MATHS

BOOKS - SAI MATHS (TELUGU ENGLISH)

DIFFERENTIAL EQUATIONS

Problems

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

The correct match is:

	(i)	(ii)	(iii)	(iv)
(a)	(d)	(a)	(b)	(c)
(b)	(e)	(a)	(b)	(c)
(c)	(e)	(b)	(c)	(f)
(d)	(e)	(a)	(c)	(d)

1.

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2. 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. $e^{y/x} = 2\ln|cx|$

Answer: D

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3. The differential equation of the family of curves $y = ax + \frac{1}{a}$, 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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4. 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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5. The differential equation $\frac{dy}{dx} = \frac{1}{ax + by + c}$ where a, b, c are all nonzero real numbers , is

A. Linear in y

B. Linear in x

C. Linear in both x and y

D. Homogenous equation

Answer: B

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6. The differential equation of the family of parabolas with vertex at $(0, -1)$ and having axis long the Y-axis is

A. $yy' + 2xy + 1 = 0$

B. $xy' + y + 1 = 0$

C. $xy' - 2y - 2 = 0$

D. $xy' - y - 1 = 0$

Answer: C

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7. The solution of $x\frac{dy}{dx} = y + xe^{y/x}$ with $y(1) = 0$ is

A. $e^{y/x} + \log x = 1$

B. $e^{-y/x} = \log x$

C. $e^{-y/x} + 2\log x = 1$

D. $e^{-y/x} + \log x = 1$

Answer: D

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

A. e^x

B. x^2

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

D. x

Answer: D

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9. 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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10. If $\frac{dy}{dx} + 2x\tan(x-y) = 1,$ then $\sin(x-y)$ is equal to

A. Ae^{-x^2}

B. Ae^{2x}

C. Ae^{x^2}

D. Ae^{-2x}

Answer: C

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11. An 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. $\frac{x}{\sqrt{1-x^2}}$

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

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

Answer: D

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12. The solution of the differential equation $\frac{dy}{dx} = \frac{y}{x} + \frac{\phi(y/x)}{\phi'(y/x)}$ 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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13. 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 $y\left(\frac{\pi}{2}\right)$ is equal to

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

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

C. 1

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

Answer: A

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

A. $\sec y = 2\cos x + c$

B. $\sec y = -2\cos x + c$

C. $\tan y = -2\cos x + c$

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

Answer: B

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

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

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

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

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

Answer: B

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

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

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

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

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

Answer: B

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17. The differential equation of the family $y = ae^x + bxe^x + cx^2e^x$ of curves, where a, b, c are arbitrary constants , 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: D

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18. The solution of the differential equation $\frac{dy}{dx} = \frac{xy + y}{xy + x}$ 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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19. The solution of the differential equation $\frac{dy}{dx} = \frac{x - 2y + 1}{2x - 4y}$ is

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

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

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

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

Answer: A

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

A. $y = e^x \cos x + c$

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

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

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

Answer: B

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21. The solution of the differential equation $xy^2dy - \left(x^3 + y^3\right)dx = 0$ is

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

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

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

D. $y^3 + 3x^2 = \log(cx)$

Answer: B

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

A. $x.\dfrac{d^2y}{dx^2} + 2.\dfrac{dy}{dx} - xy = 0$

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

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

D. $\dfrac{d^2y}{dx^2} + \dfrac{dy}{dx} - xy = 0$

Answer: A

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23. The solution $(x+y+1)\frac{dy}{dx}=1$ is

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

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

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

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

Answer: C

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

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

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

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

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

Answer: B

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

A. $e^{-(x+y)} + x + c = 0$

B. $e^{-(x+y)} - x + c = 0$

C. $e^{x+y} + x + c = 0$

D. $e^{x+y} - x + c = 0$

Answer: A

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26. The solution of $\left(x^2+y^2\right)dx = 2xydy$ is

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

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

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

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

Answer: A

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27. The solution of

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

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

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

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

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

Answer: B

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

Answer: B

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29. If $dx + dy = (x + y)(dx - dy)$, then $\log(x + y)$ is equal to

A. $x + y + c$

B. $x + 2y + c$

C. $x - y + c$

D. $2x + y + c$

Answer: C

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

A. $\sin x$

B. $2\sin x + c$

C. $3\sin x + c$

D. $3\cos x + c$

Answer: C

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31. 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 not II is true

C. I is true, II is false

D. I is false, II is true

Answer: C

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32. If $\frac{dy}{dx} = \frac{y + x \tan. \frac{y}{x}}{x}$, then $\sin. \frac{y}{x}$ is equal to

A. cx^2

B. cx

C. cx^3

D. cx^4

Answer: B

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

A. $e^{\frac{1}{y}}$

B. $e^{-\left(\frac{1}{y}\right)}$

C. y

D. $\frac{-1}{y}$

Answer: A

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

A. $y''' - 6y'' + 11y' - 6y = 0$

B. $y''' + 6y'' + 11y' + 6y = 0$

C. $y''' + 6y'' - 11y' + 6y = 0$

D. $y''' - 6y'' - 11y' + 6y = 0$

Answer: A

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35. Assertion (A) Integrating factor of $\frac{dy}{dx} + y = x^2$ is e^x.

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

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

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

C. (A) is true, (R) is false

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

Answer: A

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36. The differential equation of the family of parabola with focus at the origin and the 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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37. 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. $y\sin y = x^2\log x$

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

Answer: A

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

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

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

Answer: A

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39. 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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40. The solution of $\frac{dy}{dx} + \frac{1}{3}y = 1$ is

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

B. $y = 3 + ce^{-x/3}$

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

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

Answer: B

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

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

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

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

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

Answer: A

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42. The solution of $\frac{dy}{dx} = \left(\frac{x}{y}\right)^{-1/3}$ 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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43. The solution of $xdx + ydy = x^2ydy - xy^2dx$ is

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

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

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

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

Answer: A

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44. The solution of $x^2 + y^2 \frac{dy}{dx} = 4$ is

A. $x^2 + y^2 = 12x + c$

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

C. $x^2 + y^2 = 8x + c$

D. $x^3 + y^3 = 12x + c$

Answer: D

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

Answer: C

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46. If $y = A\cos nx + B\sin nx$, then $y_2 + n^2 y$ is equal to

A. 0

B. 1

C. y

D. -1

Answer: A

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47. The family of curves in which the sub-tangent at any point to any curve is double the abscissa is given by

A. $x = cy^2$

B. $y = cx^2$

C. $x^2 = cy^2$

D. $y^2 = cy^2$

Answer: A

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48. If c is a parameter, then the differential equation whose solution is $y = c^2 + \frac{c}{x}$, is

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

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

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

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

Answer: B

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