

Integration

Exercise 3.8 Differential Equation

1. Check that each of the following equations written against the differential equation is its solution.

(i) $x \frac{dy}{dx} = 1 + y$ (ii) $x^2(2y+1) \frac{dy}{dx} - 1 = 0$ (iii) $y \frac{dy}{dx} - e^{2x} = 1$
(iv) $\frac{1}{x} \frac{dy}{dx} - 2y = 0$ (v) $\frac{dy}{dx} = \frac{y^2 + 1}{e^{-x}}$

Solve the following differential equations

2. $\frac{dy}{dx} = -y$ 3. $ydx + xdy = 0$ 4. $\frac{dy}{dx} = \frac{1-x}{y}$
5. $\frac{dy}{dx} = \frac{y}{x^2}$ 6. $\sin y \operatorname{cosec} y \frac{dy}{dx} = 1$ 7. $x dy + y(x-1) dx = 0$
8. $\frac{x^2+1}{y+1} = \frac{x}{y} \frac{dy}{dx}$ 9. $\frac{1}{x} \frac{dy}{dx} = \frac{1}{2}(1+y^2)$ 10. $2x^2y \frac{dy}{dx} = x^2 - 1$
11. $\frac{dy}{dx} + \frac{2xy}{2y+1} = x$ 12. $(x^2 - yx^2) \frac{dy}{dx} + y^2 + xy^2 = 0$
13. $\sec^2 x \tan y dx + \sec^2 y \tan x dy = 0$ 14. $\left(y - x \frac{dy}{dx}\right) = 2\left(y^2 + \frac{dy}{dx}\right)$
15. $1 + \cos x \tan y \frac{dy}{dx} = 0$ 16. $y - x \frac{dy}{dx} = 3\left(1 + x \frac{dy}{dx}\right)$
17. $\sec x + \tan y \frac{dy}{dx} = 0$ 18. $(e^x + e^{-x}) \frac{dy}{dx} = e^x - e^{-x}$
19. Find the general solution of the equation $\frac{dy}{dx} - x = xy^2$ also find the particular solution if $y = 1$ when $x = 0$
20. Solve the differential equation given that $\frac{dx}{dt} = 2x$ When $t = 0$ then $x = 4$
21. Solve the differential equation $\frac{ds}{dt} + 2st = 0$ Also find the particular solution if $s = 4e$ When $t = 0$
22. In a culture, bacteria increase at the rate proportional to the number of bacteria present. If bacteria are 200 initially and are doubled in 2 hours. Find the number of bacteria present four hours later.
23. A ball is thrown vertically upward with a velocity of 240 m/s. Neglecting air resistance, find
i) Velocity of ball at any time
ii) Distance travel in any time
iii) Maximum height attained by the ball