Federal Board HSSC-II (2016)
MATHEMATICS

Time: 25 Minutes   Marks: 20

SECTION – A (Marks 20)

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

(i) if $u = 3i + 3j + k$ and $w = i + 1k$ then $(u \times v) \cdot w = ?$
- A   25
- B $\sqrt{25}$
- C   5√2
- D   25a

(ii) What is domain of y^{-1}, when $f(x) = 2 + \sqrt{x+1}$
- A   Real numbers R
- B $[1, \infty)$
- C $(2, \infty)$
- D $[-1, 1]$

(iii) for parametric equations $x = a t^2$, $y = 2at$ represent the equation.
- A $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$
- B $x^2 + y^2 = 1$
- C $y^2 = 4ax$
- D $\dfrac{x^2}{a^2} - \dfrac{y^2}{b^2} = 1$

(iv) $\lim_{x \to 0} \left(1 + \dfrac{1}{x}\right)^x = ?$
- A   Zero
- B e^0
- C e
- D e^{-1}

(v) Derivative of $\sin^2\sqrt{x} + \cos^2\sqrt{x}$ is:
- A $\tan x \sec x$
- B $\dfrac{1}{2}\sin x$
- C $\dfrac{\sqrt{x}}{2\cos x}$
- D $3\sin^2 x$

(vi) $\dfrac{d}{dx} a^x = ?$
- A $a^x \ln a$
- B $a^x \ln a$
- C $a^x \ln a$
- D a^x

(vii) Notation used for derivative of $y = f(x)$ is:
- A $\int y\, dx$
- B $\dfrac{dy}{dx}$
- C $f'^{-1}(x)$
- D $D^2 f(x)$

(viii) If $y = (2x + 5)^{\frac{1}{2}}$, then y_2 will be:
- A $\dfrac{3}{2\sqrt{x}5}$
- B $3(2x + 5)^{\frac{1}{2}}$
- C $\sqrt{2x+5}$
- 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 $\dfrac{x^3}{3} + x + c$
- B $\dfrac{10}{33}$
- C   10
- D $\dfrac{10}{3}$

(xi) Solution of $y\,dx + x\,dy = 0$ 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 $m_1 = m_2$
- D $m_1 = \dfrac{1}{m_2}$

(xiii) The equation of the straight line whose slope is 2 and y-intercept is 5 is:
- A $y = 5 - m$
- 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 unite
- 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 $\dfrac{g}{f}$

(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 $v = 3i + 4j$:
- A $3(5)$
- B $4(5)$
- C $\dfrac{3}{5}i + \dfrac{4}{5}j$
- D $3i + 4j$

(xx) Attitudes of a triangle are always:
- A   Perfect squares
- B   Parallel
- C   Perpendicular
- D   Concurrent

MATHEMATICS HSSC-II (2016)

Time allowed: 2:35 Hours   Total Marks : 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.

(i) Evaluate $\lim_{x \to 0} \dfrac{1 - \cos x}{\sin^2 x}$

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

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

(iv) If $y = \tan x + \sqrt{\tan x + \sqrt{\tan x + \cdots \infty}}$
Prove that $(2y - 1)\dfrac{dy}{dx} = \sec^2 x$

(v) Find $\dfrac{dy}{dx}$ if $y = x^{\cos x}$

(vi) Evaluate $\int \sqrt{x}(\sqrt{x} + 1) dx$ $(x > 0)$

(vii) Evaluate $\int \dfrac{1}{x^2 - 1} dx$

(viii) Show that 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 $-\dfrac{3}{2}$

(x) Find the equation of the circle whose ends of diameter 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 point of intersection of the given conic $3x^2 - 4y^2 = 12$ and $3y^2 - 2x^2 = 7$

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

SECTION – C

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

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

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

Q.6 Find the interior angles 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 $-x \leq 8$; $-y \leq 4$; $x > 0$; $y > 0$

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

Q.9 Find a unit vector perpendicular to the plane containing a and b. Also find sine of angle between them.
$a = 2i - 6j - 3k$;
$b = 4i + 3j - k$