Roll No. ☐☐☐☐☐☐ **Answer Sheet No.**________________

Sig. of Candidate.________________ **Sig. of Invigilator.**________________

MATHEMATICS HSSC–II

SECTION – A (Marks 20)

Time allowed: 25 Minutes

NOTE: **Section–A is compulsory and comprises pages 1–2. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.**

Q. 1 Circle the correct option i.e. A / B / C / D. Each part carries one mark.

(i) $y = sin\,x$ is a ____________

A. Linear function B. Constant function

C Rational function D. Trigonometric function

(ii) $x^2 + xy + y^2 = 2$ is a/an ____________

A. Implicit function B. Inverse function

C. Explicit function D. Constant function

(iii) If $f(\theta) = 2\,sin\,\theta + 3\,cos\,\theta\ then\ f(\theta)$ is a/an ____________

A. Odd function B. Even function

C Hyperbolic function D. None of these

(iv) $\lim\limits_{x \to a} \dfrac{x^n - a^n}{x - a} =$ ____________

A. na^{n-1} B. na^n C. na^{n+1} D. None of these

(v) $\lim\limits_{n \to \infty} \left(1 + \dfrac{1}{n}\right)^{n/2}$ is ____________

A. $\sqrt[3]{e}$ B. $\sqrt{e}$ C. $\sqrt[4]{e}$ D None of these

(vi) Equation of parabola is ____________

A. $x^2 + y^2 = 1$ B. $x = y$ C. $x^2 = 4ay$ D. None of these

(vii) If $f(x) = sin\,x$ and $q(x) = sin^{-1}x$ then____________

A. $(gof)x = sin^{-1}(\sin x)$ B. x

C. $sin\,x + sin^{-1}x$ D. None of these

(viii) $\underset{\delta x \to o}{Lim} \dfrac{f(x + \delta x) - f(x)}{\delta x}$ is called ____________

A. Velocity B. Derivative

C. Integration D. None of these

(ix) If $x = at^2$ and $y = 2at$ then $\dfrac{dy}{dx}$ is ____________

A. $\dfrac{y}{2a}$ B. $\dfrac{y}{2}$ C. $\dfrac{2a}{y}$ D. y

DO NOT WRITE ANYTHING HERE

(x) $\int e^x(\tan x + sec^2 x)dx$ then ____________

A. $e^x \tan x + c$ B. $e^x sec^2 x + c$

C. $e^x cot^{-1} x + c$ D. None of these

(xi) Distance of the line $-x+3y+1=0$ from $(0,2)$ is ____________

A. $\frac{7}{\sqrt{10}}$ B. $\frac{\sqrt{7}}{10}$

C. $\sqrt{\frac{7}{10}}$ D. $\frac{10}{\sqrt{7}}$

(xii) If the lines $ax-y-1=0$ and $x+y+1=0$ are perpendicular to each other then valve of "a" is ____________

A. 3 B. 1 C. 2 D. 4

(xiii) A point of a solution region where two of its boundary lines intersect is called a____________

A. Solution B. Corner point C. Open half D. Half plane

(xiv) Which Unit vector is along y-axis?

A. $-\vec{j}$ B. $\vec{k}$ C. $\vec{i}$ D. $\vec{j}$

(xv) Length of transverse axis of hyperbola is ____________

A. $\pm 2a$ B. $2a$ C. $-2a$ D. Zero

(xvi) The value of c for $y = mx + c$ touch the ellipse at (x, y) is ____________

A. $\sqrt{a^2m^2 - b^2}$ B. $\sqrt{3a^2 + b^2}$ C. $\sqrt{a^2m^2 + b^2}$ D. None of these

(xvii) If the vector $\vec{a}$ and $\vec{b}$ are perpendicular to each other then $\vec{a} \times \vec{b}$ is ____________

A. $\sqrt{|a||b|}$ B. $|a||b|$ C. $|a|^2|b|^2$ D. None of these

(xviii) The vectors $\vec{a}, \vec{b}$ and $\vec{c}$ are said to be coplanar if $\vec{a}.(\vec{b} \times \vec{c})$ is ____________

A. 1 B. 0 C. $\sqrt{2}$ D. ab

(xix) The co-ordinate of foci of an ellipse are____________

A. $(\pm ae, 0)$ B. $(0, \pm ae)$ C. $(\pm a, 0)$ D. None of these

(xx) The area of the triangle having $\vec{a}$ and $\vec{b}$ as two sides is given by ____________

A. $\vec{a} \times \vec{b} = o$ B. $\frac{1}{2}|\vec{a} \times \vec{b}|$ C. $\vec{a}.\vec{b}$ D. None of these

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For Examiner's use only:

Total Marks: 20

Marks Obtained:

MATHEMATICS HSSC–II

Time allowed: 2:35 Hours **Total Marks Sections B and C: 80**

NOTE: **Attempt any ten parts from Section 'B' and any five questions from Section 'C' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly.**

SECTION – B (Marks 40)

Q. 2 **Attempt any TEN parts. All parts carry equal marks.** **(10 x 4 = 40)**

(i) Evaluate $\lim\limits_{\theta\to 0}\dfrac{1-\cos p\theta}{1-\cos q\theta}$.

(ii) Find the values of m and n so that the given function f is continuous:

$$f(x)=\begin{cases} mx & if\ x<3 \\ n & if\ x=3 \\ -2x+9 & if\ x>3 \end{cases}$$

(iii) If $y=\sqrt{x}-\dfrac{1}{\sqrt{x}}$, then show that $2x\dfrac{dy}{dx}+y=2\sqrt{x}$.

(iv) Differentiate ab – ignition w.r.t x if $y=\sin\sqrt{x}$

(v) Prove that $e^{x+h}=e^{x}\{1+h+\dfrac{h^2}{\underline{|2}}+\dfrac{h^3}{\underline{|3}}+.......\}$

(vi) Evaluate $\int(\ln x)^2\,dx$.

(vii) Write the equation of the parabola with focus $(-1,0)$ and vertex $(-1,2)$.

(viii) Solve $\dfrac{dy}{dx}=\dfrac{y^2+1}{e^{-x}}$

(ix) Find an equation of an ellipse with foci $(-3\sqrt{3},0)$ and vertices $(\pm 6,0)$.

(x) Write the equation of the tangent to the conic $3x^2-7y^2=20$ at the points where $y=-1$

(xi) Show that $10xy+8x-15y-12=0$ represents a pair of straight lines.

(xii) Find the values of "a" and "b" so that the vectors $3\underline{i}-\underline{j}+4\underline{k}$ and $a\underline{i}+b\underline{j}-2\underline{k}$ are parallel.

(xiii) Find 'k' so that the line joining $A(7,3)$; $B(k,-6)$ and the line joining $C(-4,5)$ and $D(-6,4)$ are perpendicular.

(xiv) Find measure of the angle between the lines represented by $x^2-xy-6y^2=0$.

SECTION – C (Marks 40)

Note: **Attempt any FIVE questions. All questions carry equal marks.** **(5 x 8 = 40)**

Q. 3 Prove that $\lim\limits_{x\to 0}\dfrac{\sqrt{x+a}-\sqrt{a}}{x}=\dfrac{1}{2\sqrt{a}}$

Q. 4 Expand a^x in the Maclaurin series.

Q. 5 Evaluate $\int\dfrac{e^x(x^2+1)}{(x+1)^2}\,dx$

Q. 6 If $x=a(\theta+\sin\theta)$; $y=a(1-\cos\theta)$ then show that $y^2\dfrac{d^2y}{dx^2}+a=0$

Q. 7 The points $A(-1,2)$, $B(6,3)$ and $C(2,-4)$ are vertices of a triangle. Show that the line joining the midpoint D of AB and mid point E of AC is parallel to BC and $DE=\dfrac{1}{2}BC$

Q. 8 Find the center, foci, eccentricity and vertices of $\dfrac{(x-1)^2}{2}-\dfrac{(y-1)^2}{6}=1$.

Q. 9 Find a vector perpendicular to each of the vectors $\vec{a}=2\vec{i}+\vec{j}+\vec{k}$ and $\vec{b}=4\vec{i}+2\vec{j}-\vec{k}$

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MATHEMATICS HSSC–II

SECTION – A (Marks 20)

Time allowed: 25 Minutes

NOTE: **Section–A is compulsory and comprises pages 1–2. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.**

Q. 1 **Circle the correct option i.e. A / B / C / D . Each part carries one mark.**

(i) Functions are used to explain the relationship between________________

A. Variable quantities B. Notations

C. Values D. None of these

(ii) Volume of a sphere depends on its ________________

A. π B. $\frac{4}{3}$

C. Radius D. Centre

(iii) A function in which the variable appears as exponent is called a/an ________________

A. Rational function B. Exponential function

C. Hyperbolic function D. Inverse function

(iv) $\lim_{x \to 0} \frac{\sin x^{\circ}}{x}$ is ________________

A. 1 B. $\frac{\pi}{90}$

C. $\frac{180}{\pi}$ D. $\frac{45}{\pi}$

(v) $\frac{d}{dx}\left(\frac{1}{\sqrt{x+a}}\right)$ is ________________

A. $\frac{-3}{\sqrt[2]{x+a}}$ B. $\frac{-1}{2(x+a)^{\frac{3}{2}}}$ C. $\frac{1}{2}$ D. None of these

(vi) If $x^2 + y^2 = 4$ then $\frac{dy}{dx}$ is ________________

A. $-\frac{y}{x}$ B. $\frac{x}{y}$ C. $\frac{x}{y}$ D. None of these

(vii) If $f(x) = a^x$ then $f'(x)$ is ________________

A. $a^x \ln a$ B. a^x

C. $\ln a$ D. None of these

(viii) A function is said to be increasing function if ________________

A. $f(x_1) = f(x_2)$ B. $f(x_2) > f(x_1)$

C. $f(x_2) < f(x_1)$ D. None of these

(ix) $\int a^x dx$ ________________

A. $a^x + c$ B. $a^x \ln a + c$ C. $\frac{a^x}{\ln a} + c$ D. None of these

DO NOT WRITE ANYTHING HERE

(x) $\int_{o}^{\frac{1}{\sqrt{3}}}\frac{dx}{1+x^2}$ ______________

A. $\frac{\pi}{3}rad$
B. $\frac{\pi}{6}rad$
C. πrad
D. $\frac{\pi}{2}rad$

(xi) Solution of differential equation $\frac{dy}{dx}=-tan\,x$ is ______________

A. $y=ln\cos x+c$
B. $xy=ln\cos x$
C. $x=ln\cos y+c$
D. None of these

(xii) Each equal part of a plane is called ______________

A. Quadrant
B. Ordinate
C. Origin
D. Abscissa

(xiii) Where does the point $(0,5)$ lie?

A. $x-axis$
B. $y-axis$
C. In the first quadrant
D. In the forth quadrant

(xiv) Equation of the line parallel to $y-axis$ through $(3,7)$ is ______________

A. $x=7$
B. $y=3$
C. $y=7$
D. $x=3$

(xv) Equation of the line through $(-6,5)$ with slope 7 is ______________

A. $x+7y+47=0$
B. $7x+y+47=0$
C. $7x-y+47=0$
D. None of these

(xvi) Slope of the line $(1+7k)x+(k-1)y-4+20k=0$ is______________

A. $\frac{k+1}{1+7k}$
B. $-\frac{7k+1}{k-1}$
C. $\frac{k-1}{1+7k}$
D. None of these

(xvii) Two lines represented by $ax^2+2hxy+by^2=0$ are parallel if ______________

A. $h^2-ab<0$
B. $h^2-ab=0$
C. $h^2-ab>ab$
D. $h^2-ab=ab$

(xviii) Conics are the curves obtained by cutting a right circular cone by a______________

A. Line
B. Plane
C. Circle
D. Sphere

(xix) A unit vector $\hat{n}$ perpendicular to $\vec{a}$ and $\vec{b}$ is ______________

A. $\frac{\vec{a}\times\vec{b}}{|\vec{a}\times\vec{b}|}$
B. $\vec{a}\times\vec{b}$
C. $\frac{\vec{a}.\vec{b}}{|\vec{a}.\vec{b}|}$
D. $\vec{a}.(\vec{b}\times\vec{c})$

(xx) If three points are collinear then area of a triangle will be ______________

A. Zero
B. 1
C. 2
D. 3

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MATHEMATICS HSSC–II

Time allowed: 2:35 Hours **Total Marks Sections B and C: 80**

NOTE: Answer any ten parts from Section 'B' and any five questions from Section 'C' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly.

SECTION – B (Marks 40)

Q. 2 Attempt any TEN parts. All parts carry equal marks. **(10 x 4 = 40)**

(i) Evaluate $\lim\limits_{x \to a} \dfrac{\sqrt{x+a}-\sqrt{a}}{x}$

(ii) If $f(x) = \begin{cases} 3x & if\ x \leq -2 \\ x^2 - 1 & if -2 < x < 2 \\ 3 & if\ x \geq 2 \end{cases}$ Discuss the continuity at $x = -2$

(iii) Prove that $y\dfrac{dy}{dx} + x = 0$ if $x = \dfrac{1-t^2}{1+t^2}$, $y = \dfrac{2t}{1+t^2}$

(iv) If $y = tan(2\ tan^{-1}\dfrac{x}{2})$ show $\dfrac{dy}{dx} = \dfrac{4(1+y^2)}{4+x^2}$

(v) Find the extreme value of $f(x) = 5 + 3x - x^3$

(vi) Use differential to approximate the value of $(31)^{1/5}$

(vii) Evaluate $\int tan^2 x\, dx$

(viii) Find the area bounded by $y = x(x^2 - 4)$ and the $x - axis$.

(ix) Find an equation of the parabola whose focus is $F(-3, 4)$ and directrix is $3x - 4y + 5 = 0$.

(x) Find the angle between the lines represented by $ax^2 + 2hxy + by^2 = 0$

(xi) Find an equation of the ellipse with vertices $(0, \pm 5)$ and eccentricity $\dfrac{3}{5}$

(xii) Show that the product of the distances from the foci to any tangent to the hyperbola $\dfrac{x^2}{a^2} - \dfrac{y^2}{b^2} = 1$ is constant.

(xiii) In any triangle ΔABC prove that $\dfrac{a}{sin\,A} = \dfrac{b}{sin\,B} = \dfrac{c}{sin\,C}$

(xiv) Find analytic expression of $\underline{u}.(\underline{v} \times \underline{w})$

SECTION – C (Marks 40)

Note: Attempt any FIVE questions. All questions carry equal marks. **(5 x 8 = 40)**

Q. 3 If θ is measured in radian then show that $\lim\limits_{\theta \to 0} \dfrac{\sin\theta}{\theta} = 1$

Q. 4 Find from definition the differential co-efficient of $(ax+b)^n$ $w.r.t$ $'x'$ when n is a positive integer.

Q. 5 If $y = a\cos(ln\,x) + b\ sin\ (ln\,x)$ then prove that $x^2\dfrac{d^2y}{dx^2} + x\dfrac{dy}{dx} + y = 0$

Q. 6 Evaluate $\int \dfrac{3}{x(x^3-1)}dx$, $x \neq 0$, $x \neq -1$.

Q. 7 Find equations of altitudes of a triangle whose vertices are $A(-3, 2)$, $B(5, 4)$ and $C(3, -8)$.

Q. 8 Find the area of the region bounded by $10x^2 - xy - 21y^2 = 0$ and $x + y + 1 = 0$.

Q. 9 Graph the solution region of the system of linear inequalities:

$$\begin{aligned} 2x + y &\leq 10 \\ x + y &\leq 7 \\ -2x + y &\leq 4 \end{aligned}$$