Differential Equations

JEE-MAINS (PREVIOUS YEAR)

MCQ-Single Correct

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

(1) 1/3　　(2) -2/3

(3) -1/3　　(4) 4/3　　**[2017]**

2. If a 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 equal to :

(1) - 4/5　　(2) 2/5

(3) 4/5　　(4) -2/5　　**[2016]**

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

(1) 0　　(2) 2

(3) 2e　　(4) e　　**[2015]**

4. Let the population of rabbits surviving at a 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

(1) $400-300e^{t/2}$　　(2) $300-200e^{-t/2}$

(3) $600-500e^{t/2}$　　(4) $400-300e^{-t/2}$　　**[2014]**

5. At present, a firm is manufacturing 2000 items. It is estimated that the rate of change of production P w.r.t. 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

(1) 3000 (2) 3500

(3) 4500 (4) 2500 **[2013]**

6. A spherical baloon is filled with 4500 π cubic meters of helium gas. If a leak in the balloon causes the gas to escape at the rate of 72 π cubic metres per minute, then the rate (in meters per minute) at which the radius of the balloon decreases 49 minutes after the leakage began is

(1) 2/9 (2) 9/2

(3) 9/7 (4) 7/9 **[2012]**

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

(1) $\frac{1}{2}\ln 18$ (2) ln 18

(3) 2 ln 18 (4) ln 9. **[2012]**

8. Consider the differential equation $y^2 dx + \left(x - \frac{1}{y}\right) dy = 0$. If y(1) = 1, then x is given by

(1) $1 + \frac{1}{y} - \frac{e^{1/y}}{e}$ (2) $1 - \frac{1}{y} + \frac{e^{1/y}}{e}$

(3) $4 - \frac{2}{y} - \frac{e^{1/y}}{e}$ (4) $3 - \frac{1}{y} + \frac{e^{1/y}}{e}$ **[2011]**

9. Solution of the differential equation cos x dy = y(sin x – y) dx, $0 < x < \frac{\pi}{2}$ is

(1) y sec x = tan x + c (2) y tan x = sec x + c

(3) tan x = (sec x + c)y (4) sec x = (tan x +c)y **[2010]**

10. 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

(1) $y' = y^2$ (2) $y'' = y'y$

(3) $yy'' = y'$ (4) $yy'' = (y')^2$ **[2009]**

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

(1) y = ln x + x
(2) y = x ln x + x^2
(3) y = $xe^{(x-1)}$
(4) y = x ln x + x **[2008]**

12. The differential equation of the family of circles with fixed radius 5 units and centre on the line y = 2 is

(1) $(x-2)y'^2 = 25 - (y-2)^2$
(2) $(y-2)y'^2 = 25 - (y-2)^2$
(3) $(y-2)^2y'^2 = 25 - (y-2)^2$
(4) $(x-2)^2y'^2 = 25 - (y-2)^2$ **[2008]**

13. The normal to a curve at P(x,y) meets the x-axis at G. If the distance of G from the origin is twice the abscissa of P, then the curve is

(1) an ellipse
(2) a parabola
(3) a circle
(4) a hyperbola **[2007]**

14. The differential equation of all circles passing through the origin and having their centres on the x-axis is

(1) $x^2 = y^2 + xy\frac{dy}{dx}$
(2) $x^2 = y^2 + 3xy\frac{dy}{dx}$
(3) $y^2 = x^2 + 2xy\frac{dy}{dx}$
(4) $y^2 = x^2 - 2xy\frac{dy}{dx}$ **[2007]**

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

(1) second order and second degree
(2) first order and second degree
(3) first order and first degree
(4) second order and first degree **[2006]**

16. The differential equation representing the family of curves $y^2 = 2c(x + \sqrt{c})$, where c > 0, is a parameter, is of order and degree as follows:

(1) order 1, degree 2
(2) order 1, degree 1
(3) order 1, degree 3
(4) order 2, degree 2 **[2005]**

17. If $x\frac{dy}{dx} = y(\log y - \log x + 1)$, then the solution of the equation is

(1) $y\log\left(\frac{x}{y}\right)=cx$ (2) $x\log\left(\frac{y}{x}\right)=cy$

(3) $\log\left(\frac{y}{x}\right)=cx$ (4) $\log\left(\frac{x}{y}\right)=cy$ **[2005]**

18. The differetnatial equation for the family of curves $x^2 + y^2 - 2ay = 0$, where a is an arbitrary constant is

(1) $2(x^2 - y^2)y' = xy$ (2) $2(x^2 + y^2)y' = xy$

(3) $(x^2 - y^2)y' = 2xy$ (4) $(x^2 + y^2)y' = 2xy$ **[2004]**

19. The solution of the differential equation $y\,dx + (x + x^2y)\,dy = 0$ is

(1) $-\frac{1}{xy}=C$ (2) $-\frac{1}{xy}+\log y=C$

(3) $\frac{1}{xy}+\log y=C$ (4) $\log y = Cx$ **[2004]**

20. The degree and order of the differential equation of the family of all parabolas whose axis is x-axis, are respectively

(1) 2,1 (2) 1,2

(3) 3,2 (4) 2,3 **[2003]**

21. The solution of the differential equation $(1+y^2)+\left(x-e^{\tan^{-1}y}\right)\frac{dy}{dx}=0$, is

(1) $(x-2)=ke^{-\tan^{-1}y}$ (2) $2xe^{2\tan^{-1}y}=e^{2\tan^{-1}y}+k$

(3) $xe^{\tan^{-1}y}=\tan^{-1}y+k$ (4) $xe^{2\tan^{-1}y}=e^{\tan^{-1}y}+k$ **[2003]**

22. The solution of the equation $\frac{d^2y}{dx^2}=e^{-2x}$

(1) $\frac{1}{4}e^{-2x}$ (2) $\frac{1}{4}e^{-2x}+cx+d$

(3) $\frac{1}{4}e^{-2x}+cx^2+d$ (4) $\frac{1}{4}e^{-2x}+c+d$ **[2002]**

23. The order and degree of the differential equation $\left(1+3\frac{dy}{dx}\right)^{2/3}=4\frac{d^3y}{dx^3}$ are

(1) 1, 2/3 (2) 3,1

(3) 3,3 (4) 1,2 **[2002]**