

**SECOND YEAR HIGHER SECONDARY SAMPLE QUESTION PAPER 2023
MATHEMATICS**

Time : 2Hours
Cool off time 15 minutes

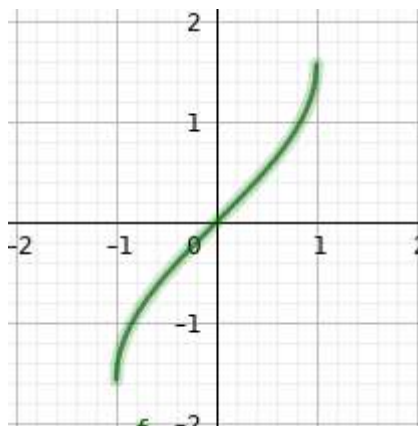
Maximum ; 60 Scores

Answer any 6 from 1 to 8. Each carries 3 scores

- 1(i) Let $f : \mathbb{N} \rightarrow \mathbb{N}$ be defined as $f(x)=2x$, then
 (a) f is one one , onto
 (b) f is many one, onto
 (c) f is one one into
 (d) f is many one into (1)
- (ii) Show that the function $f:\mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = 3-4x$ is one one (2)
2. If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$ Show that $A^2-5A+7I = 0$ (3)
- 3.(i) Write the order and degree of the differential equation $\left(\frac{dy}{dx}\right)^3 + 3y \frac{d^2y}{dx^2} = 0$ (1)
- (ii) Find the rate of change of the area of the circle with respect to its radius when $r= 7\text{cm}$ (2)
4. Find the general solution of the differential equation $\frac{dx}{dy} - \frac{x}{y} = 2y$ (3)
5. Find the area of the triangle with the vertices $(1,0)$, $(6,0)$, $(4,3)$ (3)
6. Find $\int \frac{dx}{(x+1)(x+2)}$ (3)
7. Using the property $\int_0^a f(x)dx = \int_0^a f(a-x)dx$, evaluate $\int_0^1 x(1-x)^n dx$ (3)
8. If A and B are two independent events such that $P(A) = \frac{1}{4}$, $P(B) = \frac{1}{2}$
 find $P(A^1 \cap B^1)$ (3)

Answer any 6 questions from 9 to 16. Each carries 4 scores

9. Show that the relation R in the \mathbb{Z} of the integer given by
 $R = \{(a,b) : 2 \text{ divide } a-b\}$ is an equivalence relation (4)
- 10 Identify the graph
 (i) A) $\cos^{-1}x$ B) $\sin^{-1}x$ C) $\tan^{-1}x$ D) $\sec^{-1}x$ (1)



(ii) The principal value of the $\cos^{-1}\left(\frac{1}{2}\right) =$ _____ (1)

(iii) Find the value of the
 $\tan^{-1}(1) + \cos^{-1}\left(-\frac{1}{2}\right) + \sin^{-1}\left(-\frac{1}{2}\right)$ (2)

11. Express $A = \begin{bmatrix} 3 & 3 & -1 \\ -2 & -2 & 1 \\ -4 & -5 & 2 \end{bmatrix}$ as the sum of symmetric and skew-symmetric matrix (4)
12. Find the two positive numbers whose sum is 15 and the sum of the whose squares is minimum (4)
13. Find the area enclosed by the circle $x^2 + y^2 = 9$ using integration (4)
- 14.(i) Find the angle between two vectors \vec{a} and \vec{b} with magnitude 1 and 2 respectively and when $\vec{a} \cdot \vec{b} = 1$. (1)
- (ii) Find the vector and the cartesian equation of the line through the point (5,2,-4) and which is parallel to the vector $3\hat{i} + 2\hat{j} - 8\hat{k}$ (3)
- 15.(i) Find the projection of the vector $\vec{a} = 2\hat{i} + 3\hat{j} + 2\hat{k}$ on the vector $\vec{b} = \hat{i} + 2\hat{j} + \hat{k}$ (2)
- (ii) Find the area of the parallelogram whose adjacent sides are given by the vector $\vec{a} = 3\hat{i} + \hat{j} + 4\hat{k}$ and $\vec{b} = \hat{i} - \hat{j} + \hat{k}$ (2)
16. Give three identical boxes I,II,III, each containing two coins. In the box I, both coins are gold coins, in the box II, both are silver coins and in the box III, there is one gold, one silver coins. A person chooses a box at the random and takes out a coin. If the coin is of gold, what is the probability that the other coin in the box is also of gold? (4)

Answer any 3 questions from 17 to 20 . Each carries 6 scores

17. Solve the following system of equation by the matrix method
 $2x + 3y + 3z = 5$
 $x - 2y + z = -4$
 $3x - y - 2z = 3$ (6)
- 18.(i) Find $\frac{dy}{dx}$, if $x = at^2$, $y = 2at$ (3)
- (ii) If $y = (\tan^{-1}x)^2$, show that $(x^2 + 1)^2 y_2 + 2x(x^2 + 1)y_1 = 2$ (3)
- 19.(i) If $\vec{a} = 5\hat{i} - \hat{j} - 3\hat{k}$, $\vec{b} = \hat{i} + 3\hat{j} - 5\hat{k}$, show that the vectors $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ are mutually perpendicular. (2)
- (ii) Find the shortest distance between the lines
 $\vec{r} = (\hat{i} + 2\hat{j} + \hat{k}) + \lambda(\hat{i} - \hat{j} + \hat{k})$ and $\vec{r} = (2\hat{i} - \hat{j} - \hat{k}) + \gamma(2\hat{i} + \hat{j} + 2\hat{k})$ (4)
20. Solve the following linear programming problem graphically
 Minimize $z = 200x + 500y$
 subject to the constraints
 $x + 2y \geq 10$
 $3x + 4y \leq 24$
 $x \geq 0, y \geq 0$ (6)

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