



MATHS

BOOKS - OMEGA PUBLICATION

DIFFERENTIAL EQUATIONS

Questions

1. Find the order and degree (if defined) of the differential equation $y'' + (y')^2 + 2y = 0$



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2. Find the degree and order (if defined) of the differential equation $y'''' + y^2 e^{y'} = 0$

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3. Show that the function y , defined by $y(x) = \sqrt{1+x^2}$ ($x \in \mathbb{R}$) is the solution of $(1+x^2)y' = xy$

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4. Verify that the function $y = \cos x + c$ is a solution of the differential equation $y' + \sin x = 0$

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5. Verify that whether $y = e^x + 1$ is the solution of differential equation $y'' - y' = 0$ or not?

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6. Verify that the function $x + y = \tan^{-1} y$ satisfies the differential equation $y^2 y' + y^2 + 1 = 0$

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7. Form the differential equation of the family of circles touching the X-axis at origin.

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8. Form the differential equation representing the family of parabolas having vertex at origin and x-axis along positive direction of x-axis.

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9. Form the differential equation of the family of circles in the second quadrant and touching the coordinate axes.

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10. Form the differential equation of the family of hyperbolas having foci on x-axis and centre at origin.

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11. Form the differential equation of the family of ellipses having foci on y-axis and centre at origin.



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12. Form the differential equation representing the family of ellipses having foci on x-axis and centre at the origin.



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13. Form the differential equation representing the family of curves $y = mx$, where, m is arbitrary constant.



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14. Form the differential equation representing the family of ellipses having foci on x-axis and centre at the origin.

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15. Form a differential equation by eliminating the arbitrary constants a and b from

(i) $y^2 = a(b^2 - x^2)$, (ii) $y = e^x(a \cos x + b \sin x)$.

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16. For the differential equation, find the general solution:

$$(e^x + e^{-x})dy - (e^x - e^{-x})dx = 0$$

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17. Solve the following differential equation

$$e^x \tan y dx + (1 - e^x) \sec^2 y dy = 0$$

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18. Solve $\frac{dy}{dx} = (1 + x^2)(1 + y^2)$

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19. Solve

$$\sec^2 x \tan y dx + \sec^2 y \tan x dy = 0.$$

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20. Find the particular solution of the differential equation

$$x(x^2 - 1) \frac{dy}{dx} = 1, y = 0, \text{ when } x=2.$$

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21. Find the equation of a curve passing through the points

$(0,0)$ and whose differential equation is $y' = e^x \sin x$.

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22. Solve the following differential equations

$$x dy - y dx = \sqrt{x^2 + y^2} dx$$

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23. Solve the following differential equations

$$x \cos\left(\frac{y}{x}\right) \frac{dy}{dx} = y \cos\left(\frac{y}{x}\right) + x$$



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24. Solve the differential equation:

$$ydx + x \log\left(\frac{y}{x}\right) dy - 2x dy = 0$$



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25. Solve the differential equation :

$$(x - y)dy - (x + y)dx = 0.$$



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26.

Solve:

$$\left\{ x \cos\left(\frac{y}{x}\right) + y \sin\left(\frac{y}{x}\right) \right\} y dx = \left\{ y \sin\left(\frac{y}{x}\right) - x \cos\left(\frac{y}{x}\right) \right\} x dy$$

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

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28. Solve: $x^2 \frac{dy}{dx} = x^2 - 2y^2 + xy$

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29. Solve the differential equation :

$$(x^2 - y^2)dx + 2xydy = 0.$$

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30. Show that the family of curves for which the slope of the tangent at any point (x, y) on it is $\frac{x^2 + y^2}{2}xy$, is given by

$$x^2 - y^2 = cx$$

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31. Find the particular solution of

$$\left[x \sin^2\left(\frac{y}{x}\right) - y \right] dx + x dy = 0, \text{ where } y = \frac{\pi}{4} \text{ when } x = 1.$$

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32. Find the particular solution of

$$\frac{dy}{dx} - \frac{y}{x} + \operatorname{cosec}\left(\frac{y}{x}\right) = 0, \text{ where } y=0 \text{ when } x=1$$

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33. For the differential equation, find the particular solution satisfying the given condition:

$$(x + y)dy + (x - y)dx = 0, y = 1 \text{ when } x = 1$$

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34. Solve $(x + y)\frac{dy}{dx} = 1$

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35. Solve the following differential equation :

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

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37. Solve the differential equation

$$\cos^2 x \frac{dy}{dx} + y = \tan x \left(0 \leq x < \frac{x}{2} \right).$$

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38. Solve the differential equation : $x \left(\frac{dy}{dx} \right) + 2y = x^2$



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39. For the differential equation, find the general solution:

$$\frac{dy}{dx} + 3y = e^{-2x}$$



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40. Solve the differential equation:

$$\frac{dy}{dx} + 2y = \sin x$$



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41. Solve the differential equation : $x \left(\frac{dy}{dx} \right) + 2y = x^2 \log x$

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

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43. For the differential equation, find the general solution:

$$(1 + x^2)dy + 2xydx = \cot x dx (x \neq 0)$$

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44. Solve the differential equation

$$(x + 3y^2) \frac{dy}{dx} = y, (y > 0).$$

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45. For the differential equation, find a particular solution satisfying the given condition:

$$(1 + x^2) \frac{dy}{dx} + 2xy = \frac{1}{1 + x^2}, y = 0 \text{ when } x = 1$$

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46. For the differential equation, find the general solution:

$$(x) \frac{dy}{dx} + y - x + xy \cot x = 0 (x \neq 0)$$

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47. Solve the following differential equation :

$$x \frac{dy}{dx} + y = x \log x, x \neq 0.$$



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$$x \frac{dy}{dx} + y = x \log x, x \neq 0.$$



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



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Important Questions From Miscellaneous Exercise

1. For each of the following, indicate their order and degree.

$$\frac{d^2y}{dx^2} + 5x \frac{dy}{dx} - 6y = \log x$$



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2. For the differential equation given below, indicate its order

and degree (if defined): $\left(\frac{dy}{dx}\right)^3 - 4\left(\frac{dy}{dx}\right)^2 + 7y = \sin x$



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3. For the differential equation given below, indicate its order

and degree (if defined): $\left(\frac{d^4y}{dx^4}\right) - \sin\left(\frac{d^3y}{dx^3}\right) = 0$



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4. Form the differential equation representing the family of

curves given by $(x - a)^2 + 2y^2 = a^2$, where a is an arbitrary

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$$x \frac{dy}{dx} - y + x \sin\left(\frac{y}{x}\right) = 0$$

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6. Solve $y' e^{x/y} dx = (x \cdot e^{x/y} + y^2) dy, y \neq 0$

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7. Solve the following differential equation :

$$(3xy + y^2) dx - (x^2 + xy) dy = 0$$

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8. Solve the differential equation:

$$\left[\frac{e^{-2\sqrt{x}}}{\sqrt{x}} - \frac{y}{\sqrt{x}} \right] \frac{dx}{dy} = 1, (x \neq 0)$$



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9. Solve the following differential equation:

$$x \frac{dy}{dx} = y - x \tan\left(\frac{y}{x}\right)$$



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10. Solve the following differential equation: $\frac{dy}{dx} - y = \cos x$



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11. For each of the following, indicate their order and degree.

$$\frac{d^2y}{dx^2} + 5x \frac{dy}{dx} - 6y = \log x$$

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14. Form the differential equation representing the family of curves given by $(x - a)^2 + 2y^2 = a^2$, where a is an arbitrary constant.

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15. Solve the differential equation :

$$x \frac{dy}{dx} - y + x \sin\left(\frac{y}{x}\right) = 0$$

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16. Solve $y' e^{x/y} dx = (x \cdot e^{x/y} + y^2) dy, y \neq 0$

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17. Solve the following differential equation :

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20. Solve the following differential equation:

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Multiple Choice Questions Mcqs

1. The degree of the differential equation

$$\left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^2 + \sin\left(\frac{dy}{dx}\right) + 1 = 0 \text{ is:}$$

A. 3

B. 2

C. 1

D. not defined

Answer: D



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2. The degree of differential equation:

$$\frac{d^4y}{dx^4} + \sin(y''') = 0$$

A. 1

B. 3

C. 4

D. not defined

Answer: D



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3. The number of arbitrary constants in the general solution of a differential equation of fourth order are:

A. 0

B. 2

C. 3

D. 4

Answer: D



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4. The order of the differential equation:

$$2x^2 \frac{d^2y}{dx^2} - 3 \frac{dy}{dx} + y = 0 \text{ is:}$$

A. 2

B. 1

C. 0

D. not defined

Answer: A



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5. The order of the differential equation:

$$(y'''')^2 + (y'') + (y')^4 + y^5 = 0 \text{ is:}$$

A. 3

B. 5

C. 4

D. None of these

Answer: A



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6. The number of arbitrary constants in the particular solution of a differential equation of 'third order are:-

A. 3

B. 2

C. 0

D. 1

Answer: C



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7. Which of the following differential equations has

$y = c_1e^x + c_2e^{-x}$ as a general solution ?

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

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

C. $\frac{d^2y}{dx^2} + 1 = 0$

D. $\frac{d^2y}{dx^2} - 1 = 0$

Answer: B



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8. Which of the following differential equation 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. $\frac{d^2y}{dx^2} + x \frac{dy}{dx} + xy = 0$

Answer: C



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9. A homogeneous differential equation of the form

$\frac{dx}{dy} = h\left(\frac{x}{y}\right)$ can be solved by making the substitution.

A. $y=vx$

B. $v=yx$

C. $x=vy$

D. $x=v$

Answer: C



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10. Which of the following is a homogeneous differential equation?

A. $(4x + 6y + 5)dy - (3y + 2x + 4)dx = 0$

B. $(xy)dx - (x^3 + y^3)dy = 0$

C. $(x^3 + 2y^2)dx + 2xydy = 0$

D. $y^2dx + (x^2 - xy - y^2)dy = 0$

Answer: D



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11. The integrating factor of the differential equation

$$x \frac{dy}{dx} - y = 2x^2 \text{ is:}$$

A. e^{-x}

B. e^{-y}

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

D. x

Answer: C



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12. The integrating factor of the differential equation

$$(1 - y^2) \frac{dx}{dy} + yx = ay, \quad (-1 < y < 1) \text{ is:}$$

A. $\frac{1}{y^2 - 1}$

B. $\frac{1}{\sqrt{y^2 - 1}}$

C. $\frac{1}{1 - y^2}$

D. $\frac{1}{\sqrt{1 - y^2}}$

Answer: D



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13. The general solution of the differential equation

$$\frac{ydx - xdy}{y} = 0 \text{ is:}$$

A. $xy=c$

B. $x = cy^2$

C. $y = cx$

D. $y = cx^2$

Answer: C



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14. The general solution of the differential equation of the

type:

$$\frac{dx}{dy} + P_1x = Q_1 \text{ is:}$$

A. $y. e^{\int P_1 dx}$

B. $\int (Q_1 e^{\int P_1 dx}) dx + c$

$$C. x. e^{\int P_1 dy} = \int (Q_1 e^{P_1 dy}) dy + c$$

$$D. x. e^{\int P_1 dx} = \int (Q_1 e^{P_1 dx}) dx + c$$

Answer: C



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15. The general solution of the differential equation $e^x dy + (ye^x + 2x)dx = 0$ is:

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

B. $xe^y + y^2 = c$

C. $ye^x + x^2 = c$

D. $ye^y + x^2 = c$

Answer: C



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16. The integrating factor of $x \frac{dy}{dx} + 2y = x^2$ is:

A. x

B. e^x

C. e^{x^2}

D. x^2

Answer: D



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17. Solve the following differential equations

$$\frac{dy}{dx} - y = \cos x$$

A. e^{-x}

B. e^x

C. x

D. $-\frac{1}{x}$

Answer: A



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18. The degree of differential equation:

$$\frac{d^2y}{dx^2} = y + \left(\frac{dy}{dx}\right)^2 \text{ is:}$$

A. 4

B. 2

C. 1

D. None of these

Answer: C



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19. The degree of the differential equation

$$3\frac{d^2y}{dx^2} + 4\left(\frac{dy}{dx}\right)^3 = \log x \text{ is:}$$

A. 1

B. 4

C. 2

D. None of these

Answer: A



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20. The degree of the differential equation

$$\frac{d^2y}{dx^2} + 3\left(\frac{dy}{dx}\right)^3 = x^2 \log\left(\frac{d^2y}{dx^2}\right), \text{ is}$$

A. 1

B. 2

C. 3

D. None of these

Answer: D



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21. The degree of differential equation:

$$\frac{d^2y}{dx^2} + \cos\left(\frac{dy}{dx}\right) = 0$$

A. 2

B. 1

C. Not defined

D. None of these

Answer: C

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22. The degree of differential equation:

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

A. 0

B. 2

C. 1

D. None of these

Answer: C

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23. The degree of the differential equation

$$\left(\frac{d^2y}{dx^2} \right)^3 + \left(\frac{dy}{dx} \right)^2 + \sin \left(\frac{dy}{dx} \right) + 1 = 0 \text{ is:}$$

A. 3

B. 2

C. 1

D. not defined

Answer: D



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24. The degree of differential equation:

$$\frac{d^4y}{dx^4} + \sin(y''') = 0$$

A. 1

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C. 4

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25. The number of arbitrary constants in the general solution of a differential equation of fourth order are:

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26. The order of the differential equation:

$$2x^2 \frac{d^2y}{dx^2} - 3 \frac{dy}{dx} + y = 0 \text{ is:}$$

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

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A. $y=vx$

B. $v=yx$

C. $x=vy$

D. $x=v$

Answer: C



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32. Which of the following is a homogeneous differential equation?

A. $(4x + 6y + 5)dy - (3y + 2x + 4)dx = 0$

B. $(xy)dx - (x^3 + y^3)dy = 0$

C. $(x^3 + 2y^2)dx + 2xydy = 0$

D. $y^2dx + (x^2 - xy - y^2)dy = 0$

Answer: D



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33. The integrating factor of the differential equation

$$x \frac{dy}{dx} - y = 2x^2 \text{ is:}$$

A. e^{-x}

B. e^{-y}

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

D. x

Answer: C



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34. The integrating factor of the differential equation

$$(1 - y^2) \frac{dx}{dy} + yx = ay, \quad (-1 < y < 1) \text{ is:}$$

A. $\frac{1}{y^2 - 1}$

B. $\frac{1}{\sqrt{y^2 - 1}}$

C. $\frac{1}{1 - y^2}$

D. $\frac{1}{\sqrt{1-y^2}}$

Answer: D

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35. The general solution of the differential equation

$$\frac{ydx - xdy}{y} = 0 \text{ is:}$$

A. $xy=c$

B. $x = cy^2$

C. $y = cx$

D. $y = cx^2$

Answer: C

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36. The general solution of the differential equation of the type:

$$\frac{dx}{dy} + P_1x = Q_1 \text{ is:}$$

A. $y \cdot e^{\int P_1 dx}$

B. $\int(Q_1 e^{\int P_1 dx}) dx + c$

C. $x \cdot e^{\int P_1 dy} = \int(Q_1 e^{P_1 dy}) dy + c$

D. $x \cdot e^{\int P_1 dx} = \int(Q_1 e^{P_1 dx}) dx + c$

Answer: C



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37. The general solution of the differential equation

$$e^x dy + (ye^x + 2x)dx = 0 \text{ is:}$$

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

B. $xe^y + y^2 = c$

C. $ye^x + x^2 = c$

D. $ye^y + x^2 = c$

Answer: C



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38. The integrating factor of $x \frac{dy}{dx} + 2y = x^2$ is:

A. x

B. e^x

C. e^{x^2}

D. x^2

Answer: D



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39. Solve the following differential equations

$$\frac{dy}{dx} - y = \cos x$$

A. e^{-x}

B. e^x

C. x

D. $-\frac{1}{x}$

Answer: A



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40. The degree of differential equation:

$$\frac{d^2y}{dx^2} = y + \left(\frac{dy}{dx}\right)^2 \text{ is:}$$

A. 4

B. 2

C. 1

D. None of these

Answer: C



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41. The degree of the differential equation

$$3\frac{d^2y}{dx^2} + 4\left(\frac{dy}{dx}\right)^3 = \log x \text{ is:}$$

- A. 1
- B. 4
- C. 2
- D. None of these

Answer: A



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42. The degree of the differential equation

$$\frac{d^2y}{dx^2} + 3\left(\frac{dy}{dx}\right)^3 = x^2 \log\left(\frac{d^2y}{dx^2}\right), \text{ is}$$

A. 1

B. 2

C. 3

D. None of these

Answer: D



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43. Determine order and degree (if defined) of differential

equation:
$$\left(\frac{d^2y}{dx^2}\right)^2 + \cos\left(\frac{dy}{dx}\right) = 0$$

A. 2

B. 1

C. Not defined

D. None of these

Answer: C



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44. The degree of differential equation:

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

A. 0

B. 2

C. 1

D. None of these

Answer: C



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