NEB-GRADE XII
2081 (2024)
Mathematics
(For Regular Students only)
(For the students whose first two digits of registration number starts from 80)

Attempt **all** the questions.

Group 'A' [11×1=11]

Rewrite the correct options of each questions in your same answer sheet.

1. The permutation of 'n' things taken 'r' at a time when each things may occur any numbers of times is...

   A) n ways   B) r^n ways   C) n^r ways   D) (n×r) ways.

2. Which one of the following is Euler's form of complex number -i ?
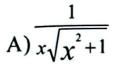
   A) $e^{\frac{\pi i}{4}}$
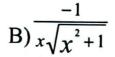
   B) $e^{\frac{3\pi i}{2}}$

   C) $e^{\frac{3\pi i}{4}}$

   D) $e^{\frac{\pi i}{2}}$

3. in $\triangle ABC$, $\angle A = 30^0$, $\angle B = 45^0$, which one of the following is a:c ?

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

4. Which one of the following has transverse axis and conjugate axis ?

   A) $y^2 - 4y - 4x + 4 = 0$ B) $2y^2 - 3x^2 - 6 = 0$

   C) $2y^2 + 3x^2 - 6 = 0$ D) $2x^2 + 2y^2 = 72$

5. It is given that $\vec{a}$ and $\vec{b}$ are two vectors such that $\left| \vec{a} \times \vec{b} \right| = \left| \vec{a} \cdot \vec{b} \right|$.
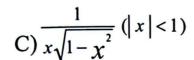
   What is the angle between $\vec{a}$ and $\vec{b}$?

   A) π B) $\frac{\pi}{2}$ C) $\frac{\pi}{4}$ D) $\frac{\pi}{6}$

6. In a school there were 100 students, 35% students failed in mathematics, 20% students failed in science and 15% failed in both of the subjects. A student selected at random, the probability of the student fail in mathematics given that failed in science already is

   A) $\frac{3}{7}$ B) $\frac{4}{7}$ C) $\frac{3}{4}$ D) $\frac{1}{4}$

7. Which one of the following is the derivative of cosec h^{-1}(x) ?

   A) $\dfrac{1}{x\sqrt{x^2+1}}$ B) $\dfrac{-1}{x\sqrt{x^2+1}}$

   C) $\dfrac{1}{x\sqrt{1-x^2}}$ $(|x|<1)$ D) $\dfrac{-1}{x\sqrt{1-x^2}}$ $(|x|<1)$

8. Which one of the following is equal to $\displaystyle\lim_{x \to 0} \dfrac{e^{3x}-1}{2x}$?

   A) 0   B) $\dfrac{1}{2}$ C) $\dfrac{3}{2}$ D) 3

9. Which one of the following represents the equation of normal to the curve $x^2 = 2y$ at the point (-2, 2) ?

   A) 2x+y+6 = 0   B) 2x-2y+6 = 0
   C) 2x-y+6 = 0   D) x-2y+6= 0

10. Which one of the following is the solution of differential equation $x\,dy - y\,dx = 0$?
    A) x = cy   B) y = cx   C) xy = c   D) x-y = c

11. In Gauss elimination method, the coefficient of the variables of the element a_{ij} where $i = j$ are known as...
   A) pivot element   B) common element
   C) non basic element   D) basic element

Or

A shot 40 kg projected from a 400 kg gun with a velocity of 60 m/sec, then the velocity with which the gun would commence to recoil, if free to move in the line of projection is
   A) 6 m/sec   B) *60 m/sec*   C) *6 km/min*   D) *600 m/sec*

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Mathematics
(New Course)
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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'

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

Group 'B'   [8×5=40]

12. a) Write the number of the total terms in the expansion of

$$\left((x - \frac{1}{x})^2 \right)^{25}.$$ [1]

   b) Write the middle term in the expansion of $(x+a)^n$ when n is even . [1]
   c) What is the sum of binomial coefficient in the expansion $(1+x)^n$? [1]
   d) Write $\log_e (1+x)$ in series form.$[-1 < x \le 1]$ [1]
   e) Write e^{-x} in series form .   [1]

13. a) Find the value of $(1 - w + w^2)^4 + (1 + w - w^2)^4$, where w and w^2 are imaginary cube roots of unity.   [2]
   b) Solve the following system of equations using inverse matrix method.[3]
      $x+2y+3z = 20$, $5x = 2y+4$, $3z = 4x+4$

14. a) If $\frac{1}{p+r} = \frac{3}{p+q+r} - \frac{1}{q+r}$ in a triangle PQR, prove that $\angle R = 60^0$ [3]

   b) Find the eccentricity and foci of the ellipse
      $9x^2 + 4y^2 - 18x - 16y - 11 = 0$ [2]

15. a) Find the equations of tangent and normal to the circle $x^2+y^2=13$ at the point $(2, 3)$ [3]

    b) In a rhombus, two of the diagonals are perpendicular to each other. Verify it by taking vector dot product of two vectors. [2]

16 a) Write the order of differential equation $\left(\dfrac{d^3y}{dx^3}\right)^3+\left(\dfrac{dy}{dx}\right)^2+5=0$ [1]

    b) Write the derivative of sin h x with respect to x. [1]

    c) Write an example of exact differential equation in x and y. [1]

    d) Write the integral of $\int\dfrac{1}{x^2-a^2}dx$ [1]

    e) State L - Hospital's rule. [1]

17. The supply and price of a commodity for the last six year is given below.

Price in Rs. per kg	100	110	112	115	120	140
Supply in kg	30	40	45	20	55	55

    a) Find the coefficient of correlation between price and supply. [2]

    b) Estimate supply in kg on which rate of price is Rs 150. [3]

18. a) Integrate : $\int\dfrac{dx}{3\sin x-4\cos x}$ [2]

    b) Solve : $\dfrac{dt}{dx}=\dfrac{e^{\tan^{-1}x}-t}{1+x^2}$ [3]

19. Using simplex method maximize $P\,(x,\ y)=15x+10y$ subject to $2x+y\le 10$, $x+3y\le 12$, $x,y\ge 0$. [5]

<div align="center">Or</div>

    a) Three forces A, B and C are acting at P along PX, PY, PZ where P is the in-centre of triangle XYZ, are in equilibrium. Prove that

$$\dfrac{A}{\cos\dfrac{X}{2}}=\dfrac{B}{\cos\dfrac{Y}{2}}=\dfrac{C}{\cos\dfrac{Z}{2}}$$

[3]

    b) A force equal to 9.8 N acting on a body changes its velocity from 6 ms^{-1} to 10ms^{-1} when it covers a distance of 32m. Find the mass of body. [2]

<div align="right">Contd...</div>

Group 'C'   [3×8=24]

20. a) if $(1+x)^n = C_0 + C_1 x + C_2 x^2 + \cdots, \cdots, \cdots + C_n x^n$, prove that

$$C_1 + 2C_2 + 3C_3 + \cdots, \cdots + n\, C_n - \frac{1}{2}(n.2^n) = 0.$$ [3]

   b) Find the square root of $1 - \sqrt{3}\, i$ using De-Moivre's theorem.   [2]

   c) Use principle of mathematical induction to prove that
$1 + 3 + 5 + 7 + \ldots + (2n-1) = n^2.$ [3]

21. a) Find the equation of the parabola whose focus is at the point $(-3, 4)$ and the directrix is $2x+5 = y$.   [3]

   b) Find the area of parallelogram whose diagonals are represented by the

vectors $2\vec{i} + 3\vec{j} - 4\vec{k}$ and $3\vec{i} - 5\vec{j} + 2\vec{k}$.   [3]

   c) In a triangle ABC, $a = 2$, $b = \sqrt{6}$ and $\angle A = 45°$. Solve the triangle.   [2]

22. a) Water flows into an inverted conical tank at the rate of 36 cm³/min. When the depth of water is 12 cm, how fast is level rising, if the radius of base and height of the tank is 21cm and 35 cm respectively   [3]

   b) The concept of anti-derivative is necessary for solving a differential equation. Justify the statement with an example.   [2]

   c) A differential equation of the first degree and first order is homogenous

if it satisfies the condition $\dfrac{dy}{dx} = f\left(\dfrac{y}{x}\right)$. Justify the statement with an

example and solve it .   [3]

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