1. For any differentiable function y = f(x), the value of $\frac{d^2y}{dx^2}+\left(\frac{dy}{dx}\right)^3\frac{d^2x}{dy^2}$ is

(a) Always zero (b) Always non-zero
(c) Equal to $2y^2$ (d) Equal to x^2

2. The degree of the differential equation, of which $y^2 = 4a(x + a)$ is a solution, is -

(a) 1 (b) 2 (c) 3 (d) None of these

3. The degree of the differential equation whose general solution is given by

$y = (c_1 + c_2)\cos(x + c_3) - c_4 e^{x+c_5}$ where c_1, c_2, c_3, c_4, c_5 are arbitrary constants, is -

(a) 5 (b) 4
(c) 1 (d) 2

4. The equation of the curve passing through the point $\left(a,-\frac{1}{a}\right)$ and satisfying the differential equation $y - x\frac{dy}{dx} = a\left(y^2+\frac{dy}{dx}\right)$ is -

(a) $(x + a)(1 + ay) = -4a^2y$ (b) $(x + a)(1 - ay) = 4a^2y$
(c) $(x + a)(1 - ay) = -4a^2y$ (d) None of these

5. Solution of the equation $Xdy = \left(y + x\frac{f(y/x)}{f'(y/x)}\right)dx$ is -

(a) $f\left(\frac{x}{y}\right) = cy$ (b) $f\left(\frac{y}{x}\right) = cx$

(c) $f\left(\frac{y}{x}\right) = cxy$ (d) None of these

6. If $y' = \frac{x-y}{x+y}$, then its solution is -

(a) $y^2 + 2xy - x^2 = c$ (b) $y^2 + 2xy + x^2 = c$
(c) $y^2 - 2xy - x^2 = c$ (d) $y^2 - 2xy + x^2 = c$

7. If $y = (x + \sqrt{1+x^2})^n$, then $(1 + x^2)\frac{d^2y}{dx^2} + x\frac{dy}{dx}$ is -

(a) n^2y (b) $-n^2y$ (c) $-y$ (d) $2n^2y$

8. Solution of the equation $x\,dx + y\,dy + \frac{x\,dy - ydx}{x^2+y^2} = 0$ is -

(a) $y = x\tan\left(\frac{c+x^2+y^2}{2}\right)$

(b) $x = y\tan\left(\frac{c+x^2+y^2}{2}\right)$

(c) $y = x\tan\left(\frac{c-x^2-y^2}{2}\right)$

(d) None of these

9. Solution of the equation $xdy - [y + xy^3(1 + \log x)]dx = 0$ is -

(a) $\frac{-x^2}{y^2} = \frac{2x^3}{3}\left(\frac{2}{3}+\log x\right) + C$

(b) $\frac{x^2}{y^2} = \frac{2x^3}{3}\left(\frac{2}{3}+\log x\right) + C$

(c) $\frac{-x^2}{y^2} = \frac{x^3}{3}\left(\frac{2}{3}+\log x\right) + C$

(d) None of these

10. The solution of the equation $\frac{d^2y}{dx^2} = e^{-2x}$ is -

(a) $\frac{e^{-2x}}{4}$ (b) $\frac{e^{-2x}}{4} + cx + d$

(c) $\frac{e^{-2x}}{4} + cx^2 + d$ (d) $\frac{1}{4}e^{-2x} + cx^3 + d$

11. If sin x is an integrating factor of the differential equation $\frac{dy}{dx} + Py = Q$, then P can be -

(a) log sin x (b) cot x (c) sin x (d) log cos x

12. Solution of the equation $(xy^4 + y)dx - x\,dy = 0$ is -

(a) $4x^4y^3 + 3x^3 = cy^3$ (b) $3x^3y^4 + 4y^3 = cx^3$
(c) $3x^4y^3 + 4x^3 = cy^3$ (d) None of these

13. Solve $(p - x)(p - e^x)(p - 1/y) = 0$; where $p = \frac{dy}{dx}$:

(a) $(y - \frac{x^2}{2} + c)(y - e^x + c)(\frac{y^2}{2} - x + c) = 0$

(b) $(y + \frac{x^2}{2} + c)(y - e^x + c)(\frac{y^2}{2} - x + c) = 0$

(c) $(y - \frac{x^2}{2} + c)(y - e^x + c)(\frac{y^2}{2} + x + c) = 0$

(d) None of these

14. Solve $xy^2(p^2 + 2) = 2py^3 + x^3$

(a) $(y^2 + x^2 - c)(y^2 - x^2 - cx^4) = 0$
(b) $(y^2 - x^2 - c)(y^2 - x^2 - cx^4) = 0$
(c) $(y^2 - x^2 - c)(y^2 - x^2 + cx^4) = 0$
(d) None of these

15. Solve $y = 2px - p^2$:

(a) $\frac{2}{3}p + cp^{-1}$ (b) $\frac{2}{3}p + cp^{-2}$

(c) $\frac{2}{3}p + cp^{-3}$ (d) None of these

16. Solve $xp^2 - 2yp + ax = 0$:

(a) $y^2 = 3cx + c^2$ (b) $y^2 = cx + c^2$
(c) $2y = cx^2 + a/c$ (d) None of these

17. If the population of a country doubles in 50 years in how many years will it triple under the assumption that the rate of increase is proportional to the number of inhabitants -

(a) 79 years (b) 78 years (c) 76 years (d) 77 years

18. The general solution of $\frac{dy}{dx} = \frac{2x-y}{x+2y}$ is -

(a) $x^2 - xy + y^2 = c$ (b) $x^2 - xy - y^2 = c$
(c) $x^2 + xy - y^2 = c$ (d) $x^2 + xy^2 = c$

19. If $y = f(x)$ is the equation of the curve and its differential equation is given by $\frac{dy}{dx} = \frac{x+2}{y+3}$, then the equation of the curve, if it passes through (2, 2), is -
(a) $x^2 - y^2 + 4x - 6y + 4 = 0$ (b) $x^2 - y^2 + 4x + 6y = 0$
(c) $x^2 - y^2 - 4x - 6y = 0$ (d) $x^2 - y^2 - 4x - 6y - 4 = 0$

20. Solution of differential equation $\frac{dt}{dx} = \frac{t\left(\frac{d}{dx}(g(x))\right) - t^2}{g(x)}$ is -
(a) $t = \frac{g(x)+c}{x}$ (b) $t = \frac{g(x)}{x} + c$
(c) $t = \frac{g(x)}{x+c}$ (d) $t = g(x) + x + c$

21. Solution of differential equation $t = 1 + (ty)\frac{dy}{dt} + \frac{(ty)^2}{2!}\left(\frac{dy}{dt}\right)^2 + \ldots \infty$ is -
(a) $y = \pm\sqrt{(\log t)^2 + c}$
(b) $ty = t^{y+c}$
(c) $y = \log t + c$
(d) $y = (\log t)^2 + c$

22. The solution of the differential equation $(1 + y^2) + (x - e^{\tan^{-1} y})\frac{dy}{dx} = 0$ is -
(a) $(x - 2) = k\, e^{\tan^{-1} y}$
(b) $2x\, e^{\tan^{-1} y} = e^{2\tan^{-1} y} + k$
(c) $x\, e^{\tan^{-1} y} = \tan^{-1} y + k$
(d) $x\, e^{2\tan^{-1} x}\, y = e^{\tan^{-1} y} + k$

23. The solution of $y = x\frac{dy}{dx} + \frac{dy}{dx} - \left(\frac{dy}{dx}\right)^2$, is -
(a) $y = (x - 1)^2$ (b) $4y = (x + 1)^2$
(c) $(y - 1)^2 = 4x$ (d) None of these

24. A normal is drawn at a point P (x, y) of a curve. It meets the x-axis and the y-axis in point A and B, respectively, such that $\frac{1}{OA} + \frac{1}{OB} = 1$, where O is the origin, find the equation of such a curve passing through (5, 4) -
(a) $(x - 1)^2 + (y - 1)^2 = 16$ (b) $(x - 1)^2 + (y - 1)^2 = 25$
(c) $(x - 2)^2 + (y - 2)^2 = 9$ (d) None of these

25. The solution of the equation $\frac{d^2y}{dx^2} = e^{-2x}$ is -
(a) $y = \frac{1}{4}e^{-2x}$
(b) $y = \frac{1}{4}e^{-2x} + cx + d$
(c) $y = \frac{1}{4}e^{-2x} + cx^2 + d$
(d) $y = \frac{1}{4}e^{-2x} + c + d$

26. Degree of differential equation $e^{dy\backslash dx} = x$ is -
(a) 1 (b) 2 (c) 3 (d) None of these

27. The solution of $\frac{dy}{dx} = \frac{ax+h}{by+k}$ represents a parabola when -
(a) $a = 0, b = 0$ (b) $a = 1, b = 2$
(c) $a = 0, b \neq 0$ (d) $a = 2, b = 1$

28. The order and degree of the differential equation $\left(1 + 3\frac{dy}{dx}\right)^{\frac{2}{3}} = 4\frac{d^3y}{dx^3}$ are -
(a) 1, $\frac{2}{3}$ (b) 3, 1
(c) 3,3 (d) 1, 2

29. The differential equation of the family of circles passing through the points (0, 0) and (a, 0) is
(a) $(x^2 - y^2 - ax)\frac{dy}{dx} = (2x - a)\, y$
(b) $(x^2 + y^2)\frac{dy}{dx} = (2x - a)\frac{dy}{dx}$
(c) $(x^2 + y^2)\frac{dy}{dx} = (2a - x)y$
(d) None of these

30. Solution of the differential equation $\frac{dy}{dx} + \frac{y}{x} = x^2$ under the condition that $y = 1$ when $x = 1$, is
(a) $4xy = x^3 + 3$ (b) $4xy = x^4 + 3$
(c) $4xy = x^2 + 3$ (d) $4xy = y^3 + 3$