



## MATHS

### BOOKS - RS AGGARWAL MATHS (HINGLISH)

### HOMOGENEOUS DIFFERENTIAL EQUATION

#### Solved Examples

1. Show that the differential equation

$$2x^2 \frac{dy}{dx} - 2xy + y^0 = 0 \text{ is homogeneous and solve it.}$$



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2. Show that the differential equation  $\frac{dy}{dx} = \frac{y - x}{y + x}$  is homogenous and solve it.



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3. Show that the differential equation is  $x \frac{dy}{dx} - y = \sqrt{x^2 + y^2}$ , is homogenous and solve it.



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4. Show that the differential equation  $\left(x \sqrt{x^2 + y^2 - y^2}\right) dx + xy dy = 0$  is homogenous and solve it.

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5. Show that the differential equation  $(x^2 + xy)dy = (x^2 + y^2)dx$  is homogeneous and solve it.

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6. Show that the differential equation  $y^2 dx + (x^2 - xy + y^2)dy = 0$  is homogenous and solve it.

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7. Show that the differential equation

$$x^2 \frac{dy}{dx} = (x^2 - 2y^2 + xy) \text{ is homogenous and solve}$$

it.



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8. Solve the following differential equation:

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



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9. Show that the differential equation

$$(y^2 - x^2)dy = 3xydx \text{ is homogenous and solve it}$$





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10. Show that the differential equation  $(x^3 - 3xy^2)dx = (y^3 - 3x^2y)dy$  is homogenous and solve it.



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11. Show that the differential equation  $\frac{(x - y)dy}{dx} = x + 2y$ , is homogeneous and solve it.



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12. Show that the differential equation

$$x \frac{dy}{dx} = y - x \tan\left(\frac{y}{x}\right) \text{ is homogenous and solve it.}$$



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13. Show that the differential equation:

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

is homogenous and solve it.



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14. Show that the differential equation

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

homogeneous and solve it.



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15. Show that the differential equation

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

Find the particular solution of this differential

equation, given that  $x = 1$  when  $y = \frac{\pi}{2}$ .



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16. Find the particular solution of the differential

equation

$$(3xy + y^2)dx + (x^2 - xy)dy = 0; f \text{ or } x = 1, y = 1.$$



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17. Find the particular solution, satisfying the given condition, for the following differential equation:

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



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18. The differential equations , find the particular solution satisfying the given condition:

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



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**19.** Find the equation of the family of curves for which the slope of tangent at any point  $(x,y)$  on it, is  $\frac{x^2 + y^2}{2xy}$ .

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**20.** Show that the differential equation  $2ye^{\frac{x}{y}} dx + (y - 2xe^{xy}) dy = 0$  is homogeneous. Find the particular solution of this differential equation, given that  $x = 0$  when  $y = 1$ .

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21. Show that the differential equation

$$\left(1 + e^{x/y}\right)dx + e^{x/y}\left(1 - \frac{x}{y}\right)dy = 0 \quad \text{is}$$

homogenous and solve it.

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22. Show that the given differential equation is homogeneous and solve each of them.

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

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1.  $x dy = (x + y) dx$



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



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



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



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5. Solve :  $(x + y)dy + (y - 2x)dx = 0$



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6. Solve the following differential equations:

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



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7.  $2xydx + (x^2 + 2y^2)dy = 0$



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$$8. \frac{dy}{dx} + \frac{x - 2y}{2x - y} = 0$$



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$$9. \frac{dy}{dx} = \frac{2xy}{x^2 - y^2}$$



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$$10. \frac{dy}{dx} = \frac{x^2 + y^2}{2xy}$$



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$$11. \frac{dy}{dx} = \frac{2xy}{x^2 - y^2}$$



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$$12. \text{Solve - } x^2 \frac{dy}{dx} = 2xy + y^2$$



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



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$$14. y^2 + (x^2 - xy) \frac{dy}{dx} = 0$$



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$$15. x \frac{dy}{dx} - y = 2\sqrt{y^2 - x^2}$$



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$$16. y^2 dx + (x^2 + xy + y^2) dy = 0$$



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$$17. (x - y) \frac{dy}{dx} = x + 3y$$



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$$18. (x^3 + 3xy^2)dx + (y^3 + 3x^2y)dy = 0$$



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$$19. (x - \sqrt{xy})dy = ydx$$



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$$20. x^2 \frac{dy}{dx} + y^2 = xy$$



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$$21. x \frac{dy}{dx} = y(\log y - \log x + 1)$$





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$$22. x \frac{dy}{dx} - y + x \sin\left(\frac{y}{x}\right) = 0$$



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$$23. x \frac{dy}{dx} = y - x \cos^2\left(\frac{y}{x}\right)$$



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$$24. \left(x \cos\left(\frac{y}{x}\right)\right) \frac{dy}{dx} = \left(y \cos\left(\frac{y}{x}\right)\right) + x$$



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**25.** Find the particular solution of the differential equation

$$2xy + y^2 - 2x^2 \frac{dy}{dx} = 0, \text{ it being given that } y = 2$$

when  $x = 1$ .



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**26.** Find the particular solution of the differential

$$\text{equation } \left\{ x \sin^2 \left( \frac{y}{x} \right) - y \right\} dx + x dy = 0, \text{ it being}$$

given that  $y = \frac{\pi}{4}$  when  $x = 1$ .



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27. Find the particular solution of the differential

equation  $\frac{dy}{dx} = \frac{y(2y - x)}{x(2y + x)}$ , given that  $y = 1$  when

$x = 1$ .



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28. Find the particular solution of the differential

equation  $(xe^{y/x} + y)dx = xdy$ , given that  $y(1) = 0$ .



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29. Find the particular solution of the differential

equation  $xe^{\frac{y}{x}} - y + x\frac{dy}{dx} = 0$ , given that  $y(e) = 0$ .



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**30.** The slope of the tangent to a curve at any point  $(x, y)$  on its given by  $\frac{y}{x} - \frac{\cot y \cos y}{x}$ ,  $(x > 0, y > 0)$  and the curve passes through the point  $(1, \pi/4)$ . Find the equation of the curve.



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