

# CHAPTER - 19

## Differential Equations

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### 1 MCQ'S WITH ONE CORRECT ANSWER

- 1) The differential equation whose solution is  $Ax^2 + By^2 = 1$  where  $A$  and  $B$  are arbitrary constants is of

- a) second order and second degree      c) first order and first degree  
b) first order and second degree      d) second order and first degree

[2006]

- 2) The differential equations of all the circles passing through the origin and having their centres on x-axis is

- a)  $y^2 = x^2 + 2xy \frac{dy}{dx}$       c)  $x^2 = y^2 + xy \frac{dy}{dx}$   
b)  $y^2 = x^2 - 2xy \frac{dy}{dx}$       d)  $x^2 = y^2 + 3xy \frac{dy}{dx}$

[2007]

- 3) The solution of the differential equation  $\frac{dy}{dx} = \frac{x+y}{x}$  satisfying the condition  $y(1) = 1$  is

- a)  $y = \ln x + x$       c)  $y = xe^{(x-1)}$   
b)  $y = x \ln x + x^2$       d)  $y = x \ln x + x$

[2008]

- 4) The differential equation which represents the family of curves  $y = c_1 e^{c_2 x}$ , where  $c_1$  and  $c_2$  are arbitrary constants, is

- a)  $\frac{d^2 y}{dx^2} = y \frac{dy}{dx}$       c)  $y \frac{d^2 y}{dx^2} = \left( \frac{dy}{dx} \right)^2$   
b)  $y \frac{d^2 y}{dx^2} = \frac{dy}{dx}$       d)  $\frac{dy}{dx} = y^2$

[2009]

- 5) Solutions of the differential equation  $\cos x dy = y(\sin x - y) dx$ ,  $0 < x < \frac{\pi}{2}$  is

- a)  $y \sec x = \tan x + c$       c)  $\tan x = (\sec x + c)y$   
b)  $y \tan x = \sec x + c$       d)  $\sec x = (\tan x + c)y$

[2010]

- 6) If  $\frac{d^2 y}{dx^2} = y + 3$  and  $y(0) = 2$ , then  $y(\ln 2)$  is equal to:

- a) 5  
b) 13
- c) -2  
d) 7.

[2011]

- 7) Let be the purchase value of an equipment and  $V(t)$  be the value after it has been used for  $t$  years. The value  $V(t)$  depreciates at a rate given by differential equation  $\frac{dV(t)}{dt} = -k(T-t)$ , where  $k$  is a constant and  $T$  is the total life in years of the equipment. Then the scrap value  $V(T)$  of the equipment is

- a)  $l - \frac{kT^2}{2}$   
b)  $l - \frac{k(T-t)^2}{2}$
- c)  $e^{-kT}$   
d)  $T^2 - \frac{1}{k}$

[2011]

- 8) The population  $p(t)$  at time of a certain mouse species satisfies the differential equation  $\frac{dp(t)}{dt} = 0.5p(t) - 450$ . If  $p(0) = 850$ , then the time at which the population becomes zero is:

- a)  $2 \ln 18$   
b)  $2 \ln 9$
- c)  $\frac{1}{2} \ln 18$

[2012]

- 9) At present, a firm is manufacturing 2000 times. It is estimated that the rate of change of production  $P$  with respect to additional number of workers  $x$  is given by  $\frac{dP}{dx} = 100 - 12\sqrt{x}$ . If the firm employs 25 more workers, then the new level of production of items is

- a) 2500  
b) 3000
- c) 3500  
d) 4500

[JEE M 2013]

- 10) Let the population of rabbits surviving at time  $t$  be governed by the differential equation  $\frac{dp(t)}{dt} = \frac{1}{2}p(t) - 200$ . If  $P(0) = 100$ , then  $p(t)$  equals:

- a)  $600 - 500e^{\frac{t}{2}}$   
b)  $400 - 300e^{\frac{-t}{2}}$
- c)  $400 - 300e^{\frac{t}{2}}$   
d)  $300 - 200e^{\frac{-t}{2}}$

[JEE M 2014]

- 11) Let  $y(x)$  be the solution of the differential equation  $(x \log x) \frac{dy}{dx} + y = 2x \log x$ , ( $x \geq 1$ ). Then  $y(e)$  is equal to:

- a) 2  
b)  $2e$
- c)  $e$   
d) 0

[JEE M 2015]

- 12) If the curve  $y = f(x)$  passes through the point  $(1, 1)$  and satisfies the differential equation,  $y(1 + xy) dx = x dy$ , then  $f\left(\frac{-1}{2}\right)$  is equals to

a)  $\frac{2}{5}$   
b)  $\frac{3}{5}$

c)  $\frac{2}{5}$   
d)  $\frac{3}{5}$

[JEE M 2016]

13) If  $(24 \sin x) \frac{dy}{dx} + (y + 1) \cos x = 0$  and  $y(0) = 1$  then  $y\left(\frac{\pi}{2}\right)$  is equal to

a)  $\frac{4}{3}$   
b)  $\frac{1}{3}$

c)  $\frac{2}{3}$   
d)  $\frac{1}{3}$

[JEE M 2017]

14) Let  $y = y(x)$  be the solution of the differential equation  $\sin x \frac{dy}{dx} + y \cos x = 4x, x \in (0, 2)$ . If  $y\left(\frac{\pi}{2}\right) = 0$ , then  $y\left(\frac{\pi}{6}\right)$  is equal to

a)  $\frac{-8}{9\sqrt{3}}\pi^2$   
b)  $\frac{-8}{9}\pi^2$

c)  $\frac{-4}{9}\pi^2$   
d)  $\frac{4}{9\sqrt{3}}\pi^2$

[JEE M 2018]

15) If  $y = y(x)$  is the differential equation  $\sin x \frac{dy}{dx} + 2y = x^2$  satisfying  $y(a) = 1$ , then  $y\left(\frac{1}{2}\right)$  is equal to

a)  $\frac{7}{64}$   
b)  $\frac{1}{4}$

c)  $\frac{49}{16}$   
d)  $\frac{13}{16}$

[JEE M 2019-9April(M)]

16) The solution of the differential equation  $x \frac{dy}{dx} + 2y = x^2$  ( $x \neq 0$ ) with  $y(1) = 1$ , is :

a)  $y = \frac{4}{5}x^3 + \frac{1}{5x^2}$   
b)  $y = \frac{x^3}{5} + \frac{1}{5x^2}$

c)  $y = \frac{x^2}{4} + \frac{3}{4x^2}$   
d)  $y = \frac{3}{4}x^2 + \frac{1}{4x^2}$

[JEE M 2019-9April(M)]