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) If $\underline{u}=3\underline{i}+2\underline{k}$, $\underline{v}=\underline{i}+2\underline{j}+\underline{k}$ and $\underline{w}=-\underline{j}+4\underline{k}$ then $(\underline{u}\times\underline{v}).\underline{w}=?$

A. 25 B. $\sqrt{25}$ C. $5\sqrt{2}$ D. $25a$

(ii) What is domain of f^{-1}, when $f(x)=2+\sqrt{x-1}$

A. Real Number B. $[1,\infty]$ C. $[2,+\infty]$ D. $[-1,1]$

(iii) For parametric equations $x=at^2$; $y=2at$ represent the equation:

A. $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ B. $x^2+y^2=1$ C. $y^2=4ax$ D. $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$

(iv) $\lim\limits_{n\to+\infty}[1+\frac{1}{n}]^{2n}=?$

A. zero B. e^{2n} C. e^2 D. e^n

(v) Derivative of $\sin^3 x$ *w.r.t* $\cos^2 x$ is:

A. $\frac{3}{2}\tan x.\sec x.$ B. $-\frac{3}{2}\sin x$ C. $\frac{3\sin^2 x}{2\cos x}$ D. $3\sin^2 x$

(vi) $\frac{d}{dx}\ a^x=?$

A. $\ell n\, a$ B. $a^x.\ell n\, a$ C. $a^x.\ell n\, x$ D. a^x

(vii) Notation used for derivative of $y=f(x)$ is:

A. $\int y dx$ B. $\frac{dy}{dx}$ C. $f''(x)$ D. $D^2 f(x)$

(viii) If $y=(2x+5)^{\frac{3}{2}}$, then y_2 will be:

A. $\frac{3}{2x+5}$ B. $3(2x+5)^{\frac{1}{2}}$ C. $\frac{3}{\sqrt{2x+5}}$ D. $6(2x+5)^{-\frac{1}{2}}$

(ix) $\int x\, e^x dx=?$

A. xe^x+c B. xe^x C. xe^x-e^x+c D. xe^x+e^x+c

(x) $\int_1^2 (x^2+1)dx=?$

A. $\frac{x^3}{3}+x+c$ B. $\frac{10}{33}$ C. 10 D. $\frac{10}{3}$

DO NOT WRITE ANYTHING HERE

(xi) Solution of $ydx + xdy = 0$ is:

A. $xy = 1$ B. zero C. $xy = 0$ D. $xy = c$

(xii) Two lines ℓ_1 and ℓ_2 with respective slopes m_1 and m_2 are parallel if:

A. $m_1 - m_2 = -1$ B. $m_1 . m_2 = -1$ C. $m_1 + m_2 = -1$ D. $m_1 = m_2$

(xiii) The equation of the straight line whose slope is 2 and y-intercept is 5 is:

A. $\frac{y-5}{x-2} = m$ B. $y = 5x + 2$ C. $y = x + 2$ D. $y = 2x + 5$

(xiv) If lines are parallel, then solution:

A. Does not exist B. Is finite C. Exists D. Is infinite

(xv) An expression involving any of the symbols $<$, $>$, $\leq$, $\geq$ is called:

A. Inequality B. Equation C. Not inequality D. Identity

(xvi) The equation of the circle $x^2 + y^2 + 2gx + 2fy + c = 0$ has radius:

A. $\sqrt{g^2 + f^2 - c}$ B. $g^2 + f^2 - c$ C. $g^2 + f^2$ D. $(-g, -f)$

(xvii) A line that touches the curve without cutting through it is called:

A. Tangent B. Secant C. Radius D. Normal

(xviii) The point of parabola which is closest to the focus is the vertex of the:

A. Circle B. Parabola C. Ellipse D. Hyperbola

(xix) Unit vector in the same direction of vector $\underline{v} = [3, -4]$:

A. $3(5)\ , -4(5)$ B. $3\underline{i} - 4\underline{j}$ C. $\left[\frac{3}{5}, \frac{-4}{5}\right]$ D. $\left[\frac{3}{5}, \frac{4}{5}\right]$

(xx) Altitudes of a triangle are always:

A. Perfect squares B. Parallel C. Perpendicular D. Concurrent

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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. Graph paper will be provided on Demand.

SECTION – B (Marks 40)

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

(i) Evaluate $\lim_{\theta \to 0} \frac{1-\cos\theta}{\sin^3\theta}$

(ii) Graph the curve of following parametric equations $x = \sec\theta$, $y = \tan\theta$ where θ is a parameter.

(iii) Find $\frac{dy}{dx}$ if $x^2 - 4xy - 5y = 0$

(iv) If $y = \sqrt{\tan x + \sqrt{\tan x + \sqrt{\tan x + \ldots\ldots\infty}}}$ then prove that $(2y-1)\frac{dy}{dx} = \sec^2 x$

(v) Find $\frac{dy}{dx}$ for $y = x.\ e^{\sin x}$

(vi) Evaluate $\int x(\sqrt{x}+1)\,dx$

(vii) Evaluate $\int_{-2}^{0} \frac{1}{(2x-1)^2} dx$

(viii) Show that the points $A(3\ ,\ 1)$, $B(-2\ ,\ -3)$ and $C(2\ ,2)$ are vertices of an isosceles triangle.

(ix) Find an equation of the line through $(-4,-6)$ and perpendicular to a line having slope $\frac{-3}{2}$

(x) Find an equation of the circle whose ends of a diameter are at $(-3,2)$ and $(5,-6)$.

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

(xii) Find the points of intersection of the given coinc $3x^2 - 4y^2 = 12$; $3y^2 - 2x^2 = 7$

(xiii) Prove that the line segment joining the mid points of two sides of a triangle is parallel to the third side and half as long.

(xiv) Find area of triangle, determined by the points P, Q and R.

P (0, 0, 0) , Q (2, 3,2) , R (-1,1,4)

SECTION – C (Marks 40)

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

Q. 3 If $f(x) = \begin{cases} \frac{\sqrt{2x+5} - \sqrt{x+7}}{x-2} & x \neq 2 \\ k & x = 2 \end{cases}$

Then find value of k so that f is continuous at $x = 2$

Q. 4 Show that $\frac{dy}{dx} = \frac{y}{x}$ if $\frac{y}{x} = \tan^{-1}\frac{x}{y}$

Q. 5 Solve the differential equation $(x^2 - yx^2)\frac{dy}{dx} + y^2 + xy^2 = 0$

Q. 6 Find the interior angle of the triangle whose vertices are $A(-2,11)$, $B(-6,-3)$, $C(4,-9)$

Q. 7 Maximize $f(x,y) = 2x + 5y$ subject to the constraints $2y - x \leq 8$; $x - y \leq 4$; $x \geq 0$; $y \geq 0$

Q. 8 Let a be positive number and $0 < c < a$. Let $F(-c,0)$ and $F'(c,0)$ be two given points. Prove that the locus of points of $P(x,y)$ such that $|PF| + |PF'| = 2a$ is an ellipse.

Q. 9 Find a unit vector perpendicular to the plane containing $\underline{a}$ and $\underline{b}$. Also find sine of triangle between them while $\underline{a} = 2\underline{i} - 6\underline{j} - 3\underline{k}$, $\underline{b} = 4\underline{i} + 3\underline{j} - \underline{k}$

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MATHEMATICS HSSC–II

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

(i) $\lim_{x\to 0}(1+x)^{\frac{1}{x}} = ?$

A. e^x B. ∞ C. $e^{\frac{1}{x}}$ D. e

(ii) For real valued function $f(x) = 2x+1$ what will be $fof(x)$?

A. $3x-4x$ B. $2x-1$ C. $2x+1$ D. $4x+3$

(iii) Evaluate $\lim_{\theta\to 0}\frac{\sin 7\theta}{\theta}$:

A. Zero B. $\frac{1}{7}$ C. 7 D. One

(iv) $\int \sin 3x\, dx = ?$

A. $3\sin 3x + C$ B. $-\cos 3x$ C. $\frac{-\cos 3x}{3}+C$ D. $\frac{-\cos 3x}{3}$

(v) $\frac{d}{dx}\sec x = ?$

A. $\tan x$ B. $\cos x$ C. $\sec x.\tan x$ D. $\frac{1}{\cos x}$

(vi) If $y = 2x^5 - 3x^4 + 4x^3 + x - 2$ then $y_2 = ?$

A. $\frac{dy^2}{dx}$ B. $40x^3 - 36x^2 + 36x$

C. $y_2 - y_1$ D. dy_2

(vii) $\frac{d}{dx}\sin h\, x = ?$

A. $\frac{e^x - e^{-x}}{2}$ B. $\cosh x$ C. $\frac{1}{\cos echx}$ D. $\frac{e^x + e^{-x}}{2}$

(viii) $\int_1^3 \frac{x^2}{2}dx = ?$

A. 4.3 B. $\frac{x^3}{3}+C$ C. $\frac{x^3}{6}+C$ D. $\frac{x^3}{6}$

(ix) $\int_{-\pi}^{\pi} \sin x\, dx = ?$

A. $\cos x$ B. Zero C. $-\cos x$ D. 1

DO NOT WRITE ANYTHING HERE

(x) Altitudes of a triangle are:

A. Concurrent B. Equivalent C. Equal D. Collinear

(xi) Distance between $(-1,2)$ and $(7,5)$ is:

A. ± 73 B. $2\sqrt{73}$ C. 73 D. $\sqrt{73}$

(xii) Equation of a non-vertical straight line with slope m and y intercept c is:

A. $y \leq mx + c$ B. $y = mx + c$ C. $y = mx$ D. $y > mx + c$

(xiii) Region which is restricted to the 1st quadrant is called:

A. Feasible region B. Feasible area

C. Feasible solution D. Solution

(xiv) $y^2 = 4ax$ is the standard equation of:

A. Circle B. Parabola C. Ellipse D. Hyperbola

(xv) If $0 < e < 1$, then conic is called:

A. Circle B. Hyperbola C. Parabola D. Ellipse

(xvi) The circle is a special case of:

A. An Ellipse B. Distance C. Parabola D. Hyperbola

(xvii) The dot product of vectors $\underline{u}$ and $\underline{v}$ is:

A. $\cos\theta.\sin\theta$ B. $|\underline{u}||\underline{v}|\cos\theta$ C. $uv\sin\theta$ D. $|\underline{u}||\underline{v}|\sin\theta$

(xviii) If $P = (2,3), Q(6,-2)$, then vector $\overrightarrow{PQ}$ is:

A. $\frac{4\underline{j} - 5\underline{i}}{\sqrt{41}}$ B. $\frac{4\underline{i} - 5\underline{j}}{\sqrt{41}}$ C. $4\underline{i} - 5\underline{j}$ D. $4 - 5\underline{k}$

(xix) Unit vector in the direction of vector $\underline{v} = 2\underline{i} - \underline{j}$:

A. $2\underline{i} + \underline{j}$ B. $2\underline{i} - \underline{j}$ C. $\frac{2\underline{i} - \underline{j}}{\sqrt{5}}$ D. $\sqrt{5}$

(xx) $\frac{d}{dx}(ax+b)^3 = ?$

A. $3a(ax+b)^3$ B. $3(ax+b)^2$ C. $3a(ax+b)$ D. $3a(ax+b)^2$

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Total Marks:	**20**
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MATHEMATICS HSSC–II

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

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SECTION – B (Marks 40)

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

(i) Evaluate $\lim_{\theta\to 0}\frac{\tan\theta-\sin\theta}{\sin^3\theta}$

(ii) Graph the curve of following parametric equations $x=t^2$, $y=t$ and $-2\le t\le 2$

(iii) Differentiate $\frac{2x-3}{2x+1}$

(iv) Find $\frac{dy}{dx}$ of following parametric functions $x=\theta+\frac{1}{\theta}$, $y=\theta+1$

(v) Find the extreme value of the function $f(x)=x^2-x-2$

(vi) Evaluate $\int\frac{dx}{\frac{1}{2}\sin x+\frac{\sqrt{3}}{2}\cos x}$

(vii) Solve the differential equation $x.dy+y\ (x-1)\ dx=0$

(viii) Evaluate $\int\frac{1-x^2}{1+x^2}\,dx$

(ix) Using slope, show that the triangle with its vertices $A(6,1)$, $B(2,7)$ and $C(-6,-7)$ is a right angled triangle.

(x) Find the point of intersection of the lines $x-2y+1=0$ and $2x-y+2=0$

(xi) Prove that the normal lines of a circle passes through the centre of the circle.

(xii) Find an equation of the ellipse having centre at $(0,0)$, focus at $(0,-3)$ and one vertex at $(0,4)$. Sketch its graph.

(xiii) Prove that the angle in a semicircle is a right angle.

(xiv) If $\underline{a}\times\underline{b}=0$ and $\underline{a}.\underline{b}=0$ what conclusion can be drawn about $\underline{a}$ or $\underline{b}$?

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 prove that $\lim_{\theta\to 0}\frac{\sin\theta}{\theta}=1$

Q. 4 If $y=x^4+2x^2+2$, then prove that $\frac{dy}{dx}=4x\sqrt{y-1}$

Q. 5 Evaluate $\int\frac{x^2+3x-34}{x^2+2x-15}\,dx$

Q. 6 Find an equation of the line through $(11,-5)$ and parallel to a line with slope -24

Q. 7 Prove that the Latus rectum of the Ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is $\frac{2b^2}{a}$

Q. 8 Graph the feasible region and corner points of the following linear inequalities:

$2x-3y\le 6$, $2x+3y\le 12$, $x\ge 0$, $y\ge 0$

Q. 9 A Force $F=7\underline{i}+4\underline{j}-3\underline{k}$ is applied at $P(1,-2,3)$. Find its moment about the point $Q(2,1,1)$