athematics | HSSC (12th) 1st Annual 2024 | Roll No ______ (To be filled by the candidate)

SWL-24

Paper : II | Subjective | Marks : 80 | Time : 2:30 Hours

SECTION – B **Note: - Section B is compulsory.**

2. **Write short answers to any EIGHT parts.** (8 x 2 = 16)

i. Express the volume V of a cube as a function of area A of its base.
ii. Prove the identity $\sec h^2 x = 1 - \tan h^2 x$.
iii. Determine whether $f(x) = x^{\frac{2}{3}} + 6$ is even or odd.
iv. Evaluate $\lim_{x \to 0} \frac{\sin x^0}{x}$.
v. Differentiate $\frac{2x-1}{\sqrt{x^2+1}}$ w.r.t 'x'.
vi. Find $\frac{dy}{dx}$ if $y^2 + x^2 - 4x = 5$.
vii. Find $\frac{dy}{dx}$ by making suitable substitution if $y = (3x^2 - 2x + 7)^6$.
viii. Differentiate $\sin x$ w.r.t $\cot x$.
ix. Find $\frac{dy}{dx}$ if $y = ln\left(x + \sqrt{x^2+1}\right)$.
x. Find y_2 if $y = \sqrt{x} + \frac{1}{\sqrt{x}}$.
xi. Find the extreme value of $f(x) = x^2 - x - 2$.
xii. Divide 20 into two parts so that the sum of their squares will be minimum.

3. **Write short answers to any EIGHT parts.** (8 x 2 = 16)

i. Using differential find $\frac{dx}{dy}$ if $xy - ln x = c$.
ii. Evaluate $\int (2x-3)^{\frac{1}{2}} dx$.
iii. Evaluate $\int \frac{e^x}{e^x + 3} dx$.
iv. Find $\int x \cos x \, dx$.
v. Evaluate $\int_2^{\sqrt{5}} x\sqrt{x^2-1} \; dx$.
vi. Find the area between the $x-axis$ and the curve $y = x^2 + 1$ from $x = 1$ to $x = 2$.
vii. Solve the differential equation $ydx + xdy = 0$.
viii. Find the distance between the points $A(-8,3)$; $B(2,-1)$. Find the mid-point of the line-segment joining the given points also.
ix. Find the point three-fifth of the way along the line-segment from $A(-5,8)$ to $B(5,3)$.
x. Find the slope and inclination of the line joining the points $(-2,4)$; $(5,11)$.
xi. Determine the value of p such that the lines $2x - 3y - 1 = 0$, $3x - y - 5 = 0$ and $3x + py + 8 = 0$ meet at a point.
xii. Find an equation of each of the lines represented by $20x^2 + 17xy - 24y^2 = 0$.

4. **Write short answers to any NINE parts.** (9 x 2 = 18)

i. Graph the solution set of inequality $5x - 4y \leq 20$.
ii. Define a linear inequality.
iii. Show that the equation $2x^2 - xy + 5x - 2y + 2 = 0$ represents a pair of lines.
iv. If centre is $(0,0)$, focus is $(6,0)$ and vertex is $(4,0)$, find the equation of hyperbola.
v. Find the length of latus rectum of the ellipse $9x^2 + y^2 = 18$.
vi. Find the focus and vertex of parabola $y^2 = 8x$.
vii. Find the equation of tangent to the circle $x^2 + y^2 = 25$ at the point $(4,3)$.
viii. Find the centre and radius of the circle $x^2 + y^2 + 12x - 10y = 0$.
ix. If $\vec{u} = 2i - 7j$, $\vec{v} = i - 6j$ and $\vec{w} = -i + j$, find $2\vec{u} - 3\vec{v} + 4\vec{w}$.
x. Find a vector of length 5 in the direction opposite to $\vec{v} = \hat{i} - 2\hat{j} + 3\hat{k}$.
xi. Find the projection of $\vec{a}$ along $\vec{b}$ and $\vec{b}$ along $\vec{a}$ when $\vec{a} = 3i + j - k$ and $\vec{b} = -2i - j + k$.
xii. Prove that $\vec{a} \times (\vec{b} + \vec{c}) + \vec{b} \times (\vec{c} + \vec{a}) + \vec{c} \times (\vec{a} + \vec{b}) = \vec{0}$.
xiii. A force $\vec{F} = 4\hat{i} - 3\hat{k}$ passes through the point $A(2,-2,5)$. Find the moment of $\vec{F}$ about the point $B(1,-3,1)$.

SECTION-C **Note: Attempt any THREE questions. Each question carries (5+5=10) marks.**

5. (a) Prove that $\lim_{x \to 0} \frac{a^x - 1}{x} = \log_e^a$.
(b) Differentiate with respect to 'x' $\frac{\sqrt{1+x} - \sqrt{1-x}}{\sqrt{1+x} + \sqrt{1-x}}$.

6. (a) If $y = (\cos^{-1} x)^2$, prove that $(1-x^2)y_2 - xy_1 - 2 = 0$.
(b) Evaluate the indefinite integral $\int \sqrt{a^2 + x^2} \; dx$.

7. (a) Solve the differential equation $\left(y - x\frac{dy}{dx}\right) = 2\left(y^2 + \frac{dy}{dx}\right)$.
(b) Maximize $f(x,y) = 2x + 5y$ subject to the constraints $2y - x \leq 8$, ; $x - y \leq 4$, $x \geq 0$, ; $y \geq 0$.

8. (a) Find the equation of the tangent to the circle $x^2 + y^2 = 2$ parallel to the line $x - 2y + 1 = 0$.
(b) Show that mid-point of hypotenuse a right triangle is equidistant from its vertices (use vectors).

9. (a) Prove that the latus rectum of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is $\frac{2b^2}{a}$.
(b) The points $(4,-2)$, $(-2,4)$ and $(5,5)$ are vertices of a triangle. Find in-centre of the triangle.

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SWL-24

★ **Mathematics** **HSSC (12th) 1st Annual 2024** Roll No ____________ (To be filled by the candidate)

Paper : II Objective (i) Paper Code 8 1 9 1 Marks : 20 Time : 30 Minutes

Note:- You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question number in your answer book. Use marker or pen to fill the circles. Cutting or filling up two or more circles will result no mark.

SECTION–A

Q.1	Questions	A	B	C	D
1.	$\lim_{x\to a}\frac{f(x)-f(a)}{x-a}=$	$f'(x)$	$f'(0)$	$f'(x-a)$	$f'(a)$
2.	The range of $f(x)=2+\sqrt{x+1}$ is:	$[-1,\infty[$	$[0,\infty[$	$[2,\infty[$	$[-2,\infty[$
3.	If $f(x)=\tan x$ then $f'\left(\frac{\pi}{3}\right)=$	4	2	1	0
4.	If $f(x)=x^3+2x+9$ then $f'''(0)$ is:	0	2	3	6
5.	Maclaurin series for $\frac{1}{1+x}$ is:	$1-x+x^2-x^3+\ldots$	$1-x-x^2-x^3-x^4\ldots$	$1+x+x^2+x^3+\ldots$	$-1-x-x^2-x^3-$
6.	A function $f(x)$ is increasing in the interval (a,b) if $f(x_2)>f(x_1)$ whenever:	$x_2>x_1$	$x_2<x_1$	$x_2=x_1$	$x_1=0\,,\ x_2=$
7.	$\int\frac{\sin 2x}{\sin x}dx=$	$\sin 2x+c$	$2\sin 2x+c$	$\frac{1}{2}\sin x+c$	$2\sin x+c$
8.	Solution of differential equation $\frac{dy}{dx}=-y$ is:	$y=c\ e^{-x}$	$y=ce^{x}$	$y=e^{cx}$	$y=x\ e^{-x}$
9.	$\int\frac{e^x}{e^x-2}dx=$	$ln(e^x+2)+c$	$ln(e^x+3)+c$	$ln(e^x-2)+c$	$ln(e^x-3)+$
10.	If $\int f(x)\,dx=\frac{1}{a}\sec^{-1}\frac{x}{a}+c$ then $f(x)=$	$\frac{1}{\sqrt{x^2-a^2}}$	$\frac{1}{x\sqrt{x^2-a^2}}$	$\frac{1}{x\sqrt{x^2+a^2}}$	$\frac{1}{x\sqrt{a^2-x^2}}$

(2)

	Questions	A	B	C	D
11.	Equation of a line passing through $(-2,5)$ having slope 0 is:	$y=-5$	$y=5$	$x=-2$	$x=2$
12.	If the distance of the point $(5,x)$ from $x-axis$ is 3 then $x=$	7	5	3	-5
13.	The slope of the line with inclination 60° is:	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$
14.	$(3,2)$ is not in the solution of inequality:	$x+y>2$	$x-y>1$	$3x+5y>7$	$3x-7y<3$
15.	The vertex of the parabola $(x-1)^2=8(y+2)$ is:	$(1,-2)$	$(0,1)$	$(2,0)$	$(0,0)$
16.	The end points of the major axis of the ellipse are called its:	Foci	Vertices	Covertices	Directrix
17.	Directrix of parabola $x^2=16y$ is:	$x+4=0$	$x-4=0$	$y-4=0$	$y+4=0$
18.	For any two vectors $\underline{a}$ and $\underline{b}$ projection of $\underline{a}$ on $\underline{b}$ is:	$\frac{\underline{a}.\underline{b}}{\lvert\underline{a}\rvert}$	$\frac{\underline{a}.\underline{b}}{\lvert\underline{b}\rvert}$	$\frac{\underline{a}.\underline{b}}{\lvert\underline{a}\rvert\lvert\underline{b}\rvert}$	$\underline{a}.\underline{b}$
19.	The unit vector of $2\underline{i}+\underline{j}$ is:	$2\underline{i}-\underline{j}$	$\frac{2\underline{i}+\underline{j}}{5}$	$\frac{2\underline{i}+\underline{j}}{3}$	$\frac{2\underline{i}+\underline{j}}{\sqrt{5}}$
20.	If $\frac{\underline{U}.\underline{V}}{\lvert\underline{U}\rvert\lvert\underline{V}\rvert}=\frac{1}{2}$, then the angle between $\underline{U}$ and $\underline{V}$ is:	30°	60°	300°	90°

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