NEB-GRADE XII

2082 (2025)

Mathematics (Optional)

(New Course)

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

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]

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

1. What is the number of combinations of n object taken r at a time ?

   A) $\dfrac{n\ !}{(n\ -\ r\ )!}$
   B) $\dfrac{n\ !}{(n\ -\ r\ )!\ r\ !}$
   C) $\dfrac{n!}{r!}$
   D) $\dfrac{n\ !}{n\ !\ r\ !}$

2. Which one of following is the argument of a complex number $z=-1+\sqrt{-3}$?

   A) $\dfrac{\pi}{3}$
   B) $\dfrac{\pi}{6}$
   C) $\dfrac{2\pi}{3}$
   D) $\dfrac{3\pi}{2}$

3. In a triangle ABC, 2cosA = sinB : sinC, what type of triangle is ABC ?

   A) Isosceles
   B) Scalene
   C) Right angled
   D) Equilateral

4. What is the length of the tangent to the circle $x^2 + y^2 = 25$ from a point (3, 5) ?

   A) 8 units
   B) 5 units
   C) 4 units
   D) 3 units

5. If $|\vec{a}| = 5$, and $|\vec{b}| = 6$ and $\vec{a}.\vec{b} = 15$, which of the following is the angle between $\vec{a}\ and\ \vec{b}$?

   A) $\dfrac{\pi}{6}$
   B) $\dfrac{\pi}{4}$
   C) $\dfrac{\pi}{3}$
   D) $\dfrac{\pi}{2}$

6. For two events A and B, P(B) = 0.32, P(A∩B) = 0.2 and P(B/A) = 0.5, then what is the probability of P(A) ?

   A) 0.40
   B) 0.20
   C) 0.15
   D) 0.10

7. Which one of the following is the derivative of *cothx* ?

   A) $tanh^2x$
   B) $-coth^2x$
   C) $-cosech^2x$
   D) $-cosechx\ cothx$

8. What is the slope of the curve of the function $f(x) = x^2 - 2x$ at x = 5 ?

   A) 2
   B) 4
   C) 8
   D) 10

9. Which one of the following is equal to $\lim\limits_{x\to0}\dfrac{1-\cos x}{6x^2}$?

   A) 0
   B) $\dfrac{1}{6}$
   C) $\dfrac{1}{8}$
   D) $\dfrac{1}{12}$

10. A circular copper plate is heated so that its radius increases from 5 cm to 5.06 cm then what is approximate increase in area ?

    A) $0.6036\pi cm^2$
    B) $0.6\pi cm^2$
    C) $0.675\pi cm^2$
    D) $0.634\pi cm^2$

11. Which one of the following system of linear equation is diagonally dominant ?

    A) $12x_1+3x_2 - 5x_3 =1$
       $x_1+5x_2+3x_3= 28$
       $3x_1+7x_2+13x_3= 1$

    B) $3x_1+12x_2 - 5x_3 =1$
       $x_1+5x_2+3x_3= 28$
       $2x_1+7x_2+13x_3= 1$

    C) $12x_1- 5x_2 +3x_3 =1$
       $x_1+2x_2+4x_3= 2$
       $5x_1+3x_2+ x_3= 28$

    D) $x_1+2x_2 + 4x_3 = 2$
       $5x_1+3x_2- 4x_3= 28$
       $2x_1+4x_2- x_3= 1$

Or

A particle starts from rest and moves with a uniform acceleration of 10cm/sec². What will be its velocity at the end of 20 seconds ?

A) *200cm/sec*
B) *100cm/sec*
C) *2cm/sec*
D) *0.5cm/sec*

Group 'B'   [8×5=40]

12. a) Write the total number of permutations P(n, n) of a set of n different objects taken 'n' at a time ?   [1]

    b) In the expansion of $(1 + x)^n$, what is the sum of the binomial coefficients ? [1]

    c) Write the general term in the expansion of $(1 + x)^n$.   [1]

    d) Write the series for $\log_e (1 + x), |x<1|$.   [1]

    e) Write series representing e^{-1} .   [1]

13. a) Sum to n terms of the series $1^2.1 + 2^2.3 + 3^2.5 + ...\ ...$ [2]

    b) Solve the following system of linear equations by using matrix inversion method. $x +2y = 5, 3x - y = 2.$ [3]

14. a) Solve the triangle ABC if a = 1, b = $\sqrt{3}$ and C = 30°.   [2]

    b) Prove that the equation $9x^2 - 16y^2 + 18x + 32y -151 = 0$ represents equation of hyperbola. Also find eccentricity and foci of the given equation of hyperbola.   [3]

15. a) Find the condition that a line $ax + by + c = 0$ may be normal to the parabola $y^2 = 4mx$.   [3]

    b) Prove that the area of a plane quadrilateral ABCD is $\dfrac{1}{2}|\vec{AC}\times\vec{BD}|$,where AC and BD are its diagonals of the quadrilateral ABCD.   [2]

16. Following are the marks in physics and chemistry of six students

Marks in Physics (X)	11	12	13	14	15	16
Marks in Chemistry (Y)	23	24	26	22	25	27

   a) Find the coefficient of correlation between X and Y. [2]

   b) Estimate the marks in Physics whose marks in Chemistry is 30. [3]

17. a) What is the derivative of $cosh^{-1}x$? [1]

   b) What is the integral of $\int \frac{dx}{a^2 - x^2}$? $|x<a|$ [1]

   c) Define L Hospital's rule for the form $\frac{0}{0}$. [1]

   d) Write the order of differential equation $\frac{d^2y}{dx^2} + \frac{dy}{dx} + 5 = 0$. [1]

   e) If the differential equation $ydx - xdy = 0$ is not exact differential equation then how can you make exact differential equation ? [1]

18. a) Evaluate: $\int \frac{dx}{5 + 4cosx}$ [3]

   b) Solve the differential equation $\sqrt{1-x^2}\,dy + \sqrt{1-y^2}\,dx = 0$ [2]

19. a) Solve the following system of equations by Gauss elimination method.
$x + 2y = 5$ and $2x - y = 0$. [2]

   b) Using simplex method to maximize $(Z) = 6x - 9y$ subject to the constraints.
$x+y \leq 20$; $2x - 3y \leq 6$; $x \geq 0$, $y \geq 0$. [3]

Or

a) A bullet of mass 0.006 kg travelling at 120 ms^{-1} penetrates deeply into a fixed target and is then brought to rest in 0.01sec. Find the distance of penetration of the target. [3]

b) A ball is thrown with the velocity of 29.4 m/sec, find the two directions in which the ball may be thrown so as to give a range of 44.1 m. $(g=9.8m/s^2)$ [2]

Group 'C' [3×8=24]

20. a) In how many ways can 8 boys and 6 girls be arranged in a straight line so that no two girls are together ? [3]

   b) If $y = \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + ...$ to ∞, prove that : $x = y - \frac{y^2}{2} + \frac{y^3}{3} - \frac{y4}{4} + ...$ to ∞ [2]

   c) Prove by the method of mathematical induction that :

$\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + ... + \frac{1}{n(n+1)} = \frac{n}{n+1}$ [3]

Contd...

21. a) Find the equation of the ellipse whose major axis is twice its minor axis and passes through the point (0, 1). [3]

   b) The position vectors of the vertices of $\triangle ABC$ are $7\vec{j} + 10\vec{k}$, $-\vec{i} + 6\vec{j} + 6\vec{k}$ and $-4\vec{i} + 9\vec{j} + 6\vec{k}$. Prove that the triangle is isosceles right angled triangle. [3]

   c) In any triangle ABC, prove that :
$a^2+b^2+c^2-2(bcCosA + caCosB + abCosC) = 0$ [2]

22. a) Water is poured into a right circular cylinder of radius 8cm at the rate of 18cu.cm/min. Prove that the rate which the level of water is rising in the cylinder is $\frac{9}{32\pi} cm/min$. [2]

   b) Evaluate : $\int \frac{x^2 -1}{x^4 + x^2 +1} dx$. [3]

   c) $\frac{dy}{dx} = \frac{x^2 + y^2}{2xy}$ gives a solution. Is this solution represents a polynomial ? Give reason. [3]

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