BOARD OF INTERMEDIATE EDUCATION (TS)

JUNIOR INTER MATHEMATICS – IA

MODEL PAPER

Time: 3 hours   **Max. Marks: 75**

SECTION – A

I.   **i) Very short answer type questions.**

     ii) Answer ALL questions.

     iii) Each question carries TWO marks.   **10 × 2 = 20**

1.   If f: R – {±1} $\longrightarrow$ R is defined by f(x) = $log \left| \dfrac{1 + x}{1 - x} \right|$ then show that $f\left(\dfrac{2x}{1 + x^2} \right)$ = 2f(x).

2.   Find the domain of the real valued fuction   f(x) = $\dfrac{1}{(x^2 - 1)(x + 3)}$.

3.   If A = $\begin{bmatrix} 2 & -4 \\ -5 & 3 \end{bmatrix}$ then find $A + A^T$ and AA^T.

4.   Find the rank of $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$.

5.   If the position vectors of the points A, B, C are $-2\overline{i} + \overline{j} - \overline{k}$; $-4\overline{i} + 2\overline{j} + 2\overline{k}$ and $6\overline{i} - 3\overline{j} - 13\overline{k}$ respectively in which $\overline{AB} = \lambda\overline{AC}$. Then find λ.

6.   Find the vector equation of the line passing through the point $2\overline{i} + 3\overline{j} + \overline{k}$ and parallel to the vector $4\overline{i} - 2\overline{j} + 3\overline{k}$.

7.   Find the area of the parallelogram having $\overline{a} = 2\overline{j} - \overline{k}$ and $\overline{b} = -\overline{i} + \overline{k}$ as adjacent sides.

8.   Find the value of sin 330°cos 120° + cos 210° sin 300°.

9.   Find the maximum and minimum values of the function 13 cosx + $3\sqrt{3}$ sinx − 4.

10.   Show that tan h$^{-1}\left(\dfrac{1}{2} \right)$ = $\left(\dfrac{1}{2} \right) log_e 3$.

SECTION – B

II.   **i) Short answer type questions.**

     ii) Answer any FIVE questions.

     iii) Each question carries FOUR marks.   **5 × 4 = 20**

11.   If A is non singular matrix then prove that $A^{-1} = \dfrac{adjA}{|A|}$.

12.   If $\overline{a}, \overline{b}, \overline{c}$ are non coplaner then prove that four points $-\overline{a} + 4\overline{b} - 3\overline{c}$; $3\overline{a} + 2\overline{b} - 5\overline{c}$; $-3\overline{a} + 8\overline{b} - 5\overline{c}$ and $-3\overline{a} + 2\overline{b} + \overline{c}$ are coplaner.

13. If $\bar{a} = 2\bar{i} + \bar{j} - \bar{k}$, $\bar{b} = -\bar{i} + 2\bar{j} - 4\bar{k}$ and $\bar{c} = \bar{i} + \bar{j} + \bar{k}$ then find the value of $(\bar{a} \times \bar{b})(\bar{b} \times \bar{c})$.

14. Prove that $\cos^2 76° \cos^2 16° - \cos 76° \cos 16° = \dfrac{3}{4}$.

15. Solve $\sqrt{2}(\sin x + \cos x) = \sqrt{3}$.

16. Prove that $\cos\left(2 \tan^{-1} \dfrac{1}{7}\right) = \sin\left(2 \tan^{-1} \dfrac{3}{4}\right)$.

17. In the triangle ABC, if $\dfrac{1}{a + c} + \dfrac{1}{b + c} = \dfrac{3}{a + b + c}$ then show that $\angle c = 60°$.

SECTION - C

III. **i) Long answer type questions.**

    ii) Answer any FIVE questions.

    iii) Each question carries SEVEN marks.   **5 × 7 = 35**

18. Show that the function $f : Q \to Q$ defined by $f(x) = 5x + 4$ for all $x \in Q$ is a bijection and find f^{-1}.

19. Using mathematical induction prove that $1.2.3 + 2.3.4 + 3.4.5 + ...$up to n terms $(n \in N)$

    $= \dfrac{n(n + 1)(n + 2)(n + 3)}{4}$.

20. Without expanding the determinant prove that $\begin{vmatrix} b + c & c + a & a + b \\ c + a & a + b & b + c \\ a + b & b + c & c + a \end{vmatrix} = 2\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$.

21. Solve $2x - y + 3z = 9$, $x + y + z = 6$, $x - y + z = 2$ by using cramer's rule.

22. If $\bar{a} = \bar{i} - 2\bar{j} - 3\bar{k}$, $\bar{b} = 2\bar{i} + \bar{j} - \bar{k}$ and $\bar{c} = \bar{i} + 3\bar{j} - 2\bar{k}$ verify that $\bar{a} \times (\bar{b} \times \bar{c}) \neq (\bar{a} \times \bar{b}) \times \bar{c}$.

23. If $A + B + C = 180°$ then prove that $\cos A + \cos B - \cos C = -1 + 4 \cos\dfrac{A}{2} \cos\dfrac{B}{2} \sin\dfrac{C}{2}$.

24. In the triangle ABC prove that $\dfrac{r_1}{bc} + \dfrac{r_2}{ca} + \dfrac{r_3}{ab} = \dfrac{1}{r} - \dfrac{1}{2R}$.

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