MATHS

JEE (MAIN AND ADVANCED) MATHEMATICS

DIFFERENTIAL EQUATIONS

Solved Example

1. Form the differential equation from the relation $xy = ax^2 + \frac{b}{x}$ eliminating the arbitrary constant a, b

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2. Obtain the differental equations of the family of parabolas having their focus at the origin and the axis along the x-axis.

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3. Solve the following differential equations.

$$y - x\frac{dy}{dx} = 5\left(y^2 + \frac{dy}{dx}\right)$$

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4. Solve $y^2 - x\frac{dy}{dx} = a\left(y + \frac{dy}{dx}\right)$

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5. Solve the following differential equations.

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

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6. Solve $\frac{dy}{dx} + 1 = e^{x+y}$

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7. Solve $\frac{dy}{dx} = 1 + x\tan(y - x)$

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

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9. Solve $(x - y)^2 \frac{dy}{dx} = a^2$

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10. Solve $\frac{dy}{dx} = (3x + y + 4)^2$

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11. Find the equation of the curve whose slope, at any point, (x, y) is $\frac{y}{x^2}$ and which stisfies the conditon y=1 when x=3.

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12. (i) Express $\left(x+\sqrt{x^2+y^2-y^2}\right)dx+xydy=0$ in the form $\frac{dy}{dx}=F\left(\frac{y}{x}\right)$

(ii) Express the differental equation

$xydx+x^2dy-y\sqrt{x^2+y^2}dy=0$ in the form $\frac{dx}{dy}=F\left(\frac{x}{y}\right)$

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13. Solve $\left(x^2+y^2\right)dx=2xydy$

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14. Solve the following differential equations.

$y^2 dx + (x^2 - xy + y^2)dy = 0$

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15. Solve $(x^3 - 3xy^2)dx + (3x^2y - y^3)dy = 0$

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16. Solve the following differential equations.

$(x^2y - 2xy^2)dx = (x^3 - 3x^2y)dy$

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17. Solve : $(x - y\log y + y\log x)dx + x(\log y - \log x)dy = 0$

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18. Solve $x\sec\left(\frac{y}{x}\right)\cdot(ydx+xdy)=y\ \ \text{cosec}\left(\frac{y}{x}\right)\cdot(xdy-ydx)$

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19. Solve $\left(1+e^{\frac{x}{y}}\right)dx+e^{\frac{x}{y}}\left(1-\frac{x}{y}\right)dy=0$

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20. Give the solution of $x\ \ \sin^2\frac{y}{x}dx=ydx-xdy$ which passes through the point $\left(1,\frac{\pi}{4}\right)$.

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21. Solve the following differential equations.

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

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22. Solve the following differential equations.

$$\frac{dy}{dx} = \frac{4x + 6y + 5}{3y + 2x + 4}$$

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23. Solve the following differential equations.

$$\frac{dy}{dx} = \frac{3y - 7x + 7}{3x - 7y - 3}$$

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24. Find the I.F's of the following differential equations by transforming them into linear form.

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

(ii) $\left(2x - 10y^3\right) \frac{dy}{dx} + y = 0$

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25. Solve $\frac{1}{x}\frac{dy}{dx}+y.\,e^{x}=e^{(1-x)e^{x}}$

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26. Find the solution of the equation

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

which satisfies the condition that y = 9 when x = 3.

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27. Solve the following differential equations.

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

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28. The solution of $\frac{dy}{dx}+x\sin 2y=x^{3}\cos^{2}y$ is

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Example

1. The solution of $(x^2+1)\frac{dy}{dx}+4xy=\frac{1}{x^2+1}$ is

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2. Solve $\frac{dy}{dx}+\frac{y}{x}=x^2y^6$

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Additional Solved Example

1. Find the order and degree of the D.E

$$\frac{d^2y}{dx^2}+2\frac{dy}{dx}+y=\log\left(\frac{dy}{dx}\right)$$

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2. Form the differential equations the family of curves $y = cx + c - c^2$ where c is a parameter.

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3. (i) Find the differential equation of the family of circles of fixed radius r with centres on the X-axis.

(ii) Form the differential equation representing all the tangents to the prabola $y^2 = 2x$.

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4. Solve $4xdy - ydx = x^2dy$.

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5. Solve $\frac{dx}{dt} = \frac{t(2\log t + 1)}{\sin x + x\cos x}$

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6. Solve $ydx - xdy + 4x^3y^2e^{x^4}dx = 0$

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7. Solve $xdy + ydx - \frac{a^2(xdy - ydx)}{x^2 + y^2}$

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8. Solve $\left(2x\sin h\frac{y}{x} + 3y\cos h\frac{y}{x}\right)dx - 3x\cos h\frac{y}{x}dy = 0$

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Exercise 4 1 Very Short Answer Questions

1. Find the order and degree of the following D.E's

(i) $\frac{d^2y}{dx^2} + 2\left(\frac{dy}{dx}\right)^2 + 5y = 0$

(ii) $2\frac{d^2y}{dx^2} = \left(5 + \frac{dy}{dx}\right)^{\frac{5}{3}}$

(iii) $1 + \left(\frac{d^2y}{dx^2}\right)^2 = \left[2 + \left(\frac{dy}{dx}\right)^2\right]^{(3/2)}$

(iv) $\left[\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^3\right]^{\left(\frac{6}{5}\right)}$ = $6y$

(v) $\left[\left(\frac{dy}{dx}\right)^2 + \frac{d^2y}{dx^2}\right]^{\frac{7}{3}} = \frac{d^{3y}}{dx^3}$

(vi) $\left[\left(\frac{dy}{dx}\right)^{\frac{1}{2}} + \left(\frac{d^2y}{dx^2}\right)^{\frac{1}{2}}\right]^{\frac{1}{4}} = 0$

(vii) $\frac{d^2y}{dx^2} + p^2y = 0$

(viii) $\left(\frac{d^3y}{dx^3}\right)^2 - 3\left(\frac{dy}{dx}\right)^2 - e^x = 4$

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2. Find the order of the differential equation corresponding to

(i) $y = c(x - c)^2$ where c is an arbitrary constant.

(ii) $y = Ae^x + Be^{3x} + Ce^{5x}$ where A, B, C are arbitrary constant.

(iii) $xy = ce^{x} + be^{-x} + x^{2}$ where b, c are arbitrary constants.

(iv) The family of all circles in the xy-plane with centre at the origin.

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Exercise 4 1 Short Answer Questions

1. Form the differential equations corresponding to the family of curves.

(i) y = c(x-2c) where c is a parameter.

(ii) y = a cos 3x + b sin 3x where a, b are parameters.

(iii) y = a cos x + b sin x where a, b are parameters.

(iv) $y = ae^{x} + be^{-x}$ where a, b are parameters.

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2. Form the differential equations of the following families of curves by elimnating the parameters (arbitrary constants) given against them in the brackets.

(i) $y = c(x - c)^2$, (c)

(ii) $xy = ae^x + be^{-x}$, (a, b)

(iii) $y = (a + bx)e^{Kx}$, (a, b)

(iv) $y = a\cos(nx + b)$, (a, b)

(v) = $y = ae^{3x} + be^{4x}$, (a, b)

(vi) $y = ax^2 + bx$, (a, b)

(vii) $ax^2 + by^2 = 1$ (a,b)

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3. Find the differential equations of the family of circles (i) touching the y-axis at the origin (ii) having centres on the y-axis and passing through the origin.

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4. The differential equation of the family of ellipses having centres at the origin and whose axes are the coordinate axes is

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5. Find the D.E. of the family of rectangular hyperbolas which have the corrdinate axes as asymptotes.

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Exercise 4 2 Very Short Answer Questions

1. Express the following differential equations in the form f(x)dx+g(y)dy = 0

(i) $\frac{dy}{dx} = \frac{2y}{x}$ (ii) $x + y\frac{dy}{dx} = 0$

(iii) $\frac{dy}{dx} = e^{x-y} + x^2 . e^{-y}$

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

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2. Solve the following differential equations.

(i) $\frac{dy}{dx}=\frac{1+y^2}{1+x^2}$ (ii) $\frac{dy}{dx}=\frac{\sqrt{1-y^2}}{\sqrt{1-x^2}}$

(iii) $\frac{dy}{dx}=2y\tan hx$

(iv) $\sqrt{1+x^2}dx+\sqrt{1+y^2}dy=0$

(v) $\frac{dy}{dy}=e^{x-y}+x^2e^{-y}$

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3. Solve the following differential equations.

(i) Solve $\sqrt{1-x^2}dy+\sqrt{1-y^2}dx=0$

(ii) Solve $x+y\frac{dy}{dx}=0$

(iii) Solve $\frac{dy}{dx}=\frac{2y}{x}$

(iv) Solve $\frac{dy}{dx}+x^2=x^2e^{3y}$

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Exercise 4 2 Short Answer Questions

1. Find the general solutions of the following differential equations.

(i) $\frac{dy}{dx} = e^{x+y}$ (ii) $\frac{dy}{dx} = e^{y-x}$

(iii) $\frac{dy}{dx} = \frac{xy + y}{yx + x}$

(iv) $y(1 + x)dx + x(1 + y)dy = 0$

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2. Find the general solutions of the following differential equations.

(i) $\sin^{-1}\left(\frac{dy}{dx}\right) = x + y$

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

(iii) $\frac{dy}{dx} = \sqrt{y - x}$ (iv) $\frac{dy}{dx} = (x - y)^2$

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3. Find the general solutions of the following differential equations.

$$\frac{dy}{dx} = (4x + 9y + 1)^2$$

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4. Solve the following differential equations.

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

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5. Find the general solutions of the following differential equations.

(i) $\left(xy^2 + x\right)dx + \left(yx^2 + y\right)dy = 0$

(ii) $\dfrac{dy}{dx} = \dfrac{y^2 + 2y}{x - 1}$

(iii) $(e^x + 1)ydx + (y + 1)dx = 0$

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6. Find the general solutions of the following differential equations.

(i) $\tan y. \sec^2 x dx + \tan x. \sec^2 y dy = 0$

(ii) tan ydx + tan xdy = 0

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7. Solve the following differential equations.

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

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8. Solve the following differential equations.

$$y-x\frac{dy}{dx}=5\left(y^2+\frac{dy}{dx}\right)$$

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9. Find the general solutions of the following differential equations.

$$\frac{dy}{dx}=\frac{x(1+2\log x)}{\sin y+y\cos y}$$

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Excerise 4 3 Very Short Answer Questions

1. Express the following differential equations in the form $\frac{dy}{dx} = F\left(\frac{y}{x}\right)$.

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

(ii) $\left[x - y\tan^{-1}\left(\frac{y}{x}\right)\right]dx + x\tan^{-1}\left(\frac{y}{x}\right)dy = 0$

(iii) $xdy = y(\log y - \log x + 1)dx$

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2. Express the following differential equations in the form $\frac{dx}{dy} = F\left(\frac{x}{y}\right)$

(i) $\left(1 + e^{\frac{x}{y}}\right)dx + e^{\frac{x}{y}}\left(1 - \frac{x}{y}\right)dy = 0$

(ii) $xdy - ydx + ye^{-\frac{2x}{y}}dy = 0$

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Excerise 4 3 Short Answer Questions

1. Solve the following differential equations

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

(ii) $y^2dx + (x^2 - xy)dy = 0$

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

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

(v) $(x^2 + y^2)dy = 2xydx$

(vi) $(x^2 - y^2)dx - xydy = 0$

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2. Solve : $x \sin\frac{y}{x} . \frac{dy}{dx} = y \sin\frac{y}{x} - x$

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3. Solve the following differential equations.

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

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4. Solve the following differential equations.

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

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5. Find the general solution the following differential equations

$$xy^2dy=(x^3+y^3)dx$$

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6. Find the general solution the following differential equations

(i) $\frac{dy}{dx}=\frac{y^2-2xy}{x^2-xy}$

(ii) $(y^2-2xy)dx+(2xy-x^2)dy=0$

(iii) $(3x^2+y^2)dy+(x^2+3y^2)dx=0$

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7. Solve the following differential equations.

$$(2x - y)dy = (2y - x)dx$$

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8. Solve the following differential equations.

$$(x^2 - y^2)\frac{dy}{dx} = xy$$

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9. Find the general solution the following differential equations

$$(ydx + xdy)x\cos\left(\frac{y}{x}\right) = (xdy - ydx)y\sin\left(\frac{y}{x}\right)$$

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10. Find the equation of a curve whoise gradient is $\frac{dy}{dx} = \frac{y}{x} - \cos^2\frac{y}{x}$, where $x > 0, y > 0$ and which passes through the point $\left(1, \frac{\pi}{4}\right)$.

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Exercise 4 4 Very Short Answer Questions

1. Solve the following D.E's

(i) $\frac{dy}{dx} = \frac{3x - y + 7}{x - 7y - 3}$

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

(iii) $\frac{dy}{dx} = \frac{-3x - 2y + 5}{2x + 3y + 5}$

(iv) $\frac{dy}{dx} = \frac{-3x - 2y + 5}{2x + 3y - 5}$

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

(vi) $2(x - 3y + 1)dy = (4x - 2y + 1)dx$

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Exercise 4 4 Short Answer Questions

1. Find the general solution of the following D.E's

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

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2. Find the general solution of the following D.E's

(i) $\frac{dy}{dx} = \frac{x - y + 3}{2x - 2y + 5}$

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

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3. Find the general solution of the following D.E's

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

(ii) $(2x + y + 1)dx + (4x + 2y - 1)dy = 0$

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

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Exercise 4 4 Long Answer Questions

1. Solve the following D.E's

(i) $\frac{dy}{dx} = \frac{6x + 5y - 7}{2x + 18y - 14}$

(ii) $(x - y - 2)dx + (x - 2y - 3)dy = 0$

(iii) $(2x + 3y - 8)dx = (x + y - 3)dy$

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2. Solve the following differential equations.

$$\frac{dy}{dx} + \frac{10x + 8y - 12}{7x + 5y - 9} = 0$$

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3. Solve the following differential equations.

$$\frac{dy}{dx} = \frac{2x + 9y - 20}{6x + 2y - 10}$$

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4. Solve the following D.E's

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

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5. Solve the following differential equations.

$$\frac{dy}{dx} = \frac{x + 2y + 3}{2x + 3y + 4}$$

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Exercise 4 5 Very Short Answer Questions

1. Find the I.F. of the following differential equations by transforming them into linear form.

(i) $x\frac{dy}{dx} - y = 2x^2 \sec^2 2x$

(ii) $y\frac{dx}{dy} - x = 2y^2$

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Exercise 4 5 Short Answer Questions

1. Solve the following differential equations.

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

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2. Solve the following differential equations

(i) $\dfrac{dy}{dx}-y\tan x=e^x\sec x$

(ii) $\dfrac{dy}{dx}+y\tan x=\sin x$

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3. Solve the following differential equations.

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

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4. Solve the following differential equations.

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

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5. Solve the following differential equations.

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

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6. Solve the following differential equations.

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

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7. Solve the following differential equations

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

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

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8. Solve the following differential equations.

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

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9. Solve the following differential equations

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

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

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10. Solve the following differential equations

$$\sec x \frac{dy}{dx} - y = \sin x$$

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11. Solve the following differential equations

$$(1+x^2)\frac{dy}{dx}+2xy-4x^2=0$$

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Exercise 4 5 Long Answer Questions

1. Solve the following differential equations.

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

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2. Solve the following differential equations

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

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3. Solve the following differential equations.

$$x(x-1)\frac{dy}{dx} - y = x^3(x-1)^3$$

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4. Solve the following differential equations.

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

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5. Solve the following differential equations (i)

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

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

$$\left(x - \frac{1}{y}\right)\frac{dy}{dx} + y^2 = 0$$

(iv) $\frac{dy}{dx}(x^2y^3 + xy) = 1$

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Additional Exercise

1. Find the I.F. of $\frac{dy}{dx} + 2y \tan x = \sin x$ by transforming it into linear form.

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2. Find the I.F. of $x\frac{dy}{dx} + 2y = x^2 \log x$ by transforming it into linear form.

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3. Solve $\frac{dy}{dx} + y \cot x = 5e^{\cos x}$. Find the $x = \frac{\pi}{2}, y = -4$.

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4. Find the particular solution of $(1+x^3)dy - x^2 y dx = 0$ satisfying the initial conditions x = 1, y = 2.

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5. A curve is defined by the condition that the sum of the x and y intercepts of its tangents is always equal to 2. Express the condition by means of a differential equation.

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6. Solve $\left(1+2e^{x/y}\right)dx + 2e^{x/y}\left(1-\frac{x}{y}\right)dy = 0$

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7. Solve $(x-y-1)dx = (1-x-4y)dy.$

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8. Solve $(2x - 5y + 3)dx - (2x + 4y - 6)dy = 0$

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9. Solve $(1 + xy + x^2y^2)dx + (x^3y - x^2)dy = 0$

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10. Solve $y(xy + 1)dx + x(1 + xy + x^2y^2)dy = 0$

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11. Solve y log y dx + (x-log y) dy = 0.

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12. Solve the following differential equations.

$$\frac{dy}{dx} = \frac{x + 2y + 3}{2x + 3y + 4}$$

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Exercise I

1. The order and degree of the differential equation $\left[\left(\frac{dy}{dx}\right)^2 + \left(\frac{d^2y}{dx^2}\right)\right]^{5/4} = k\frac{d^3y}{dx^3}$ is

A. 1,2

B. 2,3

C. 3,4

D. 4,5

Answer: C

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2. The order and degree of $\left(\frac{d^4y}{dx^4}+\frac{d^2y}{dx^2}\right)^{\frac{5}{2}}=a\frac{d^2y}{dx^2}$ are p,q then p+q =

A. (4,5)

B. (5,4)

C. (4,2)

D. (2,5)

Answer: A

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3. The order and degree of the differential equation $y=x\frac{dy}{dx}-\sqrt{1+\left(\frac{dy}{dx}\right)^2}$

A. (2,1)

B. (2,2)

C. (1,2)

D. (1,1)

Answer: C

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4. The order and degree of the differential equation $y = \frac{\left[5 + \left(\frac{dy}{dx}\right)^2\right]^{4/3}}{\frac{d^2y}{dx^2}}$ is

A. (2,1)

B. (1,2)

C. (2,3)

D. (2,4)

Answer: C

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5. The degree of the differential equation

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

A. 1

B. 2

C. 3

D. cannot be defined

Answer: D

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6. The order of the differential equation

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

A. 1

B. 2

C. 3

D. cannot be defined

Answer: B

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7. The order and degree of the differential equation $\left(\frac{d^2y}{dx^2}+\left(\frac{dy}{dx}\right)^3\right)^{6/5}=6y$ is

A. 2,1

B. 1,2

C. 2,6

D. 6,2

Answer: C

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8. The differential equation of the family of curve $y = ax + \frac{1}{a}$, where $a \neq 0$ is an arbitrary constant, has the degree

A. 4

B. 3

C. 1

D. 2

Answer: D

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9. Order of the differential equation of the family of all concentric circles centered at (h, k) is

A. 1

B. 2

C. 3

D. 4

Answer: A

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

A. 2,1

B. 1,2

C. 3,2

D. 2,-3

Answer: B

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11. The differential equation by eliminating A and B from $y = Ae^{3x} + Be^{2x}$ is

A. $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$

B. $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} - 6y = 0$

C. $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} - 6y = 0$

D. $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = 0$

Answer: A

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12. The differential equationby eliminating arbitrary constants from the equation $y = Ae^{5x} + Be^{-2x}$ is

A. $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} - 10y = 0$

B. $\frac{d^2y}{dx^2} - 7\frac{dy}{dx} - 10y = 0$

C. $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} - 10y = 0$

D. $\frac{d^2y}{dx^2} + 7\frac{dy}{dx} + 10y = 0$

Answer: C

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13. The differential equation by eliminating A, B from $y = 5e^{5x}(Ax + B)$ is

A. $\frac{d^2y}{dx^2} + 10\frac{dy}{dx} + 25y = 0$

B. $\frac{d^2y}{dx^2} - 10\frac{dy}{dx} + 25y = 0$

C. $\frac{d^2y}{dx^2} + 10\frac{dy}{dx} - 25y = 0$

D. $\frac{d^2y}{dx^2} - 10\frac{dy}{dx} - 25y = 0$

Answer: B

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14. The differential equation by eliminating A, B from $y = e^{2x} = (A \cos 3x + B \sin 3x)$ is

A. $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} - 13y = 0$

B. $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} - 13y = 0$

C. $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 13y = 0$

D. $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 13y = 0$

Answer: C

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15. The differential equation by eliminating A, B, C from $y = Ae^{2x} + Be^{3x} + Ce^{-2x}$ is

A. $\frac{d^3y}{dx^3} - 3\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 12y = 0$

B. $\frac{d^3y}{dx^3} + 3\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 12y = 0$

C. $\frac{d^3y}{dx^3} - 3\frac{d^2y}{dx^2} + 4\frac{dy}{dx} - 12y = 0$

D. $\frac{d^3y}{dx^3} + 3\frac{d^2y}{dx^2} - \frac{dy}{dx} + 12y = 0$

Answer: A

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16. $y = Ae^x + Be^{2x} + Ce^{3x}$ satisfies the differential equation

A. $y_3 - 6y_2 + 11y_1 - 6y = 0$

B. $y_3 + 6y_2 + 11y_1 + 6y = 0$

C. $y_3 + 6y_2 - 11y_1 + 6y = 0$

D. $y_3 - 6y_2 - 11y_1 + 6y = 0$

Answer: A

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17. The differential equation by eliminating A, B from $y = e^{3x}(A + Bx + Cx^2)$ is

A. $\frac{d^3y}{dx^3} + 9\frac{d^2y}{dx^2} - 27\frac{dy}{dx} + 27y = 0$

B. $\frac{d^3y}{dx^3} + 9\frac{d^2y}{dx^2} + 27\frac{dy}{dx} + 27y = 0$

C. $\frac{d^3y}{dx^3}9\frac{d^2y}{dx^2} - 27\frac{dy}{dx} - 27y = 0$

D. $\frac{d^3y}{dx^3} - 9\frac{d^2y}{dx^2} + 27\frac{dy}{dx} - 27y = 0$

Answer: D

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18. Form the differential equation by eliminating the arbitrary constant from $y = A\cos 3x + B\sin 3x$

A. $\frac{d^2y}{dx^2} + 9y = 1$

B. $\frac{d^2y}{dx^2} + 9y = 1$

C. $\frac{d^2y}{dx^2} - 9y = 0$

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

Answer: B

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19. The differential equation of the family of parabolas having vertices at the origin and foci on y-axis is

A. $\frac{dy}{dx} = \frac{2y}{x}$

B. $\frac{dy}{dx} = \frac{y}{2x}$

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

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

Answer: A

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20. Form the differential equation from $ax^2 + by^2 = 1$

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

B. $xyy_2 - xy_1^2 - yy_1 = 0$

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

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

Answer: A

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

A. $(x-2)(y^1)^2 = 25 - (y-2)^2$

B. $(y-2)(y^1)^2 = 25 - (y-2)^2$

C. $(y-2)^2(y^1)^2 = 25 - (y-2)^2$

D. $(x-2)^2(y^1)^2 = 25 - (y-2)^2$

Answer: C

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22. Form the differential equation by eliminating the arbitrary constant from the equation $x^2/a^2 - y^2/b^2 = 1$

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

B. $xyy_2 - xy_1^2 - yy_1 = 0$

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

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

Answer: A

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23. $dx + dy = (x + y)(dx - dy) \Rightarrow \log(x + y) =$

A. x+y+c

B. x+2y+c

C. x-y+c

D. $2x + y + c^3$

Answer: C

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24. The solution of the equation $\frac{dy}{dx} = e^{-2x}$ is

A. $\frac{e^{-2x}}{4} = y$

B. $\frac{e^{-2x}}{-2} + c = y$

C. $\frac{1}{4}e^{-2x} + cx^2 + d = y$

D. $\frac{1}{4}e^{-2x} + cx + d = y$

Answer: B

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25. The solution of the $\cos ec^{2x}\dfrac{dy}{dx}-\dfrac{1}{y}=0$ is

A. $2y^2=2x-\sin 2x+c$

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

C. $2y^2=2x+\sin 2x+c$

D. $2y^2=x+\sin 2x+c$

Answer: A

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26. The solution of $\dfrac{dy}{dx}=\left(\dfrac{y}{x}\right)^{1/3}$ is

A. $x^{2/3}+y^{2/3}=c$

B. $y^{2/3}-x^{2/3}=c$

C. $x^{1/3}+y^{1/3}=c$

D. $y^{1/3} - x^{1/3} = c$

Answer: B

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27. The solution of $\sqrt{1+x^2}dx + \sqrt{1+y^2}dy = 0$ is

A. $x\sqrt{1+x^2} + y\sqrt{1+y^2} + \sin h^{-1}x + \sin h^{-1}y = c$

B. $x\sqrt{1+x^2} + y\sqrt{1+y^2} = c$

C. $x\sqrt{1+x^2} - y\sqrt{1+y^2} + \sin h^{-1}x - \sin h^{-1}y = c$

D. $\sin h^{-1}x + \sin h^{-1}y = c$

Answer: A

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28. The solution of $x^2\frac{dy}{dx} = \sqrt{4-y^2}$ is

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

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

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

D. $\sin^{-1}(y/2) + \frac{1}{x} = c$

Answer: D

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29. The solution of $3e^x \cos^2 y dx + (1 - e^x)\cot y dy = 0$ is

A. $\tan y = c(e^x - 1)^3$

B. $\tan y = c(e^x + 1)^3$

C. $\tan y = c(e^x - 1)^2$

D. $\cos y = c(e^x - 1)^3$

Answer: A

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30. A particle moves in a line with velocity given by $\frac{ds}{dt} = s + 1$. The time taken by the particle to cover a distance of 9 metre is

A. 1

B. $\log_e 10$

C. $2 \log_e 10$

D. 10

Answer: B

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31. Equation of the curve passing through the point (4,3) and having slope = y/2 at a point (x,y) on it is

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

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

C. $y = 3e^{x-2}$

D. $y^2 = x + 5$

Answer: A

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32. The slope of a curve at any point on it is the reciprocal of twice of ordinate at that point. If the curve passes through (4,3) then the equation is

A. $y^2 = x + 4$

B. $y^2 = x + 7$

C. $y^2 = x + 5$

D. $y^2 = x + 9$

Answer: D

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

A. $e^{\frac{x^2}{y^2} = cx}$

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

C. $e^{\frac{y^2}{2x^2} = cy}$

D. $e^{\frac{y^2}{2x^2} = c}$

Answer: A

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34. The solution of $\frac{dy}{dx} + y = e^x$ is

A. $e^{y/x} = cx$

B. $e^{x/y} = cx$

C. $e^{y/x} = cy$

D. $e^{x/y} = cy$

Answer: B

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35. The solution of $\frac{dy}{dx} = \frac{y + x\tan.\frac{y}{x}}{x} \Rightarrow \sin.\frac{y}{x}$=

A. cx^2

B. cx

C. cx^3

D. cx^4

Answer: A

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36. The solution of $(x^2 + y^2)dx = 2xydy$ is

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

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

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

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

Answer: A

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37. The equation $\frac{dy}{dx} = \frac{x + 2y - 3}{2x + y - 3}$ can be changed to homogeneous form by shifting the origin to

A. (1,-1)

B. (-1,-1)

C. (-1,1)

D. (1,1)

Answer: D

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38. The substitution required to change $(3y - 7x + 7)dx + (7y - 3x + 3)dy = 0$ into a homogeneous equation is

A. x = X+1 y = Y

B. x = X, y = Y+1

C. x = X + 1 y = Y+1

D. x = X +2, y = Y+2

Answer: A

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39. The solution of $(12x + 5y - 9)dx + (dx + 2y - 4)dy = 0$ is

A. $6x^2 + 5xy + y^2 + 9x + 4y = c$

B. $6x^2 + 5xy + y^2 - 9x - 4y = c$

C. $6x^2 - 5xy - y^2 - 9x - 4y = c$

D. $3x^2 + 5xy + 2y^2 - 9x - 4y = c$

Answer: B

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40. Solve the following differential equations.

$$\frac{dy}{dx} = \frac{-3x - 2y + 5}{2x + 3y - 5}$$

A. $3x^2 + 4xy + 3y^2 - 10x - 10y = c$

B. $3x^2 + 4xy - 3y^2 + 10x + 10y = c$

C. $3x^2 - 4xy + 3y^2 - 10x - 10y = c$

D. $3x^2 - 4xy + 3y^2 + 10x + 10y = c$

Answer: A

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41. The I.F. of $\frac{dy}{dx} - 3y\cot x = \sin x$ is

A. $\sin^3 x$

B. $\frac{1}{\sin^3 x}$

C. $._e \sin^3 x$

D. $._e \log \sin^2 x$

Answer: B

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42. Integrating factor of $(x + 2y^3)\frac{dy}{dx} = y^2$ is

A. $e^{1/y}$

B. $e^{-1/y}$

C. 77y

D. $-1/y$

Answer: A

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43. The solution of $x\frac{dy}{dx}+y=x\cos x$ is

A. $xy=x\cos x+\sin x+c$

B. $xy=x\sin x+\cos x+c$

C. $xy=x\sin x-\cos x+c$

D. $x+y=x\sin x-\cos x+c$

Answer: B

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44. The solution of $x\frac{dy}{dx}+2y=x^2\log x$ is

A. $yx^2=\frac{x^4}{4}\log x-\frac{x^4}{16}+c$

B. $yx^2 = \frac{x^4}{4}\log x + \frac{x^4}{16} + c$

C. $xy^2 = \frac{x^4}{4}\log x - \frac{x^4}{16} + c$

D. $xy^2 = \frac{x^4}{4}\log x - \frac{x^4}{6} + c$

Answer: A

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45. The solution of $\frac{dy}{dx} + y = e^x$ is

A. $2y = e^{2x} + c$

B. $2ye^x = e^x + c$

C. $2ye^x = e^{2x} + c$

D. $2ye^{2x} = 2^{2x} + c$

Answer: C

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46. $y + x^2 = \frac{dy}{dx}$ has the solution

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

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

C. $y + x + x^2 + 2 = ce^x$

D. $y^2 + x + x^2 + 2 = ce^x$

Answer: A

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47. The solution of $(1 + x^2)\frac{dy}{dx} + 2xy - 4x^2 = 0$ is

A. $3x(1 + y^2) = 4y^3 + c$

B. $3y(1 + x^2) = 4y^3 + c$

C. $3x(1 - y^2) = 4y^3 + c$

D. $3y(1 + y^2) = 4x^3 + c$

Answer: B

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48. The solution of $(x+y+1)\dfrac{dy}{dx}=1$ is

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

B. $x-y+2=ce^{y}$

C. $x+y-2=ce^{y}$

D. $x+y+2=ce^{2y}$

Answer: A

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49. The solution of $x\dfrac{dy}{dx}+y\log y=xye^{x}$ is

A. $x\log y=(x+1)e^{x}+c$

B. $\log y = (x-1)e^x + c$

C. $(x-1)\log y = xe^x + c$

D. $x \log y = (x-1)e^x + c$

Answer: D

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50. The solution of $\frac{dx}{dy} + \frac{x}{y} = x^2$ is

A. $\frac{1}{y} = cx - x \log x$

B. $\frac{1}{x} = cy - y \log y$

C. $\frac{1}{x} = cx + x \log y$

D. $\frac{1}{y} = cx - y \log x$

Answer: B

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Exercise Ii

1. The order of the differential equation whose solution is given by $y = (c_1 + c_2)\cos(x + c_3) - c_4 e^{x + c5} where$c_(1), c_(2), c_(3), c_(4), c_(5)`are arotrary constant -

A. 5

B. 4

C. 3

D. 2

Answer: C

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2. The degree, order of the differential equation $y_2^{3/2} - y_1^{1/2} - 4 = 0$ is

A. 6,2,

B. 3,2

C. 2,5

D. 4,6

Answer: A

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3. The order, degree of the differential equation $x = 1 + \left(\frac{dy}{dx}\right) + \frac{1}{2!}\left(\frac{dy}{dx}\right)^2 + \frac{1}{3!}\left(\frac{dy}{dx}\right)^3 + \ldots$ is

A. 3,1

B. 4,2

C. 1,1

D. not defined

Answer: C

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4. 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.

A. order 1, degree 2

B. order 1, degree 1

C. order 1, degree 3

D. order 2, degree 2

Answer: C

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5. The order and degree of the differential equation of all circles in the first quadrant which touch the co-ordinate axes is

A. 1,2

B. 2,1

C. 3,2

D. 4,3

Answer: A

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6. The order, degree of the differential equation of all circles of radius r, having centre on y-axis passing through the origin is (where r is arbitrary constant)

A. 1,1

B. 2,1

C. 3,1

D. 4,2

Answer: A

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

A. first order and second degree

B. first order and first degree

C. second order and first degree

D. second order and second degree

Answer: C

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8. The differential equation of all non vertical lines in a plane is

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

B. $\frac{d^2x}{dy^2} = 0$

C. $\frac{dy}{dx} = 0$

D. $\frac{dx}{dy} = 0$

Answer: A

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9. The differential equation of all non-horizontal lines in a plane is

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

B. $\frac{d^2x}{dy^2} = 0$

C. $\frac{dy}{dx} = 0$

D. $\frac{dx}{dy} = 0$

Answer: B

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10. The subnormal at any point of a curve is of constant length '8'. Then the differential equation of the family of curves is

A. $\frac{dy}{dx} = 8$

B. $y\left(\frac{dy}{dx}\right) = 8$

C. $y\sqrt{1\left(\frac{dy}{dx}\right)^2} = 8$

D. $y\sqrt{1\left(\frac{dy}{dx}\right)^2} = 8dy/dx$

Answer: B

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11. The differential equation of the family of straight lines $y = mx + a/m$ where m is the parameter, is

A. $x\frac{dy}{dx} = 0$

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

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

D. $x\left(\frac{dy}{dx}\right)^2 - y\frac{dy}{dx} + a = 0$

Answer: D

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12. The differential equation of curve given by $y = a\cos\left(\frac{n}{x} + b\right)$ (a,b are arbitrary constants)

A. $x^2 y_2 + 2xy_1 + n^2 y = 0$

B. $x^3 y_2 + 2x^2 y_1 + n^2 xy = 0$

C. $x^4 y_2 + 2x^3 y_1 + n^2 y = 0$

D. $x^4 y_2 + 2x^3 y_1 + n^2 x^2 y = 0$

Answer: C

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13. Form the differential equation by eliminating the arbitrary constant from the equation $y = a\cos x + b\sin x + x\sin x$

A. $y_2 + y = 3\cos x$

B. $y_2 + 2y = 2\cos x$

C. $y_2 + y = 2\cos x$

D. $y_2 - y = 2\cos x$

Answer: C

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14. The differential equation obtained by eliminating the arbitrary constant a and b from $xy = ae^{x} + be^{-x}$ is

A. $xy_2 + 2y_1 + xy = 0$

B. $xy_2 - 2y_1 + xy = 0$

C. $xy_2 + 2y_1 - xy = 0$

D. $xy_2 - 2y_1 - xy = 0$

Answer: C

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

A. $y^{11} = y^1 y$

B. $yy^{11} = (y^1)^2$

C. $yy^{11} = y^1$

D. $y^1 = y^2$

Answer: B

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16. Form the differential equation by eliminating the arbitrary constant from the equation $xy = ae^x + be^{-x} + x^2$

A. $xy_2 + 2y_1 - xy = 2 - x^2$

B. $xy_2 + 2y_1 + xy = 2$

C. $xy_2 - 2y_1 - xy = 2$

D. $xy_2 - 2y_1 + xy = 2$

Answer: A

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17. The differential equation by eliminating A & B from $y = Ax^3 + Bx^2$ is

A. $x^2\left(\frac{d^2y}{dx^2}\right) + 4x\left(\frac{dy}{dx}\right) + 6y = 0$

B. $x^2\left(\frac{d^2y}{dx^2}\right) - 4x\left(\frac{dy}{dx}\right) - 6y = 0$

C. $x^2\left(\frac{d^2y}{dx^2}\right) - 4x\left(\frac{dy}{dx}\right) + 6y = 0$

D. $x^2\left(\frac{d^2y}{dx^2}\right) - 5x\left(\frac{dy}{dx}\right) + 6y = 0$

Answer: C

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18. The differential equation of the family $y = ae^{x} + bxe^{x} + cx^{2}e^{x}$ of curves, where a, b, x are arbitrary constant is

A. $y''' + 3y'' + 3y' + y = 0$

B. $y''' + 3y'' - 3y' - y = 0$

C. $y''' - 3y'' + 3y' + y = 0$

D. $y''' - 3y'' - 3y' + y = 0$

Answer: C

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19. The differential equation of family of curves $x^{2} + y^{2} - 2ay = 0$ where 'a' is arbitrary constant is

A. $\left(x^2+y^2\right)y_1=2xy$

B. $2\left(x^2+y^2\right)y_1=xy$

C. $\left(x^2-y^2\right)y_1=2xy$

D. $2\left(x^2-y^2\right)y_1=xy$

Answer: C

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20. The differential equation by eliminating a, b from $(x-a)^2+(y-b)^2=r^2$ is

A. $\left(1-y_1^2\right)^3=r^2y_2^2$

B. $\left(1+y_1^2\right)^3=r^2y_2^2$

C. $\left(1+y_1^2\right)^3=ry^2$

D. $y_1^2=ry^2$

Answer: B

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

A. $x^2 = y^2 + xy + \frac{dy}{dx}$

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

C. $y^2 = x^2 + 2xy\frac{dy}{dx}$

D. $y^2 = x^2 - 2xy\frac{dy}{dx}$

Answer: C

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22. The differential equation of the family of circles of fixed radius r and having their centre on y-axis is

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

B. $\left(\frac{dy}{dx}\right)^2 = \frac{x^2}{r^2 + y^2}$

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

D. $\left(\frac{dy}{dx}\right)^2 = \frac{x^2}{x^2 + r^2}$

Answer: A

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23. The differential equation of the family of parabolas with focus at origin and X-axis as axis is

A. $y\left(\frac{dy}{dx}\right)^2 + 4x\frac{dy}{dx} = 4y$

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

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

D. $y\left(\frac{dy}{dx}\right)^2 + 2xy\frac{dy}{dx} + y = 0$

Answer: B

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24. The differential equation of the system of curves given by

$$\frac{x^2}{a^2} + \frac{y^2}{a^2 + \lambda} = 1$$

(λ is arbitrary constant) is

A. $x^2 - xy\frac{dy}{dx} = a^2$

B. $x^2 - \frac{xy}{\left(\frac{dy}{dx}\right)} = a^2$

C. $x^2 + xy = a^2\frac{dy}{dx}$

D. $x^2 - xy = a^2\frac{dy}{dx}$

Answer: B

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25. The solution of $\frac{xdx + ydx}{x^2 + y^2} = 0$ is

A. log(xy) = c

B. log(x+y) = c

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

D. $\log\left(\frac{x}{y}\right) = c$

Answer: C

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26. The solution of $\frac{dy}{dx} = (1 + y^2)(1 + x^2)^{-1}$ is

A. $y - x = c(1 + xy)$

B. $y + x = c(1 + xy)$

C. $y + x = c(1 - xy)$

D. $y - x = c(1 - xy)$

Answer: A

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27. $\tan^{-1}(x) + \tan^{-1}(y) = c$ is the solution of

A. $\dfrac{dy}{dx} = \dfrac{1+y^2}{1+x^2}$

B. $\dfrac{1+x^2}{1+y^2} = \dfrac{dy}{dx}$

C. $(1+x^2)dy + (1+y^2)dx = 0$

D. $\dfrac{\sqrt{(1+x^2)}}{\sqrt{(1+y^2)}} = \dfrac{dy}{dx}$

Answer: C

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28. The solution of $xd(xy) = \left(\dfrac{f(xy)}{f^1(xy)}\right)dx$ is

A. f(xy) = c

B. xf(xy) = c

C. y f(xy) = c

D. cx = f(xy)

Answer: D

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29. The solution of $(e^x + 1)ydy + (y + 1)dx = 0$ is

A. $e^{x+y} = c(y + 1)\left(e^{x+1}\right)$

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

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

D. $e^{x+y} = c(y - 1)(e^x - 1)$

Answer: A

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30. If $2f(x) = f'(x)$ and $f(0) = 3$ then f(2) =

A. $4e^3$

B. $3e^4$

C. $2e^3$

D. $3e^2$

Answer: B

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31. The solution of $\frac{dy}{dx} = \frac{x \log x^2 + x}{\sin y + y \cos y}$ is

A. $y \sin y = x^2 \log x + c$

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

C. $y \sin y = x^2 + \log x + c$

D. $y \sin y = x \log x + c$

Answer: A

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32. The solution of $y - x\left(\frac{dy}{dx}\right) = a\left(y^2 + \frac{dy}{dx}\right)$ is

A. $(x + a)(y + a) = cy$

B. $(x + a)(y - a) = cy$

C. $(x + a)\left(y + \frac{1}{a}\right) = cy$

D. $(x + a)(1 - ay) = cy$

Answer: D

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33. The solution of the differential equation $ydx + (x + x^2y)dy = 0$ is

A. $\frac{-1}{xy} = c$

B. log y = cx

C. $\frac{1}{xy} + \log y = c$

D. $\frac{-1}{xy} + \log y = c$

Answer: D

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34. The solution of $xdx + ydx = x^2ydy - xy^2dx$ is

A. $x^2 - 1 = c(1 + y^3)$

B. $x^2 + 1 = c(1 - y^2)$

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

D. $x^2 + 1 = c(1 - y^3)$

Answer: C

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35. The solution of $ydx - xdy + 3x^2y^2e^{x^3}dx = 0$ is

A. $\frac{y}{x} + e^{x^3} = c$

B. $\frac{y}{x} - e^{x^3} = c$

C. $\frac{x}{y} + e^{x^3} = c$

D. $\frac{x}{y} - e^{x^3} = c$

Answer: C

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36. The solution of $\frac{dy}{dx} = 2xy - 3y + 2x - 3$ is

A. $e^{x^2} + 3x = c(y+1)$

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

C. $e^{x^2} - 3x = c(y-1)$

D. $e^{x^2 - 3x} = c(y+1)$

Answer: D

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37. The solution of $\log\left(\frac{dy}{dx}\right)=ax+by$ is

A. $be^{ax}+ae^{-by}=c$

B. $be^{ax}-ae^{-by}=c$

C. $be^{-ax}-ae^{-by}=c$

D. $be^{ax}+ae^{by}=c$

Answer: A

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38. The solution of $y^2\cos\sqrt{x}dx-\sqrt{x}e^{\frac{1}{y}}dy=0$ is

A. $2\cos\sqrt{x}+e^{\frac{1}{y}}=c$

B. $-2\sin\sqrt{x}+e^{\frac{1}{y}}=c$

C. $-2\sin\sqrt{x}-e^{\frac{1}{y}}=c$

D. $2\sin\sqrt{x}+e^{\frac{1}{y}}=c$

Answer: D

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39. The solution of $\frac{dy}{dx}+\left(\frac{y^2+y+1}{x^2+x+1}\right)=0$ is

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

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

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

D. $\tan^{-1}\left(\frac{2x}{\sqrt{3}}\right)(2x)+\tan^{-1}\left(\frac{2y}{\sqrt{3}}\right)=c$

Answer: A

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40. The solution of cos y log (sec x + tan x)dx = cos x log (sec y + tan y) dy is

A. $[\log(\sec x + \tan x)]^2 - \left[\log(\sec y + \tan y)^2\right] = c$

B. $[\log(\sec x + \tan x)]^2 + [\log(\sec y + \tan y)]^2 = c$

C. $[\log(\sec x - \tan x)]^2 - [\log(\sec y - \tan y)]^2 = c$

D. $[\log(\sec x - \tan x)]^2 + [\log(\sec y + \tan y)]^2 = c$

Answer: A

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41. Solution of the differential equation $2y \sin x \frac{dy}{dx} = 2 \sin x \cos - y^2 \cos x$ satisfying $y(\pi/2) = 1$ is given by

A. $y^2 = \sin x$

B. $y = \sin^2 x$

C. $y^2 = \cos x + 1$

D. $y^2 \sin x = 4 \cos^2 x$

Answer: A

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42. The equation of the curve through $\left(0, \frac{\pi}{4}\right)$ satisfying the differential equation $e^x \tan y dx + (1 + e^x)\sec^2 y dy = 0$ is given by

A. $(1 + e^x)\tan y = 2$

B. $1 + e^x = 2\tan y$

C. $1 + e^x = 2S\sec y$

D. $(1 + e^x) = \tan y = k$

Answer: A

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43. The solution of the differential equation $(1 + e^x)y\frac{dy}{dx} = e^x$ when y=1 and x = 0 is

A. $e^{y^2/2} = \sqrt{e}(1 + e^x)$

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

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

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

Answer: C

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44. The solution of the differential equation $(\tan y)\frac{dy}{dx} = \sin(x + y) + \sin(x - y)$ is

A. secy + 2cos x = C

B. sec y - 2 cos x = C

C. cosy - 2 sin x = C

D. tan y - 2 sec x = C

Answer: A

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45. The solution of $(x+y)^2\frac{dy}{dx}=a^2$ is

A. $y=\tan^{-1}\left(\frac{x+y}{a}\right)+c$

B. $ay=\tan^{-1}(x+y)+c$

C. $y=a\tan^{-1}\left(\frac{x+y}{a}\right)+c$

D. $x=a\tan^{-1}\left(\frac{x+y}{a}\right)+c$

Answer: C

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46. The solution of $\frac{dy}{dx}=\sec(x+y)$ is

A. $\sec(x+y)+\tan(x-y)=c.\,e^{2x+y}$

B. $\sec(x-y)+\tan(x-y)=c.\,e^{2x+y}$

C. $\sec(x-y)+\tan(x+y)=c.\,e^{2x+y}$

D. $y=c+\tan.\,\frac{x+y}{2}$

Answer: D

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47. The solution of $\sin^{-1}\left(\frac{dy}{dx}\right) = y + x$ is

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

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

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

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

Answer: A

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

A. $1 + \tan\left\{\frac{(x+y)}{2}\right\} = ce^x$

B. $1 - \tan\left\{\frac{(x+y)}{2}\right\} = ce^x$

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

D. $1 + \tan\left\{\frac{(x-y)}{2}\right\} = ce^x$

Answer: A

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49. The solution of the differential equation $\frac{dy}{dx} = \sin(x+y)\tan(x+y) - 1$ is

A. $x + \cos ec(x+y) = c$

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

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

D. $x + \sec(x+y) = c$

Answer: A

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50. The value of 'b' such that the solution of $x = by\frac{dy}{dx}$ represents a family of circles with centre origin is

A. b=1

B. b=-1

C. for all value of b

D. for any value of b the solution does not represents the circle

Answer: B

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51. A curve passes through the poit (5,3) and at any point (x,y) on it the product of its slope and the ordinate is equal to abscissa of the curve is

A. parabola

B. ellipse

C. hyperbola

D. circle

Answer: C

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52. A curve C has the property that if the tangent drawn at any point 'P' on C meets the coordinate axes at A and B, and P is midpoint of AB. If the curve passes through the point (1,1) then the equation of the curve is

A. $xy = 2$

B. $xy = 3$

C. $xy = 1$

D. $xy = 4$

Answer: C

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53. 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 abscisa of P, then the curve is a

A. Ellipse

B. Parabola

C. Circle

D. Hyperbola

Answer: D

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54. The normal line to a given curve at each point (x,y) on the curve passes through the point (3,0). If the curve contains the point (3,4) then its equation is

A. $x^2 + y^2 + 6x - 7 = 0$

B. $x^2 + y^2 - 6x - 7 = 0$

C. $x^2 + y^2 - 6x - 25 = 0$

D. $x^2 + y^2 + 6x + 25 = 0$

Answer: B

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

A. $y \log(x/y) = cx$

B. $x \log(y/x) = cy$

C. $\log(y/x) = cx$

D. $\log(x/y) = cy$

Answer: C

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56. The solution of $\frac{dy}{dx} = \frac{y^2}{xy - x^2}$ is

A. $e^{y/x} = kx$

B. $e^{y/x} = ky$

C. $e^{-y/x} = kx$

D. $e^{-y/x} = ky$

Answer: B

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57. A family of curves has the differential equation $xy\frac{dy}{dx} = 2y^2 - x^2$. Then, the family of curves is

A. $y^2 = x + cx^4$

B. $y^2 = x^2 + cx^4$

C. $y^2 = cx^4 + x^3$

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

Answer: B

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58. An equation of the curve satisfying $xdy - ydx = \sqrt{x^2 - y^2}dx$ and y(1) = 0 is

A. $y = x^2 \log|\sin x|$

B. $y = x \sin(\log|x|)$

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

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

Answer: B

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59. The solution of $x \cos. \frac{y}{x}(ydx + xdy) = y \sin. \frac{y}{x}(xdy - ydx)$ is

A. $cxy\cos\left(\frac{2y}{x}\right)=1$

B. $cxy\cos\left(\frac{y}{x}\right)=1$

C. $xy\cos\left(\frac{y}{x}\right)=c$

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

Answer: C

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60. The general solution of the differential equation $x^2ydx-(x^3+y^3)dy=0$ is

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

B. $y^3=3x^3\log(Cx)$

C. $y^3=3x^3+\log(Cx)$

D. $y^3+3x^3-\log(Cx)$

Answer: B

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61. The solution of the differential equation $xy' = 2xe^{-y/x} + y$ is

A. $e^{y/x}|\ln|cx|| = 0$

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

C. $e^{y/x} = \ln|cx|$

D. $e^{y/x} = 2lx|cx|$

Answer: D

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62. The general solution of $y^2dx + (x^2 - xy + y^2)dy = 0$ is

A. $\tan^{-1}\left(\frac{x}{y}\right) + \log y + c = 0$

B. $2\tan^{-1}\left(\frac{x}{y}\right) + \log x + c = 0$

C. $\log\left(y + \sqrt{x^2 + y^2}\right) + \log y + c = 0$

D. $\sin h^{-1}\left(\frac{x}{y}\right) + \log y + c = 0$

Answer: A

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63. The solution of $\frac{dy}{dx} = \frac{x + y + 1}{x + y - 1}$ is

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

B. $e^{y-x} = c(x - y)$

C. $e^{y+x} = c(x + y)$

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

Answer: A

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64. The solution of the differential equation $\frac{dy}{dx} = \frac{x - 2y + 1}{2x - 4y}$

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

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

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

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

Answer: A

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65. The solution of $\cos^2 x \frac{dy}{dx} + y = \tan x$ is

A. $ye^{\tan x} = (\tan x - 1)e^{\tan x} - \tan x + c$

B. $ye^{\tan x} = (\tan x + 1)e^{\tan x} + \tan x + c$

C. $ye^{\tan x} = (\tan x - 1)e^{\tan x} + c$

D. $ye^{\tan x} = (\tan x - 1)e^{\tan x} + \tan x + c$

Answer: C

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66. The solution of $\frac{dy}{dx}+y\cot x=4x\cos ecx$, given that y = 0, $x=\frac{\pi}{2}$ is

A. $y\sin x=2x^2-\frac{\pi}{3}$

B. $y\sin x=x^2-\frac{\pi^2}{2}$

C. $y\sin x=2x^2-\frac{\pi^2}{2}$

D. $y\sin x=2x^2+\frac{\pi^2}{2}$

Answer: C

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67. The general solution of $\left(y^5+x\right)\frac{dy}{dx}=y$ is

A. $xy=\frac{y^4}{4}+c$

B. $\frac{x}{y}=\frac{y^6}{6}+c$

C. $xy=\frac{y^5}{5}+c$

D. $\frac{x}{y} = \frac{y^4}{4} + c$

Answer: D

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68. The solution of $x^2 \frac{dy}{dx} + (x-2)y = x^2 e^{-2/x}$ is

A. $xye^{\frac{2}{x}} = x^2 + c$

B. $xye^{\frac{2}{x}} = \frac{x^2}{2} + c$

C. $xy^2 e^{\frac{2}{x}} = \frac{x^2}{2} + c$

D. $2xye^{\frac{2}{x}} = \frac{x^2}{2} + c$

Answer: B

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69. The solution of $\cos x \frac{dy}{dx} + y = \sin x$ is

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

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

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

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

Answer: B

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70. Solve the following differential equations.

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

A. $y\frac{(x-1)}{x^2}=x^2-x+c$

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

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

D. $y\frac{(x-1)}{x^2}=x^2+x+c$

Answer: A

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71. The solution of $ydx - xdy + \log x dx = 0$ is

A. $y - \log x - 1 = cx$

B. $x + \log y + 1 = cx$

C. $y + \log x + 1 = cx$

D. $y + \log x - 1 = cx$

Answer: C

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72. The solution of $(1 + x^2)\dfrac{dy}{dx} + y = e^{\tan^{-1}x}$ is

A. $ye^{\tan^{-1}x} = e^{\tan^{-1}x} + c$

B. $ye^{\tan^{-1}x} = \dfrac{\left(e^{\tan^{-1}x}\right)^2}{2} + c$

C. $ye^{\tan^{-1}x} = \left(e^{\tan^{-1}}x\right)^2 + c$

D. $ye^{\tan^{-1}x} = \dfrac{\left(e^{\tan^{-1}}x\right)^2}{3} + c$

Answer: B

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73. The solution of $\dfrac{1}{x}\dfrac{dy}{dx} + ye^x = e^{(1-x)^{e^x}}$ is

A. $ye^{e^{x(x-1)}} = \dfrac{x^2}{2} + c$

B. $ye^{e^{x(x+1)}} = \dfrac{x^2}{2} + c$

C. $ye^{e^{x(x-1)}} = \dfrac{x^3}{3} + c$

D. $ye^{e^{x(x-1)}} = \dfrac{x^4}{4} + c$

Answer: A

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74. Which of the following statement is correct ?

Statement I if $dy + 2xydx = 2e^{-x^2}dx$, Then $ye^{x^2} = 2x + c$

Statement II If $ye^{x^2} - 2x = c$, Then $dx = \left(2e^{-x^2} - 2xy\right)dy$

A. Both I and II are true

B. Neither I nor II is true

C. I is true, II is false

D. I is false, II is true

Answer: C

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75. The general solution of $e^y\left(\frac{dy}{dx}\right) + 2\frac{e^y}{x} = \sin x$ is

A. $xe^y = -x\cos x + \sin x + c$

B. $x^2e^y = -x^2\cos x + 2x\sin x - \cos x + c$

C. $xe^y = x\cos x - \sin x + c$

D. $e^{y} = -\cos x + \frac{2\sin x}{x} + \frac{2\cos x}{x^2} + \frac{c}{x^2}$

Answer: D

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76. Solution of $xy - \frac{dy}{dx} = y^3 e^{-x^2}$ is

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

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

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

D. $y^2 = e^{-x^2}(2x - c)$

Answer: B

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77. Solve $\frac{dy}{dx} + \frac{y}{x} = x^2 y^6$

A. $\frac{1}{x^5 y^5}$

B. $\frac{1}{x^5 y^5} = \frac{5}{x^2} + c$

C. $\frac{1}{x^2 y^5} = \frac{5}{2x^2} + c$

D. $\frac{1}{x^2 y^2} = \frac{5}{2x^2} + c$

Answer: A

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78. The solution of $(1 - x^2)\frac{dy}{dx} + xy = xy^2$ is

A. $\sqrt{x^2 - 1} = y\sqrt{x^2 + 1} + cy$

B. $\sqrt{x^2 - 1} = y\sqrt{x^2 - 1} + cy$

C. $\sqrt{x^2 + 1} = y\sqrt{x^2 + 1} + cy$

D. $\sqrt{x^2 + 1} = \sqrt{x^2 - 1} + cy$

Answer: B

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79. The solution of $\frac{dy}{dx} + x\sin 2y = x^3 \cos^2 y$ is

A. $\tan y = \frac{x^2}{2} + \frac{1}{2} + ce^{-x^2}$

B. $\tan y = \frac{x^2}{2} - \frac{1}{2} + ce^{-x^2}$

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

D. $\cos y = \frac{x^2}{2} - \frac{1}{2} + ce^{-x^2}$

Answer: B

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80. If $x^2 y - x^3 \frac{dy}{dx} = y^4 \cos x$ then $x^3 y^{-3}$ is equal to

A. $y^3(1 + 3\sin x) = x^3$

B. $x^3(1 + \sin x) = y^3$

C. $y^3(1 - \sin x) = x^3$

D. $x^3(1 - \sin x) = y^3$

Answer: A

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81. Match the differential equations in List-I to their integrating factors in List-II

	List - I		List-II
(i)	$(x^3+1)\frac{dy}{dx} + x^2 y = 0$	(a)	x^3
(ii)	$x^2\frac{dy}{dx} + 3xy = x^6$	(b)	$(x^3+1)^2$
(iii)	$(x^3+1)\frac{dy}{dx} + 6x^2(x^3+1)y = x^2$	(c)	$(x^2+1)^2$
(iv)	$(x^2+1)\frac{dy}{dx} + 4xy = \ln x$	(d)	x^2+1
		(e)	$(x^3+1)^{\frac{1}{3}}$
		(f)	$(x^3+1)^{\frac{1}{2}}$

The correct matching is

A. i-d, ii-a, iii-b, iv-c

B. i-e, ii-a, iii-a, iv-c

C. i-e, ii-b, iii-c, iv-f

D. i-e, ii-a, iii-c, iv-d

Answer: B

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82. The solution of $\frac{dx}{dy} - \frac{2}{3}xy = x^4y^3$ is

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

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

C. $\frac{1}{x^4} = \frac{3}{2}(1 - y^2) + ce^{y^2}$

D. $\frac{1}{x^4} = \frac{3}{2}(1 + y^2) + ce^{y^2}$

Answer: A

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83. If the solution of $\cos ec^2 x \frac{dy}{dx} - \frac{1}{y} = 0$ is $ax + b\sin 2x + cy^2 = k, a > 0$ then ascending order of a,b,c is

A. a,b,c

B. c,b,a

C. c,a,b

D. b,a,c

Answer: B

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84. Assertion (A) : Integrating factor of $1 + (x\tan y - \sec)\frac{dy}{dx} = 0$ is sec y

Reason (R) : Integrating factor of

$\frac{dy}{dx} + P(x)y = Q(x)$ is $e^{\int P(x)\,dx}$

Then the statement among the following is

A. Both (A) and (R) are true and R is correct explanation of A

B. Both (A) and (R) are true and R is not correct explanation of A

C. A is true, (R) is false

D. (A) is false (R) is true

Answer: A

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85. Assertion (A) : The differential equaiton of the family of rectangular hyperbolas which have the coordinate axes as asymptotes is $xy_1 + y = 0$

Reason (R) : The number of arbitrary constants in the general solution of differential equation is equal to the order of the differential equation.

Then the statement among the following is

A. Both (A) and (R) are true and R is correct explanation of A

B. Both (A) and (R) are true and R is not correct explanation of A

C. A is true, (R) is false

D. (A) is false (R) is true

Answer: A

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86. Asserton (A) : The solution of $\frac{dy}{dx}=\frac{x+y}{x}$ is $e^{y/x}=cx$

Reason (R) : To solve $\frac{dy}{dx}=\frac{f(x,y)}{g(x,y)}$, where f(x,y) and g(x,y) are homogeneous function of same degree in x and y, put x =vy.

Then the Statement among the following is

A. Both (A) and (R) are true and R is correct explanation of A

B. Both (A) and (R) are true and R is not correct explanation of A

C. A is true, (R) is false

D. (A) is false (R) is true

Answer: A

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

A. $y\sin 2x = e^x + c$

B. $y\cos 2x = e^x + c$

C. $y = e^x \cos 2x + c$

D. $y\cos 2x + e^x = c$

Answer: B

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88. An integrating factor of the equation $(1 + y + x^2 y)dx + (x + x^3)dy = 0$ is

A. e^x

B. x^2

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

D. x

Answer: D

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89. The solution of the differential equation $\frac{dy}{dx} + \frac{y}{2}\sec x = \frac{\tan x}{2y}$, where $0 \leq x < \frac{\pi}{2}$, and y(0) = 1, is given

A. $y^2 = 1 + \frac{x}{\sec x + \tan x}$

B. $y = 1 + \frac{x}{\sec x + \tan x}$

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

D. $y^2 = 1 - \frac{x}{\sec x + \tan x}$

Answer: D

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90. The differential equation of co-axial system of circles $x^2+y^2-4+\lambda(2x+y-5)=0$ is

A. $\left(2+\frac{dy}{dx}\right)\left(x^2+y^2-4\right)-\left(2x+2y\frac{dy}{dx}\right)(2x+y-5)=0$

B. $x^2+y^2-4+\frac{dy}{dx}(2x+y-5)=0$

C. $x^2+y^2-4+\left(2+\frac{dy}{dx}\right)(2x+y-5)=0$

D. $\left(x^2+y^2-4\right)(2x+2y)\frac{dy}{dx}=0$

Answer: A

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91. The trajectories orthogonal to $x^2+y^2=2ax$ is

A. $y=x^2$

B. $y=c(x-a)$

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

D. $y^2=x$

Answer: B

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92. The volume of spherical ballon being inflated changes at a constant rate. If initially its radius is 3 units and after 3 seconds it is 6 units. Find the radius of ballon after t seconds.

A. $3\sqrt{63t+9}$

B. $3\sqrt{63t+27}$

C. $3\sqrt{63t-9}$

D. $3\sqrt{63t-27}$

Answer: B

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93. In a bank, principal increases continuously at the rate of r% per yeat.

Find the value of r if Rs 100 double itself in 10 years $(\log_e 2 = 0.6931)$

A. 5

B. 6.9

C. 0.069

D. 0.0069

Answer: B

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94. In a bank, principal increases continuously at the rate of 5% per year.

An amount of Rs 1000 is deposited with this bank, how much will it worth

after 10 years $\left(e^{\frac{1}{2}} = 1.648\right)$

A. 1648

B. 164.8

C. 16480

D. 32296

Answer: A

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95. In a culture, the bacteria count is 1,00,000. The number is increased by 10% in 2 hours. In how many hours will the count reach 2,00,000, if the rate of growth of bacteria is proportional to the number present ?

A. $\frac{2\log 2}{\log(110)}$

B. $\frac{2\log 2}{\log.\ \frac{11}{10}}$

C. $\frac{\log 2}{\log\left(\frac{11}{10}\right)}$

D. None

Answer: B

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96. The population of a village increases continuously at the rate proportional to the number of its inhabitants present at any time. If the population of the village was 0,000 in 1999 and 25000 in the year 2004, what will be the population of the village in 2009 ?

A. 31250

B. 3125

C. 312500

D. None

Answer: A

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97. The solution of the differential equation

$$\frac{dy}{dx} = \frac{y}{x} + \frac{\Phi\left(\frac{y}{x}\right)}{\Phi^1\left(\frac{y}{x}\right)}$$ is

A. $x\Phi\left(\frac{y}{x}\right) = k$

B. $\Phi\left(\frac{y}{x}\right) = kx$

C. $y\Phi\left(\frac{y}{x}\right) = k$

D. $\Phi\left(\frac{y}{x}\right) = ky$

Answer: B

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98. If y = y (x) is the solution of the differential equation $\left(\frac{2+\sin x}{y+1}\right)\frac{dy}{dx} + \cos x = 0$ with y(0) = 1 then $y\left(\frac{\pi}{2}\right)$=

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

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

C. 1

D. $\frac{4}{3}$

Answer: A

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99. $\frac{dy}{dx} + 2x\tan(x - y) = 1 \Rightarrow \sin(x - y) =$

A. Ae^{-x^2}

B. Ae^{2x}

C. Ae^{x^2}

D. Ae^{-2x}

Answer: C

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100. Integrating factor of the differential equation $(1 - x^2)\frac{dy}{dx} + xy = \frac{x^4}{(1 + x^5)\left(\sqrt{1 - x^2}\right)^3}$ is

A. $\sqrt{1 - x^2}$

B. $\dfrac{x}{\sqrt{1-x^2}}$

C. $\dfrac{x^2}{\sqrt{1-x^2}}$

D. $\dfrac{1}{\sqrt{1-x^2}}$

Answer: D

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101. The differential equation $\dfrac{dy}{dx} = \dfrac{1}{ax+by+c}$ where a,b,c are all non zero real numbers, is

A. Linear in y

B. Linear in x

C. Linear in both x & y

D. Homogeneous equation

Answer: B

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102. The solution of $\frac{dy}{dx}+\frac{1}{x}=\frac{e^{y}}{x^{2}}$ is

A. $2x=\left(1+Cx^{2}\right)e^{y}$

B. $x=\left(1+Cx^{2}\right)e^{y}$

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

D. $x^{2}=\left(1+Cx^{2}\right)e^{-y}$

Answer: A

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103. The differential equation corresponding to the family of circles given by $(x-a)^{2}+(y-b)^{2}=4$ where a and b are parameters, is

A. $4\frac{d^{2}y}{dx^{2}}+9y=0$

B. $4\left(\frac{d^{2}y}{dx^{2}}\right)^{2}+\left[1+\left(\frac{dy}{dx}\right)^{2}\right]^{3}$

C. $y\frac{d^{2}y}{dx^{2}}+\left(\frac{dy}{dx}\right)^{2}=6y$

D. $4\left(\frac{d^2y}{dx^2}\right)^2 + \left[1 + \left(\frac{dy}{dx}\right)^2\right]^2 = 0$

Answer: B

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104. The solution of $\cos^2 x \frac{dy}{dx} + y = \tan x$ is

A. $ye^{\tan x} = (\tan x - 1)e^{\tan x} - \tan x + c$

B. $ye^{\tan x} = (\tan x + 1)e^{\tan x} + \tan x + c$

C. $ye^{\tan x} = (\tan x - 1)e^{\tan x} + c$

D. $ye^{\tan x} = (\tan x - 1)e^{\tan x} + \tan x + c$

Answer: C

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105. The differential equation of the simple harmonic motion given by $x = A\cos(nt + \alpha)$ is

A. $\frac{d^2x}{dt^2} - n^2x = 0$

B. $\frac{d^2x}{dt^2} + n^2x = 0$

C. $\frac{dx}{dt} - \frac{d^2x}{dt^2} = 0$

D. $\frac{d^2x}{dt^2} - \frac{dx}{dt} + nx = 0$

Answer: B

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Practice Exercise

1. The degree and order of the differential equation $\left[1 + 2\left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}} = 5\frac{d^2y}{dx^2}$ are

A. 1,2

B. 2,2

C. 3,1

D. 4,3

Answer: B

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2. The order and degree of the differential equation $(1+3y_1)^{2/3}=4y_3$ are

A. $2/3$

B. 3,1

C. 3,3

D. 1,2

Answer: C

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3. Degree and order of differential equation $y = x\frac{dy}{dx} + m\sqrt{1 + \left(\frac{dy}{dx}\right)^2}$ are

A. 2,1

B. 1,2

C. 4,2

D. not defined

Answer: A

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4. The order and degree of $\left(\frac{d^4y}{dx^4} + \frac{d^2y}{dx^2}\right)^{\frac{5}{2}} = a\frac{d^2y}{dx^2}$ are p,q then p+q =

A. 9

B. 6

C. 7

D. 10

Answer: A

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5. The order degree of the D.E. corres ponding to the family of curve $y = a(x+a)^2$ where a is an arbitrary constant is

A. 1,2

B. 2,4

C. 3,1

D. 1,3

Answer: D

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6. The degree and order of D.E. of the family of rectangular hyperbolas whose axis of symmetry are the coordinates axes

A. 1,1

B. 1,2

C. 2,1

D. 2,2

Answer: A

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7. Form the differential equation by eliminating the arbitrary constant from the equation $y = a\cos(2x + b)$

A. $\dfrac{d^2y}{dx^2} + 4y = 0$

B. $\dfrac{d^2y}{dx^2} - 4y = 0$

C. $\dfrac{d^2y}{dx^2} + 2y = 0$

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

Answer: A

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8. If the differential equation formed by eliminating a,b,c from the equaiton

$y = ae^{x} + be^{2x} + ce^{3x}$ is $Py_3 + Qy_2 + Ry_1 + Sy = 0$ then

A. P = 1, Q = 6, R=11, S = 6

B. P=1, Q=-6, R = 11, S=-6

C. P=1, Q=6, R = -11, S=6

D. P=1, Q = -6, R = 11, S=6

Answer: B

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9. The differential equation of family of coaxal circles $x^2 + y^2 + 2\lambda x + c = 0$ is

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

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

C. $\left(\frac{d^2y}{dx^2}\right) + \left(\frac{dy}{dx}\right)^2 + 1 = 0$

D. $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 = 0$

Answer: A

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10. The D.E. of the family of circles touching X-axis at (0,0) is (or) The D.E. of the family of circles passing through the origin and having their centre on Y-axis is

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

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

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

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

Answer: A

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11. The differential equations of hyperbolas with coordinate axis as asymptotes is

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

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

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

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

Answer: B

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12. The differential equation of the family of hyperbolas having centres at the origin and whose axes are the coordinate axes is

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

B. $xyy_2 - xy_1^2 - yy_1 = 0$

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

D. $xyy_2 - xy_1^2 - yy_1 = 0$

Answer: C

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13. The solution of $\frac{dy}{dx} = e^{x+y} + x^2 e^{x^3+y}$ is

A. $e^x - e^{-y} + \frac{1}{3}e^{x^3} = c$

B. $e^x + e^{-y} + \frac{1}{3}e^{x^3} = c$

C. $e^{-x} - e^{-y} + \frac{1}{3}e^{x^3} = c$

D. $e^x + e^y + \frac{1}{3}e^{x^3} = c$

Answer: B

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14. The solution of the differential equation $\frac{dy}{dx} = \frac{xy + y}{yx + x}$ is

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

B. $x + y = \log(Cxy)$

C. $x - y = \log\left(\frac{Cx}{y}\right)$

D. $y - x = \log\left(\frac{Cx}{y}\right)$

Answer: D

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15. The solution of $ydx - xdy = xydx$ is

A. $\frac{x}{y} = ce^{x}$

B. $xy = ce^{x}$

C. $\dfrac{x^2}{y^2} = c \log x$

D. $\dfrac{x}{y} = ce^{y}$

Answer: A

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16. Solution of $\log\left(\dfrac{dy}{dx}\right) = 3x + 4y, y(0) = 0$ is

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

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

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

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

Answer: D

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17. The solution of $y = x\frac{dy}{dx} + a\sqrt{1+\left(\frac{dy}{dx}\right)^2}$ is

A. y = mx + c

B. $y = mx + a\sqrt{1+m^2}$

C. y = mx

D. $y = a\sqrt{1+m^2}$

Answer: B

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18. $\frac{dy}{dx} = xy + x + y + 1$ has the solution

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

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

C. $\log(y+1) = x + c$

D. $\log(y+1) = x^2 + x + c$

Answer: B

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19. The solution of $\left(x^2-y^2x^2\right)(dy/dx)+\left(y^2+x^2y^2\right)=0$ is

A. $x+\frac{1}{x}+y+\frac{1}{y}+c=0$

B. $x-\frac{1}{x}+y-\frac{1}{y}=c$

C. $x+\frac{1}{x}-y-\frac{1}{y}+c=0$

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

Answer: D

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20. The solution of $\left(x^2y^3+x^2\right)dx+\left(y^2x^3+y^2\right)dy=0$ is

A. $\left(x^3+1\right)\left(y^3+1\right)=c$

B. $\left(x^3-1\right)\left(y^3-1\right)=c$

C. $\left(x^3-1\right)\left(y^3+1\right)=c$

D. $\left(x^3+1\right)\left(y^3-1\right)=c$

Answer: A

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21. Solution the differential equation $\frac{dy}{dx}+1=e^{x+y}$ is

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

B. $e^{x+y}+x+y=c$

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

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

Answer: C

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22. The solution of $\frac{dy}{dx} = e^{2x-y} + x^3 e^{-y}$ is

A. $4e^y = 2e^{2x} - x^4 + c$

B. $4e^y = 2e^{2x} + x^4 - x^2 + c$

C. $4e^y = 2e^{2x} + x^4 + c$

D. $4e^y = 2e^{2x} - x^4 + x^2 + c$

Answer: C

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23. The solution of $\frac{dy}{dx} = \tan^2(x+y)$ is

A. $\tan(x+y) = x + c$

B. $2(x+y) + \sin(2x+2y) = 4x + c$

C. $2(x+y) - \sin(2x+2y) = 4x + c$

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

Answer: B

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24. The solution of $\frac{dy}{dx} = \cos(x+y)$ is

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

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

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

D. $\cot\left(\frac{x+y}{2}\right) = y + c$

Answer: A

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25. The solution of $\frac{dy}{dx} = (4x+9y+1)^2$ is

A. $3(4x+9y+1) = \tan(6x+c)$

B. $3(4x+9y+1)=2\tan(6x+c)$

C. $3(4x-9y-1)=2\tan(6x+c)$

D. $3(4x+9y-1)=\tan(6x+c)$

Answer: C

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26. The equation of the curve through the origin and satifying the differential equation $\frac{dy}{dx}=(x-y)^2$ 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

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27. The equation of curve passing through (1,3) whose slope at any point (x,y) on it is y/x^2 is given by

A. $y = 3e^{-1/x}$

B. $y = 3e^{1-1/x}$

C. $y = ce^{1/x}$

D. $y = 3e^{1/x}$

Answer: B

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28. The equation of curve passing through (0,1) which is a solution of differential equation $(1+y^2)dx + (1+x^2)dy = 0$ is given by

A. $\tan^{-1}(x) + \tan^{-1}(y) = 0$

B. $\tan^{-1}(x) + \tan^{-1}(y) = \pi/4$

C. $\sin h^{-1}(x) + \sin h^{-1}(y) = 0$

D. $\sin h^{-1}(x) + \sin h^{-1}(y)\log\left(1 + \sqrt{2}\right) = 0$

Answer: B

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29. The curve whose sub tangent is twice the abscissa of the point of contact passing through (1,2) is

A. $y^2 = 4x$

B. $y^2 = -4x$

C. $x^2 = 4y$

D. $x^2 = -4y$

Answer: A

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30. Equation of the curve passing through the point (a,1) and has length of subtangent = a is

A. $y = e^{x}$

B. $y = e^{x/a}$

C. $y = e^{\frac{x-a}{a}}$

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

Answer: C

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31. The D.E $y\frac{dy}{dx} + x = a$ represents

A. a circle whose centre is on X-axis

B. a circle whose centre is on Y-axis

C. a circle whose centre is origin

D. a parabola

Answer: A

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32. The solution of $\frac{ydx - xdy}{y^2} = 0$ represents a family of

A. straight lines passing though the origin

B. circles

C. parabola

D. hyperbola

Answer: A

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33. Solve : $xdy = \left(y + x \quad \cos^2 \frac{y}{x}\right) dx$

A. $\tan\left(\frac{y}{x}\right) = \log(cx)$

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

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

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

Answer: A

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34. Solve : $x \quad \sin\frac{y}{x}. \frac{dy}{dx} = y \quad \sin\frac{y}{x} - x$

A. $e^{\frac{y}{x}} = cy$

B. $e^{\cos y / x} = cx$

C. $e^{\frac{x}{y}} = cx$

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

Answer: B

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

A. $x = ce^{\frac{x^2}{y^2}}$

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

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

D. $x = ce^{\frac{2x^2}{y^2}}$

Answer: C

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36. The solution of $\left(x^2 - y^2\right)dx + 2xydy = 0$ is

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

B. $x^2 - y^2 = cx$

C. $x^2 + y^2 = cy$

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

Answer: A

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37. The substitution required to change equation $\frac{dy}{dx}=\frac{2x+3y+5}{4x+6y+9}$ into variable separable is

A. $4x-6y=z$

B. $2x+3y=z$

C. $2x-3y=z$

D. $y=vx$

Answer: B

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38. To change $(3x+4y+5)-(2x+3y+4)\frac{dy}{dx}=0$ into homogeneous equation, origin is shifted to (h,k) then h + k = 0

A. 3

B. 1

C. -2

D. -1

Answer: D

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39. The solution of $\frac{dy}{dx} = \frac{x - 2y + 3}{2x - y + 5}$ is

A. $x^2 - 4xy + y^2 + 6x - 10y = c$

B. $x^2 - 4xy + y^2 + 6x + 10y = c$

C. $x^2 + 4xy + y^2 + 6x - 10y = c$

D. $x^2 - 4xy - y^2 - 6x - 10y = c$

Answer: A

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40. The integrating factor of the differential equation $\frac{dy}{dx}(x \log x) + y = 2 \log x$ is given by

A. log (log x)

B. e^x

C. log x

D. x

Answer: C

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41. An equation $\frac{dy}{dx} + p(x).\, y = q(x)$ is called

A. Variable separable

B. Homogeneous

C. Linear equation in x

D. Linear equation in y

Answer: D

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42. The solution of $\left(1+x^2\right)\frac{dy}{dx}+y=e^{\tan^{-1}x}$ is

A. $\tan^{-1}y$

B. $e^{\tan^{-1}y}$

C. $1+y^2$

D. e^{1+y^2}

Answer: B

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43. The integrating factor of

$$c\cos x\left(\frac{dy}{dx}\right)+(x\sin x+\cos x)y=1$$ is

A. x Cos x

B. x Sin x

C. x Sec x

D. x Cosec x

Answer: C

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44. The solution of $2x\dfrac{dy}{dx}+y=2x^3$ is

A. $y\sqrt{x}=\frac{2}{5}x^{5/2}+c$

B. $y\sqrt{x}=\frac{2}{7}x^{7/2}+c$

C. $y\sqrt{x}=\frac{2}{9}x^{9/2}+c$

D. $y\sqrt{x} = \frac{2}{3}x^{3/2} + c$

Answer: B

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45. The solution of $\frac{dy}{dx} + \frac{xy}{1+x^2} = \frac{1}{x(1+x^2)}$ is

A. $y\sqrt{1+x^2} = \sec^{-1}x + c$

B. $y\sqrt{1+x^2} = -\operatorname{cosec}h^{-1}x + c$

C. $y\sqrt{1+x^2} = \sin^{-1}x + c$

D. $y\sqrt{1-x^2} = \tan^{-1}x + c$

Answer: B

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46. The solution of $\frac{dy}{dx} - y\tan x = e^x \sec x$ is

A. $ye^{x} = \cos x + c$

B. $y\cos x = e^{x} + c$

C. $y\sin x = e^{x} + c$

D. $ye^{x} = \sin x + c$

Answer: B

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47. The solution of $\frac{dy}{dx} + \frac{3x^2 y}{1+x^3} = \frac{1+x^2}{1+x^3}$ is

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

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

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

D. $y(1-x^3) = x - \frac{x^3}{3} + c$

Answer: A

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48. The solution of $x \log x \frac{dy}{dx} + y = 1$ is

A. $\log x = \frac{c}{(y-1)}$

B. $y \log x \frac{dy}{dx} + y = 1$

C. $xy = \log(\log x) + c$

D. $\frac{x}{y} \log y = c$

Answer: A

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49. The solution of $y^2 dx + (3xy - 1)dy = 0$ is

A. $xy^3 = y^2 + c$

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

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

D. $xy^3 = \frac{x^2}{2} + c$

Answer: B

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50. The solution of $dx + xdy = e^{-y} \sec^2 y dy$ is

A. $xe^y = \sin y + c$

B. $x^2 e^y = \tan y + c$

C. $xe^y = \tan y - x + c$

D. $xe^y = \tan y + c$

Answer: D

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51. The solution of $\sec x \frac{dy}{dx} = y + \sin x$ is

A. $ye^{-\sin x} = e^{-\sin x}(-\sin x - 1) + c$

B. $ye^{-\sin x} = e^{\sin x}(\sin x + 1) + c$

C. $ye^{\cos x} = e^{\cos x}(\sin x + 1) + c$

D. $ye^{-\sin x} = e^{-\sin x}(\sin x + 1) + c$

Answer: A

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52. The solution of $\frac{dy}{dx} + \frac{3}{x}y = \frac{1}{x^2}$, at y=2, x=1

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

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

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

D. $2x^3y = x^2 + 5$

Answer: B

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53. The solution of $\frac{dy}{dx} + \frac{2x}{1+x^2}y = \frac{1}{(1+x^2)^2}$, is

A. $y(1+x^2) = \tan^{-1}x - \frac{\pi}{4}$

B. $y(1-x^2) = \tan^{-1}x - (\pi)/(4)$

C. $y(1+x^2) = \tan^{-1}x + \frac{\pi}{4}$

D. $x(1+x^2) = \tan^{-1}x - \pi/4$

Answer: A

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54. The solution of $\frac{dy}{dx} + \frac{\tan y}{1+x} = (1+x)e^x \sec y$ is

A. $\frac{\sin y}{1+x} = e^x + c$

B. $\frac{\cos y}{1+x} = e^x + c$

C. $\frac{\cos y}{1-x} = e^x + c$

D. $\frac{\cos y}{x+1} = e^y + c$

Answer: A

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55. The solution of $2\frac{dy}{dx_1} = \frac{y}{x} + \frac{y^2}{x^2}$ is

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

B. $\frac{1}{y} = x + \frac{c}{\sqrt{x}}$

C. $\frac{1}{y} = \frac{1}{x} + \frac{c}{\sqrt{x}}$

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

Answer: C

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56. If the solution of $\frac{dy}{dx} = \frac{x-y}{x+y}$ is $ax^2 + bxy + cy^2 = k, k > 0$ then the ascending order of a,b,c is

A. b,c,a

B. a,b,c

C. c,a,b

D. a,c,b

Answer: D

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57. Match the following

	List-I		List-II
(1)	$\left(x + 2y^3\right)\frac{dy}{dx} = y$	(a)	$e^{\tan x}$
(2)	$\cos^2 x \frac{dy}{dx} + y = \tan x$	(b)	$\frac{1}{x}$
(3)	$\log x . \frac{dy}{dx} + \frac{y}{x} = \sin 2x$	(c)	$\frac{1}{y}$
(4)	$ydx - xdy + \log x dx = 0$	(d)	$\lvert \log x \rvert$
		(e)	y

A. 1-c, 2-a, 3-d, 4-b

B. 1-a, 2-b, 3-d, 4-c

C. 1-c, 2-d, 3-b, 4-a

D. 1-a, 2-d, 3-b, 4-c

Answer: A

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58. Match the following

	List-I
(1)	The equation of family of curves for which length of the normal = The radius vector.
(2)	Solution of the differential equation $\left(\frac{dy}{dx}\right)^2 - \frac{dy}{dx}(e^x + e^{-x}) + 1 = 0$
(3)	The solution of $\frac{xdy}{(x^2+y^2)} = \left(\frac{y}{x^2+y^2} - 1\right)dx$ is

A. 1-a, 2-b, 3-d

B. 1-c, 2-, 3-a

C. 1-c, 2-a, 3-d

D. 1-c, 2-a, 3-b

Answer: D

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59. Match the following.

	List -I (Differential equation)		List-II (Order O, Degree = D)
(1)	$\left[\left(\frac{dy}{dx}\right)^3 + \frac{d^2y}{dx^2}\right]^2 = a\frac{dy}{dx}$	(a)	$2O + 3D = 8$
(2)	$3y = 7x\frac{dy}{dx} + \frac{5}{dy/dx}$	(b)	$O^D + D^O = 4$
(3)	$\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$	(c)	$O = D$
(4)	$\left(\frac{dy}{dx} + 4x\right)^{3/2} = x + 5\frac{dy}{dx}$	(d)	$3^O + 2^D = 11$

The correct match from List-I from List -II

A. 1-a, 2-c, 3-b, 4-d

B. 1-b, 2-d, 3-c, 4-a

C. 1-c, 2-a, 3-d, 4-b

D. 1-d, 2-b, 3-a, 4-c

Answer: C

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60. I : The degree of the differential equation of

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

II : The number of arbitrary constant in the general number of a differential equation is equal to the degree of the differential equation.

Which of the above statement is correct.

A. only I

B. only II

C. Both I and II

D. Neither I nor II

Answer: D

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61. Statement - I : The differential equation of $y = 5x - c$ is $y_1 = 5$

Statement - II : The differential equaiton of $y = Ae^{-2x} + Be^{5x}$ is $y_2 - 3y_1 - 10y = 0$

Statement - III : The solution of the differential equation $y = Ae^{2x}\left(c_1 + c_2 x + c_3 x^2\right)$ is $y_3 - 6y_2 - 12y_1 - 8y = 0$

Which of the above statement is correct.

A. I & III

B. II & III

C. I & II

D. I, II & III

Answer: C

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62. The solution of the differential equation $y' = \dfrac{1}{e^{-y} - x}$, is

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

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

C. $x = e^{y}(y + c)$

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

Answer: A

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