

CHAPTER 9

MARCH 2017

DIFFERENTIAL EQUATIONS

SAY 2018

1. a) Write the integrating factor of the differential

$$\text{equation: } \frac{dy}{dx} + \frac{y}{x} = \sin x \quad (1)$$

- b) slope of the tangent to a curve at any point is twice the x coordinate of the point. If the curve passes through the point (1,4), find its equation. (3)

MARCH 2018

2. a) The degree of the differential equation

$$xy \left(\frac{d^2 y}{dx^2} \right)^2 + x^4 \left(\frac{dy}{dx} \right)^3 - \frac{dy}{dx} = 0 \text{ is}$$

- a) 4 b) 3
c) 2 d) 1 (1)

- b) Find the general solution of the differential

$$\text{equation } \sec^2 x \tan y dx + \sec^2 y \tan x dy = 0 \quad (3)$$

SAY 2017

3. a) The degree of the differential equation

$$2x^2 \frac{d^2 y}{dx^2} + x^4 \left(\frac{dy}{dx} \right)^3 + 7 = 0 \text{ is}$$

- a) 4 b) 3
c) 2 d) 1 (1)

- b) Solve the differential equation

$$(1 + y^2) \frac{dx}{dy} + x = e^{-\tan^{-1} y} \quad (5)$$

4. a) The order of the differential equation

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

- a) 1 b) 3
c) 4 d) 2 (1)

- b) Find the particular solution of the differential

$$\text{equation } (1 + x^2) \frac{dy}{dx} + 2xy = \frac{1}{1 + x^2}, y = 0 \text{ when } x = 1 \quad (5)$$

SAY 2016

5. a) The degree of the differential equation

$$\left(\frac{d^2 y}{dx^2} \right)^2 + \cos \left(\frac{dy}{dx} \right) = 0 \text{ is}$$

- i) 2 ii) 1
iii) 0 iv) not defined (1)

6. Solve
- $\frac{dy}{dx} + 2y \tan x = \sin x$
- ,
- $y = 0$
- , when
- $x = \frac{\pi}{3}$
- (5)

MARCH 2016

7. a)
- $y = a \cos x + b \sin x$
- is the solution of the differential equation.

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

- b) Find the solution of the differential equation

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

$$\text{when } x = 1 \quad (5)$$

SAY 2015

8. (a) Write the order and degree of the differential

$$\text{equation: } xy \left(\frac{d^2y}{dx^2} \right)^2 + x \left(\frac{dy}{dx} \right)^3 - y \frac{dy}{dx} = 0 \quad (1)$$

- (b) Find the general solution of the differential

$$\text{equation } y \log y \, dx - x \, dy = 0 \quad (3)$$

- (c) Find the integrating factor of the differential

$$\text{equation } x \frac{dy}{dx} - y = 2x^2. \quad (2)$$

MARCH 2015

9. (a) Consider the family of all circles having their centre at the point (1, 2). Write the equation of the family. (1)

Write the corresponding differential equation. (1)

- (b) Write the integrating factor of the differential

$$\text{equation } \cos x \frac{dy}{dx} + y = \sin x; 0 \leq x < \frac{\pi}{2} \quad (2)$$

JUNE 2014

10. Consider the differential equation

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

- a) Find its integrating factor. (1)

- b) Find its solution, given that $y = 2$ when

$$x = \frac{\pi}{2}. \quad (5)$$

MARCH 2014

11. Consider the differential equation $\frac{d^2y}{dx^2} + y = 0$

- a) Write its order and degree. (1)

- b) Verify that $y = a \cos x + b \sin x$, where $a, b \in R$ is a solution of the given differential equation. (2)

SAY 2013

12. a) From the differential equation of the family of circle having centre on y-axis and radius

$$3 \text{ units.} \quad (3)$$

- b) Solve the differential equation:

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

MARCH 2013

13. a) The general solution of the differential

$$\text{equation } \frac{dy}{dx} = e^{x-y} \text{ is}$$

- a) $e^y + e^x = c$ b) $e^y - e^x = c$
c) $e^{-y} + e^{-x} = c$ d) $e^{-y} - e^{-x} = c$ (1)

- b) Solve the differential equation

$$\frac{dy}{dx} = \frac{2xy}{1+x^2} + x^2 + 2 \quad (5)$$

SAY 2012

14. Prove that the differential equation

$$(3xy + y^2) dx + (x^2 + xy) dy = 0 \text{ is a homogenous differential equation of degree zero.} \quad (2)$$

$$\text{Solve the differential equation.} \quad (4)$$

MARCH 2012

15. Consider the differential equation

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

- a) Express it in the form $\frac{dy}{dx} = F(x, y)$ (1)
- b) Show that it is a homogeneous of degree zero. (2)
- c) Find its general solution. (3)

SAY 2011

16. a) Write the order and degree of the differential

$$\text{equation of } \left(\frac{dy}{dx}\right)^2 + \left(\frac{dy}{dx}\right) - \sin^2 y = 0 \quad (1)$$

b) Solve the differential equation

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

MARCH 2011

17. a) i) Solution of the differential equation

$$y' - y = 0 \text{ is } y = \dots\dots\dots (1)$$

ii) Solve the differential equation

$$\frac{dy}{dx} + y \sec x = \tan x \quad (2)$$

b) From the differential equation of the family of ellipses, having foci on the x- axis and centre at the origin. (3)

SAY 2010

18. If $\cos x \frac{dy}{dx} + y \sin x = \tan^2 x$ is a differential

equation, then

a) Find its order and degree. (1)

b) Find its general solution. (3)

MARCH 2010

19. a) Prove that the integrating factor of the differential equation:

$$(1 - x^2) \frac{dy}{dx} - xy = 1 \text{ is } \sqrt{1 - x^2} \quad (2)$$

b) Solve : $xy^2 \frac{dy}{dx} = x^3 + y^3$ (3)

JUNE 2009

20. a) From the differential equation corresponding to the equation $xy = c^2$. (1)

b) Consider the differential equation

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

i) Write the equation in the form

$$\frac{dy}{dx} = g\left(\frac{y}{x}\right) \quad (1)$$

ii) Solve the equation completely. (3)

MARCH 2009

21. a) From the differential equation corresponding to the function $y = ae^x + be^{2x}$. (2)

b) State the order and degree of the differential equation obtained. (1)

c) Solve the differential equation:

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

MARCH 2008

22. Consider the differential equation

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

- i) Find its integrating factor. (2)
- ii) Solve the differential equation. (2)

MARCH 2007

23. Consider the differential equation $\frac{d^2 y}{dx^2} = \cos x$

- i) Write the order and degree. (1)
- ii) Find a two parameter family of solutions to the above differential equation. (2)
- iii) Solve the differential equation:

$$\sec^2 x \tan y \, dx + \sec^2 y \tan x \, dy = 0 \quad (2)$$

