MATHS

JEE (MAIN AND ADVANCED MATHEMATICS) FOR BOARD AND COMPETITIVE EXAMS

DIFFERENTIAL EQUATIONS

Example

1. Find the order of the differential equation $\frac{dy}{dx} = \sin x$

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2. Find the order of the differential equation $\frac{d^2y}{dx^2} - \frac{dy}{dx} - 6y = 0.$

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3. Find the order of the differential equation $\frac{d^3y}{dx^3} + 2\left(\frac{d^2y}{dx^2}\right)^2 + \frac{dy}{dx} + y = 0$

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4. Find the degree of the differential equation $\frac{d^2y}{dx^2} - \frac{dy}{dx} - 6y = 0$

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5. Find the degree of the differential equation $\left(\frac{d^3y}{dx^3}\right) + 2\left(\frac{d^2y}{dx^2}\right) + \frac{dy}{dx} + y = 0.$

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6. Find the degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^{\frac{2}{3}} - \frac{dy}{dx} - y = 0$

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7. Verify that the function $y = \lambda x + \frac{\mu}{x}$ where λ, μ are arbitary constants is a solution of the differential equation $x^2 y'' + xy' - y = 0$.

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8. Verify that $y = e^{-2x}$ is a solution of the differential equation $y''' + 4y'' + 3y' - 2y = 0$.

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9. Verify that $y^2 = 4(1 - x^2)$ is a solution of the differential equation $xyy'' + x(y')^2 - yy' = 0$

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10. Form the differential equation of family of circles having center at origin.

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11. Form the differential equation representing the family of curves $y = a \sin x + b \cos x$, where a, b are the arbitrary constants.

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12. Form the differential equation of family of curves $y = ae^{2x} + be^{3x}$, where a, b are arbitrary constants.

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13. Find the differential equation of all the ellipses whose center is at origin and axis are co-ordinate axis.

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14. Solve the differential equation (2 + x) dy = (1 + y) dx

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15. Find the general solution of the differential equations $e^x \tan y dx + (1 - e^x)\sec^2 y dy = 0$

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16. Solve the differential equation $(1 + \cos 2x) + (1 - \cos 2y)\frac{dx}{dy} = 0$

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17. In a bank, principal increases continuously at the rate of 5% per year. In how many years Rs 1000 double itself?

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18. Show that the differential equation $x \sin\left(\frac{y}{x}\right)\frac{dy}{dx} = y\sin\left(\frac{y}{x}\right) + x$ is homogeneous. Also find its general solution.

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19. Show that the differential equation $\left(y\sin^2\left(\frac{x}{y}\right) - x\right)dy + ydx = 0$ is homogeneous differential equation. Also find its general solution.

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20. Find the particular solution of the differential equation.

$\frac{dy}{dx} = \frac{\left(x\sin\left(\frac{x}{y}\right) - y\cos\left(\frac{x}{y}\right)\right)y}{\left(y\cos\left(\frac{x}{y}\right) + x\sin\left(\frac{x}{y}\right)\right)x}$, given that y = 1 when $x = \frac{\pi}{4}$

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21. Show that $y^2dx + (xy + x^2)dy = 0$ is a homogeneous differential equation. Also find its general solution.

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22. Find the general solution of the differential equation $\frac{dy}{dx} = \frac{y}{x} + \cos\left(\frac{y}{x}\right)$.

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23. Find the general solution of the differential equation $\frac{dy}{dx} + 3y = \cos x$

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24. Solve the differential equation $(1 + x^2)dy + 2xydx = \sin^2 xdx$

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25. Solve the differential equation $\cos^2 ydx + xdy = \tan ydy$.

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26. Find the equation of a curve passing through (1,1) and whose slope of tangent at a point (x, y) is $-\frac{x}{y}$.

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27. Find the equation of the curve passing through (1, 1) and the slope of the tangent to curve at a point (x, y) is equal to the twice the sum of the abscissa and the ordinate.

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28. Solve the following differential equation:

$$\sqrt{1+x^2+y^2+x^2y^2}+xy\frac{dy}{dx}=0$$

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29. Solve: $\left(x^2+2xy+y^2+1\right)\frac{dy}{dx}=2(x+y)$

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30. Solve the following differential equation: $\frac{dy}{dx}=\sec(x+y)$

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31. Solve (i) $xdx+ydy+\frac{xdy-ydx}{x^2+y^2}=0$

(ii) $y(1+xy)dx-xdy=0$

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32. Solve $\left(x^2+y^2\right)\frac{dy}{dx}=2xy$

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33. Solve $\frac{dy}{dx}=\frac{x+2y-3}{2x+y-3}$

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34. Solve the following differential equation:

$\left(1+y^2\right)dx=\left(\tan^{-1}y-x\right)dy$

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35. Solve : $\frac{dy}{dx}-\frac{2y}{x}=y^4$

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36. The solution of (dy)/(dx)+x sin 2y=x^(3) cos^(2) y, is

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37. The curves for which the length of the normal is equal to the length of the radius vector is/are

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38. Show that the equation of the curve whose slope at any point is equal to y + 2x and which passes through the origin is $y = 2(e^x - x - 1)$.

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39. Find the orthogonal of the family of circles $x^2 + y^2 = 2ax$ each of which touches the y-axis at origin.

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40. solve $\frac{xdx+ydy}{xdy-ydx}=\sqrt{\frac{a^2-x^2-y^2}{x^2+y^2}}$

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Try Yourself

1. Find the order of the following differential equations:

$$\left(\frac{d^2y}{dx^2}\right)^2+3\left(\frac{dy}{dx}\right)^3=5x^2$$

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2. Find the order of the following differential equations:

$$\frac{d^2y}{dx^2}=\sin x$$

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3. Find the order of the following differential equations:

$$\frac{d^3y}{dx^3} + \frac{3dy}{dx} - y = 0$$

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4. Find the degree of the following :

$$x^2y'' - xy(y')^2 + y = 0$$

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5. Find the degree of the following :

$$\left(1 + \frac{ds}{dt}\right)^{\frac{3}{2}} = 5\frac{d^2s}{dt^2}$$

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6. Find the degree of the following :

$$\cos^{-1}\left(\frac{dy}{dx}\right) = \frac{d^2y}{dx^2}$$

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7. In the following questions verify that the given function is a solution of the given differential equation :

$y = c_1 \sin x + c_2 \cos x, \frac{d^2y}{dx^2} + y = 0$

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8. In the following questions verify that the given function is a solution of the given differential equation :

$y = e^x + e^{2x} + e^{-3x}, y''' - 7y' + 6y = 0$

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9. In the following question verify that the given function is a solution of the given differential equation :

$y = a\cos(wx + y), yy''' - y.y'' = 0$

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10. Form the differential equation of the family of curves represented by $y = a\cos(bx + c)$ where a, b, c are the arbitrary constants.

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11. Form the differential equation of the family of all the parabolas whose vertex is at origin and axis is y-axis.

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12. Find the differential equation of all the circles whose radius is one unit.

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13. Find the differential equation of the circles represented by $y = k(x + k)^2$ where k is an arbitrary constant.

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14. Find the general solution of the equation given by $\frac{dy}{dx} + \frac{1 + y^2}{1 + x^2} = 0$

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15. Find the equation of the curve passing through origin and satisfying the differential equation $2xdy = \left(2x^2 + x\right)dx$.

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16. Solve the differential equation $x \sec^2 ydy = (xInx + 1)e^x dx$.

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17. In how many years the amount of Rs 2,000 triples if the rate is which it increases continuously is 5% ?

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18. Show that the differential equation $x^2\frac{dy}{dx} = x^2 + xy + y^2$ is homogeneous differential equation. Also find its general solution.

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19. Show that $(3xy + x^2)dy + (y^2 + xy)dx = 0$ is homogeneous differential equation. Also find its general solution.

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20. Find the general solution of the equation $x - y\frac{dx}{dy} = y + x\frac{dx}{dy}$.

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21. Solve the following differential equation :

$$\left(1+e^{\frac{y}{x}}\right)dy+e^{\frac{y}{x}}\left[1-\frac{y}{x}\right]dx=0(x\neq 0)$$

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22. Solve the differential equation $\frac{dy}{dx}+2y=x.$

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23. Find the general solution of the differential equation $(x-1)\frac{dy}{dx}+xy=(x+1)^2$

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24. Solve the differential equation $y^2\frac{dx}{dy}+x=1.$

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25. Find the equation of the curve passing through the point (0,0) and whose slope of the normal at a point (x, y) is equal to the sum of the ordinate and the product of the abscissa and ordinate of that point.

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26. A curve has a property that the slope of the tangent at a point (x, y) is $\frac{y}{x+2y^2}$ and it passes through (1, 1). Find the equation of the curve.

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Assignment Section A Competition Level Questions

1. If m, n are order and degree of differential equation $y\frac{dy}{dx}+x^3\left(\frac{d^2y}{dx^2}\right)-xy=\cos x$ then

A. $m<n$

B. m= n

C. $m > n$

D. m-n = 3

Answer: C

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2. Write degree of the differential equation $\left(1+\frac{dy}{dx}\right)^3=\left(\frac{d^2y}{dx^2}\right)^2$.

A. 4

B. $\frac{3}{2}$

C. Not defined

D. 2

Answer: D

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3. The degree of the differential equation of the curve $(x-a)^2+y^2=16$ will be

A. 0

B. 2

C. 3

D. 1

Answer: B

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4. If $y=A\sin(\theta+B)$, where A and B are arbitrary constant then to form a differential equation how many times it should be differentiated ?

A. 1

B. 2

C. 3

D. Cannot be formed

Answer: B

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5. Which of the following differential equations has y = x as one of its particular solution?

(A) $\frac{d^2y}{dx^2} - x^2\frac{dy}{dx} + xy = x$

(B) $\frac{d^2y}{dx^2} + x\frac{dy}{dx} + xy = x$

(C) $\frac{d^2y}{dx^2} - x^2\frac{dy}{dx} + xy = 0$

(D) $\frac{d^2y}{dx^2} + x\frac{dy}{dx} + xy = 0$

A. $\frac{d^2y}{dx^2} - x^2\frac{dy}{dx} + xy = x$

B. $\frac{d^2y}{dx^2} - x^2\frac{dy}{dx} + xy = 0$

C. $\frac{d^2y}{dx^2} + x^2\frac{dy}{dx} + xy = x$

D. $\frac{d^2y}{dx^2} + x\frac{dy}{dx} + xy = 0$

Answer: B

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6. The differential equation for which $y = a\cos x + b\sin x$ is a solution is

A. $\frac{d^2y}{dx^2} + y = 0$

B. $\frac{d^2y}{dx^2} - y = 0$

C. $\frac{d^2y}{dx^2} + (a+b)y = 0$

D. $\frac{d^2y}{dx^2} + (a-b)y = 0$

Answer: A

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7. The solution of $\frac{dy}{dx} + y = e^{-x}, y(0) = 0$ is

A. $y = e^{-x}(x-1)$

B. $y = xe^{x}$

C. $y = xe^{-x} + 1$

D. $y = xe^{-x}$

Answer: D

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8. Which of the following is a general solution of $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = 0$

A. $y = (Ax + B)e^{x}$

B. $y = (Ax + B)e^{-x}$

C. $y = A\cos x + B\sin x$

D. $y = Ae^{x} + Be^{-x}$

Answer: A

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9. The solution of differential equation xdy-ydx=0 represents

A. A rectangular hyperbola

B. Parabola whose vertex is at origin

C. Straight line passing through origin

D. A circle whose centre is at origin

Answer: C

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10. Integrating factor of differential equation $\cos x \frac{dy}{dx} + y \sin x = 1$ is (a) $(b)(c)\cos x(d)$ (e) (b) $(f)(g)\tan x(h)$ (i) (c) $(d)(e)\sec x(f)$ (g) (d) $(h)(i)\sin x(j)$ (k)

A. cos x

B. tan x

C. sec x

D. sin x

Answer: C

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11. Solution of the differential equation $\tan y.\sec^2 x dx + \tan x.\sec^2 y dy = 0$ is

A. tan x + tan y = k

B. tan x - tan y = k

C. $\frac{\tan x}{\tan y} = k$

D. tanx.tany = k

Answer: D

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12. The integrating factor of $\frac{xdy}{dx} - y = x^4 - 3x$ is

A. x

B. log x

C. $\frac{1}{x}$

D. $-x$

Answer: C

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13. The general solution of differential equation $(e^x + 1)ydy = (y + 1)(e^x)dx$is

A. $y + 1 = k(e^x + 1)$

B. $y + 1 = e^x + k$

C. $y = \log\{k(y + 1)(e^x + 1)\}$

D. $y = \log\left(\frac{e^x + 1}{y + 1}\right) + k$

Answer: C

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14. The solution of differential equation $\frac{dy}{dx} = e^{x-y} + x^2 e^{-y}$ is

A. $y = e^{x-y} - x^2 e^{-y} + c$

B. $e^y - e^x = \frac{x^3}{3} + c$

C. $e^x + e^y = \frac{x^3}{3} + c$

D. $e^x - e^y = \frac{x^3}{3} + c$

Answer: B

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15. The solution of differential equation $\frac{dy}{dx} + \frac{2xy}{1 + x^2} = \frac{1}{(1 + x^2)^2}$ is

A. $y\left(1+x^2\right)=c+\tan^{-1}x$

B. $\frac{y}{1+x^2}=c+\tan^{-1}x$

C. $y\log\left(1+x^2\right)=c+\tan^{-1}x$

D. $y\left(1+x^2\right)=c+\cos^{-1}x$

Answer: A

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16. The number of solutions of $\frac{dy}{dx}=\frac{y+1}{x-1}$, Then $y(1)=2$ is

A. None

B. One

C. Two

D. Infinite

Answer: A

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17. The differential equation $y\frac{dy}{dx} + x = C$ represents

A. Family of hyperbolas

B. Family of parabolas

C. Family of ellipse

D. Family of circles

Answer: D

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18. The integrating factor of differential equation $\frac{dy}{dx} + y = \frac{1+y}{x}$ is

A. $\frac{x}{e^x}$

B. $\frac{e^x}{x}$

C. ex^x

D. e^x

Answer: B

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19. The differential equation of the family of curves of $x^2 + y^2 - 2ay = 0$ where a is arbitary constant, is

A. $\left(x^2 - y^2\right)\frac{dy}{dx} = 2xy$

B. $2\left(x^2 + y^2\right)\frac{dy}{dx} = xy$

C. $\left(x^2 - y^2\right)\frac{dy}{x} = xy$

D. $\left(x^2 + y^2\right)\frac{dy}{dx} = 2xy$

Answer: A

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20. The general solution of $\frac{dy}{dx} = 2xe^{x^2-y}$ is

A. $e^{x^2-y} = c$

B. $e^{-y} + e^{x^2} = c$

C. $e^{y} = e^{x^2} + c$

D. $e^{x^2+y} = c$

Answer: C

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21. The curve in which the slope of the tangent at any point equal the ratio of the abscissa to the ordinate of the point is

A. An ellipse

B. Parabola

C. Circle

D. Rectangular hyperbola

Answer: D

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22. The solution of equation $(2y-1)dx-(2x+3)dy=0$ is

A. $\left(\frac{2x-1}{2y+3}\right)=k$

B. $\frac{2y+1}{2x-3}=k$

C. $\frac{2x+3}{2y-1}=k$

D. $\frac{2x-1}{2y-1}=k$

Answer: C

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23. Let $f(x)=\sec x\cdot f'(x), f(0)=1,$ then $f\left(\frac{\pi}{6}\right)$ is equal to

A. $\frac{1}{\sqrt{e}}$

B. $\sqrt{e}$

C. $e^{\frac{3}{2}}$

D. $\frac{1}{2\sqrt{e}}$

Answer: B

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24. The integrating factor of $\left(1+y^2\right)dx = \left(\tan^{-1}y - x\right)dy$ is -

A. $\tan^{-1}y$

B. tan y

C. $e^{\tan^{-1}y}$

D. $e^{\tan y}$

Answer: C

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25. The order & the degree of the differential equation whose general solution is, $y = c(x - c)^2$, are respectively

A. 1,1

B. 1,2

C. 1,3

D. 2,1

Answer: C

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26. The solution of the differential equation $\frac{dy}{dx} = \cos(x - y)$ is

A. $y + \cot\left(\frac{x - y}{2}\right) = c$

B. $x + \cot\left(\frac{x - y}{2}\right) = c$

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

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

Answer: B

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27. $\frac{dy}{dx} = \frac{xy+y}{xy+x}$, then the solution of differential equation is

A. $y = xe^x + c$

B. $y = e^x + c$

C. $y = cxe^{x-y}$

D. y = x+c

Answer: C

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28. The differential equation ydy+xdx = dx represents

A. A set of circles with centre on x axis

B. A set of concentric circles

C. A set of ellipse

D. A set of circles with centre on y axis

Answer: A

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29. The integrating factor of $\cos^2 x \frac{dy}{dx} + y = \tan x$ is

A. $e^{\sin x}$

B. $e^{\cos x}$

C. $e^{\tan x}$

D. $e^{\cot x}$

Answer: C

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30. The integrating factor of $(dy) + 2y = xe^{4x}$ is

A. e^{2x}

B. x^2

C. e^{4x}

D. e^x

Answer: A

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31. The general solution of differential equation $\frac{dy}{dx} = e^{\frac{x^2}{2}} + xy$ is

A. $y = ce^{-\frac{x^2}{2}}$

B. $y = ce^{\frac{x^2}{2}}$

C. $y = (x + c)e^{\frac{x^2}{2}}$

D. $y = (c - x)e^{\frac{x^2}{2}}$

Answer: C

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32. Family $y = Ax + A^3$ of curves will correspond to a differential equation of order :

A. 3

B. 2

C. 1

D. Not defined

Answer: C

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33. The solution of differential equation $\cos x \sin y dx + \sin x \cos dy = 0$

A. $\frac{\sin x}{\sin y} = c$

B. `sinx.siny = c

C. sinx + sin y = c

D. cos x. cos y = c

Answer: B

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34. $\frac{dy}{dx} = \frac{1+y^2}{1+x^2}$

A. $y = \tan^{-1} x + c$

B. $\tan^{-1} y = x + c$

C. $(y - x) = c(1 + xy)$

D. tan xy = c

Answer: C

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35. The solution of differential equation ydx + (x+xy)dy = 0 is

A. $y + \log\left(\frac{y}{x}\right) + x = 0$

B. y + log xy + c = 0

C. y - log xy + c = 0

D. $x + \log\left(\frac{x}{y}\right) + c = 0$

Answer: B

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Assignment Section B Objective Type Questions One Option Is Correct

1. The degree of the differential equation

$$\left(\frac{d^3y}{dx^3}\right)^{2/3} + 4 - 3\frac{d^2y}{dx^2} + 5\frac{dy}{dx} = 0, \text{ is}$$

A. 1

B. 2

C. 3

D. Not defined

Answer: C

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2. The degree of the differential equation corresponding to the family of curves $y = a(x + a)^2$, where a is an arbitrary constant is

A. 1

B. 2

C. 3

D. 4

Answer: C

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3. The differential equation representing the family of curves $y^2 = 2c(x + \sqrt{c})$, where c is a positive parameter, is of (a) order 1 (b) order 2 (c) degree 3 (d) degree 4

A. Order 1, degree 3

B. Order 1, degree 2

C. Order 2, degree 3

D. Order 2, degree 2

Answer: A

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4. The differential equation of the family of curves $y = P(x + Q)^2$ is

A. $yy'' = (y')^2$

B. $2yy'' = (y')^2$

C. 2y y'' = y' + y

D. 2y y'' = y' - y

Answer: B

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5. The differential equation of all circles passing through the origin and having their centres on the x-axis is (1) $x^2 = y^2 + xy\frac{dy}{dx}$ (2) $x^2 = y^2 + 3xy\frac{dy}{dx}$ (3) $y^2 = x^2 + 2xy\frac{dy}{dx}$ (4) $y^2 = x^2 - 2xy\frac{dy}{dx}$

A. $y^2 = x^2 - 2xy\frac{dy}{dx}$

B. $x^2 = y^2 + xy\frac{dy}{dx}$

C. $x^2 = y^2 + 3xy\frac{dy}{dx}$

D. $y^2 = x^2 + 2xy\frac{dy}{dx}$

Answer: D

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6. The solution of $\frac{dy}{dx} = \frac{ax + h}{by + k}$ represent a parabola when

A. a = 0, b = 0

B. a = 1, b = 2

C. a = 0, $b \neq 0$

D. a = 2, b = 1

Answer: C

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7. The order of the differential equation of ellipse whose major and minor axes are along x-axis and y-axis respectively, is

A. $xyy_2 - xy_1^2 + yy_1 = 0$

B. $xyy_2 + xy_1^2 - yy_1 = 0$

C. $xyy_2 + xy_1^2 + yy_1 = 0$

D. $xyy_2 + xy_1^2 = 0$

Answer: B

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8. The differential equation of all parabolas whose axis are parallel to the y-axis is

A. $y_2 = 2y_1 + x$

B. $y_3 = 2y_1$

C. $y_2^3 = y_1$

D. $y_3 = 0$

Answer: D

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9. The solution of the equation $2xy' - y = 3$ represents a family of

A. Circle

B. Straight line

C. Ellipse

D. Parabola

Answer: D

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10. If $\frac{dp}{dy} = 3^{\cos y} \sin y$, then P is equal to

A. sin y + C

B. $3^{\cos y} + C$

C. $\frac{-3^{\cos y}}{\ln 3} + C$

D. $3^{\sin y} + c$

Answer: C

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11. The solution of $\frac{dy}{dx} - y = 1, y(0) = 1$ is given by

A. $-\exp(x)$

B. $-\exp(-x)$

C. 1

D. 2exp(x)-1

Answer: D

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12. The general solution of the differential equaiton $\left(1+y^2\right)dx+\left(1+x^2\right)dy=0$, is

A. (x-y) = c(1-xy)

B. (x-y) = c(1+xy)

C. (x+y) = c(1-xy)

D. (x+y) = c(1+xy)

Answer: C

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13. The solution of the differential equation $y\frac{dy}{dx}=x-1$ satisfying y(1) = 1, is

A. $y^2=x^2+2x+2$

B. $y^2=2x^2+x+1$

C. $y^2 = 2x^2 - x - 1$

D. $y^2 = x^2 - 2x + 2$

Answer: D

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14. Solution of the differential equation sin x. cos y dy + cos x. sin y dx = 0 is

A. sin x + sin y = C

B. cos x + cos y = C

C. sin x . Sin y = C

D. $\frac{\sin x}{\sin y} = C$

Answer: C

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15. Solution of differential equation $\frac{dy}{dx} = \frac{2}{x+y}$ is

A. $x + y + 2 = ke^{y/2}$

B. $x - y + 2 = ke^{y/2}$

C. $x + y + 2 = ke^{-y/2}$

D. $x - y + 2 = ke^{-y/2}$

Answer: A

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16. The differential equation $\frac{dy}{dx} = \frac{\sqrt{1-y^2}}{y}$ determines a family of circle with (a) variable radii and a fixed centre at (0, 1) (b) variable radii and a fixed centre at $(c)(d)((e)(f)0, -1(g))(h)$ (i) (j) Fixed radius 1 and variable centres along the x-axis. (k) Fixed radius 1 and variable centres along the y-axis.

A. Variable radii and a fixed centre at (0, 1)

B. Variable radii and a fixed centre at (0, -1)

C. Fixed radius 1 and variable centre along the x-axis

D. Fixed radius 1 and variable centre along the y-axis

Answer: C

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17. If $y = y(x)$ and $\frac{2+\sin x}{y+1}\left(\frac{dy}{dx}\right) = -\cos x, y(0) = 1,$ then $y\left(\frac{\pi}{2}\right) =$

A. $\frac{1}{3}$

B. $\frac{2}{3}$

C. $-\frac{1}{3}$

D. 1

Answer: A

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18. The slope of the tangent at (x, y) to a curve passing through a point $(2, 1)$ is $\frac{x^2 + y^2}{2xy}$, then the equation of the curve is (a) $(b)(c)2\Big((d)(e)(f)x^{(g)2(h)}(i) - (j)y^{(k)2(l)}(m)(n)\Big) = 3x(o)$ (p) (b) *[Math Processing Error]* (ee) (c) $(d)(e)x\Big((f)(g)(h)x^{(i)2(j)}(k) - (l)y^{(m)2(n)}(o)(p)\Big) = 6(q)$ (r) (d) $(s)(t)x\Big((u)(v)(w)x^{(x)2(y)}(z) + (aa)y^{(bb)2(cc)}(dd)(ee)\Big) = 10(ff)$ (gg)

A. $x\left(x^2 + y^2\right) = 10$

B. $x\left(x^2 - y^2\right) = 6$

C. $2\left(x^2 - y^2\right) = 6y$

D. $2\left(x^2 - y^2\right) = 3x$

Answer: D

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19. The solution of the differential equation

$$\frac{dy}{dx} = \frac{y}{x} + \frac{Q\left(\frac{y}{x}\right)}{Q'\left(\frac{y}{x}\right)}$$ is

A. $Q\left(\frac{y}{x}\right) = kx$

B. $xQ\left(\frac{y}{x}\right) = k$

C. $Q\left(\frac{y}{x}\right) = ky$

D. $y.\ Q\left(\frac{y}{x}\right) = k$

Answer: A

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20. The solution of differential equation $x^2y^2dy = \left(1 - xy^3\right)dx$ is

A. $x^3y^3 = x^2 + C$

B. $2x^3y^3 = 3x^2 + C$

C. $x^3y^3 = x^2 + x + C$

D. $x^3y^3 = 3x^2 + C$

Answer: B

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21. Solve the following differential equation:

$(1 + x^2)\frac{dy}{dx} + y = e^{\tan \hat{} ((-1)x)}$

A. $ye^{\tan^{-1}x} = \frac{1}{2}e^{2\tan^{-1}x} + C$

B. $y = \frac{1}{2}e^{2\tan^{-1}x} + C$

C. $ye^{\tan^{-1}x} = 2e^{2\tan^{-1}x} + C$

D. $y.\tan^{-1}x = \frac{1}{2}e^{2\tan^{-1}x} + C$

Answer: A

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22. $ydx + \left(x + x^2y\right)dy = 0$

A. log y = Cx

B. $-\frac{1}{xy} + \log y = C$

C. $\frac{1}{xy} + \log y = C$

D. $-\frac{1}{xy} = C$

Answer: B

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23. The family whose x and y intercepts of a tangent at any point are respectively double of the x and y co-ordinates of that point is

A. $x^2 + y^2 = C$

B. $x^2 - y^2 = C$

C. xy = C

D. $x^2y = C$

Answer: C

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24. The solution of the equation $y' = \cos(x - y)$ is

A. $y + \cot.\left(\frac{x - y)}{2}\right) = c$

B. $x + \cot.\left(\frac{x - y)}{2}\right) = c$

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

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

Answer: B

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25. Solution of $ydx - xdy = x^2 ydx$ is:

A. $y^2 e^{x^2} = cx^2$

B. $ye^{-x^2} = cx^2$

C. $y''' + y'' + y = 0$

D. y' = y

Answer: A

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26. The equation of the curve, slope of whose tangent at any point (h, k) is 2k/h and which passes through the point (1, 1) is

A. $x^2 = y$

B. $y^2 = x$

C. $x^2 = 2y$

D. $y^2 = 2x$

Answer: A

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27. Which of the following is a second order differential equation

A. $(y')^2 = y^2 - x$

B. y'y'' + y = sin x

C. $y''' + y'' + y = 0$

D. y' = y

Answer: B

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28. The order of the differential equation whose general solution is $y = (C_1 + C_2)\cos(x + C_3) - C_4 e^{x^4}$ where C_1, C_2, C_3 and C_4 are arbitrary is

A. 2

B. 3

C. 4

D. 5

Answer: B

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29. The equation of curve in which portion of y-axis cutoff between origin and tangent varies as cube of abscissa of point of contact is

A. $y = \frac{kx^3}{3} + c$

B. $y = \frac{-kx^3}{2} + cx$

C. $y = \frac{-kn^3}{2} + c$

D. $y = \frac{kx^3}{3} + \frac{cx^2}{2}$

Answer: B

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30. A curve $y = f(x)$ passes through point $P(1, 1)$. The normal to the curve at P is a $(y - 1) + (x - 1) = 0$. If the slope of the tangent at any point on the curve is proportional to the ordinate of the point, then the equation of the curve is (a) $(b)(c)y = (d)e^{(e)\,(f)K((g)\,(h)x-1(i))\,(j)}(k)(l)$ (m) (b) $(n)(o)y = (p)e^{(q)\,(r)Ke(s)}(t)(u)$ (v) (c) $(d)(e)y = (f)e^{(g)\,(h)K((i)\,(j)x-2(k))\,(l)}(m)(n)$ (o) (d) None of these

A. $y = e^{ax} - 1$

B. $y = e^{ax} + 1$

C. $y = e^{ax} + a$

D. $y = e^{a(x-1)}$

Answer: D

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31. Solve the following differential equation:

$\tan y \frac{dy}{dx} = \sin(x + y) + \sin(-y)$

A. sec y + 2 cos x = c

B. sec y - 2 cos x = c

C. cos y - 2 sin x = c

D. tan y - 2 sec x = c

Answer: A

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32. For solving $\frac{dy}{dx} = 4x + y + 1$, suitable substitution is

A. y = vx

B. y = 4x

C. y = 4x + v

D. y + 4x + 1 = v

Answer: D

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33. A continuously differentiable function $\phi(x)$ in $(0, \pi)$ satisfying $y' = 1 + y^2, y(0) = 0 = y(\pi)$ is

A. tan x

B. $x(x - \pi)$

C. $(x - \pi)(1 - e^x)$

D. Not possible

Answer: D

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34. Solve $\left(1+e^{\frac{x}{y}}\right)dx+e^{\frac{x}{y}}\left(1-\frac{x}{y}\right)dy=0$

A. $k=x+ye^{x/y}$

B. $k=x-ye^{x/y}$

C. $k=x^2+ye^{x/y}$

D. $k=x^3+ye^{x^2/y}$

Answer: A

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35. Order of the differential equation of the family of all concentric circles centred at (h, k) is

A. 1

B. 2

C. 3

D. 4

Answer: A

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36. The number of solutions of $\frac{dy}{dx} = \frac{y+1}{x-1}$, Then $y(1)=2$ is

A. 0

B. 1

C. 2

D. ∞

Answer: A

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37. The differential $\sin^{-1} x + \sin^{-1} y = 1$, is

A. $\sqrt{1-x^2}dx+\sqrt{1-y^2}dy=0$

B. $\sqrt{1-x^2}dy+\sqrt{1-y^2}dx=0$

C. $\sqrt{1-x^2}dy+\sqrt{1-y^2}dx=0$

D. $\sqrt{1-x^2}dx=\sqrt{1-y^2}dy=0$

Answer: B

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38. The solution of $\left(\frac{dy}{dx}\right)^2+(2x+y)\frac{dy}{dx}+2xy=0,$ is

A. $(y+x^2-c_1)(x+\log y+y^2-c_2)=0$

B. $(y+x^2-c_1)(x-\log y-c_2)=0$

C. $(y+x^2-c_1)(x+\log y-c_2)=0$

D. $(y+x^2-c_1)(3x+\log y-c_2)=0$

Answer: C

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39. For $x \in R, x \neq 0$, if $y(x)$ differential function such that $x\int_1^x y(t)dt = (x+1)\int_1^x ty(t)dt$, then $y(x)$ equals: (where C is a constant.)

A. $y = \frac{c}{x^3}e^{-\frac{1}{x}}$

B. $y = -\frac{c}{x^3}e^{\frac{1}{x}}$

C. $cx^3e^{-\frac{1}{x}}$

D. $cx^3e^{\frac{1}{x}}$

Answer: C

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Assignment Section C Objective Type Questions Multiple Than One Options Are Correct

1. The foci of the curve which satisfies the equation $(1+y^2)dx - xydy = 0$ and passes through the point (1, 0) are

A. $(\sqrt{2}, 0)$

B. $(0, \sqrt{2})$

C. $(\sqrt{-2}, 0)$

D. $(0, -\sqrt{2})$

Answer: A::C

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2. The general solution of the equation, $x\left(\frac{dy}{dx}\right) = y\ln\left(\frac{y}{x}\right)$ is

A. $y = xe^{1-cx}$

B. $y = xe^{1+cx}$

C. $y = xe.\ e^{cx}$

D. $y = xe^{cx}$

Answer: A::B::C

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3. The equation of the curve satisfying the differential equation $y\left(\frac{dy}{dx}\right)^2 + (x-y)\frac{dy}{dx} - x = 0$ can be a (a) circle (b) Straight line (c) Parabola (d) Ellipse

A. x-y+1 = 0

B. $x^2 + y^2 = 25$

C. $x^2 + y^2 - 5x - 10 = 0$

D. x+y-7 = 0

Answer: A::B

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4. The graph of the function $y = f(x)$ passing through the point (0,1) and satisfying the differential equation $\frac{dy}{dx} + y\cos x = \cos x$ is such that (a) it is a constant function. (b) it is periodic (c) it is neither an even nor an odd function. (d) it is continuous and differentiable for all $(e)(f)x\dot{g}$ (h)

A. it is a differential function $\forall x \in R$

B. It is continuous $\forall x \in R$

C. It is periodic

D. It is passing through $(\pi, 1)$

Answer: A::B::C::D

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5. Orthogonal trajectories of the system of curves $\left(\frac{dy}{dx}\right)^2 = \frac{a}{x}$ are

A. $9a(y+c)^2 = 4x^3$

B. $y+c=\frac{-2}{9\sqrt{a}}x^{3/2}$

C. $y^2+c=\frac{2}{3\sqrt{a}}x^{3/2}$

D. $9a(y+c)^2=4x^2$

Answer: A

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6. A curve has the property that area of triangle formed by the x-axis, the tangent to the curve and radius vector of the point of tangency is k^2. The equation of all such curves passing through (0, 1) is ln (ay) $=\frac{xy^b}{2k^2}$ then

A. (a)a=1

B. (b)b=1

C. (c)a=2

D. (d)b=2

Answer: A::B

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7. The tangent at any point P of a curve C meets the x-axis at Q whose abscissa is positive and $OP = OQ$, O being the origin, the equation of curve C satisfying these conditions may be

A. (a) $y^2 = \frac{1}{4}(1 - 4x)$

B. (b) $y^2 = \frac{1}{4}(9 - 12x)$

C. (c) $y^2 = \frac{1}{4}(16 - 16x)$

D. (d) $y^2 = \frac{1}{4}(25 - 20x)$

Answer: A::B::C::D

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8. Consider a curved mirror y = f(x) passing through (8, 6) having the property that all light rays emerging from origin, after reflected from the

mirror becomes parallel to x-axis. The equation of the mirror is $y^a = b(c - x^d)$ where a, b, c, d are constants, then

A. b=4

B. b = 36

C. c= 9

D. c = 1

Answer: B::C

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9. The differential equation representing all possible curves that cut each member of the family of circles $x^2 + y^2 - 2Cx = 0$ (C is a parameter) at right angle, is

A. $x^2 + y^2 - ky = 0$

B. $x^2 + y^2 + ky = 0$

C. $x^2 + y^2 + kx = 0$

D. $x^2 + y^2 - kx = 0$

Answer: A::B

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10. Suppose that a mothball loses volume by evaporation at a rate proportional to its instantaneous area. If the diameter of the ball decreases from 2cm to 1cm in 3 months, how long will it take until the ball has practically gone?

A. 4 months

B. 3 months

C. 2 months

D. 1 months

Answer: A::B::C

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11. Let $x(1-x)\dfrac{dy}{dx} = x - y$

A. a) General solution of given differential equation is

$$xy = (1-x)\ln|1-x| + 1 + c(1-x)$$

B. b) General solution of given differential equation is

$$xy = (1-x)\ln|1-x| - 1 + cx(1-x)$$

C. c) If $y = f(x)$ is a solution of given differential equation, then

$\lim_{x \to 1} f(x)$ does not exist

D. d) If $y = f(x)$ is solution of given differential equation then

$$\lim_{x \to 1} f(x) = 1$$

Answer: A::D

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12. Let a curve passes through (3, 2) and satisfied the differential equation

(x-1) dx + 4(y -2) dy = 0

A. It represents equation of a circle

B. It represents equation of an ellipse

C. Area euclosed by the curve is 2π.

D. Line y = 1 is a tengent to the curve

Answer: B::C::D

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13. A curve satisfies the differential equation $\frac{dy}{dx} = \frac{x+1-xy^2}{x^2y-y}$ and passes through $(0, 0)$ (1) The equation of the curve is $x^2 + y^2 + 2x = x^2y^2$ (2) The equation of the curve is $x^2 + y^2 + 2x + 2y = x^2y^2$ (3) $x = 0$ is a tangent to curve (4) $y = 0$ is a tangent to curve

A. The equation of the curve is $x^2 + y^2 + 2x = x^2y^2$

B. The equation of the curve is $x^2 + y^2 + 2x + 2y = x^2y^2$

C. x=0 is a tangent to curve

D. y = 0 is a tangent to curve

Answer: A::C::D

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14. Tangent is drawn at any point P of a curve which passes through $(1, 1)$ cutting x-axis and y-axis at A and B respectively. If $AP : BP = 3 : 1$, then,

A. (a)Differential equation of the curve is $3x\frac{dy}{dx} + y = 0$

B. (b)Differential equation of the curve is $3x\frac{dy}{dx} - y = 0$

C. (c)Curve is passing through $\left(\frac{1}{8}, 2\right)$

D. (d)Normal at (1, 1) is x+3y = 4

Answer: B::C

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15. $y = c_1 x + c_2 \sin(2x + c_3)$ (C_1, C_2, C_3 are arbitrary constants)

A. Order of differential equation is 2

B. Order of differential equation is 3

C. Degree of differential equation is 1

D. The differential equation is $\frac{yd^3y}{dx^3} = \frac{dy}{dx} \cdot \frac{d^2y}{dx^2}$

Answer: A

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16. Which of the following statements is/are true ?

A. An integrating factor of the differential equation $\frac{dy}{dx} + \frac{2y}{x} = x^3 \sin x$ is x^2

B. An integrating factor of the differential equation $xdy - ydx = x^2y^2dy$ is $\frac{1}{x^2}$

C. An integrating factor of the differential equation

$$x\frac{dy}{dx} + xy\cot x = \cos ecx$$ is sin x

D. An integrating factor of the differential equation

$$(ydx - xdy) = xy^3(xdy + ydx)$$ is $\frac{1}{y^2}$

Answer: A::B::C::D

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17. A curve passes through $(1, 0)$ and satisfies the differential equation

$$\left(2x\cos y + 3x^2y\right)dx + \left(x^3 - x^2\sin y - y\right)dy = 0$$

A. The equation of curve is $x^2\cos y + x^3y - y^2 = 1$

B. The equation of curve is $x^2\cos y + x^3y - \frac{y^2}{2} = 1$

C. The equation of normal at (1, 0) is y = 0

D. The equation of tangent at (1, 0) is x = 1

Answer: B::C::D

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Assignment Section D Linked Comprehension Type Questions

1. Newton's law of cooling states that the rate of change of the temperature T of an object is proportional to the difference between T and the (constant) temperature τ of the surrounding medium, we can write it as $\frac{dT}{dt} = -k(T-\tau) k > 0$ constant

An cup of coffee is served at $185^\circ F$ in a room where the temperature is $65^\circ F$. 2 minutes later the temperature of the coffee has dropped to $155^\circ F$.

$\log_e 3 = 1.09872, \log_e . \frac{3}{4} = 0.2877$

Temperature of coffee at time t is given by

A. $\tau e^{-k} + [T(0)]e^{-2k}$

B. $\tau e^{k} + [T(0) - \tau]e^{-2k}$

C. $\tau + [T(0) - \tau]e^{-2k}$

D. $\tau + 2[T(0) + \tau]e^{-}$

Answer: C

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2. Newton's law of cooling states that the rate of change of the temperature T of an object is proportional to the difference between T and the (constant) temperature τ of the surrounding medium, we can write it as $\frac{dT}{dt} = -k(T-\tau) k > 0$ constant

An cup of coffee is served at $185^\circ F$ in a room where the temperature is $65^\circ F$. 2 minutes later the temperature of the coffee has dropped to $155^\circ F$.

$\log_e 3 = 1.09872, \log_e . \frac{3}{4} = 0.2877$

Time required for coffee to have $105^\circ F$ temperature is

A. a)6 minute

B. b)6.43 minute

C. c)7.23 minute

D. d)7.63 minute

Answer: D

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3. Newton's law of cooling states that the rate of change of the temperature T of an object is proportional to the difference between T and the (constant) temperature τ of the surrounding medium, we can write it as $\frac{dT}{dt} = -k(T-\tau) k > 0$ constant

An cup of coffee is served at $185^\circ F$ in a room where the temperature is $65^\circ F$. 2 minutes later the temperature of the coffee has dropped to $155^\circ F$.

$\log_e 3 = 1.09872, \log_e . \frac{3}{4} = 0.2877$

Temperature of coffee at time t is given by

A. $65 + 120e^{-kt}$

B. $75 + 110e^{-kt}$

C. $65 + 140e^{-2kt}$

D. $75 + 10e^{-kt}$

Answer: A

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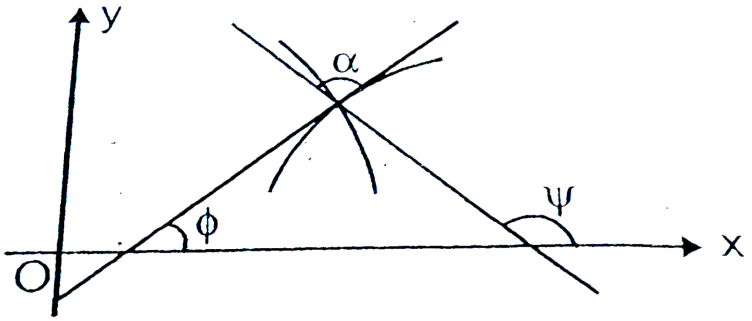
4. Let the trajectories cut the crve of given family at an angle α where $tna\alpha = k.$

The slope $\frac{dy}{dx} = \tan\Psi$ (of the tangent to a member of the family and the slope $\frac{dy_T}{dx} = \tan\Phi$ to the isogonal trajectory are connected by the relationship



$$\tan\phi = \tan(\Psi - \alpha) = \frac{\tan\Psi - \tan\alpha}{1 + \tan\alpha\tan\Psi}$$

i.e., $$\frac{dy}{dx} = \frac{\left(\frac{dy_T}{dx}\right) - k}{k\frac{dy_T}{dx} + 1}$$

Substituting this expression into equation, (I') and dropping the subscript T, we obtain the differential equation of isogonal trajectories.

The isogonal trajectories of a family of straight lines y = c, that cuts the given family at angle α, the tangent of which is k, is

A. $x^2 + y^2 = c^2$

B. $y^2 = 4cx$

C. $\frac{x^2}{c^2} + \frac{y^2}{2 - c^2} = 1$

D. $\left(x^2 + y^2\right)^{\frac{1}{2}} = ce^{\frac{1}{k}\tan^{-1}(y/x)}$

Answer: D

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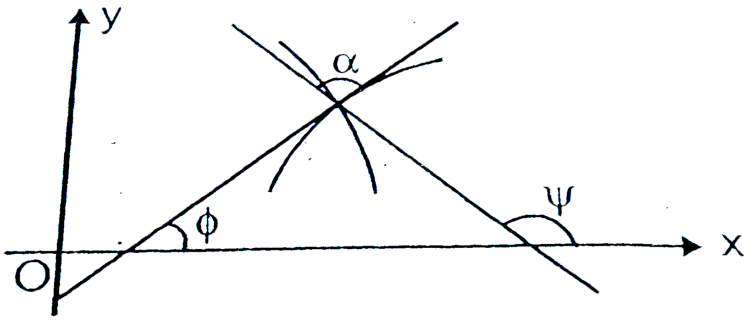
5. Let the trajectories cut the crve of given family at an angle α where $tna\alpha = k.$

The slope $\frac{dy}{dx} = \tan\Psi$ (of the tangent to a member of the family and the slope $\frac{dy_T}{dx} = \tan\Phi$ to the isogonal trajectory are connected by the relationship



$$\tan\phi = \tan(\Psi - \alpha) = \frac{\tan\Psi - \tan\alpha}{1 + \tan\alpha\tan\Psi}$$

i.e., $$\frac{dy}{dx} = \frac{\left(\frac{dy_T}{dx}\right) - k}{k\frac{dy_T}{dx} + 1}$$

Substituting this expression into equation, (I') and dropping the subscript T, we obtain the differential equation of isogonal trajectories.

The isogonal trajectories of a family of straight lines y = c, that cuts the given family at angle α, the tangent of which is k, is

A. (a)y = kx

B. (b)$y = k\tan\alpha x$

C. (c)$y = k\cot 2x$

D. (d)y = cx

Answer: A

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6. A family of curves is such that the slope of normal at any point (x, y) is 2(1-y).

If y = f(x) is a member of this family passing through (-1, 2) then its equation is

A. A) $y^2 - 2y - x - 1 = 0$

B. B) $y^2 + 2y + x - 7 = 0$

C. C) $y^2 - 2y + x + 1 = 0$

D. D) $y^2 + 2y - x - 9 = 0$

Answer: A

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7. A family of curves is such that the slope of normal at any point (x, y) is 2(1-y).

The area bounded by the curve y = f(x) of question number 1 and the line x+2y = 0 is

A. $\frac{10}{3}$ sq. units

B. $\frac{4}{3}$ sq. units

C. $\frac{28}{3}$ sq. units

D. $\frac{16}{3}$ sq. units

Answer: B

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8. A family of curves is such that the slope of normal at any point (x, y) is 2(1-y).

The orthogonal trajectories of the given family of curves is

A. (a) $y = ke^{-2x}, -1$

B. (b) $y = ke^{2x} + 1$

C. (c) $y = ke^{+2x} - 1$

D. (d) $y = ke^{-2x} + 1$

Answer: D

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9. A tangent to a curve at P(x, y) intersects x-axis and y-axis at A and B respectively. Let the point of contact divides AB in the ratio $y^2 : x^2$.

If a member of this family passes through (3, 4) then the equation of curve and area of the curve is

A. $x^2 + y^2 = c^2$

B. $x^2 + y^2 - 2x = c$

C. $x^2 + y^2 = cx^2y^2$

D. xy = c

Answer: A

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10. A tangent to a curve at P(x, y) intersects x-axis and y-axis at A and B respectively. Let the point of contact divides AB in the ratio $y^2 : x^2$.

If a member of this family passes through (3, 4) then the equation of curve and area of the curve is

A. $x^2 + y^2 = 25$

B. $x^2 + y^2 - 2x = 19$

C. $x^2 + y^2 = 25x^2y^2$

D. $x^2 + y^2 = 7$

Answer: A

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11. A tangent to a curve at P(x, y) intersects x-axis and y-axis at A and B respectively. Let the point of contact divides AB in the ratio $y^2 : x^2$.

If a member of this family passes through (3, 4) then the equation of curve and area of the curve is

A. $\left(\frac{25}{4}+\frac{2\pi}{3}\right)$

B. $2(\pi+4)$

C. 25π

D. $\left(16\pi+\frac{4}{5}\right)$

Answer: C

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Assignment Section E Assertion Reason Type Questions

1. STATEMENT-1 : To find complete solution of a second order differential equation we need two different conditions.

and

STATEMENT-2 : An n^{th} order differential equation has n independent parameters.

A. (a)Statement-1 is true, Statement-2 is true, Statement-2 is a correct explanation for Statement-1.

B. (b)Statement-1 is true, Statement-2 is true, Statement-2 is NOT a correct explanation for Statement-1.

C. (c)Statement-1 is True, Statement-2 is False

D. (d)Statement-1 is False, Statement-2 is True

Answer: A

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2. STATEMENT-1 : The orthogonal trajectory of a family of circles touching x-axis at origin and whose centre the on y-axis is self orthogonal.

and

STATEMENT-2 : In order to find the orthogonal trajectory of a family of curves we put $-\frac{dx}{dy}$ in place of $\frac{dy}{dx}$ in the differential equation of the given family of curves.

A. (a)Statement-1 is true, Statement-2 is true, Statement-2 is a correct explanation for Statement-1.

B. (b)Statement-1 is true, Statement-2 is true, Statement-2 is NOT a correct explanation for Statement-1.

C. (c)Statement-1 is True, Statement-2 is False

D. (d)Statement-1 is False, Statement-2 is True

Answer: D

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3. STATEMENT-1 : If the length of subtangent and subnormal at point (x, y) on y = f(x) are 9 and 4 then x is equal to + 6.

and

STATEMENT-2 : Product of subtangent and subnormal is square of the ordinate of the point.

A. Statement-1 is true, Statement-2 is true, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is true, Statement-2 is true, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: D

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4. STATEMENT-1 : The differential equation of all non-horizontal lines in a plane $\frac{d^2y}{dx^2} = 0$

and

STATEMENT-2 : The general equation of all non-horizontal line in xy plane is ax + by = 1, $a \neq 0$

A. Statement-1 is true, Statement-2 is true, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is true, Statement-2 is true, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: D

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5. STATEMENT-1 : The differential equation whose general solution is $y = c_1 . x + \frac{c_2}{x}$ for all values of c_1, and c_2 is linear equation.

and

STATEMENT-2 : The equation $y = c_1, x + \frac{c_2}{x}$ has two arbitrary constants, so the corresponding differential equation is second order.

A. Statement-1 is true, Statement-2 is true, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is true, Statement-2 is true, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: B

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6. STATEMENT-1 : The differential equation $\frac{d^2y}{dx^2} + \cos x . \frac{dy}{dx} + (x^3 + 7)y = e^x$ is a linear equation

and

STATEMENT-2 : Every first degree equation is a linear equation.

A. Statement-1 is true, Statement-2 is true, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is true, Statement-2 is true, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: C

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7. STATEMENT -1 : The differential equation $\frac{dy}{dx} = \frac{2xy}{x^2 + y^2}$ Can't be solved by the substitution x = vy.

and

STATEMENT-2 : When the differential equation is homogeneous of first order and first degree, then the substitution that solves the equation is y = vx.

A. Statement-1 is true, Statement-2 is true, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is true, Statement-2 is true, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: D

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8. Solution of the equation $\cos^2 x \frac{dy}{dx} - (\tan 2x)y = \cos^4 x$, where $|x| < \frac{\pi}{4}$ and $y\left(\frac{\pi}{6}\right) = \frac{3\sqrt{3}}{8}$ is

A. Statement-1 is true, Statement-2 is true, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is true, Statement-2 is true, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: A

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9. STATEMENT-1 : Solution of the differential equation $xdy - ydx = ydy$ is $ye^{x/y} = c$.

and

STATEMENT-2 : Given differential equation can be re-written as $d\left(\frac{x}{y}\right) = -\frac{dy}{y}$.

A. Statement-1 is true, Statement-2 is true, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is true, Statement-2 is true, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: A

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10. STATEMENT-1 : The differential equation of all circles in a plane can be of order 3.

and

STATEMENT-2 : General equation of a circle in plane has three independent constant parameters

A. Statement-1 is true, Statement-2 is true, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is true, Statement-2 is true, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: A

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Assignment Section F Matrix Match Type Questions

1. Match the following

Column-I	Column-II
(A) $\frac{dy}{dx}+\frac{2y}{x}=0$, $y(1)=2$, $y(x_0)=8$ then x_0 is	(p) $\frac{1}{2}$
(B) $(x^2+y^2)dy = xydx$ and $y(1)=1$ and $y(x_0)=e$, then x_0 is	(q) Rational number
(C) If $y(u)$ is solution of $(u+1)\frac{dy}{du}-uy=1$, $y(0)=-1$, then $y(1)$ is	(r) $\sqrt{3}e$
(D) $x\,dy = y(dx+ydy)$, $y>0$, $y(1)=1$ and $y(x_0)=-3$, then x_0 is	(s) -15
	(t) $-\frac{1}{2}$

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2. Match the following

Column-I	Column-II
(A) $y=cx+c^2-3c^{\frac{3}{2}}+2$	(p) Order 2, degree not defined
(B) $\frac{d^2y}{dx^2}=\sin\left(\frac{dy}{dx}\right)+xy$	(q) Order 1, degree 4
(C) $y=(c_1+c_2)\cos(x+c_3)-c_4e^{x+c_5}$	(r) Order 2, degree 2
(D) $y=a\sin^2x+b\cos^2x+c\sin 2x+d\cos 2x$	(s) Order 3, degree 1
	(t) Order 3, degree infinite

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Assignment Section G Integer Answer Type Questions

1. If $x \sin\left(\frac{y}{x}\right) dy = \left(y \sin\left(\frac{y}{x}\right) - x\right) dx$ and y(1) $= \frac{\pi}{2}$ then the value of $\cos\left(\frac{y}{e^7}\right)$ is _____.

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2. If $xy = ae^x + be^{-x}$ satisfies the equation $Axy'' + By' = xy$, then $|A - B|$ is_____.

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3. If $\sec^2 y \frac{dy}{dx} + 2x \tan y = x^3$ satisfies $\tan y = ce^{-x^A} + B\{x^2 - 1\}$, then $(AB)^2$ equals

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Assignment Section H Multiple True False Type Questions

1. STATEMENT-1 : If m and n are respectively order and degree of differential equation , then m and n are mutually independent.

STATEMENT-2 : If general solution of a differential equation contains two arbitrary constants, then its order is 2.

STATEMENT-3 : The order and degree of differential equation $\sqrt{1+\left(\frac{dy}{dx}\right)^2}=\left(x\frac{d^2y}{dx^2}\right)^{1/3}$ are 2 and 2 respectively.

A. (a)T F T

B. (b)T T T

C. (c)F F F

D. (d)F F T

Answer: B

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2. STATEMENT-1 : $y = e^x$ is a particular solution of $\frac{dy}{dx} = y$.

STATEMENT-2 : The differential equation representing family of curve $y = a\cos\omega t + b\sin\omega t$, where a and b are parameters, is $\frac{d^2y}{dt^2} - \omega^2 y = 0$.

STATEMENT-3 : $y = \frac{1}{2}x^3 + c_1 x + c_2$ is a general solution of $\frac{d^2y}{dx^2} = 3x$.

A. a) T F T

B. b) T T T

C. c) F F F

D. d) F F T

Answer: A

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Assignment Section I Subjective Type Questions

1. If the differential equation satisfied by $y = A\sin(98x) + B\cos(98x)$ is $y_2 + cy = 0$ then the value of c is_____.

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2. The differential equation of all straight lines which are at a fixed distance of 10 units from the origin is $(y - xy_1)^2 = A(1 + y_1^2)$ then A is equal to _____.

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3. Let $\frac{dy}{dx} = \frac{y\phi'(x) - y^2}{\phi(x)}$, where $\phi(x)$ is a function satisfies $\phi(1) = 1, \phi(4) = 1296$. If y(1) = 1 then y(4) is equal to_____

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4. If (2, 4) is a point on the orthogonal to trajectory of $x^2 + y^2 - ay = 0$, then the orthogonl trajectory is a circle with radius_____

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5. The radius of $y(\sqrt{8}) + \frac{17}{9}$ if $(1 + x^2)\frac{dy}{dx} = x(1 - y), y(0) = \frac{4}{3}$ is _____

A. 2

B. 3

C. 5

D. None of these

Answer: 3

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6. The value of $y(\log 4)$ if $y_2 - 7y_1 + 12y = 0, y(0) = 2, y_1(0) = 7$ is

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7. An object falling from rest in air is subject not only to the gravitational force but also to air resistance. Assume that the air resistance is proportional to the velocity with constant of proportionality as $k > 0$, and acts in a direction opposite to motion $\left(g = 9.8\frac{m}{s^2}\right)$. Then velocity cannot exceed. $(a) 9.8m/k \quad m/s$ (b) $98/km \quad m/s$ (c) k/g m/s (d) None of these

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8. If the curve satisfying $\left(xy^4 + y\right)dx - xdy = 0$ passes through (1,1) then the value $-41(y(2))^3$ is _____

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9. Solve the differential equation $\frac{dy}{dx} = y + \int_0^1 y(x)dx$, given that the value of y is 1, when $x = 0$.

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10. Suppose $g(x)$ is a real valued differentiable function satisfying $g'(x) + 2g(x) > 1$. Then show that $e^{2x}\left(g(x) - \frac{1}{2}\right)$ is an increasing function.

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11. The differential equation of family of curves of $y^2 = 4a(x + a)$is

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12. Find the curve for which the perpendicular from the foot of the ordinate to the tangent is of constant length.

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13. Solve $x\frac{dy}{dx} + y = y^2 \ln x$

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14. The solution of the differential equation $\frac{dy}{dx} = \frac{1}{xy\left[x^2 \sin y^2 + 1\right]}$ is

(a)

$(b)(c)(d)x^{(e)2(f)}(g)\left(\cos(h)y^{(i)2(j)}(k) - \sin(l)y^{(m)2(n)}(o) - 2C(p)e^q(r\right.$

(z) (aa) [Math Processing Error] (zz) (aaa)

$(bbb)(c)(ddd)x^{(eee)2(fff)}(ggg)\left(\cos(hhh)y^{(iii)2(jjj)}(kkk) - \sin(lll)y^{(mmm\right.$

(zzz) (aaaa) None of these

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15. Solve $\frac{dy}{dx} + 2 \cdot \frac{y}{x} = \frac{y^3}{x^3}$

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16. Solve $\frac{dy}{dx} + y\phi'(x) = \phi(x).\phi'(x)$, where $\phi(x)$ is a given function.

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Assignment Section J Aakash Challengers Questions

1. The family of curves, the subtangent at any point of which is the arithmetic mean of the coordinates of the point of tangency, is given by

A. $(x-y)^2 = cy$

B. $(y-x)^2 = cx$

C. $(x-y)^2 = cxy$

D. $(x-y)^2 = cx^2y^2$

Answer:

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2. A line is drawn from a point p(x,y) on curve y=f(x), making an angle with the x-axis which is supplementaty to the one made by the tangent to the curve at p(x,y). The line meets the x-axis at A. another line perpendicular to the first, if drawn from p(x,y) meeting the y-axis at B. If OA=OB, where O is origin, find all curve which passes through (1,1)

A. $x^2 - y^2 + 2xy + 2 = 0$

B. $x^2 - y^2 + 2xy - 2 = 0$

C. $x^2 - y^2 + 2xy + 1 = 0$

D. $x^2 - y^2 + 2xy - 1 = 0$

Answer:

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3. The tangent and a normal to a curve at any point P meet the x and y axes at A,B,C and D respectively. Find the equation of the curve passing through (1,0) if the centre of circle through O,C,P and B lies on the line y=x (where O is origin).

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4. Given two curves: $y = f(x)$ passing through the point $(0, 1)$ and $g(x) = \int_{-\infty}^{x} f(t)dt$ passing through the point $\left(0, \frac{1}{n}\right)$. The tangents drawn to both the curves at the points with equal abscissas intersect on the x-axis. Find the curve $y = f(x)$.

A. $y = e^{nx}$

B. y = nx

C. y = nlnx

D. $y = nx^2$

Answer:

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