NOTE: There are three sections of this paper. Carefully read the instructions for each section and attempt accordingly. Attempt all questions of Section-A and return it to the Superintendent within given time, even if you have not attempted any question. Select the correct choice and write only A, B, C or D, whichever is appropriate, in the answer box. No marks will be awarded for cutting/erasing or overwriting

SECTION-A

Time: 20 Minutes   Marks: 20

1. F(x) is anti derivative of f(x) if F'(x) = ... A) f(x), B) f(x²), C) $f\left(\frac{x}{2}\right)$, D) none of these [   ]

2. Solution set of $(x-3)e^x = 0$ is .... A) {3,0}, B) {3}, C) {0}, D) none of these [   ]

3. The derivative of $x^2 + y^2 = a$ is .... A) $\frac{-x}{y}$, B) $2x+2y=0$, C) $\frac{y}{x}$, D) $\frac{y^2}{x^2}$ [   ]

4. If $f(x) = \sqrt{x}$ then $f'(0) = $ .... A) -1, B) 0, C) ∞, D) none of these [   ]

5. A function f(x) is strictly increasing on (a,b) if .... A) $f'(x)<0$, B) $f'(x)=0$, C) $f'(x)>0$, D) none [   ]

6. The graph of a function f(x) is concave upward on (a,b) if .... A) $f''(x)>0$, B) $f''(x)<0$, C) $f''(x)=0$, D) all these [   ]

7. A suitable substitution for $\sqrt{a^2+x^2}$ in the integration method of substitution is .... A) $x=a\sec\theta$, B) $x=a\sin\theta$, C) $x=a\tan\theta$, D) all these [   ]

8. $\int \frac{\sec^2 x}{\tan x}dx = $ .... A) $\frac{\sec^3 x}{3}+c$, B) $\ln|\cot x|+c$, C) $\ln|\tan x|+c$, D) none of these [   ]

9. The distance from the origin (0(0,0) to point $p(x_1,y_1)$ is .... A) $\sqrt{x_1^2-y_1^2}$, B) $\sqrt{x_1^2+y_1^2}$, C) $\sqrt{(x_1-y_1)^2}$, D) $\sqrt{(x_1+y_1)^2}$ [   ]

10. The equation of the y-axis is .... A) y=0, B) y=x, C) x=0, D) none of these [   ]

11. Any line equation in two variables that passes through the origin is called a .... equation.
A) homogenous, B) quadratic, C) non-homogenous, D) joint [   ]

12. The ratio of vertical rise to horizontal run is called .... A) intercept, B) dispersion, C) direction, D) slope [   ]

13. If a point P(x,y) is out sides of the circle then there will be .... tangents. A) 1, B) 2, C) 0, D) 3 [   ]

14. An angle in a semicircle is a .... angle. A) acute, B) obtuse, C) right, D) none of these [   ]

15. In hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$, $c^2 = $ .... A) a^2-b^2, B) a^2+b^2, C) b^2-a^2, D) none of these [   ]

16. If e>1, then the conic is .... A) circle, B) ellipse, C) parabola, D) hyperbola [   ]

17. The highest order derivative occurring in the differential equation is .... of the differential equation.
A) degree, B) order, C) solution, D) both A&C [   ]

18. For $\frac{ds}{dt} = 30$, S(0) = 0 then S(t) = ... A) $-32t$, B) $30t+A$, C) $-16t$, D) $32t$ [   ]

19. The function $f(x,y) = 2xy + y^2$ is homogenous function of degree .... A) 0, B) 1, C) 2, D) none [   ]

20. The root of the function lie in the inverted {a,b} if .... A) f(a), f(b) = 0, B) f(a), f(b)<0, C) f(a), f(b)>0, D) none of these [   ]

Time: 2 Hours 40 Minutes

SECTION-B

Marks: 50

1. Attempt any ten of the following. All carry equal marks.

   i. Evaluate $\lim\limits_{x \to 0} \dfrac{\sec x - 1}{x \sec x}$

   ii. Differentiate $y = \dfrac{5}{2x - 4}$ by first principle rule.

   iii. Find the critical values of the function $f(x) = 3x^{4/3} - 12x^{1/3}$

   iv. Evaluate $\lim\limits_{t \to 2}[(2i - tj + e^t k) \times (t^4 i + 4 \sin t j)]$

   v. Evaluate definite integral $\displaystyle\int_{-1}^{7} \dfrac{x}{\sqrt{x + 2}} dx$

   vi. Find the perpendicular from a point $P(3, -4)$ to a line $4x - 3y + 6 = 0$

   vii. For what value of n the line $3x + 4y + n = 0$ touches the circle $x^2 + y^2 - 4x - 6y - 12 = 0$

   viii. Find an equation for a parabola whose focal chord has length 6, if it is known that the parabola has focus $(4, -2)$ and its directrix is parallel to the y-axis.

   ix. Determine the equation of the orthogonal trajectory of the family of the curve $e^x \sin y = c$

   x. Find the partial derivatives f_x and f_y for $f(x,y) = \sin x^2 \cos y$

   xi. Approximate by trapezoidal rule the definite integral $I = \displaystyle\int_{0}^{2} \sqrt{1 + x^2} dx$ in $n = 6$ subinterval.

   xii. Evaluate the integral $\displaystyle\int \sqrt{a^2 - x^2} dx$

   xiii. Differentiate the function $f(x) = \log_{10} \sqrt{(x^2 - 7x)} + x^3$

SECTION-C

Marks: 30

NOTE: Attempt any three of the following questions. All questions carry equal marks.

2. i. Evaluate the indefinite integral $\displaystyle\int \dfrac{2x + 5}{x^2 + 4x + 5} dx$

   ii. Find a joint equation of the straight line that passes through the origin and perpendicular to the lines represented by $2x^2 - 5xy + 3y^2 = 0$

3. i. Solve the equation for the unknown x: $\log_b x + \log_b(x - 4) = \log_b 21$

   ii. Use Maclaurin's series to approximate the value of a function $f(x) = \ln_e(1 + x)$ at a point $x_0 = 0$

4. i. Write the equation of the hyperbola with vertices at $(-3,1)$, $(-3,3)$ and that passes through the point with coordinates $(0,4)$

   ii. Find the general solution of the differential equation $e^x \dfrac{dy}{dx} + y^2 = 0$

5. i. Find the equation of the tangents to the circle $x^2 + y^2 = 25$ which are parallel to the straight line $3x + 4y + 3 = 0$

   ii. Verify Euler's theorem for the function $z = f(x,y) = ax^2 + 2hxy + by^2$