CHAPTER - 19
Differential Equations

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I. 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
   b) first order and second degree
   c) first order and first 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) $y^2 = x^2 + 2xy\frac{dy}{dx}$
   b) $y^2 = x^2 - 2xy\frac{dy}{dx}$
   c) $x^2 = y^2 + xy\frac{dy}{dx}$
   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) $y = \ln x + x$
   b) $y = x\ln x + x^2$
   c) $y = xe^{(x-1)}$
   d) $y = x\ln x + x$

[2008]

4) The differential equation which represents the family of curves $y = c_1e^{c_2}x, where c_1 and c_2$ are arbitrary constants,is
   a) $\frac{d^2y}{dx^2} = y\frac{dy}{dx}$
   b) $y\frac{d^2y}{dx^2} = \frac{dy}{dx}$
   c) $y\frac{d^2y}{dx^2} = (\frac{dy}{dx})^2$
   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) $y\sec x = \tan x + c$
   b) $y\tan x = \sec x + c$
   c) $\tan x = (\sec x + c)y$
   d) $\sec x = (\tan x + c)y$

[2010]

6) If $\frac{d^2y}{dx^2} = y + 3$ 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 2000times.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 $\frac{dp_{(t)}}{dt} = \frac{1}{2}p(t) - 200.\text{If}P(0) = 100, then p(t) equals$:
   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,$y(1+xy)dx = xdy$, then $f(\frac{-1}{2})$ is equals to
   a) $\frac{2}{5}$
   b) $\frac{4}{5}$
   c) $\frac{2}{5}$
   d) $\frac{4}{5}$

[JEE M 2016]

13) If $(24\sin x)\frac{dy}{dx} + (y+1)\cos x = 0$ and $y(0) = 1$ then $y(\frac{\pi}{2})$ 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 $y(\frac{\pi}{2}) = 0$,then $y(\frac{\pi}{6})$ 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 $y(\frac{1}{2})$ 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 $x\frac{dy}{dx} + 2y = x^2 (x \neq 0)\text{with} y(1) = 1, is$:
   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)]