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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) The term_____ was recognized by a German Mathematician Leibniz to describe the dependence of one quantity on another.

A. Limit B. Function

C. Domain D. Range

(ii) $\lim_{x\to 0}\frac{\tan x}{x}=$_____

A. 0 B. -1

C. 1 D. None of these

(iii) $y=e^{2x}$ is called a/an_____ function.

A. Linear B. Quadratic

C. Rational D. Exponential

(iv) The minimum value of a function occurs when its derivative is_____

A. Equal to zero B. Greater than zero

C. Less than zero D. Equal to one

(v) The slope of the tangent line to the graph of f at $(x, f(x))$ is_____

A. $f'(x)$ B. $f(x)$ C. y D. x

(vi) The derivative of $6x^3$ $w.r.t.$ x^2 is_____

A. $18x^2$ B. Zero C. $9x^2$ D. $9x$

(vii) $\frac{d}{dx}(a^{\ell nx})=$_____

A. $a^{\ell nx}.\ell nx$ B. $a^{\ell nx}.\frac{1}{x}$ C. $\frac{a^{\ell nx}.\ell na}{x}$ D. None of these

(viii) $\int\frac{f'(x)}{f(x)}dx=$_____

A. $\frac{d}{dx}\left[\ell nf(x)\right]+c$ B. $\ell nf(x)+c$

C. $\ell nf(x)+x+c$ D. $-\ell nf(x)+c$

(ix) $\int(\ell nx).\frac{1}{x}dx=$_____

A. $\frac{(\ell nx)^2}{x}+c$ B. $(\ell nx)^2+c$ C. $\frac{\ell nx}{x^2}+c$ D. None of these

(x) $\int\operatorname{cosec} x\,dx=$_____

A. $\ell n\left|\sec x+\tan x\right|+c$ B. $\ell n\left|\operatorname{cosec} x+\cot x\right|+c$

C. $\ell n\left|\operatorname{cosec} x-\cot x\right|+c$ D. $-\operatorname{cosec} x.\cot x+c$

DO NOT WRITE ANYTHING HERE

(xi) The centroid of a ΔABC divides each median in the ratio_____

A. 1:2 B. 1:1

C. 1:3 D. 2:1

(xii) If "P" divides the line AB in the ratio 3:3, then coordinates of "P" are_____

A. $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$ B. $\left(\frac{x_1+x_2}{3}, \frac{y_1+y_2}{3}\right)$

C. $\left(\frac{3x_1+3x_2}{2}, \frac{3y_1+3y_2}{2}\right)$ D. $\left(\frac{x_1+y_1}{2}, \frac{x_2+y_2}{2}\right)$

(xiii) The slope of a vertical line is_____

A. ∞ B. 1

C. 0 D. 2

(xiv) If slope of $\overline{AB}$ = slope of $\overline{BC}$, then points A, B, C are _____.

A. Non-collinear B. Coplanar

C. Non-coplanar D. Collinear

(xv) The feasible solution which maximizes or minimizes the objective function is called the_____

A. Feasible solution B. Simple solution

C. Optimal solution D. None of these

(xvi) Radius of a circle is given by_____

A. $\sqrt{g^2+f^2+c}$ B. $\sqrt{g^2+f^2-c}$

C. $\sqrt{g^2-f^2-c}$ D. $\sqrt{g^2-f^2+c}$

(xvii) Directices of ellipse $\frac{x^2}{b^2}+\frac{y^2}{a^2}=1, a>b$ are_____

A. $x=\pm\frac{c}{e^2}$ B. $y=\pm\frac{c}{e^2}$

C. $x=\pm c$ D. $y=\pm c$

(xviii) Vertex of parabola $(y-2)^2=10(x+3)$ is _____

A. $(0,0)$ B. $(-2,3)$

C. $(2,-3)$ D. $(3,-2)$

(xix) If $\underline{a}\times\underline{b}=0$ *and* $\underline{a}.\underline{b}=0$, then_____

A. $\underline{a}$ and $\underline{b}$ are parallel B. $\underline{a}$ and $\underline{b}$ are perpendicular

C. $\underline{a}\neq 0, b\neq 0$ D. Either $\underline{a}=0$ *or* $\underline{b}=0$

(xx) If P(2,3) and Q (6, − 2), then $\overrightarrow{PQ}$=_____

A. $4\hat{i}-5\hat{j}$ B. $-4\hat{i}+5\hat{j}$

C. $4\hat{i}+5\hat{j}$ D. $5\hat{i}-4\hat{j}$

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) Determine whether the given function "f" is Even or Odd:
$f(x) = x^{2/3} + 6$

(ii) Simplify: $\lim_{x\to 0} \frac{e^{1/x} - 1}{e^{1/x} + 1}, x > 0$

(iii) If $y = \sqrt{x} - \frac{1}{\sqrt{x}}$, prove that $2x\frac{dy}{dx} + y = 2\sqrt{x}$

(iv) Find $\frac{dy}{dx}$ if $x = y.\ sin\ y$

(v) Find the extreme values for $f(x) = 5 + 3x - x^3$

(vi) Evaluate: $\int \sin^2 x\ dx$

(vii) Evaluate: $\int x^3 . \ell n\, x\, dx$

(viii) Evaluate: $\int_1^{\sqrt{5}} \sqrt{(2t-1)^3}\ dt$

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

(x) The vertices of a triangle are A(− 2,3), B(− 4,1) and C (3,5). Find coordinates of the centroid.

(xi) Find the centre and radius of the circle
$5x^2 + 5y^2 + 14x + 12y - 10 = 0$

(xii) Show that the circles $x^2 + y^2 + 2x - 2y - 7 = 0$ and $x^2 + y^2 - 6x + 4y + 9 = 0$ touch externally.

(xiii) Find Focus and Vertex of the parabola:
$(x-1)^2 = 8(y+2)$

(xiv) If $\underline{v} = 3\hat{i} - 2\hat{j} + 2\hat{k}$ and $\underline{w} = 5\hat{i} - \hat{j} + 3\hat{k}$, then find $|3\underline{v} + \underline{w}|$

SECTION – C (Marks 40)

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

Q. 3 Prove that: $\lim_{x\to 0} \frac{a^x - 1}{x} = \log_e a$

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

Q. 5 Evaluate: $\int_{\frac{\pi}{6}}^{\frac{\pi}{2}} \frac{\cos x}{\sin x(2 + \sin x)} dx$

Q. 6 The points (4, − 2), (− 2,4) and (5,5) are vertices of a triangle. Find In-centre of the triangle.

Q. 7 Graph the feasible region of the system of linear inequalities and find the corner points:
$5x + 7y \leq 35,\ x - 2y \leq 4,\ x \geq 0, y \geq 0$

Q. 8 Find the centre, foci, eccentricity and directices of the ellipse whose equation is:
$25x^2 + 9y^2 = 225$

Q. 9 Prove by vector method that:
$\sin(\alpha + \beta) = \sin\alpha\cos\beta + \cos\alpha\sin\beta$

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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) Swiss Mathematician_____ invented a symbolic way to write the statement " y is a function of x" as y=f(x).

A. Euler B. Leibniz C. Tailor D. Cachy

(ii) If $f(x)=e^x$, then $f^{-1}(x)=$_____

A. e^x B. $\sin x$ C. $\cos x$ D. ℓnx

(iii) Range of $\cot x$ is_____

A. $(0, \infty)$ B. R

C. $(-\infty, 0)$ D. $[-1,1]$

(iv) $\lim_{n\to\infty}(1+\frac{4}{n})^n =$_____

A. e B. e^n

C. e^4 D. $e^{1/4}$

(v) $\frac{d}{dx}(3^{5x}) =$_____

A. $3^{5x}\ln 3$ B. 5.3^{5x}

C. $5.3^{5x}\ln 3$ D. $3^{5x}\ln e$

(vi) If $3x+4y+7=0$, then $\frac{dy}{dx} =$_____

A. $\frac{-3}{7}$ B. $\frac{-3}{4}$

C. $\frac{-3-7}{4}$ D. $\frac{-4}{3}$

(vii) $\frac{d}{dx}(\sin\sqrt{x}) =$_____

A. $\cos\sqrt{x}$ B. $\frac{\cos\sqrt{x}}{\sqrt{x}}$ C. $\cos\sqrt{x}.2\sqrt{x}$ D. $\frac{\cos\sqrt{x}}{2\sqrt{x}}$

(viii) $\int\frac{x}{x+2}dx =$_____

A. $x-2\ell n(x+2)+c$ B. $\ell n(x+2)+c$

C. $2\ell n(x+2)+c$ D. $x+2\ell n(x+2)+c$

(ix) $\int\tan^2 x\,dx =$_____

A. $\tan x - x + c$ B. $\tan x + x + c$

C. $2\tan x.\sec^2 x + c$ D. $sec^2 x - 1 + c$

DO NOT WRITE ANYTHING HERE

(x) $\int e^{2x}\,dx =$ _____

A. $e^{2x}+c$ B. $2e^{2x}+c$

C. $2xe^{2x}+c$ D. $\frac{e^{2x}}{2}+c$

(xi) In ordered pair (x, y), "y" is called_____

A. Abscissa B. Ordinate

C. Domain D. Horizontal distance

(xii) Slope- Intercept form of equation of a straight line is_____

A. $y-mx+c=0$ B. $y-y_1=m(x-x_1)$

C. $y=mx+c$ D. $\frac{x}{a}+\frac{y}{b}=1$

(xiii) Distance from the point P (6, -1) to the line $6x-4y+9=0$ is _____

A. 49 B. $\sqrt{52}$

C. $\frac{49}{\sqrt{52}}$ D. 10

(xiv) Inequalities are expressed by _____ symbols.

A. One B. Two

C. Four D. Three

(xv) Parametric equations of a circle are_____

A. $x=a\cos\theta, y=b\sin\theta$ B. $x=r\cos\theta, y=b\sin\theta$

C. $x=a\tan\theta, y=b\sec\theta$ D. $x=r\cos\theta, y=r\sin\theta$

(xvi) If radius of a circle is zero, then the circle is called a/an_____

A. Point circle B. Null circle

C. Circum circle D. In-circle

(xvii) Length of latusrectum of an Ellipse is_____

A. $\frac{2b^2}{a}$ B. 4a

C. $\frac{2b}{a}$ D. $4ax$

(xviii) If vectors $\underline{a}, \underline{b}$ and $\underline{c}$ are three position vectors of a triangle, then_____

A. $\underline{a}-\underline{b}-\underline{c}=0$ B. $\underline{a}=\underline{b}=\underline{c}$

C. $\underline{a}=\underline{b}-\underline{c}$ D. $\underline{a}+\underline{b}+\underline{c}=0$

(xix) Which of the following triples can be the direction angles of a single vector?

A. $30^0, 45^0, 60^0$ B. $45^0, 60^0, 60^0$

C. $45^0, 45^0, 60^0$ D. $60^0, 60^0, 60^0$

(xx) In cross product, $\underline{u}\times\underline{u}=$ _____

A. u^2 B. $2u$

C. 0 D. None of these

_____

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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) Prove the identity $sech^2 x = 1 - \tanh^2 x$

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

(iii) Find $\frac{dy}{dx}$ if $4x^2 + 2hyx + by^2 + 2gx + 2fy + c = 0$

(iv) If $\tan y(1 + \tan x) = 1 - \tan x$, show that $\frac{dy}{dx} = -1$

(v) Find $f'(x)$ if $f(x) = \ell n(\sqrt{e^{2x} + e^{-2x}})$

(vi) Evaluate $\int \cos 3x . \sin 2x \, dx$

(vii) Evaluate $\int_{-1}^{2} (x + |x|) dx$

(viii) Solve the differential equation $\frac{dy}{dx} = \frac{y}{x^2}$

(ix) Find the point three-fifth of the way along the line segment from A$(-5,8)$ to B(5,3).

(x) Determine the value of "p" such that lines $2x - 3y - 1 = 0$, $3x - y - 5 = 0$ *and* $3x + py + 8 = 0$ meet at a point.

(xi) Find an equation of the circle with ends of diameter at $(-3,2)$ and $(5,-6)$

(xii) Write an equation of parabola if Directrix $x = -2$ and Focus (2,2)

(xiii) Find α so that $\left|\alpha\hat{i} + (\alpha+1)\hat{j} + 2\hat{k}\right| = 3$

(xiv) If $\underline{a} + \underline{b} + \underline{c} = 0$, then prove that $\underline{a} \times \underline{b} = \underline{b} \times \underline{c} = \underline{c} \times \underline{a}$

SECTION – C (Marks 40)

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

Q. 3 For the real valued function f defined below find:

$f(x) = \frac{2x+1}{x-1}$

a. $f^{-1}(x)$ b. $f^{-1}(-1)$ and verify that $f(f^{-1}(x)) = x$

Q. 4 Show that $y = \frac{\ell nx}{x}$ has maximum value at $x = e$

Q. 5 Evaluate $\int e^{-x} . \sin 2x \, dx$

Q. 6 The average entry test score of engineering candidates was 592 in the year 1998, while the score was 564 in 2002. Assuming that the relationship between time and score is linear, find the average score for 2006.

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 A comet has a parabolic orbit with the Earth at the focus. When comet is 150,000 km from the Earth, the line joining the comet and the Earth makes an angle of 30^0 with the axis of the parabola. How close will the comet come to the Earth?

Q. 9 If $\underline{a} = 3\hat{i} - \hat{j} - 4\hat{k}$, $\underline{b} = -2\hat{i} - 4\hat{j} - 3\hat{k}$ and $\underline{c} = \hat{i} + 2\hat{j} - \hat{k}$

Find a unit vector parallel to $3\underline{a} - 2\underline{b} + 4\underline{c}$