Techior Solutions Pvt. Ltd.

HSC Maths Sample Paper

Total Time: 3 Hr | Total Marks: 80.0

Maths

Section A

Q. 1. Select and write the correct answer for the following multiple choice type of questions :

1) If $|\bar{a}| = 3, |\bar{b}| = 5, |\bar{c}| = 7$ and $\bar{a} + \bar{b} + \bar{c} = \bar{0}$, then the angle between $\bar{a}$ and $\bar{b}$ is **1**

A) $\frac{\pi}{2}$

B) $\frac{\pi}{3}$

C) $\frac{\pi}{4}$

D) $\frac{\pi}{6}$

2) If the equation $3x^2 - 8xy + qy^2 + 2x + 14y + p = 1$ represents a pair of perpendicular lines, then the values of p and q are respectively. **1**

A) - 3 and - 7

B) - 7 and - 3

C) 3 and 7

D) - 7 and 3

3) The direction cosines of the normal to the plane 2x - y + 2z = 3 are _____ **1**

A) $\frac{2}{3}, \frac{-1}{3}, \frac{2}{3}$

B) $\frac{-2}{3}, \frac{1}{3}, \frac{-2}{3}$

C) $\frac{2}{3}, \frac{1}{3}, \frac{2}{3}$

D) $\frac{2}{3}, \frac{-1}{3}, \frac{-2}{3}$

4) The inverse of $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ is **1**

A) $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$

B) $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$

C) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

D) none of these

5) If $\sin^{-1}\frac{4}{5} + \cos^{-1}\frac{12}{13} = \sin^{-1}\alpha$, then α = _____ **1**

A) $\frac{63}{65}$

B) $\frac{62}{65}$

C) $\frac{61}{65}$

D) $\frac{60}{65}$

6) If the corner points of the feasible solution are (0, 0), (3, 0), (2, 1), $\left(0, \frac{7}{3}\right)$ the maximum value of z = 4x + 5y is **1**

A) 12

B) 13

C) $\frac{35}{3}$

D) 0

7) If $\bar{a}$ and $\bar{b}$ are unit vectors, then what is the angle between $\bar{a}$ and $\bar{b}$ for $\sqrt{3}\bar{a} - \bar{b}$ to be a unit vector? **1**

A) 30°

B) 45°

C) 60°

D) 90°

8) If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, and A (adj A) = kI, then the value of k is **1**

A) 2
B) -2
C) 10
D) -10

Q. 2. Answer the following questions :

9) If A = {3, 5, 7, 9, 11, 12}, determine the truth value of the following. **1**

$\exists \; x \in A$ such that $3x + 8 > 40$

10) State whether the following equation has a solution or not? **1**

$$\cos 2\theta = \frac{1}{3}$$

11) Which of the following sentence is the statement in logic? Justify. Write down the truth value of the statement: **1**

If x is a whole number then x + 6 = 0.

12) Check whether the following matrix is invertible or not: **1**

$$\begin{pmatrix} 1 & 2 & 3 \\ 2 & -1 & 3 \\ 1 & 2 & 3 \end{pmatrix}$$

Section B

Attempt any EIGHT of the following questions :

1) Determine the order and degree of the following differential equation: **2**

$$\frac{d^2y}{dx^2} + x\left(\frac{dy}{dx}\right) + y = 2\sin x$$

2) Let X ~ B(10, 0.2). Find P(X ≤ 8) **2**

3) The following is the p.d.f . of r.v. X: **2**

f(x) = $\frac{x}{8}$, for 0 < x < 4 and = 0 otherwise.

Find P (x < 1·5)

4) Using derivative, prove that: **2**

$\tan^{-1}x + \cot^{-1}x = \frac{\pi}{2}$

5) Evaluate the following : **2**

$$\int_{-3}^{3} \frac{x^3}{9-x^2} \cdot dx$$

6) The displacement x of a particle a time t is given by $x = 160t - 16t^2$. Show that its velocity at t = 1 and t = 9 are equal in magnitude but opposite in directions. **2**

7) Integrate the following w.r.t. x: **2**

$$\frac{(1+\log x)^2}{x}$$

8) A table of values of f, g, f' and g' is given : **2**

x	f(x)	g(x)	f'(x)	g'(x)
2	1	6	-3	4
4	3	4	5	-6
6	5	2	-4	7

If S(x) =g [g(x)] find S'(6).

9) Integrate the following with respect to the respective variable : **2**

$$\frac{3-2\sin x}{\cos^2 x}$$

10) Differentiate the following w.r.t.x: $5^{\sin^3 x + 3}$ **2**

11) Evaluate the following : **2**

$$\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \log\left(\frac{2-\sin x}{2+\sin x}\right) \cdot dx$$

12) A table of values of f, g, f' and g' is given : **2**

x	f(x)	g(x)	f'(x)	g'(x)
2	1	6	-3	4
4	3	4	5	-6
6	5	2	-4	7

If r(x) =f [g(x)] find r' (2).

Section C

Attempt any EIGHT of the following questions :

13) In the following example verify that the given expression is a solution of the corresponding differential equation: **3**

$$y = a + \frac{b}{x}; x\frac{d^2y}{dx^2} + 2\frac{dy}{dx} = 0$$

14) A pair of dice is thrown 4 times. If getting a doublet is considered a success, find the probability of two successes. **3**

15) Solve the following differential equation: **3**

$dr + (2r \cot \theta + \sin 2\theta)\, d\theta = 0$

16) Integrate the following functions w.r.t. x : **3**

$$\frac{x^2}{\sqrt{9 - x^6}}$$

17) Differentiate the following w.r.t.x: **3**

$$\frac{(x^3 - 5)^5}{(x^3 + 3)^3}$$

18) A particle moves under the law **3**

$$s = \frac{t^3}{3} - \frac{t^2}{2} - \frac{t}{2} + 6$$

Find (i) its velocity at the end of 4 seconds

(ii) its acceleration and displacement when its velocity is $\frac{3}{2}$ units

19) Let the p.m.f . of r.v. X be **3**

P (x) = $\frac{3-x}{1}$ =0 , for x = –1, 0, 1, 2 and = 0, otherwise

Calculate E(X) and Var (X).

20) Evaluate the following : **3**

$$\int_{\frac{-\pi}{4}}^{\frac{\pi}{4}} \frac{x + \frac{\pi}{4}}{2 - \cos 2x} \cdot dx$$

21) Differentiate the following w.r.t. x : $\cos^{-1}\left(\frac{\sqrt{3}\cos x - \sin x}{2}\right)$ **3**

22) Find the area of the region bounded by the following curves, X-axis and the given lines: $y^2 = 16x$, $x = 0$, $x = 4$ **3**

23) Discuss the applicability of Rolle's theorem for the following functions: **3**

(i) $f(x) = (x - 1)(2x - 3)$, $x \in [1,3]$

(ii) $f(x) = 2+(x-1)^2$, $x \in [0,2]$

24) Show that $\frac{dy}{dx} = \frac{y}{x}$ in the following, where a and p are constants : **3**

$$\sec\left(\frac{x^5+y^5}{x^5-y^5}\right) = a^2$$

Section D

Attempt any FIVE of the following questions :

25) If $\log y = \log(\sin x) - x^2$, show that **4**

$$\frac{d^2y}{dx^2} + 4x\frac{dy}{dx} + (4x^2+3)y = 0.$$

26) The volume of a spherical balloon being inflated changes at a constant rate. If initially its radius is 3 units and after 3 seconds it is 6 units. Find the radius of the balloon after t seconds. **4**

27) From a lot of 30 bulbs which include 6 defectives, a sample of 4 bulbs is drawn at random with replacement. Find the probability distribution of the number of defective bulbs. **4**

28) Find the area of the region included between: $y = x^2$ and the line $y = 4x$ **4**

29) Show that the general solution of differential equation **4**

$\frac{dy}{dx} + \frac{y^2+y+1}{x^2+x+1} = 0$ is given by $(x + y + 1) = (1 - x - y - 2xy)$.

30) Solve the following differential equation: **4**

$$\frac{dy}{dx} = \frac{2y-x}{2y+x}$$

31) Find the equation of tangent and normal to the following curves at the indicated points on them: **4**

$2x^2+3y^2-5=0$ at (1, 1)

32) Evaluate the following integrals as limit of a sum : **4**

$$\int_0^4 x^2 \cdot dx$$