{a}$

Contd...

8. What is the value of $\lim_{x \to 1}\left(\frac{x^3-1}{x^2-1}\right)$?

A) $\frac{1}{2}$ B) $\frac{3}{2}$ C) 2 D) 3

9. Which one is the solution of $ydx - \frac{x}{2}dy = 0$?

A) $y = c\sqrt{x}$ B) $x = c\sqrt{y}$
C) $y = cx$ D) $x = cy$

10. The integrating factor for the differential equation $\frac{dy}{dx} - \frac{y}{x} = x^2$ is

A) $\log\frac{1}{x}$ B) $e^{-\frac{1}{x}}$ C) $\frac{1}{x}$ D) $-\frac{1}{x}$

11. After forward row reduction in Gauss elimination method, if the augmented matrix of given system of three linear equations reduces to following form, then the system of equations has

$$\begin{bmatrix} a_1 & b_1 & c_1 : d_1 \\ 0 & b_2 & c_2 : d_2 \\ 0 & 0 & 0 : 0 \end{bmatrix}$$

A) Unique solutions B) Infinitely many solutions

C) No solutions D) Only one solution

OR

In a projectile, initial velocity is $40ms^{-1}$ and angle of projection is 30^0, what is its time of flight ?

A) $\frac{10}{g}$ B) $\frac{20}{g}$ C) $\frac{40}{g}$ D) $\frac{80}{g}$

Note : In question No. 17 e) write $\frac{d^2y}{dx^2}$ in place of $\frac{d^2y}{2x^2}$.

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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° [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 $\frac{d^2y}{dx^2} + y\frac{dy}{dx} = 5x$ [1]

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

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

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

$2x + 6y \leq 30,\ x + 6y \leq 18,\ x, y \geq 0$ [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 ache inclination of the plane. If smooth inclined plane to the horizontal is 30^0. 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 $1+3+5+...+(2n-1)=n^2$ 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 : $(c+a-b)\left(\cot\frac{C}{2}+\cot\frac{A}{2}\right)=2b\cot\frac{B}{2}$ [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 cm^3/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]

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