

DIFFERENTIAL EQUATIONS

Multiple Choice Questions

- 1 Integrating factor of differential equation $\frac{dy}{dx} - \frac{y}{x} = 2x$ is :
(a) $\frac{1}{x}$ (b) x (c) $\frac{1}{x^2}$ (d) 1
- 2 Order of differential equation $\frac{d^2y}{dx^2} - \left(\frac{dy}{dx}\right)^3 + y = 0$ is :
(a) 3 (b) 2 (c) 0 (d) 1
- 3 Differential equation for the family of the curves $y^2 = kx$ is:
(a) $\frac{dy}{dx} = 0$ (b) $y + 2x \frac{dy}{dx} = 0$ (c) $y - 2x \frac{dy}{dx} = 0$ (d) $y \frac{dy}{dx} = 1$
- 4 Integrating factor of differential equation $\frac{dy}{dx} + \frac{y}{x} = 2x$ is:
(a) $\frac{1}{x}$ (b) x^2 (c) $\frac{1}{x^2}$ (d) x
- 5 Integrating factor of differential equation $\frac{dy}{dx} + \frac{2y}{x} = 2x$ is:
(a) $\frac{1}{x}$ (b) x^2 (c) $\frac{1}{x^2}$ (d) x
- 6 Integrating factor of differential equation $\frac{dy}{dx} + y \sec x = 2x$ is :
(a) $\sec x + \tan x$ (b) $\sec x \tan x$ (c) $e^{\sec x}$ (d) $e^{\sec x + \tan x}$
- 7 Integrating factor of differential equation $\frac{dy}{dx} + y = 2x$ is :
(a) $\frac{1}{x}$ (b) x (c) e^x (d) e^{-x}
- 8 Order of differential equation $\frac{d^3y}{dx^3} - 4\left(\frac{d^2y}{dx^2}\right)^4 + y = 0$ is
(a) 3 (b) 4 (c) 1 (d) 0
- 9 The number of arbitrary constants in the general solution of a differential equation of second order are
(a) 1 (b) 2 (c) 3 (d) 4
- 10 Degree of the differential equation $\frac{d^3y}{dx^3} - \frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^4 + y = 0$ is
(a) 1 (b) 2 (c) 3 (d) 4

Fill Ups

- 1) Order of the differential equation $\frac{d^2y}{dx^2} - \left(\frac{dy}{dx}\right)^3 + y = 0$ is _____
- 2) Degree of the differential equation $\frac{d^2y}{dx^2} - \left(\frac{dy}{dx}\right)^3 + y = 0$ is _____
- 3) Integrating factor of differential equation $\frac{dy}{dx} + xy = \sin x$ is _____
- 4) Order and degree (if defined) of a differential equation are always _____ integers.
- 5) Integrating factor of $\frac{dx}{dy} + Px = Q$ is _____
- 6) $(x + y)dy - (x - 2y)dx = 0$ is a _____ differential equation.
- 7) _____ substitution is applied to solve a homogeneous differential equation.
- 8) There are _____ number of arbitrary constants in the general solution of differential equation of order 3.
- 9) Differential equation representing the family of curve $y = mx + c$ is given by _____
- 10) After correct substitution, a homogeneous differential equation becomes _____ type of differential equation.

2 & 4 Marks Questions

1. Form the differential equations for the following family of the curves :

- (i) $y = A \cos mx + B \sin mx$
- (ii) $y = a \cos 3x + b \sin 3x$
- (iii) $y = Ae^x + Be^{-x}$
- (iv) $y = Ae^{3x} + Be^{5x} + x^2$

2. Solve the following differential equations :

- 1) $\frac{dy}{dx} = \log x$
- 2) $\frac{dy}{dx} - x \sin^2 x = \frac{1}{x \log x}$
- 3) $\frac{dy}{dx} + \frac{1+y^2}{y} = 0$
- 4) $\frac{dy}{dx} = \sin^2 y$
- 5) $\frac{dy}{dx} = \frac{1}{y^2 + \sin y}$
- 6) $\frac{dy}{dx} = e^y \sin x$
- 7) $x(e^{2y} - 1)dy + (x^2 - 1)e^y dx = 0$
- 8) $\frac{dy}{dx} - e^{y+x} = e^{x-y}$
- 9) $\log \frac{dy}{dx} = ax + by$
- 10) $(y + xy)dx + (x - xy^2)dy = 0$
- 11) $x^2(y + 1)dx + y^2(x - 1)dy = 0$
- 12) $x(x^2 - x^2y^2)dy + y(y^2 + x^2y^2)dx = 0$
- 13) $\frac{dy}{dx} = 1 - x + y - xy$
- 14) $x \sin y dy + (xe^x \log x + e^x)dx = 0$
- 15) $x \tan y dy + (xe^x \log x + e^x)dx = 0$
- 16) $\sec^2 x \tan y dx - \sec^2 y \tan x dy = 0$
- 17) $e^x \sqrt{1 - y^2} dx + \frac{y}{x} dy = 0$
- 18) $x dy + y dx = xy dx ; y(1) = 1$
- 19) $x(x dy - y dx) = y dx ; y(1) = 1$
- 20) $\frac{dy}{dx} = y \tan x ; y(0) = 1$
- 21) $\frac{dy}{dx} = y \sin 2x ; y(0) = 1$
- 22) $(1 + y^2)dx + x dy = 0 ; y(1) = 1$
- 23) $(x + y) \frac{dy}{dx} = 1$
- 24) $\frac{dy}{dx} = (4x + y + 1)^2$
- 25) $(x + y)^2 \frac{dy}{dx} = 16$
- 26) $(x^2 + xy)dy + (3xy + y^2)dx = 0$
- 27) $(y^2 - x^2)dy - 3xy dx = 0$
- 28) $2xy dx + (x^2 + 2y^2)dy = 0$
- 29) $x^2 dy - (x^2 + xy + y^2)dx = 0$
- 30) $(x^2 + y^2)dx + 2xy dy = 0$
- 31) $(x^2 - 2y^2)dx + xy dy = 0$
- 32) $ye^{\frac{x}{y}} dx = \left(xe^{\frac{x}{y}} + y\right) dy$
- 33) $2x^2 \frac{dy}{dx} - 2xy + y^2 = 0 ; y(e) = e$
- 34) $xe^{y/x} - y \sin \frac{y}{x} + xy' \sin \frac{y}{x} = 0 ; y(1) = 0$
- 35) $xdy - ydx = \sqrt{x^2 + y^2} dx$
- 36) $\frac{y}{x} \cos \frac{y}{x} dx - \left(\frac{y}{x} \sin \frac{y}{x} + \cos \frac{y}{x}\right) dy = 0$
- 37) $\frac{dy}{dx} + \frac{y}{x} = e^x$
- 38) $\frac{dy}{dx} - 4y = e^{2x}$
- 39) $x \frac{dy}{dx} + y = x^3$
- 40) $\frac{dy}{dx} + 2y = \sin 5x$
- 41) $\frac{dy}{dx} + 3y = \cos 2x$
- 42) $(1 + x^2) \frac{dy}{dx} - 2xy = (x^2 + 2)(x^2 + 1)$
- 43) $x \frac{dy}{dx} + y = x \log x$
- 44) $x \frac{dy}{dx} + y - x + xy \cot x = 0$
- 45) $(1 + x^2) \frac{dy}{dx} + y = \tan^{-1} x$
- 46) $\frac{dy}{dx} = 2x + y ; y(0) = 0$
- 47) $\frac{dy}{dx} = 4x + y ; y(0) = 1$
- 48) $x \frac{dy}{dx} + y = x^3 ; y(2) = 1$
- 49) $xy' - y = \log x ; y(1) = 0$
- 50) $(1 + x^2) \frac{dy}{dx} + (y - e^{-\tan^{-1} x}) ; y(0) = 1$