MATHS

BOOKS - BETTER CHOICE PUBLICATION

DIFFERENTIAL EQUATIONS

Solved Examples Multiple Choice Questions Section I

1. The degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^2 + \sin\left(\frac{dy}{dx}\right) + 1 = 0$ is :

A. 3

B. 2

C. 1

D. Not defined

Answer: D

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2. The order of the differential equation $2x^2\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + y = 0$ is

A. 2

B. 1

C. 0

D. Not defined

Answer: A

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3. The number of arbitrary constants in the particular solution of a differential equation of Second order is :

A. 2

B. 1

C. 3

D. 0

Answer: D

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4. The number of arbitrary constants in the particular solution of a differential equation of Fourth order is :

A. 0

B. 2

C. 3

D. 4

Answer: D

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5. Which of the following differential equations has $y = c_1 e^x + c_2 e^{-x}$ as the 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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6. The Integrating. factor of the differential equation $x\left(\frac{dy}{dx}\right) - 3y = e^{-2x}$ is :

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

B. $\frac{1}{x^2}$

C. $\frac{1}{x^3}$

D. x^3`

Answer: C

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Solved Examples Section Ii Short Answer Type Questions

1. Verify that given function (explicit or implicit), $y = e^x + 1$ is a solution of differential equation $y - y' = 1$.

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2. Verify that $y = x \sin x$ is a solution of differential equation $xy' = y + x\sqrt{x^2 - y^2}$

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3. Form a differential equation representing the given family of curves by eliminating arbitrary constants a and b: $\frac{x}{a}+\frac{y}{b}=1$

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4. Form a differential equation representing the family of curves $y^2=a\left(b^2-x^2\right)$ by eliminating a and b.

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5. In $y=ae^{3x}+be^{-2x}$ form the differential equation by eliminating arbitrary constant a and b.

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6. In $y = e^x(a\cos x + b\sin x)$ form the differential equation by eliminating arbitrary constants a and b.

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7. 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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8. Form the differential equation of the family of parabolas having vertex at origin and axis along positive y-axis.

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9. Form the differential equation of the family of circles touching the y-axis at origin.

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

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11. Form the differential equation of the family of circles having centre on y-axis and radius 3 units.

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Solved Examples Section Iii

1. Solve the differential equation : $\left(\frac{dy}{dx}\right) = -\frac{1+y^2}{y}$

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2. Solve the differential equation : $\left(\frac{dy}{dx}\right) = \frac{1-\cos x}{1+\cos x}$

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3. Find the general solution of differential equation : $\sec^2 x \tan y dx + \sec^2 y \tan x dy = 0$

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4. Find the general solution of the differential equation $\left(e^x + e^{-x}\right)dy - \left(e^x - e^{-x}\right)dx = 0$

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5. Find the general solution of differential equation $\frac{dy}{dx} = \left(1 + x^2\right)\left(1 + y^2\right)$

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6. Find the general solution of differential equation $y \log y dx - x dy = 0.$

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7. Find the general solution of the differential equation: $\left(\frac{dy}{dx}\right) + \sqrt{\frac{1-y^2}{1-x^2}} = 0$

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8. Find the particular solution of $\log\left(\frac{dy}{dx}\right) = 2x + 3y$ given that $x = 0, y = 0.$

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9. Find the particular solution of the following differential equation : $\frac{dy}{dx} = 1 + x^2 + y^2 + x^2y^2$, given that $y = 1$ when $x = 0$.

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Solved Examples Section Iv

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

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2. Solve the differential equation $\sin^{-1}\left(\frac{dy}{dx}\right) = x + y$.

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3. Find the Particular solution of differential equation $\log\left(\frac{dy}{dx}\right) = 2x + y$ given that x = 0 , y =0

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Solved Examples Section V

1. Solve the differential equation $y' = \frac{x+y}{x}$.

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2. Solve the differential equation : $(x-y)dy - (x+y)dx = 0.$

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3. Solve the differential equation $x^2 \frac{dy}{dx} = x^2 - 2y^2 + xy$

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4. Solve the differential equation $\left(ye^{\frac{x}{y}}\right)dx = \left(x\left(e^{\frac{x}{y}}\right) + y^2\right)dy (y \neq 0)$

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5. Show that the given differential equation is homogeneous and solve it:

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

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

$(x+y)dy+(x-y)dx=0, y=1$ when $x=1$

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7. Find the particular solution of the differential equation $\frac{dy}{dx}-\frac{y}{x}+\cos ec\left(\frac{y}{x}\right)=0, (x\neq 0),$ given that $y=0, x=1.$

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Solved Examples Section Vi

1. Find the general solution of the differential equation $\frac{dy}{dx} + 3y = e^{-2x}$.

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

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3. Solve the differential equation $\frac{dy}{dx} + (\sec x)y = \tan x (0 \leq x < 1)$

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4. 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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5. For the differential equation, find the general solution: $\left(1 + x^2\right) dy + 2xydx = \cot x dx (x \neq 0)$

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6. Solve the differential equation $x \frac{dy}{dx} + y - x + xy \cot x = 0 (x \neq 0).$

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7. Solve the differential equation

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

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8. Solve the differential equation $(x+y)\frac{dy}{dx} = 1$

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9. Solve the differential equation $\left(x + 3y^2\right)\frac{dy}{dx} = y, (y > 0)$

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10. Find particular solution of differential equation $\frac{dy}{dx} + 2y\tan x = \sin x, y = 0$, when $x = \frac{\pi}{3}$.

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

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

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Assignment Section Ii

1. Find the differential equation of the family of curves $(x-a)^2+(y-b)^2=r^2$, where a and b are arbitrary constants.

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2. Form the differential equation of the family of circles in the first quadrant which touch the coordinate axes.

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3. Obtain the differential equation of the family of circles, which touch the x-axis at the origin.

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4. Form the differential equation of the family of circles touching the y-axis at origin.

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Assignment Section Iii

1. Solve the following differential equations

$$\frac{dy}{dx} = x^2 + \sin 3x$$

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2. Solve the following differential equations

$$\frac{dy}{dx} - x^2 \sin^2 x = \frac{1}{x \log x}$$

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3. Solve the following differential equations

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

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4. Solve the following differential equations

$$\frac{dy}{dx} = x^5 + x^2 - \frac{2}{x}$$

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5. Find the particular solution of following differential equation

$$(x^3+x^2+x+1)\frac{dy}{dx} = 2x^2+x, y = 1 \text{when } x = 0$$

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6. Find the particular solution of following differential equation

$\cos \frac{dy}{dx} = 0 (a \in R) y = 1$ when $x = 0$

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7. Solve the following differential equations

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

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8. Solve the following differential equations

$3e^x \tan y dx + (1 - e^x)\sec^2 y dy = 0$

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9. Solve the following differential equations

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

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10. Solve the following differential equations

$4e^x \tan y dx + 3(1 + e^x)\sec^2 y dy = 0$

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11. Solve the differential equation : $(1+e^{2x})dy+(1+y^2)e^{2x}dx=0$ given that $y=1 when x=0$

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12. Solve the following differential equations

$\log\frac{dy}{dx}=ax+by$

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13. Solve the following differential equations

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

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14. Solve the following differential equations

$(e^x + 1)dy + (y + 1)e^x dx = 0$

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15. Solve the following differential equations

$(1 + x)(1 + y^2)dx + (1 + y)(1 + x^2)dy = 0$

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16. Solve the following differential equations

$\frac{dy}{dx} = 1 + x + y + xy$

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17. Solve the following differential equations ;

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

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18. Find the particular solution of following

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

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19. Find the particular solution of following

$$\frac{dy}{dx} = y \sin 2x, \text{ given that } y(0) = 1$$

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20. Find the particular solution of following

$\left(1+y^2\right)(1+\log x)dx+xdy=0$ when $x=1, y=1$

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Assignment Section Iv

1. Solve the following differential equations

$(x-y)^2\frac{dy}{dx}=a^2$

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2. Solve the following differential equations

$\frac{dy}{dx}=(4x+y+1)^2$

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3. Solve the following differential equations

$$\sin(x+y)\frac{dy}{dx}=1$$

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4. Solve the following differential equations

$$\cos(x+y)\frac{dy}{dx}=1$$

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5. Solve the following differential equations

$$\frac{dy}{dx}+1=e^{x+y}$$

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Assignment Section V

1. Solve the following differential equations

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

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2. Solve the following differential equations

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

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3. Solve the following differential equations

$$\frac{dy}{dx} + 4y = 5x$$

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4. Solve the following differential equations

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

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5. Solve the following differential equations

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

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6. Solve the following differential equations

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

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7. Solve the following differential equations

$$\left(y^2 - x^2\right) dy = 3xydx$$

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8. Solve the following differential equations

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

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9. Solve the following differential equations

$$\left(x^3+y^3\right)dy=x^2ydx$$

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10. Solve the following differential equations

$$x\frac{dy}{dx}-y+x\tan\frac{y}{x}=0$$

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11. Solve the following differential equations

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

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12. Solve the following differential equations

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

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

$x^2dy+\left(xy+y^2\right)dx=0, y=1$ when $x=1$

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14. Find the particular solution of the following differential equations, satisfying the given condition

$\left(x^2+y^2\right)dx=2xydy, y=0$ when $x=1$

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15. Find the particular solution of the following differential equations, satisfying the given condition

$(x^2 - y^2)dx + 2xydy = 0, y = 1$ when $x = 1$

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

$2xy + y^2 - 2x^2 \dfrac{dy}{dx} = 0, y = 2$ when $x = 1$

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17. Find the particular solution of the following differential equations, satisfying the given condition

$2x^2y_1 - 2xy + y^2 = 0, y(e) = e$

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Assignment Section Vi

1. Solve the following differential equations

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

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2. Solve the following differential equations

$$2x\frac{dy}{dx} + y = 6x^3$$

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3. Solve the following differential equations

$$\frac{dy}{dx} + 4y = 5x$$

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4. Solve the following differential equations

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

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5. Solve the following differential equations

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

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6. Solve the following differential equations

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

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7. Solve the following differential equations

$$\frac{dy}{dx} + 2y = \sin 3x$$

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8. Solve the following differential equations

$$\frac{dy}{dx} + 2y = \sin 5x$$

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9. Solve the following differential equations

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

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10. Solve the following differential equations

$$(x^2 - 1)\frac{dy}{dx} + 2xy = \frac{2}{x^2 - 1}$$

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11. Solve the following differential equations

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

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12. Solve the following differential equations

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

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13. Solve the following differential equations

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

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14. Solve the following differential equations

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

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15. Solve the following differential equations

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

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16. Solve the following differential equations

$$\frac{dy}{dx} + \frac{4x}{x^2 + 1} y = \frac{1}{\left(x^2 + 1\right)^3}$$

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17. Solve the following differential equations

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

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18. Solve the following differential equations

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

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19. Solve the following differential equations

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

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20. Solve the following differential equations

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

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21. Solve the following differential equations

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

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22. Solve the following differential equations

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

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23. Find the particular solution of following differential equations

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

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24. Find the particular solution of following differential equations

$xy^1 - y = \log x, y(1) = 0$

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25. Find the particular solution of the differential equation $\frac{dx}{dy} + y \cot x = 2x + x^2 \cot x (x \neq 0)$ given that y = 0 when $x = \frac{\pi}{2}$

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26. Find the particular solution of following differential equations

$\frac{dy}{dx} + y \cot x = 4x, y\left(\frac{\pi}{2}\right) = 0$

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27. Find the particular solution of following differential equations

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

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Previous Years Board S Questions For Practice Multiple Choice Questions Choose The Correct Option

1. I.F. of the differential equation : $\frac{dy}{dx} + 2y = e^{2x}$ is:

A. e^{2x}

B. e^2

C. 2

D. $\log 2$

Answer: A

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

A. 3

B. 1

C. 2

D. None of these

Answer: C

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3. The degree of differential equation $\left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^2 + \sin\left(\frac{dy}{dx}\right) + 1 = 0$ is

A. 3

B. 2

C. 1

D. Not defined

Answer: D

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4. Degree of the differential equation : $\log\left(\frac{dy}{dx}\right)^{\frac{1}{2}} = 3x + 4y$ is :

A. 2

B. 1

C. 0

D. 3

Answer: B

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5. Degree of differential equation $\left(\frac{ds}{dt}\right)^2 + 4s\frac{d^2s}{dt^2} = 0$ is

A. 1

B. 2

C. 4

D. None of these

Answer: C

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6. The general solution of differential equation : $ydx - xdy = 0$ is :

A. $xy = c$

B. $x = cy^2$

C. $y = cx$

D. $y = cx^2$

Answer: C

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7. The degree of differential equation $xy\frac{d^2y}{dx^2} + x\left(\frac{dy}{dx}\right)^2 - y\frac{dy}{dx} = 0$ is

A. 0

B. 2

C. 1

D. None of these

Answer: C

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Previous Years Board S Questions For Practice

1. Solve the following differential equation

$$x \cos y dy = (xe^x \log x + e^x)dx$$

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2. Solve the following differential equation

$$\left(x^2 - yx^2\right)dy - \left(y^2 - xy^2\right)dx = 0$$

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3. Solve the following differential equation

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

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4. Solve the following differential equation

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

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5. Solve the following differential equation

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

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6. Find the particular solution of following differential equations

$\log\left(\frac{dy}{dx}\right) = 3x + 2y, x = 0, y = 0$

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7. Find the particular solution of following differential equations

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

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8. Find the general solution of following differential equations

$$(1 + y^2) + \left(x - e^{\tan^{-1} y}\right)\frac{dy}{dx} = 0$$

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9. Find the particular solution of following differential equations

$x dx + y dy = 0$, given that y = 4 when x = 3

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10. Find the general solution of following differential equations

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

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11. Find the general solution of following differential equations

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

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12. Find the particular solution of following differential equations

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

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13. Find the general solution of following differential equations

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

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

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

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16. Solve the following differential equations

$$\frac{dy}{dx} = \sqrt{4 - y^2}(-2 < y < 2)$$

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17. Solve the following differential equations

$$\frac{dy}{dx} = \frac{x+1}{2-y}$$

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18. Solve the following differential equations

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

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19. Show that the given differential equation is homogeneous and solve it: $\left(1 + e^{\frac{x}{y}}\right)dx + e^{\frac{x}{y}}\left(1 - \left(\frac{x}{y}\right)\right)dy = 0$

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20. Find the differential equation from the equation : $y = e^x(a\cos 2x + b\sin 2x)$ where a and b are arbitrary constants.

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21. Solve the following differential equations at its initial values

$x\left(1+y^2\right)dx - y\left(1+x^2\right)dy = 0, y = 0$ when $x = 1$

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22. Solve the following differential equations at its initial values

$\left(1+e^{2x}\right)dy + \left(1+y^2\right)e^x dx = 0, y = 1$ when $x = 0$

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23. Solve the differential equation,

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

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24. Find the general solution of the following

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

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25. Find the general solution of the following

$$x\frac{dy}{dx} + y = x\log x$$

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26. Find the general solution of the following

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

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

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28. Solve the following differential equations

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

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29. Solve the following differential equations

$$(x-y)\frac{dy}{dx} = x + 2y$$

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30. Solve the following differential equations

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

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31. Solve : $\frac{dy}{dx} + 2y = \sin x$

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32. Solve the differential equation :

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

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33. Solve the following differential equations

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

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34. 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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35. Solve the following differential equations

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

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36. Find the particular solution of the differential equation ;

$\log\left(\frac{dy}{dx}\right) = 3x + 4y$, given that y = 0 when x = 0

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37. Solve the following differential equation

$$\frac{dy}{dx} = x^5 + x^2 - \frac{2}{x}$$

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38. Find the general solution of the Differential Equation :

$2xydx + \left(x^2 + 2y^2\right)dy = 0$

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39. Solve the differential equation

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

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40. Solve the following differential equations

$\left(y^2 - 2xy\right)dx = \left(x^2 - 2xy\right)dy$

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41. Solve the differential equation : $x\frac{dy}{dx} - y = 2x^3$.

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42. Solve the following differential equations

$\frac{dy}{dx} - y = \cos x$, given that $x = 0, y = 1$

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43. Solve the differential equation $xdy - ydx = \sqrt{x^2 + y^2}dx$

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44. Find the particular solution of the differential equation $\left(\frac{dy}{dx}\right) - 3y\cot x = \sin 2x, (x \neq 0)$ given that $y = 0, x = \frac{\pi}{2}$.

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

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46. Solve the differential equation $\left(x^2 + y^2\right)dx = 2xydy$

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

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48. Solve the differential equation : $x \frac{dy}{dx} + 3y = \frac{\log x}{x^3}.$

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49. Form the differential equation of the family of circles touching the y-axis at origin.

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

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