NEB-GRADE XII
Mathematics
Model Question [2077(2020)]

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks.

Time: 1.30 hrs.   **Full Marks: 40**

Note: Group A is compulsory and select another one Group either B or C.

Group 'A'

Attempt **all** the questions.

1. a) Show that $\dfrac{1}{2!} + \dfrac{2}{3!} + \dfrac{3}{4!} + \ldots = 1$. (2)

   b) Find the ratio in which the line joining the points $P\ (-2,4,7)$ and $Q\ (3,-5,-1)$ is divided by the ZX- plane. (2)

   c) If $\vec{a} = \hat{i} + 2\hat{j} - \hat{k}$ and $\vec{b} = \hat{i} - \hat{j} + \hat{k}$, find the projection of $\vec{b}$ on $\vec{a}$. (2)

2. a) Solve : $\dfrac{dy}{dx} + \dfrac{1+\cos 2y}{1-\cos 2x} = 0$. (2)

   b) Calculate the mean deviation from mean of the data: (2)
      $3, 5, 9, 11, 7, 6.$

3. Define abelian group. If $(G, *)$ is an abelian group, prove that $(a * b)^{-1} = a^{-1} * b^{-1}\ V\ a, b \in G$. (4)

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

Or

Find the vertices and foci of the ellipse $\dfrac{(x+2)^2}{16} + \dfrac{(y-5)^2}{9} = 1$.

5. Evaluate: $\int \dfrac{dx}{1 + \sin x + \cos x}$. (4)

6. From definition, find the derivative of $e^{\tan x}$. (6)

Or

State Mean value theorem. Verify it for the function $f(x) = 2x^2 - 10x + 29$ in $[\,2,\ 7\,]$.

Group 'B'

7. A ball is thrown vertically upwards at a rate of $40 ms^{-1}$. Find the time taken to attain the maximum height. $(g = 10 ms^{-2})$ (2)

8. A body slides down from rest from the top of a smooth plane of height 44.1 m and inclination 30^0 with the horizon. Divide the plane into three parts so that the body at the top of the plane may describe each part in equal interval of time. $(g = 9.8 ms^{-2})$ (4)

Or

A stone is dropped into a well and the sound of its striking the water is heard in $4\dfrac{2}{9}$ seconds. If the velocity of the sound is $352.8 ms^{-1}$, find the depth of the well. $(g = 9.8 ms^{-2})$

9. Deduce the resultant of two parallel forces. (6)

Or

Define Moment geometrically. Also state and prove the Varignon's theorem for two intersecting forces.

Group 'C'

10. Examine whether the system of equations $3x + 12y - z = 28$, $x + 4y + 7z = 2$ and $10x + 4y - 2z = 20$ is diagonally dominant. (2)

11. Use the **Bisection** method to find solutions accurate to within 10^{-2} for

$x^3 - 7x^2 + 14x - 6 = 0$ in $(\,0,\ 1\,)$. (4)

12. By Simplex method maximize

$F = 15x_1 + 10x_2$ subject to $2x_1 + x_2 \le 10$, $x_1 + 3x_2 \le 10$; $x_1,\ x_2 \ge 0$. (6)

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