# MATHS

## BOOKS - CBSE COMPLEMENTARY MATERIAL MATHS (HINGLISH)

## DIFFERENTIAL EQUATIONS

**One Mark Questions**

**1.** Write the order and degree of the following differential equations.

$$\frac{dy}{dx} + \cos y = 0$$

A. order =1, degree =1

B. order =1, degree is not defined

C. order =2, degree =1

D. order =0, degree is not defined

**Answer: B**

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**2.** Write the order and degree of the following differential equations.

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

A. order=1, degree =1

B. order=1, degree =2

C. order=2, degree =1

D. order=2, degree =2

**Answer: C**

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**3.** Write the order and degree of the following differential equations.

$$\frac{d^4y}{dx^4} + \sin x = \left(\frac{d^2y}{dx^2}\right)^5$$

A. order=4, degree =1

B. order=4, degree =2

C. order=4, degree =3

D. order=4, degree =4

**Answer: A**

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**4.** Write the order and degree of the following differential equations.

$$\frac{d^5y}{dx^5} + \log\left(\frac{dy}{dx}\right) = 0$$

A. order=2, degree is not defined

B. order=3, degree is not defined

C. order=4, degree is not defined

D. order=5, degree is not defined

**Answer: C**

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**5.** Write the order and degree of the following differential equations.

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

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**6.** Write the order and degree of the following differential equations.

$$\left[1+\left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}}=k\frac{d^2y}{dx^2}$$

A. order=1, degree =1

B. order=1, degree =2

C. order=2, degree =1

D. order=2, degree =2

**Answer: D**

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**7.** Write the order and degree of the following differential equations.

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

A. order=3, degree =3

B. order=2, degree =2

C. order=3, degree =2

D. order=2, degree =3

**Answer: C**

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**8.** Write the order and degree of the following differential equations.

$$\frac{dy}{dx} + \tan\left(\frac{dy}{dx}\right) = 0$$

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**9.** Write integrating factor differential equations

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

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**10.** Write integrating factor differential equations

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

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**11.** Write integrating factor differential equations

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

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**12.** Write integrating factor differential equations

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

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**13.** Write integrating factor differential equations

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

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**14.** The integrating factor of differential equation

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

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**15.** Write integrating factor differential equations

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

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**16.** Write order of the differential equation of the family of following curves

$y = Ae^x + Be^{x+c}$

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**17.** Write order of the differential equation of the family of following curves

$Ay = Bx^2$

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**18.** Write order of the differential equation of the family of following curves

$(x-a)^2 + (y-b)^2 = 9$

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**19.** Write order of the differential equation of the family of following curves

$$Ax + By^2 = Bx^2 - Ay$$

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**20.** Write order of the differential equation of the family of following curves

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 0$$

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**21.** Write order of the differential equation of the family of following curves

$$y = a\cos(ax + b)$$

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**22.** Write order of the differential equation of the family of following curves

$y = a + be^{x+c}$

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## Two Mark Questions

**1.** Write the general solution of the following differential equations

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

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**2.** Find the general solution of each of the following differential equations:

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

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**3.** Write the general solution of the following differential equations

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

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**4.** Write the general solution of the following differential equations

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

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**5.** Write the general solution of the following differential equations

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

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**6.** Write the general solution of the following differential equations

$$\frac{dy}{dx} = \frac{1 - 2y}{3x + 1}$$

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## Four Mark Questions

**1.** If $y = e^m \sin^{(-1)x}$, prove that $\left(1 - x^2\right)\frac{d^2y}{dx^2} - x\frac{dy}{dx} - m^2y = 0$.

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**2.** Show that $y = \sin(\sin x)$ is a solution of differential equation $\frac{d^2y}{dx^2} + (\tan x)\frac{dy}{dx} + y\cos^2 x = 0$

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**3.** Show that $y = Ax + \frac{B}{x}, x \neq 0$ is a solution of the differential equation $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} - y = 0$

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**4.** If $y = A\cos(\log x) + B\sin(\log x)$, prove that $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = 0$.

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**5.** Verify that $y = \log\left(x + \sqrt{x^2+a^2}\right)^2$ satisfies the differential equation $\left(a^2+x^2\right)\frac{d^2y}{dx^2} + x\frac{dy}{dx} = 0.$

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**6.** The differential equation of the family of curves $y = e^x(A\cos x + B\sin x)$, where $A$ and $B$ are arbitrary constants is (a) $(b)(c)(d)\frac{(e)(f)d^{(g)2(h)}(i)y}{j}\left((k)d(l)x^{(m)2(n)}(o)\right)(p)(q) - 2(r)\frac{(s)dy}{t}((u$ (y) (z) *[Math Processing Error]* (xx) (yy) *[Math Processing Error]* (eeee) (ffff) *[Math Processing Error]* (ddddd)

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**7.** Find the differential equation of an ellipse with major and minor axes 2a and 2b respectively.

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**8.** Form the differential equation representing the family of curves $(y-b)^2 = 4(x-a)$.

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**9.** Solve the following differential equations

$\left(1-x^2\right)\frac{dy}{dx} - xy = x^2 \quad \text{given that} \quad x = 0, y = 2.$

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**10.** Solve the following differential equations

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

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**11.** Solve the following differential equations

$$\frac{dy}{dx} + \frac{1}{x}y = \cos x + \frac{\sin x}{x}, \qquad x > 0.$$

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**12.** Solve the differential equation $\mathrm{dy}=\cos \mathrm{x}(2\text{-}\mathrm{y}\ \mathrm{cosec}\ \mathrm{x})\mathrm{dx}$ given that $y = 2$, when $\mathrm{x}d = \frac{\pi}{2}$

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**13.** Solve the following differential equations

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

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**14.** Solve the following differential equations

$ye^y dx = \left(y^3 + 2xe^y\right) dy.$

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**15.** Solve each of the following differential equations

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

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**16.** Solve each of the following differential equations

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

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**17.** Solve the following differential equation:

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

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**18.** Solve each of the following differential equations

$\sqrt{(1-x^2)(1-y^2)}dy + xydx = 0.$

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**19.** Solve each of the following differential equations

$(xy^2 + x)dx + (yx^2 + y)dy = 0, y(0) = 1.$

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**20.** Solve each of the following differential equations

$\frac{dy}{dx} - y\sin^3 x \cos^3 x + xye^x = 0.$

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**21.** Solve each of the following differential equations

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

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**22.** Solve each of the following differential equations

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

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**23.** Solve the following differential equations

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

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**24.** Solve the following differential equation: $\frac{x^2 dy}{dx} = x^2 + xy + y^2$

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**25.** Solve the following differential equations

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

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**26.** Solve the following differential equations

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

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**27.** Solve the following differential equations

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

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

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**29.** Solve the following differential equation: $\frac{dy}{dx} = e^{x+y} + x^2\, e^y$

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**30.** Solve the following differential equations

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

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**31.** Solve the following differential equation:

$$\left(3\mathrm{x\ y} + \mathrm{y}^2\right)\mathrm{dx} + \left(\mathrm{x}^2 + \backslash\ \mathrm{x\ y}\right)\mathrm{dy} = 0$$

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

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

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**34.** From the differential equation of the family of all parabolas having vertex at the origin and axis along the positive direction of the x-axis is given by

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**35.** Find the differential equation of all the circles which pass thorough the origin and whose centres lie on x-axis.

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**36.** From the differential equation of the family of all circles in first quadrant and touching the coordinate axes.

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

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**38.** Show that the differential equation $\left(x^2 + 2xy - y^2\right)dx + \left(y^2 + 2xy - x^2\right)dy = 0$ is homogeneous and

solve it.

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**39.** Solve the following differential equations

$$\frac{dy}{dx} - 2y = \cos 3x.$$

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**40.** Solve the following differential equations

$$\sin x \frac{dy}{dx} + y \cos x = 2 \sin^2 x \cos x \quad \text{if} \quad y\left(\frac{\pi}{2}\right) = 1.$$

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**41.** Solve the following differential equations

$$\log\left(\frac{dy}{dx}\right) = ax + by$$

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**42.** Solve the following differential equations

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

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**43.** Solve the differential equation

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

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**44.** Solve the following differential equations

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

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**45.** Solve the differential equation $x^2dy + y(x + y)dx = 0$, given that $y = 1\ when\ x = 1.$

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**46.** Solve the following differential equations

$xe^{\frac{y}{x}} - y + x\frac{dy}{dx} = 0 \text{ if } y(e) = 0.$

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**47.** Solve the following differential equations

$\left(x^3 - 3xy^2\right)dx = \left(y^3 - 3x^2y\right)dy.$

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**48.** Solve the differential equation $\frac{dy}{dx} - \frac{y}{x} + \cos ec\frac{y}{x} = 0,$ given that $y = 0$ when $x = 1$

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**49.** Solve the following differential equation: $\cos^2 x \frac{dy}{dx} + y = \tan x$

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**50.** Solve the following differential equations

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

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**51.** Solve the following differential equation:

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

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**52.** Solve the following differential equations

$(y - \sin x)dx + \tan x dy = 0, y(0) = 0.$

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## Six Mark Questions

**1.** Solve the following differential equations

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

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**2.** Solve the following differential equations

$$3e^x \tan y dx + (1 - e^x)\sec^2 y dy = 0 \quad \text{given that} \quad y = \frac{\pi}{4}, \quad \text{when} \quad x = 1$$

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**3.** Solve the following differential equations

$$\frac{dy}{dx} + y\cot x = 2x + x^2\cot x \quad \text{given that} \quad y(0) = 0.$$

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**4.** 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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