MATHS

VMC MODULES ENGLISH

DIFFERENTIAL EQUATIONS

Level 1

1. Solve $\sec^2 x \tan y dx + \sec^2 y \tan x dy = 0$

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2. Solve the following differential equation.

$$\frac{dy}{dx} = e^{x+y}$$

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3. Solve the following differential equations.

$$\frac{dy}{dx} + y \tan x = \cos^3 x$$

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4. Solve the following differential equations.

$\frac{dy}{dx} = \frac{1+y^2}{1+x^2}$ if $y = 1$ for $x = 0$

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5. Solve the following differential equations.

$$\frac{dy}{dx} = e^{x-y} + x^2 e^{-y}$$

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6. Solve the following differential equations. $e^{\frac{dy}{dx}} = x + 1$ if $y = 3$ for $x = 0$.

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7. Solve the following differential equations.

$$\frac{dy}{dx} = \frac{x + y + 1}{x + y - 1}$$

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8. Solve the following differential equations.

$$2(x - 3y + 1)\frac{dy}{dx} = (4x - 2y + 1)$$

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9. Solve the following differential equations.

$$\frac{dy}{dx} = (4x + y + 1)^2$$

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10. Solve the following differential equations.

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

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11. Solve the following differential equations.

$$\frac{dy}{dx}=\sin(x+y)+\cos(x+y)$$

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12. Solve the differential equation $\frac{dy}{dx}+1=e^{x+y}$

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13. Solve the following differential equations.

$$ydx+\left(2\sqrt{xy}-x\right)dy=0$$

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14. Solve the following differential equations.

$$x\frac{dy}{dx}+y=x^3$$

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15. Solve the following differential equations.

$$\frac{dy}{dx}=\frac{2x-y+1}{x+2y-3}$$

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16. Solve the following differential equations.

$$\frac{dx}{x+y}=\frac{dy}{x-y}$$

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17. Solve the following differential equations.

$(2x - y + 4)dy + (4x - 2y + 5)dx = 0$

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18. Solve the following differential equations.

$$\frac{dy}{dx} = \frac{2x + 2y - 2}{x + y - 5}$$

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19. Solve the following differential equations.

$$\frac{dy}{dx} = -\frac{12x + 5y - 9}{5x + 2y - 4}$$

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20. Solve the following differential equations.

$$\frac{dy}{dx} = \frac{1 - 3x - 3y}{1 + x + y}$$

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21. Solve the following differential equations.

$dy/dx + y\tan x = \sin x$

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22. Solve the following differential equations.

$x^2(dy/dx) = y^2(1+x)$

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23. Solve the following differential equations.

$(2x - 10y^2)dy + ydx = 0, y \neq 0$

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24. Solve the following differential equations.

$(x + y - 1)(dy/dx) = 1$

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25. IF of the following differential equations.

$(1 - x^2)(dy/dx) + 2xy = x(1 - x^2)^{1/2}$

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26. Solve the following differential equations.

$dy/dx + y/x = y^3$

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27. Solve the following differential equations.

$$\frac{dy}{dx} + \frac{xy}{1 - x^2} = x\sqrt{y}$$

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28. Solve the following differential equations.

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

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29. The differential equation of the curve $\dfrac{x}{c-1} + \dfrac{y}{c+1} = 1$ is (a) *[Math Processing Error]* (cc) (dd)

$(ee)(ff)\left((gg)(hh)(ii)\dfrac{(jj)dy}{kk}((ll)dx)(mm)(\cap) + 1(oo)\right)\left((pp)(qq)y - x\right.$

(fff) (ggg)

$(hhh)(iii)\left((jjj)(kkk)(lll)\dfrac{(mmm)dy}{nnn}((ooo)dx)(ppp)(qqq) + 1(rrr)\right)\left((ss\right.$

$= 2(bbbb)\dfrac{(cccc)dy}{dddd}((eeee)dx)(ffff)(gggg)(hhhh)$

(iiii)

A. $\left(\dfrac{dy}{dx} - 1\right)\left(y + x\dfrac{dy}{dx}\right) = 2\dfrac{dy}{dx}$

B. $\left(\dfrac{dy}{dx} + 1\right)\left(y - x\dfrac{dy}{dx}\right) = \dfrac{dy}{dx}$

C. $\left(\dfrac{dy}{dx} + 1\right)\left(y - x\dfrac{dy}{dx}\right) = 2\dfrac{dy}{dx}$

D. none of these

Answer: C

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30. The differential equation of the family of curves represented by $y^3 = cx + c^3 + c^2 - 1$,where c is an arbitrary constant is of :

A. Order 1, degree 1

B. order 2, degree 1

C. order 1, degree 3

D. order 2, degree2

Answer: c

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31. Form the differential equation for the curve: $y = Ax^2 + Bx$, where a and b are arbitrary constant.

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32. The differential equation of family of curves of $y^2 = 4a(x + a)$is

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33. The differential equation of family of curves of $y^2 = 4a(x + a)$is

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34. Obtain the differential equation of the curve $y = a_1e^x + a_2e^{-x} where, a_1, a_2$being arbitrary constant.

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35. The order and degree of the differential equation, of which $xy = ce^x + be^{-x} + x^2$ is a solution, is:

A. $1, 3$

B. $2, 1$

C. $3, 2$

D. none of these

Answer: B

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36. The degree of the differential equation of all tangent lines to the parabola $y^2 = 4ax$ is

A. 1

B. 2

C. 3

D. none of these

Answer: B

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37. $\int e^{4x-5} dx$

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38. The general solution of the differential equation $\left[2\sqrt{xy} - x\right]dy + ydx = 0$ is (Here x,$y > 0$)

A. $\log + \sqrt{\frac{y}{x}} = c$

B. $\log - \sqrt{\frac{x}{y}} = C$

C. $\log y + \sqrt{\frac{x}{y}} = C$

D. none of these

Answer: C

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39. The solution of the differential equation $x^3\frac{dy}{dx}=y^3+y^2\sqrt{y^2-x^2}$ is :

A. $y+\sqrt{y^2-x^2}=cxy$

B. $y-\sqrt{y^2-x^2}=cxy$

C. $y\sqrt{y^2-x^2}=cx+y$

D. $x\sqrt{y^2-x^2}=cx+y$

Answer: A

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40. If $(y^3-2x^2y)dx+(2xy^2-x^3)dy=0,$ then the value of $xy\sqrt{y^2-x^2},$ is

A. $\frac{x}{y}\sqrt{x^2-y^2}=C$

B. $xy\sqrt{x^2-y^2}=C$

C. $xy\sqrt{y^2-x^2}=C$

D. $\frac{x}{y}\sqrt{x^2+y^2}=C$

Answer: C

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41. The general solution of $\frac{dy}{dx}+y\tan x=\sec x$ is

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42. For the differential equation whose solution is $(x-h)^2+(y-k)^2=a^2$ (a is a constant), its (a) order is 2 (b) order is 3 (c) degree is 2 (d) degree is 3

A. $\left\{1+\left(\frac{dy}{dx}\right)^2\right\}^a=a^2\frac{d^2y}{dx^2}$

B. $\left\{1+\left(\frac{dy}{dx}\right)^2\right\}^2 = a^2\left(\frac{d^2y}{dx^2}\right)^2$

C. $\left\{1+\left(\frac{dy}{dx}\right)\right\}^2 = a^2\left(\frac{d^2y}{dx^2}\right)^2$

D. none of these

Answer: B

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43. Integrating factor of $\frac{dy}{dx}+\frac{y}{x}=x^7-8, (x>0)$ is :

A. x

B. log x

C. $-x$

D. e^x

Answer: A

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44. solution of $(x+y-1)dx+(2x+2y-3)dy=0$ is :

A. $y+x+\log(x+y-2)=c$

B. $y+2x+\log(x+y-2)=c$

C. $2y+x+\log(x+y-2)=C$

D. $2y+2x+\log(x+y-2)=C$

Answer: C

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45. The solution of $y'=2+2x+2y^2+2xy^2, y(0)=0$ is :

A. $y^2 \exp.\left(x+\frac{x^2}{2}\right)-1$

B. $y^2=1+c\exp\left(x+\frac{x^2}{2}\right)$

C. $y=\tan(c+x+x^2)$

D. $y=\tan(2x+x^2)$

Answer: D

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46. The solution of $\frac{dy}{dx} - y = 1, y(0) = 1$ is given by

A. $-\exp.\ (x)$

B. $-\exp.\ (-x)$

C. -1

D. $2\exp.\ (x) - 1$

Answer: D

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47. Integral curve satisfying $y' = \frac{x^2 + y^2}{x^2 - y^2}$ and $y'(1) \neq 1$ has the slope at the point (1, 0) of the curve equal to:

A. $-\frac{5}{3}$

B. -1

C. 1

D. $\frac{5}{3}$

Answer: C

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48. The differential equation of the family of curves $y = e^{x}(A\cos x + B\sin x)$, where A and B are arbitrary constants is (a) $(b)(c)(d)\frac{(e)(f)d^{(g)2(h)}(i)y}{j}\left((k)d(l)x^{(m)2(n)}(o)\right)(p)(q) - 2(r)\frac{(s)dy}{t}((u$

(y) (z) *[Math Processing Error]* (xx) (yy) *[Math Processing Error]* (eeee) (ffff) *[Math Processing Error]* (ddddd)

A. $\frac{d^2y}{dx^2} = 2\frac{dy}{dx} - y$

B. $\frac{d^2y}{dx^2} = 2\frac{dy}{dx} - 2y$

C. $\frac{d^2y}{dx^2} = 2\frac{dy}{dx} - y$

D. $\frac{d^2y}{dx^2} = 2\frac{dy}{dx} + y$

Answer: B

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49. The general solution of a differential equation is $y = ae^{bx+c}$ where are arbitrary constants. The order the differential equation is :

A. 3

B. 2

C. 1

D. none of these

Answer: B

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50. The order of the differential equation whose general solution is given by $y=(C_1+C_2)\cos(x+C_3)-C_4e^{x+4_5}$, where C_1, C_2, C_3, C_4, C_5, are arbitrary constants, is (a) 5 (b) 4 (c) 3 (d) 2

A. 5

B. 4

C. 3

D. 2

Answer: C

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51. The differential equation of the family of curves $y=e^x(A\cos x+B\sin x)$, where A and B are arbitrary constants is (a) $(b)(c)(d)\frac{(e)(f)d^{(g)2(h)}(i)y}{j}\left((k)d(l)x^{(m)2(n)}(o)\right)(p)(q)-2(r)\frac{(s)dy}{t}((u$

(y) (z) *[Math Processing Error]* (xx) (yy) *[Math Processing Error]* (eeee) (ffff) *[Math Processing Error]* (ddddd)

A. $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 2y = 0$

B. $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = 0$

C. $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} - 2y = 0$

D. none of these

Answer: B

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52. If the solution of the differential equation $\frac{dy}{dx} = \frac{ax+4}{2y+f}$ represents a circle, then the value of a is:

A. 2

B. -2

C. 3

D. -3

Answer: B

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53. The differential equation of rectangular hyperbolas whose axes are asymptotes of the hyperbola $x^2 - y^2 = a^2$, is :

A. $y\frac{dy}{dx} = x$

B. $x\frac{dy}{dx} = -y$

C. $x\frac{dy}{dx} = y$

D. $xdy + ydx = 3$

Answer: B

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54. The integrating factor of the differential equation $\frac{dy}{dx}\left(x(\log)_e x\right) + y = 2(\log)_e x$ is given by (a) $(b)x(c)$ (d) (b) $(e)(f)(g)e^{(h)x(i)}(j)(k)$ (l) (c) $(m)(n)(o)((p)\log)_q e(r)(s)x(t)$ (u) (d)

[Math Processing Error] (ii)

A. $\log(\log x)$

B. e^x

C. $\log x$

D. x

Answer: C

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55. Find the differential equation of all the ellipses whose center is at origin and axis are co-ordinate axis.

A. $xyy_2 - xy_1^2 + yy_1 = 0$

B. $y_2 + xy_1^2 - yy_1 = 0$

C. $xyy_2 + xy_1^2 + yy_1 = 0$

D. none of these

Answer: D

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56. A particular solution of $\log(dy/dx) = 3x + 5y, y(0) = 0$ is :

A. $e^{x} + 3e^{-4y} = 4$

B. $4e^{3x} - 3e^{-4y} = 3$

C. $3e^{3x} + 4e^{4y} = 7$

D. none of these

Answer: D

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57. The solution (x+ y+ 2) dy = dx is :

A. $x + y + 2 = Ce^{y}$

B. $x + y + 4 = ccy$

C. $\log(x + y + 2) = Cy$

D. none of these

Answer: A::D

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58. The degree of the differential equation $Y_2^{3/2} - Y_1^{1/2} - 4 = 0$ is :

A. 6

B. 3

C. 2

D. 4

Answer: A

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59. The equation of the curve passing through (3, 9) which satisfies $dy/dx = x + 1/x^2$ is :

A. $6xy = 3x^2 - 6x + 29$

B. $6xy = 3x^2 - 29x + 6$

C. $6y = 3x^2 + 29 - 6x$

D. none of these

Answer: C

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60. The solution of $(3x + 3y - 4)dy + (x + y)dx = 0$ is given by :

A. $(x + y) + bg|x - y| - 4| = C$

B. $3x3y - 4\log|x - 4| = C$

C. $\frac{3}{2}(x + y) + bg|x + y - 2|x = c$

D. None of these

Answer: D

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61. The differential equation of all parabolas having their axes of symmetry coincident with the axes of x, is

A. $YY_1 + y_1^2 = 0$

B. $YY_2 + Y_1^2 = 0$

C. Both a and B

D. none of these

Answer: B

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62. The solution of $\frac{dy}{dx} + \frac{x}{1-x^2}y = x\sqrt{y}$, is given by

A. $3\sqrt{y} = (1 - x^2) + C(1 - x^2)^{1/4}$

B. $3\sqrt{y} = -(1 - x^2) + c(1 - x^2)$

C. $3\sqrt{y} = (1 - x^2) + (1 - x^2)$

D. none of these

Answer: B

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63. A continuously differentiable function $\phi(x) \in (0, \pi/2)$ satisfying $y' = 1 + y^2, y(0) = 0$, is

A. $Y = \tan x$

B. $y = x(x - \pi)$

C. $y = (x - \pi)(1 - e^x)$

D. not possible

Answer: A

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64. The integrating factor of differential equation $\cos x \frac{dy}{dx} + y \sin x = 1$ is

A. $Y \sec x \tan x = c$

B. $y \sec x = \tan x + c$

C. $Y \tan x = \sec x + c$

D. $y \tan x = \sec x \tan x + c$

Answer: B

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65. The equation of the curve whose slope is given by $\frac{dy}{dx} = \frac{2y}{x}; x > 0, \ y > 0$ and which passes through the point (1,1) is

A. $x^2 = Y$

B. $x = y^2$

C. $x = 2y$

D. $y = 2x$

Answer: A

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66. IF $y' = \frac{y}{x}(\log y - \log x + 1)$, then the solution of the equation is :

A. $\frac{\log(x)}{y} = cy$

B. $\frac{\log(y)}{x} = cy$

C. $\frac{\log(x)}{y} = cx$

D. $\frac{\log(y)}{x} = cx$

Answer: C::D

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67. The solution of $(x^2 + xy)dy = (x^2 + y^2)dx$ is

A. $\log x = \log(x - y) + \frac{y}{x} + C$

B. $\log x = 2\log(x - y) + \frac{y}{x} + C$

C. $\log x = \log(x - y) + \frac{x}{y} + C$

D. none of these

Answer: B

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68. The solution $x^2 \frac{dy}{dx} = x^2 + xy + y^2$ is :

A. $\tan^{-1}\frac{y}{x} = bgy + C$

B. $\tan^{-1}\frac{x}{y} = \log x + C$

C. $\tan^{-1}\frac{x}{y} = \log + C$

D. $\tan^{-1}\frac{y}{x} = \log x + C$

Answer: D

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69. The differential equation which represents the family of curves $y = e^{Cx}$ is $y_1 = C^2 y$ b. $xy_1 - In\, y = 0$ c. $x\, In\, y = yy_1$ d. $y\, In\, y = xy_1$

A. $y = cy$

B. $xy' - \log y = 0$

C. $x \log y = YY'$

D. $Y \log = xy$

Answer: D

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70. Integrating factor of the differential equation $(x . \log x) \frac{dy}{dx} + y = 2 \log x$ is

A. e^x

B. $\log x$

C. $\log(\log x)$

D. x

Answer: B

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71. Solution of differential equation $dy - \sin x \sin y dx = 0$ is

A. $e^{\cos x}.\ \tan\frac{y}{2} = C$

B. $e^{\cos x}.\ \tan Y = C$

C. $\cos x, \tan Y = C$

D. $\cos x, \sin y = C$

Answer: A

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72. If m and n are order and degree of the differential equation

$$\left(\frac{d^2y}{dx^2}\right)^5 + \frac{4\left(\frac{d^2y}{dx^2}\right)^3}{\frac{d^3y}{dx^3}} + \frac{d^3y}{dx^3} = x^2 - 1$$

A. $m = 3, n = 3$

B. $m = 3, n = 2$

C. $m = 2, n = 5$

D. $m = 3, n = 1$

Answer: B

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73. The solution of the differential equation $2x\frac{dy}{dx} - y = 3$ represents

(a) $circles$ b.straight lines c. $ellipses$ d. $parabolas$

A. straight line

B. circle

C. parabola

D. ellipse

Answer: C

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74. Find the differential equation of the family of curves, $x = A\cos nt + B\sin nt$, where A and B are arbitrary constants.

A. $\frac{d^2y}{dx^2} - \alpha^2 Y = 0$

B. $\frac{d^2y}{dx^2} + \alpha^2 Y = 0$

C. $\frac{d^2y}{dx^2} + \alpha Y = 0$

D. $\left(\frac{d^2y}{dx^2}\right) - \alpha Y = 0$

Answer: B

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75. Solution of the differential equation $(x-y)^2\left(\frac{dy}{dx}\right)=a^2$ is

A. $Y=\frac{1}{2}\log\left|\frac{x-y-1}{x-y-1}\right|+C$

B. $Y=\frac{1}{2}\log\left|\frac{x+y-1}{x+y+1}\right|+C$

C. both a and B

D. none of these

Answer: A

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76. The solution of $(x+\log y)dy+ydx=0$ when y(0) =1 is :

A. $y(x-1)+y\log y=0$

B. $y(x-1+y\log Y)+1=0$

C. $xy+y\log y-y+1=0$

D. none of these

Answer: C

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77. If $x(t)$ is a solution of $\frac{(1+t)dy}{dx} - ty = 1$ and $y(0) = -1$ then $y(1)$ is (a) $(b)(c) - (d)\frac{1}{e}2(f)(g)(h)$ (i) (b) $(j)(k)e + (l)\frac{1}{m}2(n)(o)(p)$ (q) (c) $(d)(e)e - (f)\frac{1}{g}2(h)(i)(j)$ (k) (d) $(l)(m)(n)\frac{1}{o}2(p)(q)(r)$ (s)

A. $-\frac{1}{2}$

B. $e + \frac{1}{2}$

C. $e - \frac{1}{2}$

D. $\frac{1}{2}$

Answer: A

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78. The order and degree of the differential equation of the family of ellipse having the same foci, are respectively

A. $1, 1$

B. $2, 1$

C. $2, 2$

D. $1, 2$

Answer: D

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79. The equation of the curve through the point (1,1) and whose slope is $\dfrac{2ay}{x(y-a)}$ is

A. $y^a.\, x^{2a} = e^{y-1}$

B. $y^2.\, x^{2x} = e^y$

C. $y^{2a}x^a = e^{y-1}$

D. none of these

Answer: A

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80. The solution of the differential equation $\frac{(x+2y^3)dy}{dx}=y$ is

A. $x=y^2(c+y^2)$

B. $x=y(c-y^2)$

C. $x=3y(c-y)^2$

D. $x=y(c+y^2)$

Answer: D

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81. A curve passes through $\left(1, \frac{\pi}{4}\right)$ and at (x, y) its slope is $\frac{\sin 2y}{x + \tan y}$.

Find the equation to the curve.

A. $x = \tan y$

B. $y = \tan x$

C. $x = 2\tan Y$

D. $y = 2\tan x$

Answer: A

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82. $y\frac{dy}{dx}\sin x = \cos x\left(\sin x - \frac{y^2}{2}\right)$; where at $x = \frac{\pi}{2}$,

A. $y^2 = \sin x$

B. $y^2 = 2\sin x$

C. $x^2 = \sin Y$

D. $x^2 = 2\sin Y$

Answer: A

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83. The differential equation for the family of curve $x^2 + y^2 - 2ay = 0$, where a is an arbitrary constant, is (a)

$(b)(c)2\left((d)(e)(f)x^{(g)2(h)}(i) - (j)y^{(k)2(l)}(m)(n)\right)(o)y^{(p)\ '(q)}(r) = xy($

(t) (u)

$(v)(w)2\left((x)(y)(z)x^{(aa)2(bb)}(cc) + (dd)y^{(ee)2(ff)}(gg)(hh)\right)(ii)y^{(jj)\ '(kk)}$

(nn) (oo) *[Math Processing Error]* (hhh) (iii)

$(jjj)(kkk)\left((lll)(mmm)\left(\bigcap\right)x^{(ooo)2(ppp)}(qqq) + (rrr)y^{(sss)2(ttt)}(uuu)\right($

(bbbb)

A. $(x^2 - y^2)Y' = 2xy$

B. $2(x^2 + y^2)Y' = xy$

C. $2(x^2 - y^2)Y' = xy$

D. $(x^2 + y^2)Y' = 2xy$

Answer: A

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84. Find the particular solution of $\cos y dx + (1 + 2e^{-x})\sin y dy = 0$ when $x = 0, y = \frac{\pi}{4}$

A. If both assertion and reason are CORRECT and the reason is CORRECT explanation of the assertion.

B. If both assertion and reason are CORRECT and the reason in INCORRECT explanation of the assertion.

C. If assertion is CORRECT and the reason in INCORRECT

D. If assertion in INCORRECT and the reason is CORRECT.

Answer: C

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85. Assertion: Integrating factor of $\frac{dy}{dx} + y = x^2$ is e^x

Reason: Integrating factor of $\frac{dy}{dx} + P(x)y = Q(x)$ is $e^{\int p(x)\,dx}$

A. If both assertion and reason are CORRECT and the reason is CORRECT explanation of the assertion.

B. If both assertion and reason are CORRECT and the reason in INCORRECT explanation of the assertion.

C. If assertion is CORRECT and the reason in INCORRECT

D. If assertion in INCORRECT and the reason is CORRECT.

Answer: A

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86. Assertion: The general solution of $\frac{dy}{dx} + y = 1$is $ye^x = e^X + C$

Reason: The number of arbitrary constant in the general solution of the differential equation is equal to the order of D.E.

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87. Find the equation of the curve in which the subnormal varies as the square of the ordinate.

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88. Find the equation of the curve passing through (2,1) which has constant sub-tangent.

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89. Find the curve for which the length of normal is equal to the radius vector.

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90. The family of curves, the subtangent at any point of which is the arithmetic mean of the coordinates of the point of tangency, is given by

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91. The equation of the family of curves which intersect the hyperbola xy=2 orthogonally is

A. $y=\frac{x^3}{6}+C$

B. $y=\frac{x^2}{4}+C$

C. $Y=-\frac{x^3}{6}+C$

D. $y=-\frac{x^2}{4}+C$

Answer: A

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92. The general solution of the differential equation $\frac{dy}{dx} = y \tan x - y^2 \sec x$ is

A. $\tan x = (C + \sec x)y$

B. $\sec y = (c + \tan y)x$

C. $\sec x = (c + \tan x)y$

D. none of these

Answer: C

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93. about to only mathematics

A. 10 log 2 years

B. 20 log 2 years

C. 30 log 2 years

D. none of these

Answer: B

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94. The solution of the $\frac{dy}{dx} = \frac{xy+y}{xy+x}$ is :

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95. The equation of the curve satisfying the differential equation $y_2(x^2+1) = 2xy_1$ passing through the point (0,1) and having slope of tangent at x=0 and 3 where (y_2 and y_1 represents 2nd and 1st order derivative), then

A. $y = x^2 + 3x + 2$

B. $y = x^2 + 3x + 1$

C. $y = x^3 + 3x + 1$

D. none of these

Answer: C

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

(a) $(b)(c)y = 2(d)$ (e) (b) $(f)(g)y = 2x(h)$ (i) (c) $(d)(e)y = 2x - 4(f)$

(g) (d) $(h)(i)y = 2(j)x^{(k)2(l)}(m) - 4(n)$ (o)

A. $y = 2$

B. $4y = x^2$

C. $y = 2x - 4$

D. $y = 2x^2 - 4$

Answer: B::C

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97. Solution of $ydx - xdy = x^2 ydx$ is:

A. $ye^{x^2} = cx^2$

B. $ye^{-x^2} = cx^2$

C. $y^2 e^{x^2} = cx^2$

D. $y^2 e^{-x^2} = cx^2$

Answer: C

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98. For solving $\frac{dy}{dx} = 4x + y + 1$, suitable substitution is

A. $Y = vx$

B. $Y = 4x + v$

C. $y = 4x$

D. $Y + 4x + 1 = V$

Answer: D

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99. The equation of the curve satisfying the differential equation $Y_2(x^2+1) = 4xy_1$, passing through the point (0, – 4) and having slope of tangent at x = 0 as 4 is:

A. $y = 4\left(\frac{x^5}{5} + x + \frac{2x^3}{3} - 1\right)$

B. $y = 4\left(\frac{x^5}{5} - x + \frac{3x^3}{3} - 1\right)$

C. $y = 4\left(\frac{x^5}{5} + x + \frac{2x^3}{3} + 1\right)$

D. none of these

Answer: A

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100. The solution of $\frac{x^2 dy}{dx} - xy = 1 + \frac{\cos y}{x}$ is (a) $(b)(c)\tan\left((d)(e)(f)\frac{y}{g}((h)2x)(i)(j)(k)\right) = c - (l)\frac{1}{m}\left((n)2(o)x^{(p)2(q)}(r)\right.$

(v) (w) *[Math Processing Error]* (ii) (jj)

$(kk)(ll)\cos\left((mm)(\cap)(\infty)\frac{y}{pp}x(qq)(rr)(ss)\right) = 1 + (tt)\frac{c}{uu}x(\vee)(ww)($

(yy) (d) *[Math Processing Error]* (rrr)

A. $\cos\frac{y}{x} = 1 + \frac{c}{x}$

B. $x^2 = (c + x^2)\tan\frac{y}{x}$

C. $\tan\frac{y}{2x} = C - \frac{1}{2x^2}$

D. $\tan\frac{y}{x} = c + \frac{1}{x}$

Answer: C

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101. The equation of the curve which passes through the point (2a, a) and for which the sum of the Cartesian sub tangent and the abscissa is equal to the constant a, is:

A. $y(x-a)=a^2$

B. $y(x+a)=a^2$

C. $x(y-a)=a^2$

D. $x(y+a)=a^2$

Answer: A

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102. The solution of the differential equation $(1+y^2)+\left(x-e^{\tan^{-1}y}\right)\frac{dy}{dx}=0$ is (A) $xe^{2\tan^{-1}y}=e^{\tan^{-1}y}+k$ (B) $(x-2)=ke^{-\tan^{-1}y}$ (C) $2xe^{\tan^{-1}y}=e^{2\tan^{-1}y}+k$ (D) $xe^{\tan^{-1}y}=\tan^{-1}y+k$

A. $(x-2)=Ke^{\tan^{-1}}y$

B. $2Xe^{\tan^{-1}}y=\tan^{-1}y+K$

C. $Xe\tan^{-1}Y=\tan^{-1}y+K$

D. $Xe^2\tan^{-1}y=\tan^{-1}y+K$

Answer: B

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103. The orthogonal trajectories to the family of curve $y = cx^K$ are given by :

A. $x^2 + cy^2$ = constant

B. $x^2 + ky^2$ = constant

C. $kx^2 + y^2 =$ costant

D. $x^2 - ky^2$ = constant

Answer: B

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Level 2

1. The equation of curves which intersect the hyperbola $xy = 4$ at an angle $\frac{\pi}{2}$ is

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2. Solve:

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

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3. Solve the differential equation : $\frac{dy}{dx} = \frac{x + y + 1}{x + y - 1}$

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4. The degree of the differential equation satisfying the relation $\sqrt{1 + x^2} + \sqrt{1 + y^2} = \lambda\left(x\sqrt{1 + y^2} - y\sqrt{1 + x^2}\right)$ is

A. 1

B. 2

C. 3

D. none of these

Answer: A

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5. The equation of the curve passing through the origin and satisfying the differential equation $\left(\frac{dy}{dx}\right)^2 = (x-y)^2$, is

A. $e^{2x}(1-x+y) = 1+x-y$

B. $e^{2x}(1+x-y) = 1-x+y$

C. $e^{2x}(1-x+y) = 1+x+y$

D. $e^2x(1+x+y) = 1-x+y$

Answer: A

Watch Video Solution

6. A ray of light coming from origin after reflectiion at the point $P(x, y)$ of any curve becomes parallel to x-axis, the , equation of the curve may be :

A. $y^2 = x$

B. $y^2 = 2x + 1$

C. $y^2 = 4x$

D. $y^2 = 4x + 1$

Answer: B

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7. Solution of the equation $xdy - \left[y + xy^3(1 + \log x)\right]dx = 0$ is :

A. $-\frac{x^2}{y^2} = \frac{2x^3}{3}\left(\frac{2}{3}\right) + C$

B. $\frac{x^2}{y^2} = \frac{2x^3}{3}\left(\frac{2}{3} + \log x\right) + C$

C. $= \frac{x^2}{y^2} = \frac{x^3}{3}\left(\frac{2}{3} + \log x\right) + c$

D. none of these

Answer: A

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8. The solution of the differential equation $(xy^4 + y)dx - xdy = 0,$ is

A. $4x^4y^3 + 3x^3 = cy^3$

B. $3x^3y^4 + 4x^3 = cy^3$

C. $3x^4y^3 + 4x^3 = cy^3$

D. none of these

Answer: C

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9. A particle of mass m moves on positive x-axis under the influence of force acting towards the origin given by $-kx^2\hat{i}$. If the particle starts from rest at $x = a$, the speed it will attain when it crosses the origin is

A. $k\sqrt{a}$

B. k

C. $k\sqrt{3a}$

D. $\frac{1}{k}\sqrt{a}$

Answer: C

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10. Given a function ' g' which has a derivative $g'(x)$ for every real x and satisfies $g'(0) = 2$ and $g(x+y) = e^y g(x) + e^y g(y)$ for all x and y then: Find g(x).

A. g(x) is increasing for all $x \in [-1, \infty)$

B. range of $g(x)$ is $\left[-\frac{2}{e}, \infty\right)$

C. $g''(x) > 0 \forall x$

D. $\lim_{x \to 0} \frac{g(x)}{x} = 1$

Answer: A::B

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11. If the general solution of the differential equation $y' = \frac{y}{x} + \phi\left(\frac{x}{y}\right)$, for some function ϕ is given by $y \ln|cx| = x$, where c is an arbitray constant, then $\phi\left(\frac{x}{y}\right)$ is equal to (here $y' = \frac{dy}{dx}$)

A. $-\frac{x^2}{y^2}$

B. $\frac{y^2}{x^2}$

C. $\frac{x^2}{y^2}$

D. $-\frac{y^2}{x^2}$

Answer: D

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12. The solutions of $y = x\left(\frac{dy}{dx} + \left(\frac{dy}{dx}\right)^3\right)$ are given by (where $p = \frac{dy}{dx}$ and k is constant)

A. the constant function $y = 0$

B. $y = p^{-3}e^{P^2/2}(P + P^3)$

C. $y = \left(kp^{-3}e^{1/2p^2}(P + P^3)\right)$

D. $Ye^{-1/2} = P^2 + 1$

Answer: A::B::D

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13. for any differential function $y = F$ (x) : the value of $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^3 \cdot \frac{d^2x}{dy^2}$

A. 1

B. 2

C. 0

D. 4

Answer: C

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14. $f(x) = \sin x + \int_{-\pi/2}^{\pi/2} (\sin x + t\cos x) f(t) dt$

The range of $f(x)$ is

A. $+\frac{\sqrt{5}}{3}$

B. $-\left(\frac{\sqrt{5}}{3}\right)$

C. 0

D. 1

Answer: A

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15. IF $x\frac{dy}{dx}+y=x.\frac{f(x.y)}{f'(x.y)}$ then f (x . y) is equal to (K being an arbitary constant)

A. $Ke^{x^2/2}$

B. $Ke^{y^2/2}$

C. $Ke^{xy/2}$

D. none of these

Answer: A

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16. Let $\frac{d}{dx}F(x)=\left(\frac{e^{\sin x}}{x}\right), x>0.$ If $\int_1^4 \frac{3}{x}e^{\sin x}\,\hat{}\,3dx=F(k)-F(1),$ then one of the possible values of k, is: 15 (b) 16 (c) 63 (d) 64

A. 16

B. 63

C. 64

D. 15

Answer: C

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17. The solution of the differential equation $xdx + ydy + \dfrac{xdy - ydx}{x^2 + y^2} = 0$, is

A. $y = x\tan\left(\dfrac{c + x^2 + y^2}{2}\right)$

B. $x = y\tan\left(\dfrac{x + x^2 + y^2}{2}\right)$

C. $y = x\tan\left(\dfrac{c - x^2 - y^2}{2}\right)$

D. none of these

Answer: C

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18. The solution of $\frac{dy}{dx}=\frac{x^2+y^2+1}{2xy}$ satisfying $y(1)=0$ is given by

A. a hyperbola

B. a circle

C. $y^2=(1+x)-10$

D. None

A. a hyperbola

B. a circle

C. $y^2=(1+x)-10$

D. None

Answer: A

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19. IF x cos $(y/x)(ydx+xdy)=y\sin(y/x)(xdy-ydx)$ y (1) = 2π then the value of $4\frac{y(4)}{\pi}\cos\left(\frac{y(4)}{4}\right)$ is :

A. 1

B. 2

C. 3

D. none of these

Answer: B

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20. If f(x) and g(x) are two solutions of the differential equation a $\frac{d^2y}{dx^2}+x^2\frac{dy}{dx}+y=e^x$, then $f(x)-g(x)$ is the solution of

A. $a^2\frac{d^2y}{dx^2}+x^2\frac{dy}{dx}+y=e^X$

B. $a^2\frac{d^2y}{dx^2}+y=0$

C. $a\frac{d^2y}{dx^2}+x^2\frac{dy}{dx}+y=0$

D. $a\frac{d^2y}{dx^2}+y=0$

Answer: C

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21. The solution of the differential equation $\frac{dy}{dx}=e^{x-y}(e^x-e^y)$ is

A. $e^y=e^x-1+Ce^{-e^x}$

B. $e^x=e^y-1+Ce^{-e^x}$

C. $e^x=e^y-1+Ce^{-ey}$

D. none of these

Answer: A

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22. Solve $\frac{dx}{dy}+\frac{x}{y}=\sin y$

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23. Solve: $y^4 dx + 2xy^3 dy = \frac{ydx - xdy}{x^3y^3}$

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24. A normal is drawn at a point $P(x, y)$ of a curve. It meets the x-axis and the y-axis in point A AND B, respectively, such that $\frac{1}{OA}+\frac{1}{OB}$ =1, where O is the origin. Find the equation of such a curve passing through $(5.\ 4)$

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25. If $\int_a^x ty(t)dt = x^2 + y(x)$, then find $y(x)$

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26. The solution of differential equation $xy' = x\left(\frac{y^2}{x^2} + \frac{f\left(\frac{y^2}{x^2}\right)}{f'\left(\frac{y^2}{x^2}\right)}\right)$ is

(a)

$$(b)(c)f\left((d)(e)(f)\frac{(g)(h)y^{(i)2(j)}(k)}{l}\left((m)(n)x^{(o)2(p)}(q)\right)(r)(s)(t)\right) = c($$

(z) (b) *[Math Processing Error]* (ggg) (c)

$$(d)(e)(f)x^{(g)2(h)}(i)f\left((j)(k)(l)\frac{(m)(n)y^{(o)2(p)}(q)}{r}\left((s)(t)x^{(u)2(v)}(w)\right)($$

(bb) (d) *[Math Processing Error]* (bbb)

A. $f\left(y^2/x^2\right) = cx^2$

B. $x^2 f\left(y^2/x^2\right) = c^2y^2$

C. $x^2 f\left(y^2/x^2\right) = C$

D. $f\left(y^2/x^2\right) = cy/x$

Answer: A

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27. Solution of the differential equation $\left(y + x\sqrt{xy}(x+y)\right)dx + \left(y\sqrt{xy}(x+y) - xdy = 0\right.$ is (a) *[Math Processing Error]* (ff) (gg)

$(hh)(ii)(jj)\frac{(kk)(ll)x^{(mm)2(nn)}(oo) + (pp)y^{(qq)2(rr)}(ss)}{tt}2(uu)(\vee) + 2(v$

(lll) (mmm)

$(nnn)(\infty o)(ppp)\frac{(qqq)(rrr)x^{(sss)2(ttt)}(uuu) + (vvv)y^{(www)2(xxx)}(yyy)}{zzz}2(c$

$+ 2(cccc)(dddd)\cot^{(eeee)(ffff)-1(gggg)}(hhhh)\sqrt{(iiii)(jjjj)(kkkk)\frac{x}{llll}y(}$

(rrrr) (d) None of these

A. $f\left(y^2/x^2\right) = cx^2$

B. $x^2 f\left(y^2/x^2\right) = c^2y^2$

C. $x^2 f\left(y^2/x^2\right) = C$

D. $f\left(y^2/x^2\right) = cy/x$

Answer: B

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28. A function $y = f(x)$ satisfies $(x+1)f'(x) - 2(x^2+x)f(x) = \frac{e^{x^2}}{x+1}, Aax > -1$. If $f(0) = 5$, then f(x) is

A. $\left(\frac{3x+5}{x+1}\right)e^{x^2}$

B. $\left(\frac{6x+5}{x+1}\right)e^{x^2}$

C. $\left(\frac{6x+5}{(x+1)^2}\right)e^{x^2}$

D. $\left(\frac{5-6x}{x+1}\right)e^{x^2}$

Answer: B

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29. The solution of the differential equation $\frac{dy}{dx} + \frac{y}{x} = \cos x$ is :

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30. The solution of the differential equation $2x^2y\frac{dy}{dx} = \tan(x^2y^2) - 2xy^2$ given $y(1) = \sqrt{\frac{\pi}{2}}$ is :

A. $\sin x^2Y^2 = e^{x-1}$

B. $\sin(x^2y^2) = x$

C. $\cos x^2Y^2 + x = 0$

D. $\sin(x^2y^2) = ee^x$

Answer: D

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31. The solution of differential equation

$(2y + xy^3) + (x + x^2y^2) = 0$ is

A. $x^2 + \frac{x^3y^3}{3}$

B. $xy^2 + \frac{x^3y^3}{3} = C$

C. $x^2Y + \frac{x^4Y^4}{4} = C$

D. none of these

Answer: A

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32. The solution of $ye^{-\frac{x}{y}}dx - \left(xe^{\left(-\frac{x}{y}\right)} + y^3\right)dy = 0$ is (a) $(b)(c)(d)e^{(e)(f)-(g)\frac{x}{h}y(i)(j)(k)}(l) + (m)y^{(n)2(o)}(p) = C(q)$ (r) (b) *[Math Processing Error]* (ee) (c) $(d)(e)2(f)e^{(g)(h)-(i)\frac{x}{j}y(k)(l)(m)}(n) + (o)y^{(p)2(q)}(r) = C(s)$ (t) (d) *[Math Processing Error]* (kk)

A. $e^{-x/y} + Y^2 = C$

B. $xe^{-x/y} + Y = 0$

C. $2e^{-x/y} + y^2 = c$

D. $e^{-x/y} + 2y^2 = c$

Answer: C

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33. The curve satisfying the equation $\frac{dy}{dx} = \frac{y(x+y^3)}{x(y^3-x)}$ and passing through the point $(4, -2)$ is (a) $(b)(c)(d)y^{(e)2(f)}(g) = -2x(h)$ (i) (b) $(j)(k)y = -2x(l)$ (m) (c) $(d)(e)(f)y^{(g)3(h)}(i) = -2x(j)$ (k) (d) None of these

A. $y^2 = -2x$

B. $y = -2x$

C. $y^3 = -2x$

D. $Y^3 = -2x$

Answer: C

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34. The solution of the differential equation

$\left\{1 + x\sqrt{x^2+y^2}\right\}dx + \left\{\left(x^2+y^2\right) - 1\right\}ydy = 0$ is equal to

A. $x^2 + \frac{y^2}{2} + \frac{1}{3} + \frac{1}{3}(x^2 + y^2)^{3/2} = C$

B. $x - \frac{y^3}{3} + \frac{1}{2}(x^2 + y^2)^{1/2} = C$

C. $x - \frac{y^2}{2} + \frac{1}{3}(x^2 + y^2)^{3/2} = C$

D. none of these

Answer: C

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35. Tangent to a curve intersect y-axis at a point P. A line perpendicular to this tangent through P passes through point (1, 0). The differential equation of the curves is

A. $y\frac{dy}{dx} - x\left(\frac{dy}{dx}\right)^2 = 1$

B. $\frac{xd^2}{dx^2} + \left(\frac{dy}{(dx)^2}\right) = 0$

C. $y\frac{dx}{dy + x = 0}$

D. none of these

Answer: A

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36. The curve in the first quadrant for which the normal at any point (x, y) and the line joining the origin to that point form an isosceles triangle with the x-axis as base is (a) an ellipse (b) a rectangular hyperbola (c) a circle (d) None of these

A. an ellipse

B. a reatangular hyperbola

C. a circle

D. none of these

Answer: B

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37. The family of curves represented by $\frac{dy}{dx}=\frac{x^2+x+1}{y^2+y+1}$ and $\frac{dy}{dx}+\frac{y^2+y+1}{x^2+x+1}=0$

A. touch each other `

B. are orthogonal

C. are one and the same

D. none of

Answer: B

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38. A normal at $P(x, y)$ on a curve meets the x-axis at Q and N is the foot of the ordinate at P. If $NQ=x\frac{1+y^2}{1+x^2}$, then the equation of curve given that is passes through the point (3,1) is

A. $x^2-y^2=8$

B. $x^2+2y^2=11$

C. $x^2 - 5y^2 = 4$

D. none of these

Answer: C

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39. The normal to a curve at $P(x, y)$ meet the x-axis at G. If the distance of G from the origin is twice the abscissa of P, then the curve is a (a) parabola (b) circle (c) hyperbola (d) ellipse

A. parabola

B. circle

C. hyperbola

D. ellipse

Answer: C

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Numerical Value Type For Jee Main

1. If y= y(x) $\frac{2_{\cos x}}{y+1}\left(\frac{dy}{dx}\right) = -\sin x, y(0) = 1$ then $y\left(\frac{\pi}{2}\right)$ equal ____.

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2. A curve is such that the intercept of the x-axis cut off between the origin and the tangent at a point is twice the abscissa and which passes through the point (1, 2). If the ordinate of the point on the curve is $\frac{1}{3}$ then the value of abscissa is :

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3. A partical moves in a straight line with a velocity given by $\frac{dx}{dt} = x+1$ (x is the distance described). The time taken by a particle to traverse a distance of 99 metres, is

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4. Find the order and degree of the following differential equation:

$$\frac{d^2y}{dx^2} = \left[y + \left(\frac{dy}{dx}\right)^6\right]^{\frac{1}{4}}$$

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5. The curve satisfying the equation $\frac{dy}{dx} = \frac{y(x+y^3)}{x(y^3-x)}$ and passing through the point $(4, -2)$ is (a) $(b)(c)(d)y^{(e)2(f)}(g) = -2x(h)$ (i) (b) $(j)(k)y = -2x(l)$ (m) (c) $(d)(e)(f)y^{(g)3(h)}(i) = -2x(j)$ (k) (d) None of these

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6. By elimating the constant in the following equation $x^2 - y^2 = C(x^2 + y^2)^2$ its differeential equation is $Y' \frac{x(\lambda y^2 - x^2)}{y(\lambda x^2 - Y^2)}$, then the value of λ is ....

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7. Find the equation of the curve passing through the origin if the middle point of the segment of its normal from any point of the curve to the x-axis lies on the parabola $2y^2 = x$.

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8. If the solution of differential equation $\frac{dy}{dx} = 1 + x + y^2 + xy^2$ where Y (0) =0 is $Y = \tan\left(x + \frac{x^2}{a}\right)$, then a is ______

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9. If K is constant such that $xy + k = e^{\frac{(x-1)^2}{2}}$ satisfies the differential equation $x.\frac{dy}{dx} = ((x^2 - x - 1)y + (x - 1)$ and $y(1) = 0$ then find the value of K .

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10. The curve whose equation satisfies $x\frac{dy}{dx}-4y-x^2\sqrt{y}=0=0$ passes through $\left(1,(1n4)^2\right)$ the find the value of $\frac{y(2)}{(1n32)^2}$

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11. IF the solution of differential equation $\frac{dy}{dx}=\frac{x-y}{x+y}$ is $(x+y)^2=C+ax^2$ then a is ____

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Jee Main Archive

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

A. $\frac{1}{3}$

B. $\frac{2}{3}$

C. $-\frac{1}{3}$

D. 1

Answer: A

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

(a) $(b)(c)y = 2(d)$ (e) (b) $(f)(g)y = 2x(h)$ (i) (c) $(d)(e)y = 2x - 4(f)$

(g) (d) $(h)(i)y = 2(j)x^{(k)2(l)}(m) - 4(n)$ (o)

A. $y = 2$

B. $y = 2x$

C. $y = 2x - 4$

D. $y = 2x^2 - 4$

Answer: C

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3. The order of the differential equation whose general solution is given by $y = (C_1 + C_2)\cos(x + C_3) - C_4 e^{x + 4_5}$, where C_1, C_2, C_3, C_4, C_5, are arbitrary constants, is (a) 5 (b) 4 (c) 3 (d) 2

A. 5

B. 4

C. 3

D. 2

Answer: C

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4. Let y(x) be the solution the differential equation $(x \log x)\dfrac{dy}{dx} + y = 2x \log x, (x \geq 1)$. Then y€ is equal to

A. e

B. 0

C. 2

D. 2e

Answer: C

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5. If $xdy = y(dx + ydy), y(1) = 1$and $Y(x) > 0$. Then, `y (-3)

is epual to

A. 3

B. 2

C. 1

D. 0

Answer: A

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6. If $x(t)$ is a solution of $\frac{(1+t)dy}{dx} - ty = 1$ and $y(0) = -1$ then $y(1)$ is (a) $(b)(c) - (d)\frac{1}{e}2(f)(g)(h)$ (i) (b) $(j)(k)e + (l)\frac{1}{m}2(n)(o)(p)$ (q) (c) $(d)(e)e - (f)\frac{1}{g}2(h)(i)(j)$ (k) (d) $(l)(m)(n)\frac{1}{o}2(p)(q)(r)$ (s)

A. $-\frac{1}{2}$

B. $e + \frac{1}{2}$

C. $e - \frac{1}{2}$

D. $\frac{1}{2}$

Answer: A

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7. 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) $40 - 300e^{-t/2}$

A. $400 - 300e^{\frac{t}{2}}$

B. $300 - 200e^{\frac{t}{2}}$

C. $600 - 500e^{\frac{t}{2}}$

D. $400 - 300e^{-\frac{t}{2}}$

Answer: A

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8. 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

A. 2500

B. 3000

C. 3500

D. 4500

Answer: C

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9. Let $y = g(x)$ be the solution of the differential equation $\frac{\sin(dy)}{dx} + y\cos x = 4x, x \in (0, \pi)$ If y(pi/2)=0, $theny$(pi/6)` is equal to

A. $-\frac{4}{9}\pi^2$

B. $\frac{4}{9\sqrt{3}}\pi^2$

C. $\frac{-8}{9\sqrt{3}}\pi^2$

D. $-\frac{8}{9}\pi^2$

Answer: D

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10. Let p (x) be a polynomial with real coefficient and $p(x) = x^2 + 2x + 1.$ Find P (1).

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

A. $\frac{7}{64}$

B. $\frac{13}{16}$

C. $\frac{1}{4}$

D. $\frac{49}{16}$

Answer: D

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12. Let $f:[0,1]\to R$ be such that $f(xy)=f(x)\times f(y)$ for all x, $y\in[0,1]$ and $f(0)\ne 0$. if $'y=y(x)$ satisfues the differential equation, $\frac{dy}{dx}=f(x)$ with$y(0)=1$, then $y\left(\frac{1}{4}\right)+y\left(\frac{3}{4}\right)$ is

A. 5

B. 4

C. 2

D. 3

Answer: D

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13. If $\frac{dy}{dx}+\frac{3}{\cos^2 x}y=\frac{1}{\cos^2 x}, x\in\left(\frac{-\pi}{3},\frac{\pi}{3}\right)$ and $y\left(\frac{\pi}{4}\right)=\frac{4}{3}$, then $y\left(-\right.$

equals

A. $\frac{1}{3}$

B. $\frac{1}{3}+e^6$

C. $-\frac{4}{3}$

D. $\frac{1}{3}+e^3$

Answer: B

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14. Let f be differentiable function such that

$$f'(x) = 7 - \frac{3}{4}\frac{f(x)}{x}, (x > 0) \text{ and } f(1) \neq 4 \text{ Then } \lim_{x \to 0^+} xf\left(\frac{1}{x}\right)$$

A. exists and equals 4/7

B. exists and equals 0

C. exist and equals 4

D. does not exist

Answer: C

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15. The curve amongst the family of curves, represented by the differential equation $(x^2 - y^2)dx + 2xydy = 0$ which passes through (1,1) is

A. a circle with centre on the y- axis

B. an ellipse with major axis along the y - axis

C. a circle with centre on the x- axis

D. A hy perbola with transverse axis along the x-axis

Answer: C

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16. The solution of the differential equation $\frac{dy}{dx} = (x - y)^2, \quad \text{when} \quad y(1) = 1$, is

A. $-\log\left|\frac{1 + X - y}{1 - x + y}\right| = x + y = 2$

B. $\log_e\left|\frac{2 - y}{2 - x}\right| = 2(y - 1)$

C. $-\log_e\left|\frac{1 - x + y}{1 + x - y}\right| = 2(x - 1)$

D. $\log_e\left|\frac{2 - x}{2 - y}\right| = x - y$

Answer: C

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17. If y(x) is the solution of the differential equation $\frac{dy}{dx} + \left(\frac{2x+1}{x}\right)y = e^{-2x}, x > 0$, where $y(1) = \frac{1}{2}e^{-2}$, then

A. $y(x)$ is decreasing in $\left(\frac{1}{2}, 1\right)$

B. y(x) is decreasing in (0,1)

C. $y(bg_e 2) = \frac{\log_e 2}{4}$

D. $y(bg_e 2)) = \log_e 4$

Answer: A

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18. If a curve passes through the point (1, -2) and has slope of the tangent at any point (x,y) on it as $\frac{x^2 - 2y}{x}$, then the curve also passes through the point

A. (-1,2)

B. $(\sqrt{3}, 0)$

C. $(3, 0)$

D. $(-\sqrt{2}, 1)$

Answer: B

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19. Let y = y(x) be the solution of the differential equation $x\frac{dy}{dx} + y = x\log_e x, (x > 1)$. If $2y(2) = \log_e 4 - 1$, then $y(e)$ is equal to

A. $\frac{e}{4}$

B. $-\frac{e^2}{2}$

C. $\frac{e^2}{4}$

D. $-\frac{e}{2}$

Answer: A

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20. Let $y = y(x)$be the solution of the differential equation, $\left(x^2+1\right)^2\frac{dy}{dx} + 2x\left(x^2+1\right)y = 1$ such that $y(0) = 0$If$\sqrt{a}y(1) = \frac{\pi}{32}$ then the value of 'a' is $\frac{1}{2\alpha}$. The value of is _______.

A. $\frac{1}{4}$

B. $\frac{1}{16}$

C. $\frac{1}{2}$

D. 1

Answer: B

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21. Given that the slope of the tangent to a curve $y = f(x)$ at any point (x, y) is $\frac{2y}{x^2}$. If the curve passes through the centre of the circle $x^2 + y^2 - 2x - 2y = 0$, then its equation is :

A. $x \log_e |y| = 2(x - 1)$

B. $x^2 \log_e |y| = -2(x - 1)$

C. $xbg_e |y| = x - 1$

D. $x \log_e |y| = -2(x - 1)$

Answer: A

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22. If cos $x \frac{dy}{dx} - y$ sin x = 6x, $\left(0 < x < \frac{\pi}{2}\right)$ and $y\left(\frac{\pi}{3}\right) = 0$ and $y\left(\frac{\pi}{6}\right)$ is equal to :

A. $-\frac{\pi^2}{4\sqrt{3}}$

B. $-\frac{\pi^2}{2}$

C. $-\dfrac{\pi^2}{2\sqrt{3}}$

D. $\dfrac{\pi^2}{2\sqrt{3}}$

Answer: C

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

A. $y=\dfrac{4}{5}x^3+\dfrac{1}{5x^2}$

B. $y=\dfrac{x^3}{5}+\dfrac{1}{5x^2}$

C. $y=\dfrac{x^2}{4}+\dfrac{3}{4x^2}$

D. $y=\dfrac{3}{4}x^2+\dfrac{1}{4x^2}$

Answer: C

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24. Let y=y(x) be the solution of the differential equation,

$\frac{dy}{dx} + y\tan x = 2x + x^2 \tan x, x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$, such that

y(0)= 1. Then

A. $y'\left(\frac{\pi}{4}\right) - y'\left(-\frac{\pi}{4}\right) = \pi - \sqrt{2}$

B. $Y\left(\frac{\pi}{4}\right) - Y\left(-\frac{\pi}{4}\right) = \sqrt{2}$

C. $Y\left(\frac{\pi}{4}\right) + Y\left(-\frac{\pi}{4}\right) = \frac{\pi^2}{2} + 2$

D. $y'\left(\frac{\pi}{4}\right) + Y'\left(-\frac{\pi}{4}\right) = \sqrt{2}$

Answer: A

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25. If y=y(x) is the solution of the differential equation $\frac{dy}{dx} = (\tan x - y)\sec^2 x, x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$, such that $y(0) = 0$, then $y\left(-\frac{\pi}{4}\right)$ is equal to:

A. $e - 2$

B. $2+\frac{1}{e}$

C. $\frac{1}{e}-2$

D. $1.2-e$

Answer: A

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26. Consider the differential equation, $y^2 dx+\left(x-\frac{1}{y}\right)dy=0$. If value of y is 1 when x = 1, then the value of x for which y = 2, is

A. $\frac{3}{2}-\sqrt{e}$

B. $\frac{1}{2}+\frac{1}{\sqrt{e}}$

C. $\frac{5}{2}+\frac{1}{\sqrt{e}}$

D. 3/2 -(1)/(sqrt(e))`

Answer: D

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27. The general solution of the differential equation $\left(y^2 - x^3\right)dx - xydy = 0 (x \neq 0)$ is $y^2 + kx^l + cx^2 = 0$. The value of $(l + k)$ is ________. (Where c is a constant of intetration)

A. $y^2 - 2x^3 + cx^2 = 0$

B. $y^2 + 2x^3 + cx^2 = 0$

C. $y^2 - 2x^2 + cx^3 = 0$

D. $y^2 + 2x^2 + cx^3 = 0$

Answer: B

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28. If a curve $y = f(x)$ passes through the point $(1, -1)$ and satisfies the differential equation , $y(1 + xy)dx = xdy$, then $f\left(-\frac{1}{2}\right)$ is equal to: (1) $-\frac{2}{5}$ (2) $-\frac{4}{5}$ (3) $\frac{2}{5}$ (4) $\frac{4}{5}$

A. $-\frac{2}{5}$

B. $-\frac{4}{5}$

C. $\frac{2}{5}$

D. $\frac{4}{5}$

Answer: D

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Jee Advance Archive

1. The differential equation $\frac{dy}{dx} = \frac{\sqrt{1-y^2}}{y}$ determinea a family of circles with :

A. variable radii and a fixed centre at (0, 1)

B. variable radii and a fixed centre at (0, –1)

C. fixed radius 1 and variable centres along the X-axis

D. fixed radius 1 and variable centres along the Y-axis

Answer: C

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2. The differential equation representing the family of curves $y^2 = 2c(x + \sqrt{c})$, where c is a positive parameter, is of (a) order 1 (b) order 2 (c) degree 3 (d) degree 4

A. order 1

B. order 2

C. degree 3

D. degree

Answer: A::C

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3. Let a solution y=y(x) of the differential equation $x\sqrt{x^2-1}dy - y\sqrt{y^2-1}dx = 0$ satisfy $y(2) = \frac{2}{\sqrt{3}}$

Statement I $y(x) = \sec\left(\sec^{-1}x - \frac{\pi}{6}\right)$

Statement II y(x) is given by $\frac{1}{y} = \frac{2\sqrt{3}}{x} - \sqrt{1 - \frac{1}{x^2}}$

A. Statement I s true, Statement II is also true,

Statement II is the correct explanation of Statement I.

B. Statement I is true, Statement II is also true,

Statement II is not the correct explanation of Statement I.

C. Statement I is true, Statement II is false.

D. Statement I is false, Statement II is true.

Answer: C

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4. Prove that for $x \in \left[0, \frac{\pi}{2}\right]$, $\sin x + 2x \geq \frac{3x(x+1)}{\pi}$.

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5. Let $f: R \to R$ be a continuous function which satisfies $f(x) = \int_0^x f(t)dt$. Then the value of $f(1n5)$ is_____

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6. Let $f: [0, 1] \to R$ (the set of all real numbers) be a function. Suppose the function f is twice differentiable, $f(0) = f(1) = 0$ and $satiies$ f\'\'(x)-2f\'(x)+f(x) ge e^x, x in [0,1]$Ifthefunctione$^(-x)f(x) $as\sum esits \min i\mu m \in the \int erval$[0,1]$atx$=1/4 , $whichofthefollow \in gistrue? (A)$f\'(x) lt f(x), 1/4 lt x lt 3/4(B)f\'(x) gt f(x), $0 < x < \frac{1}{4}$ (C) $f'(x) < f(x), 0 < x < \frac{1}{4}$ (D) $f'(x) < f(x), \frac{3}{4} < x < 1$

A. $f(x) < f(x), \frac{1}{4} < x < \frac{3}{4}$

B. $f(x)' > f(x)0 < x < \frac{1}{4}$

C. $f(x) < F(x), 0 < x < \frac{1}{4}$

D. $f'(x) < f(x), \frac{3}{4} < x < 1$

Answer: C

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7. Let $f: [0, 1] \to R$ (the set of all real numbers) be a function. Suppose the function f is twice differentiable, $f(0) = f(1) = 0$ and satisfies $f''(x) - 2f'(x) + f(x) \geq e^x, x \in [0, 1]$ Which of the following is true for $0 < x < 1$? (A) $0 < f(x) < \infty$ (B) $-\frac{1}{2} < f(x) < \frac{1}{2}$ (C) $-\frac{1}{4} < f(x) < 1$ (D) $-\infty < f(x) < 0$

A. $0 < f(x) < \infty$

B. $-\frac{1}{2} < f(x) < \frac{1}{2}$

C. $-\frac{1}{4} < f(x) < 1$

D. $-\infty < f(x) < 0$

Answer: D

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8. Let $f(x) = (1-x)^2 \sin^2 x + x^2$ for all x $\in$ R, and let $g(x) = \int \left(\frac{2(t-1)}{t+1} - \ln t \right) f(t) dt$ for t $\in$ [1, x] for all x $\in$ (1, ∞).Which of the following is true ?

A. g is increasing on $(1, \infty)$

B. g in decreasing on $(1, \infty)$

C. g is increasing on (1,2) and decreasing on $(2, \infty)$

D. g is decresing on $(1, 2)$and increasing in $(2, \infty)$

Answer: B

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9. Consider the statements : P : There exists some x IR such that f(x) + 2x = 2(1+x2) Q : There exists some x IR such that 2f(x) +1 = 2x(1+x) $f(x) = (1-x)^2 \sin^2 x + x^2 \quad \forall x \in R$ Then (A) both P and Q are true

(B) P is true and Q is false (C) P is false and Q is true (D) both P and Q are false.

A. Both I and II are true

B. I is true and II is false

C. I is false and II is true

D. Both I and II are false

Answer: C

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10. The function $y = f(x)$ is the solution of the differential equation $\frac{dy}{dx} + \frac{xy}{x^2 - 1} = \frac{x^4 + 2x}{\sqrt{1 - x^2}}$ in $(-1, 1)$ satisfying $f(0) = 0$. Then $\int_{\frac{\sqrt{3}}{2}}^{\frac{\sqrt{3}}{2}} f(x) dx$ is (a) $(b)(c)(d)\frac{\pi}{e}3(f)(g) - (h)\frac{(i)\sqrt{(j)3(k)}(l)}{m}2(n)(o)(p)$ (q) (b) $(r)(s)(t)\frac{\pi}{u}3(v)(w) - (x)\frac{(y)\sqrt{(z)3(aa)}(bb)}{cc}4(dd)(ee)(ff)$ (gg) (c) $(d)(e)(f)\frac{\pi}{g}6(h)(i) - (j)\frac{(k)\sqrt{(l)3(m)}(n)}{o}4(p)(q)(r)$ (s) (d) $(t)(u)(v)\frac{\pi}{w}6(x)(y) - (z)\frac{(aa)\sqrt{(bb)3(cc)}(dd)}{ee}2(ff)(gg)(hh)$ (ii)

A. $\frac{\pi}{3} - \frac{\sqrt{3}}{2}$

B. $\frac{\pi}{3} - \frac{\sqrt{3}}{4}$

C. $\frac{\pi}{6} - \frac{\sqrt{3}}{4}$

D. $\frac{\pi}{6} - \frac{\sqrt{3}}{2}$

Answer: B

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11. Let $f: \left[\frac{1}{2}, 1\right] \to R$ (the set of all real numbers) be a positive, non-constant, and differentiable function such that $f'(x) < 2f(x)\Big) and f\left(\frac{1}{2}\right) = 1$. Then the value of $\int_{\frac{1}{2}}^{1} f(x)dx$ lies in the interval (a) $(2e-1, 2e)$ (b) $(3-1, 2e-1)$ $\left(\frac{e-1}{2}, e-1\right)$ (d) $\left(0, \frac{e-1}{2}\right)$

A. $(2e-1, 2e)$

B. $(e-1, 2-1)$

C. $\left(\frac{e-1}{2}, e-1\right)$

D. $\left(0, \frac{e-1}{2}\right)$

Answer: D

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12. Let the $f(x)$ be differentiabe function on the interval $(0, \infty)$ such that $f(1) = 1$ and $\lim_{t \to x}\left(\frac{t^2 f(x) - x^2 f(t)}{t^2 - x^2}\right) = \frac{1}{2}\, \forall x > 0$, then $f(x)$ is:

A. $\frac{1}{3x} + \frac{2x^2}{3}$

B. $-\frac{1}{3x} + \frac{4x^2}{3}$

C. $-\frac{1}{x} + \frac{2}{x^2}$

D. $\frac{1}{x}$

Answer: A

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13. Integrating factor of $\sec^2 y \frac{dy}{dx} + x \tan y = x^3$

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14. Let u(x) and v(x) be two continous functions satisfying the differential equations $(du)(dx) + p(x)u = f(x)$ and $\frac{dv}{dx} + p(x)v = g(x)$, respectively. If $u(x_1) > v(x_1)$ for some x_1 and $f(x) > g(x)$ for all $x > x_1$, prove that any point (x, y),where $x > x_1$, does not satisfy the equations $y = u(x)$ and $y = v(x)$ simultaneously.

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15. Let $y'(x) + y(x)g'(x) = g(x)g'(x), y(0), x \in R,$ where $f'(x)$ denotes $\frac{dy(x)}{dx}$, and $g(x)$ is a given non-constant differentiable function on R with $g(0) = g(2) = 0.$ Then the value of $y(2)$ is_____

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16. A curve passes through the point $\left(1, \frac{\pi}{6}\right)$. Let the slope of the curve at each point (x, y) be $\frac{y}{x} + \sec\left(\frac{y}{x}\right), x > 0$. Then the equation of the curve is (a)

$(b)(c)\sin\left((d)(e)(f)\frac{y}{g}x(h)(i)(j)\right) = \log x + (k)\frac{1}{l}2(m)(n)(o)$ (p) (q)

$(r)(s)\mathrm{c\,o\,s\,e\,c}\left((t)(u)(v)\frac{y}{w}x(x)(y)(z)\right) = \log x + 2(aa)$ (bb) (cc)

$(dd)(ee)\sec\left((ff)(gg)(hh)\frac{(ii)2y}{jj}x(kk)(ll)(mm)\right) = \log x + 2(nn)$

(oo) (pp) *[Math Processing Error]* (fff)

A. $\sin\left(\frac{y}{x}\right) = \log x + \frac{1}{2}$

B. $\cos ec\left(\frac{y}{x}\right) = \log x + 2$

C. $\sec\left(\frac{2y}{x}\right) = \log x + 2$

D. $\cos\left(\frac{2y}{x}\right) = \log x + \frac{1}{2}$

Answer: A

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17. Tangent is drawn at any point P of a curve which passes through (1, 1) cutting x-axis and y-axis at A and B respectively. If AP:BP = 3:1, then ,

A. differential equation of the curve is $3x\dfrac{dy}{dx}+y=0$

B. differential equation of the curve is $3x\dfrac{dy}{dx}-y=0$

C. curve is passing through $\left(\dfrac{1}{8},2\right)$

D. normal at $(1, 1)$ is $x+3y=4$

Answer: A::C

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18. A spherical rain drop evaporates at a rate proportional to its surface area at any instant t. The differential equation giving the rate of change of the radius of the rain drop is _____

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19. If length of tangent at any point on the curve $y = f(x)$. Intercepted between the point and the x-axis is of length 1. Find the equation of the curve.

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20. A right circular cone with radius R and height H contains a liquid which evaporates at a rate proportional to its surface area in contact with air (proportionality constant $= k > 0$). Find the time after which the cone will be empty.

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21. A country has a food deficit of 10%. Its population grows continuously at the rate of 3% per year. Its annual food production every year is 4% more than that of the last year Assuming that the average food requirement per person remains constant, prove that the country will become self-sufficient in food after n years, where n is the smallest integer bigger than or equal to $\frac{\log_e 10 - \log_e 9}{(\log_e 1.04) - 0.03}$

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22. A curve passing through the point (1,1) has the porperty that the perpendicular distance of the normal at any point P on the curve from the origin is equal to the distance of P from x-axis Determine the equation of the curve.

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23. A and B are two separate reservoirs of water. Capacity of reservoir A is double the capacity of reservoir B. Both the reservoirs are filled completely with water, their inlets are closed and then the water is released simultaneously from both the reservoirs. The rate of flow of water out of each reservoir at any instant of time is proportional to the quantity of water in the reservoir at the time. One hour after the water is released, the quantity of water is reservoir A is $1\frac{1}{2}$ times the quantity of water in reservoir B. After how many hours do both the reservoirs have the same quantity of water?

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24. Determine the equation of the curve passing through the origin, in the form $y = f(x)$, which satisfies the differential equation $\frac{dy}{dx} = \sin(10x + 6y)$.

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25. If $y = y(x)$ satisfies the differential equation

$8\sqrt{x}\left(\sqrt{9+\sqrt{x}}\right)dy = \left(\sqrt{4+\sqrt{9+\sqrt{x}}}\right)^{-1}$ dx

$x > 0$ and $y(0) = \sqrt{7}$, then $y(256)$=

A. 16

B. 3

C. 9

D. 80

Answer: B

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26. The value of $\sum_{k=1}^{13} \frac{1}{\sin\left(\frac{\pi}{4} + \frac{(k-1)\pi}{6}\right)\sin\left(\frac{\pi}{4} + \frac{k\pi}{6}\right)}$ is equal to

A. $3 - \sqrt{3}$

B. $2(3 - \sqrt{3})$

C. $2(\sqrt{3} - 1)$

D. $2(2 + \sqrt{3})$

Answer: C

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27. Let $y(x)$ be a solution of the differential equation $(1+e^x)y'+ye^x=1$. If $y(0)=2$, then which of the following statements is (are) true? (a)$y(-4)=0$ (b)$y(-2)=0$ (c)$y(x)$ has a critical point in the interval $(-1,0)$ (d)$y(x)$ has no critical point in the interval$(-1,0)$

A. $Y(-4)=0$

B. $y(-2)=0$

C. y(x) has a $(-1,0)$

D. $y(x)$ has a critical point in the interval $(-1,0)$

Answer: C

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28. Consider the family of all circles whose centers lie on the straight line $y=x$. If the family of circles is represented by the differential equation $Py^{''}+Qy'+1=0$, where P, Q are functions of x, y and y' (here

$y' = \frac{dy}{dx}, y'' = \frac{d^2y}{dx^2}$, then which of the following statements is (are) true?

A. $p = y + x$

B. $p = y - x$

C. $P + Q = 1 - x + y + y' + (y)^2$

D. $P - Q = x + y - Y' - (Y')^2$

Answer: B::C

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29.

Let $f: (0. \infty) \rightarrow R$ be a differentiable function such that $f'(x) = 2 -$

Then

A. $\lim_{x \to 0^+} f\left(\frac{1}{x}\right) = 1$

B. $\lim_{x \to 0^+} xf\left(\frac{1}{x}\right) = 2$

C. $\lim_{x \to 0^+} x^2 f'(x) = 0$

D. $|f(x) \leq 2|$ for all $x \in (0, 2)$

Answer: A

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30. Let $f: R \to R$ be a differentiable function with $f(0) = 0$. If $y = f(x)$ satisfies the differential equation

$\frac{dy}{dx} = (2 + 5y)(5y - 2)$, then the value of $\lim_{x \to \infty} f(x)$ is...................

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31. A solution curve of the differential equation $(x^2 + xy + 4x + 2y + 4)\frac{dy}{dx} - y^2 = 0, x > 0,$ passes through the point (1,3) Then, the solution curve

A. Intersects $y = x + 2$exactly at one point

B. intersects $y = x + 2$ exactly at two points

C. intersects $y = (x + 2)^2$

D. Does not intersect $y = (x + 3)^2$

Answer: A::D

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32. let T denote a curve $y = f(x)$ which is in the first quadrant and let the point (1,0) lie on it. Let the tangent to T at a point P intersect the y-axis at Y_P and PY_P has length 1 for each poinit P on T. then which of the following option may be correct?

A. Order 1

B. $xy' + \sqrt{1 - x^2} = 0$

C. $y = \log_e\left(\frac{1 + \sqrt{1 - x^2}}{x}\right) + \sqrt{1 + x^2}$

D. $xy'\sqrt{1 - x^2} = 0$

Answer: A::B

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