DIFFERENTIAL EQUATIONS

SYNOPSIS

Differnetial Equation:

An equation containing an independent variable, dependent variable and differential coefficient of dependent variable with respect to independent variable is called a differential equation

Eg: 1. $\frac{d^2y}{dx^2}+5\frac{dy}{dx}+6y=x^2$

2. $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=u$

Types of differential equation:

- **Ordinary differential equation:** A differential equation involving derivatives with respect to single independent variable is called ordinary differential equation.

  Eg: $\frac{dy}{dx}=x^3+\sin x$

- **Partial differential equation:** A differential equation involving at least two independent variables and partial derivatives with respect to either of these independent variables is called a partial differential equation.

  Eg: $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=2u$

- **Order of a differential equation:** The order of a differential equation is the order of the highest derivative appending in it.
- **Degree of a differential equation:** The degree of a differential equation is the highest derivative which occurs in it, after the differential equation has been made free from radicals and fractions as for as the derivatives are concerned.

S.No	Differential Equation	Order	Degree
•	$\frac{dy}{dx}=\frac{1+y^2}{1+x^2}$	1	1
•	$\frac{d^2y}{dx^2}+2\left(\frac{dy}{dx}\right)^2+2y=\sin x$	2	1
•	$\left[5+\left(\frac{dy}{dx}\right)^2\right]^{5/3}=5\frac{d^2y}{dx^2}$	2	3

- **Solution of the differential equation:** A relation between the variables with out derivatives which satisfy the given differential equation is called a solution of the given differential equation.

Types of Solutions:

- **General solution:** The solution which contains as many arbitarary constants as the order of the differential equation is called general solution of the differential equation.
- **Particular solution:** Solution obtained by giving particular values to the arbitarary constants in the general solution of the given equation.
- **Formation of differential equation:** Let the given equation be

  $f(x,y,c_1,c_2,---c_n)=0---(1)$

  Differentiating with respect to n times we get n more equatiions. By eliminating the arbitanary constants $c_1,c_2,---c_n$ we get the differential equation of order n.

  Note: The number of independent arbitanary constants in the solution of a differential equation is the order of the differential equation.

Types of differential equations:

- Variable separable
- Homogeneous equations
- Nonhomogeneous equation
- Linear equations
- Bernoulli's equations
- Exact differential equations

- **Variable separable method:** Its general form is

  $\frac{dy}{dx}=f(x,y)$

  $\Rightarrow \frac{dy}{dx}=\frac{f(x)}{g(y)}$ (or) $\Rightarrow \frac{dy}{dx}=\frac{g(y)}{f(x)}$

  Where $f(x),g(x)$ are continuous functions.

  $\Rightarrow g(y)dy=f(x)dx$ (or) $\frac{dx}{f(x)}=\frac{dy}{g(y)}$

  By integration we get the solution.

  Note: If the equation is of the form $\frac{dy}{dx}=f(ax+by+c)$; put $ax+by+c=z$ then

convert into variable separable form.

- **Homogeneous differential equation:**

• Homogeneous function: A function $f(x,y)$ is said to be homogeneous function in x,y of degree n if $f(kx,ky)=k^n f(x,y)$ where n is a constant.

• General form is $\frac{dy}{dx}=\frac{f(x,y)}{g(x,y)}$ by substituting $y=vx$, convert into variable separable form.

Eg: $\frac{dy}{dx}=\frac{ax+by}{cx+dy}$

- **Non-homogeneous differential equation:**

General form $\frac{dy}{dx}=\frac{ax+by+c}{a^1x+b^1y+c^1}$ where a,b,c,a^1,b^1,c^1 are constants

Case i: If $ab^1-a^1b=0$ then by putting $a^1x+b^1y=z$ convert into variable separable.

Case ii: $ab^1-a^1b\neq 0$ by shifting the origin to a suitable point convert into homogeneous form.

The suitable point is (h,k) where $h=\frac{b_1c_2-b_2c_1}{a_1b_2-a_2b_1}$

$k=\frac{c_1a_2-c_2a_1}{a_1b_2-a_2b_1}$

Case iii: If the D.E is of the form $\frac{dy}{dx}=\frac{a_1x-a_2y+c_1}{a_2x+b_2y+c_2}$ its solution is given by

$a_2xy+\frac{b_2y^2}{2}-\frac{a_1x^2}{2}-c_1x-c_2y=K$ where K is constant.

- **Linear differenital equations:**

Type(i): General form $\frac{dy}{dx}+P(x).y=Q(x)$.

Then $\int_e p(x)\,dx$ is the integrating factor and the solution is $y.e^{\int P(x)dx}=\int Q(x).e^{\int P(x)dx}dx+c$

Type (ii): General Form: $\frac{dx}{dy}+P(y)x=Q(y)$.

Then integrating factor is $e^{\int p(y)dy}$. Then solution is

$x.e^{\int P(y)dy}=\int Q(y).e^{\int P(y)dy}dy+c$

- **Bernoulli's differential equation:**

Type: 1: General form $\frac{dy}{dx}+P(x).y=Q(x).y^n$, $n\in R$ is called Bernoulli's equation in y. Dividing by y^n and substituting $\frac{1}{y^{n-1}}=Z$ convert into linear differential equation.

Type 2: General form $\frac{dx}{dy}+P(y)x=Q(y)x^n$. $n\in R$ is called Bernoulli equation in x.

- **Exact differential equation:** The equation $f(x,y)dx+g(x,y)dy=0$ which can be put in the form $d(h(x,y))=0$ is called as exact differential equation and its solution will be $h(x,y)=c$.

Note: The necessary and sufficient condition for the equation $f(x,y)dx+g(x,y)dy=0$ to be an exact differential equation is $\frac{\partial f}{\partial y}=\frac{\partial g}{\partial x}$

Standard results:

- The differential equation of $y=A_1e^{\alpha_1x}+A_2e^{\alpha_2x}$ is $y_2-(\alpha_1+\alpha_2)y_1+\alpha_1\alpha_2y=0$ (A_1,A_2 are arbitarary constants)
- The differential equation of $y=e^{\alpha x}(A_1x+A_2)$ is $y_2-2ay_1+\alpha^2y=0$ (A_1,A_2 are arbitarary constants)
- The differential equation of $y=e^{\alpha x}(A_1\cos\beta x+A_2\sin\beta x)$ is $y_2-2\alpha y_1+(\alpha^2+\beta^2)y=0$ (A_1,A_2 are arbitarary constants)
- The D.E of $y=A_1x^m+A_2x^n$ $x^2\frac{d^2y}{dx^2}-(m+n-1)x\frac{dy}{dx}+mny=0$
- The D.E of $y=A_1e^{\alpha_1x}+A_2e^{\alpha_2x}+A_3e^{\alpha_3x}$

$$\frac{d^3y}{dx^3}-(\alpha_1+\alpha_2+\alpha_3)\frac{d^2y}{dx^2}+$$

$$(\alpha_1\alpha_2+\alpha_{23}+\alpha_3\alpha_1)\frac{dy}{dx}-\alpha_1\alpha_2\alpha_3 y=0$$

- The D.E of $y=e^{\alpha x}\left[Ax^2+Bx+C\right]$

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

- The solution of the equation $xdy+ydx=0$ is $xy=C$
- The solution of the equation $\frac{ydx-xdy}{y^2}=0$ is $\frac{x}{y}=C$
- The solution of the equation $\frac{xdy-ydx}{x^2}=0$ is $\frac{y}{x}=c$
- The solution of the equation $\frac{ye^x dx-e^x dy}{y^2}=0$ is $\frac{e^x}{y}=C$
- The solution of the equation $\frac{xe^y dy-e^y dx}{x^2}=0$ is $\frac{e^y}{x}=C$
- The solution of $\frac{xdy-ydx}{x^2+y^2}=0$ is $\tan^{-1}\frac{y}{x}=C$
- The solution of $\frac{ydx-xdy}{x^2+y^2}=0$ is $\tan^{-1}\frac{x}{y}=C$
- The solution of $\frac{xdy+ydx}{xy}=0$ is $\log xy=C$
- The solution of $\frac{xdy-ydx}{xy}=0$ is $\log\frac{y}{x}=C$
- The solution of $\frac{ydx-xdy}{xy}=0$ is $\log\frac{x}{y}=C$
- The solution of the equation $\frac{xdx+ydy}{x^2+y^2}=0$ is $\log\sqrt{x^2+y^2}=C$

CONCEPTUAL QUESTIONS

1. The order of the differential equation of the curve $y^2=4ax$ is
   1. 2 2. 1
   3. 3 4.Can't be determined
2. The order of the differential equation of the parabola whose axis is parallel to *y*-axis is
   1. 1 2. 2 3. 3 4. 4
3. The order of the differenital equation of $(x-a)^2+(y-b)^2=a^2$ is
   1. 4 2. 3 3. 2 4. 1
4. The order and degree of the differential equation of rectangular hyperbola is
   1. 2,2 2. 3,2 3. 1,2 4. 1,1
5. $\frac{dy}{dx}=\frac{4x+2y+1}{x-2y+3}$ is a differential equation of the type
   1. variable separable 2. exact
   3. Homogeneous 4. non homogeneous
6. The solution of the differential equation $xdx+ydy=0$ is $f(x,y)=c$ passes through $(1,1)$ then the value of C is
   1. -2 2. 2 3. -1 4. 1
7. The differential equation of the family of circles whose centre lie on *x*-axis and passing through origin is
   1. $x^2+y^2+\frac{dy}{dx}=0$
   2. $y^2dx-x(x+2y)dy=0$
   3. $y^2dx+(x^2+2xy)dy=0$
   4. $xdy+ydx+x^2dx+y^2dy=0$
8. Equation of the curve passing through $(1,0)$ whose slope is $\frac{y-1}{x^2+x}$
   1. $(y-1)(x+1)+2x=0$
   2. $2x(y-1)+x+1=0$
   3. $x(y-1)(x+1)+2=0$
   4. $(x+1)(y+1)+2x=0$

9. A particle moves in a straight line with a velocity given by $\frac{dx}{dt} = x+1$ (where x is distance). Then the time taken by the particle to travel a distance of 99 metres is

1. $\log_{10} e$ 2. $2\log_{10} e$

3. $2\log_e 10$ 4.. $\frac{1}{2}\log_e 10$

10. If $f^1(x) = f(x)$ and $f(1) = 2$ then $f(3)$ equals to

1. e^2 2. $2e^2$ 3. $3e^2$ 4. $2e^3$

11. The order of D.E, whose solution is

$y = C_1 e^{x+c_2} + C_3 \sin(x+c_4)$

1. 4 2. 2 3.3 4.1

KEY

1. 2	2. 3	3. 3	4. 4	5. 4
6. 4	7. 2	8. 1	9. 3	10. 2
11. 3				

HINTS

9. $\log(x+1) = t + c$

$t = 0 \Rightarrow x = 0 \Rightarrow c = 0$

Put $x = 99 \Rightarrow t = 2\log 10$

10. $\frac{f^1(x)}{f(x)} = 1 \Rightarrow$

$\log f(x) = x + \log c = \log ce^x$

$f(x) = ce^x$

$f(1) = ce$

$2 = ce$

$\therefore f(x) = \frac{2}{e}.e^x \Rightarrow f(3) = 2e^2$

LEVEL - I

1. Order and degree of the differential equaltion

$\frac{dy}{dx} + 2\frac{dx}{dy} = 7$

1. 1,1 2. 1,2 3. 2,1 4. 2,2

2. Order of $\left(\frac{d^2y}{dx^2}\right)^2 + \left(\frac{dy}{dx}\right)^3 + 3y = x^4$ is

1. 3 2. 1 3. 2 4. 4

3. Order of $(3x+2y)\left(\frac{dy}{dx}\right)^2 + 5x\frac{d^2y}{dx^2} = 0$ is

1. 2 2. 1 3. 4 4. 3

4. Order of $\left(\frac{dy}{dx}\right)^3 + \left(\frac{dy}{dx}\right)^2 + y^4 = 0$ is

1. 4 2. 3 3. 1 4. 2

5. Order of $2y\left(\frac{dy}{dx}\right)^2 + 5x\left(\frac{d^2y}{dx^2}\right) = 0$ is

1. 3 2. 1 3. 2 4. 4

6. Degree of $1 + \left(\frac{d^2y}{dx^2}\right)^2 = K\left(\frac{dy}{dx}\right)^2$

1. 4 2. 3 3. 2 4. 1

7. Degree of $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^3 + 3y = x^2$ is

1. 4 2. 2 3. 3 4. 1

8. Degree of $\frac{d^3y}{dx^3} + 2\left(\frac{dy}{dx}\right)^4 + \frac{dy}{dx} = \cos x$ is

1. 4 2. 3 3. 2 4. 1

9. Order and degree of the

$\left(\frac{dy}{dx}\right)^3 + 5\left(\frac{dy}{dx}\right)^2 + 3y^4 = x^2$ are

1. 1, 3 2. 2,3 3. 3,2 4. 4,2

10. Order and degree of

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

1. 3,1 2. 4,2 3. 2,3 4.2,2

11. Order and degree of $x^2\left(y_2\right)^3+yy_1^4+y^4=0$ are

1. 2,3 2. 1,4 3. 3,4 4. 1,3

12. Order and degree of $\left(\frac{dy}{dx}\right)^2-5y=3\cos x$ are

1. 2,3 2. 1,2 3. 2,2 4. 1,1

13. The degree and order of

$x^2\frac{d^2y}{dx^2}+3x\frac{dy}{dx}+2y=e^x$ are

1. 2,1 2. 1,1 3. 1,2 4. 2,2

14. Order and degree of $\left(\frac{dy}{dx}\right)^3+\frac{d^2y}{dx^2}+3y=x^4$ are

1. 3,1 2. 2,2 3. 2,1 4. 3,2

15. Order and degree of

$x^3\frac{d^3y}{dx^3}+2x^2\frac{d^2y}{dx^2}+6y=x^4$ are

1. 3,1 2. 1,3 3. 3,2 4. 2,2

16. The degree and order of

$(2x+3y)\left(\frac{dy}{dx}\right)^3+7x\frac{d^2y}{dx^2}+y=e^{2x}$ are

1. 2,2 2. 1,3 3. 1,2 4. 2,1

17. Order and degree of

$\left(x^2+2x\right)y_2^{\,2}+\left(x^2-2\right)y_1^{\,3}-2\left(x+3\right)y=0$ are

1. 2,3 2. 2,2 3. 3,1 4. 3,2

18. Order and degree of $\left(1+y_1^{\,2}\right)y_3=3y_2y_1^{\,2}$ are

1. 2,3 2. 2,2 3. 3,1 4. 3,2

19. The order and degree of $\left(1+\frac{dy}{dx}\right)^2=5\left(\frac{dy}{dx}\right)^2$ are

1. 1,2 2. 1,1 3. 2,1 4. 2,2

20. Order and degree of

$\left(2x^2+y\right)dx+\left(x-3y\right)dy=0$ are

1. 2,1 2. 2,2 3. 1,1 4. 2,3

21. Order and degree of $\left(\frac{d^2y}{dx^2}\right)^3+\frac{dy}{dx}=e^x$ are

1. 1,2 2. 2,3 3. 3,1 4. 1,1

22. The order and degree of

$\left(\frac{d^2y}{dx^2}\right)^3-\left(\frac{dy}{dx}\right)^4+y^3=\cos ecx$ are

1. 2,3 2. 1,4 3. 3,4 4. 1,2

23. The order of the differential equation whose solution is $y=c_1e^x+c_2\sin x+c_3\cos x$ is

1. 4 2. 3 3. 2 4. 1

24. The number of arbitarary constants in the solution of a differential equation of degree 3 and order 2 is

1. 2 2. 3 3. 5 4. 1

25. The number of arbitarary constants in the solution of a differential equation of degree 2 and order 3 is

1. 2 2. 3 3. 5 4. 1

Forming of the differential equation:

26. The D.E whose solution is $y=cx^2$ is

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

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

27. The D.E whose solution in $y=ce^x$ is

1. $y_1=y^2$ 2. $y_2=y_1$

3. $y_1=y$ 4. $y_1+y=0$

28. The D.E whose solution is $y=ae^{bx}$ is

1. $yy_2=y_1^{\,2}$ 2. $yy_1=y_2^{\,2}$

3. $y_1y_2=y^2$ 4. $y_1y_2=y$

29. The D.E whose solution is $y=c\sin x$ is

1. $\frac{dy}{dx}=y\cot x$ 2. $y_2+y=0$

3. $\frac{dy}{dx}=y\cos x$ 4. $\frac{dy}{dx}=y\cos ecx$

30. The D.E whose solution is $y^2=3ay-x^3$ is

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

2. $\left(x^3-y^2\right)\frac{dy}{dx}=3xy$

3. $\left(x^3-y\right)\frac{dy}{dx}=3xy^2$

4. $\left(y^2-x^3\right)\frac{dy}{dx}=3xy$

31. The D.E whose solution is $y = cx + c - c^2$ is

1. $y_1^2 + y = (x+1)y_1$
2. $y_1^2 + y_1 = (x+1)y$
3. $y_1^2 + y = (x-1)y_1$
4. $y = xy + y_1 - y_1^2$

32. The D.E whose solution is $y = ax^3 + bx^2$ is

1. $x^2y_2 - 4xy_1 + 6y = 0$
2. $x^2y_2 - 4y_1 + 6y = 0$
3. $x^2y_2 + 4xy_1 - 6y = 0$
4. $x^2y_2 - 2xy_1 + 6y = 0$

33. The D.E whose solution is $y = a\cos x + b\sin x - 5$ is

1. $y_2 + y + 5 = 0$
2. $y_2 - y + 5 = 0$
3. $y_2 = y_1 + y$
4. $y_2 + y = 10$

34. The D.E whose solution is $y = A\cos x + \sin x$ is

1. $\frac{dy}{dx} + y\tan x = \sec x$
2. $\frac{dy}{dx} + y\sin x = \cos x$
3. $\frac{dy}{dx} + y\sec x = \tan x$
4. $\frac{dy}{dx} + y\cot x = \cos ecx$

35. The D.E whose solution is $y = \frac{c}{x}$ is

1. $y_1 + xy = 0$
2. $y_1 = xy$
3. $x.dy + y.dx = 0$
4. $x.dy - y.dx = 0$

36. $y = ce^{2x}$ is a solution of

1. $y_1 = y$
2. $y_1 = 2y$
3. $y_1 = 4y$
4. $y_1 = 6y$

37. The D.E whose solution is $y = ae^{2x}$ is

1. $y_1 = 5y$
2. $y_1 = 2ay$
3. $y_1 = 2y$
4. $y_1 = y$

38. The D.E whose solution is $y = K\sin^{-1}x$ is

1. $y = \frac{dy}{dx}\sqrt{1-x^2}\sin^{-1}x$
2. $y\frac{dy}{dx} = \left(\sqrt{1-x^2}\right)\sin^{-1}x$
3. $y\sqrt{1-x^2} = \sin^{-1}x.\frac{dy}{dx}$
4. $\frac{y}{y_1} = \sqrt{1-x^2}$

39. The D.E whose solution is $y = ax^2 + bx + c$ is

1. $y_3 = y$
2. $y_3 = x$
3. $y_3 = 0$
4. $y_2 = 0$

40. The D.E whose solution is $y = a\cos x + b\sin x$ is

1. $y_2 + 3y = 0$
2. $y_2 + 2y = 0$
3. $y_2 + y = 0$
4. $y_2 + 4y = 0$

41. The D.E whose solution is $y = A\sin 2x + B\cos 2x$ is

1. $y_2 = 4y$
2. $y_2 + 3y = 0$
3. $y_2 + y = 0$
4. $y_2 + 4y = 0$

42. The D.E whose solution is $y^2 = 4ax$ is

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

Solution of the differential equations:

43. The Solution of $\frac{dy}{dx} = \frac{1-y}{1-x}$ is

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

44. The solution of $\frac{dy}{dx}=\frac{3(y+1)}{x-2}$ is

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

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

1. $\sin^{-1}x+\sin^{-1}y=c$
2. $Tan^{-1}x+Tan^{-1}y=c$
3. $\sinh^{-1}x+\sinh^{-1}y=c$
4. $\cot^{-1}x+\cot^{-1}y=c$

46. The solution of $\frac{dy}{dx}=\frac{2x}{3y^2}$ is

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

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

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

48. The solution of $ydx-xdy=0$ is

1. $y^2=cx$
2. $y=cx^2$
3. $y=cx$
4. $x^2=cy$

49. The solution of $x^3dy-y^3dx=0$ is

1. $x^4-y^4=c$
2. $x^2-y^2=c$
3. $\frac{1}{x}-\frac{1}{y}=c$
4. $\frac{1}{x^2}-\frac{1}{y^2}=c$

50. The solution of $\frac{dy}{dx}=\tan y$ is

1. $\log\sin x=2x+c$
2. $\log\sin y=x+c$
3. $\log\sin y=2x+c$
4. $\log\sin x=2y+c$

51. The solution of $\frac{dy}{dx}=\cos echy$ is

1. $x=\cosh y+c$
2. $x=\operatorname{sech} y+c$
3. $x=\sinh y+c$
4. $x=\coth y+c$

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

1. $y=\log|e^x-e^{-x}|+c$
2. $y=\sinh x+c$
3. $y=\log|e^x+e^{-x}|+c$
4. $y=\operatorname{sech} x+c$

53. The solution of $\frac{dy}{dx}+2x=e^{3x}$ is

1. $y=3e^{3x}-x^2+c$
2. $y=\frac{e^{3x}}{3}-x^2+c$
3. $y=e^{3x}-2x+c$
4. $y=e^{3x}-x^2+c$

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

1. $\tan^{-1}y=\cos x+c$
2. $\tan^{-1}y=\sin x+c$
3. $y^3=co\sec x+c$
4. $\log(1+y^2)=\cos x+c$

55. The solution of $2xy\frac{dy}{dx}=1+y^2$ is

1. $1-y^2=|cx|$
2. $1+y^2=|cx|$
3. $1-x^2=|cy|$
4. $1+x^2=|cy|$

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

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

3. $y=\frac{c}{1+x^2}$ 4. $y=\frac{c}{\sqrt{1+x^2}}$

57. Solution of $\frac{dy}{dx}=\frac{y+2}{x-1}$ is

1. $y+2=c\left(x-1\right)$
2. $\left(y+2\right)\left(x-1\right)=c$
3. $\log\left(y+2\right)=c\left(x-y\right)$
4. $\log\left(x-1\right)=c\left(y+2\right)$

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

1. $1+y=c\left(1-x\right)$
2. $\left(1-x\right)\left(1+y\right)=c$
3. $\left(1-y\right)\left(1-x\right)=c$
4. $\left(1+x\right)\left(1+y\right)=c$

59. The Solution of $x^2\frac{dy}{dx}=2$ is

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

3. $y+\frac{2}{x}=c$ 4. $y=2x+c$

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

1. $\sin^{-1}x+\sin^{-1}y=c$
2. $\cot^{-1}x+\cot^{-1}y=c$
3. $Tan^{-1}x+Tan^{-1}y=c$
4. $\sinh^{-1}x+\sinh^{-1}y=c$

61. The solution of $\frac{dy}{dx}=e^{\log x}$ is

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

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

62. The solution of $\frac{dy}{dx}=\frac{x}{y}$ is

1. $x^2-y^2=c$ 2. $x^2+y^2=c$

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

63. The solution of $\frac{dy}{dx}+\frac{x^2}{y^2}=0$ is

1. $x^2+y^2=c$ 2. $x^2-y^2=c$

3. $x^3-y^3=c$ 4. $x^3+y^3=c$

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

1. $x+\log\left|1-y\right|=c$
2. $y+\log\left|1-x\right|=c$
3. $x\left(1-y\right)=c$
4. $y\left(1-x\right)=c$

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

1. $3\left(y^2-x^2\right)=2\left(x^3+y^3\right)+c$
2. $3\left(x^2+y^2\right)=2\left(x^3+y^3\right)+c$
3. $x^2-y^2=x^3+y^3+c$
4. $x^2+y^2=x^3+y^3+c$

66. The solution of $ydx+xdy=0$ is

1. $xy=c$ 2. $x+y=c$
3. $x-y=c$ 4. $x=cy$

67. The solution of $x^2dy-y^2dx=0$

1. $\frac{1}{x}-\frac{1}{y}=c$ 2. $\frac{1}{x}+\frac{1}{y}=c$

3. $x^3-y^3=c$ 4. $x^2-y^2=c$

68. The solution of $\frac{dy}{dx}=\tan x$ is

1. $e^y=c\sin x$ 2. $e^y=c\cos x$

3. $e^y=c\cos ec\,x$ 4. $e^y=c.sec\,x$

69. The solution of $\frac{dy}{dx} = 2y\tanh x$ is

1. $cy = \sinh^2 x$
2. $cy = \operatorname{sech}^2 x$
3. $cy = \cosh^2 x$
4. $cy = \coth^2 x$

70. The solution of $\frac{dy}{dx} + y\tan x = 0$ is

1. $y = a\cos x$
2. $y = a\sin x$
3. $y = \log\cos x + c$
4. $y = a\tan x + c$

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

1. $e^x - e^y = c$
2. $e^x + e^y = c$
3. $e^{-x} - e^y = c$
4. $e^{-x} - e^{-y} = c$

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

1. $e^y + e^x = c$
2. $e^{-x} = e^{-y} + c$
3. $e^{y-x} = c$
4. $e^{y/x} = c$

73. The solution of $\left(1+e^x\right)ydy = e^x dx$ is

1. $y^2 = \log c\left(e^x + 1\right)$
2. $\frac{y^2}{2} = \log ce^x$
3. $\frac{y^2}{2} = \log c\left(e^x + 1\right)$
4. $2y = \log c\left(e^x + 1\right)$

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

1. $2^x + 2^y = c$
2. $2^x - 2^y = c$
3. $2^{x-y} = c$
4. $2^{x+y} = c$

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

1. $\sec y = c\left(1+x^2\right)$
2. $\cos y = c\left(1+x^2\right)$
3. $\tan y = c\left(1+x^2\right)$
4. $\cot y = c\left(1+x^2\right)$

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

1. $2x = \log\left[c\left(1+y^2\right)\right]$
2. $x = cy^2$
3. $c\left(1+y^2\right) = x$
4. $2y = \log\left\{c\left(1+x^2\right)\right\}$

77. The solution of $\left(1+y^2\right)dx = xydy$ is

1. $1 + y^2 = cx^2$
2. $\left(1+y^2\right)x^2 = c$
3. $1 + y^2 = cx$
4. $\left(1+y^2\right)x = c$

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

1. $y - x = c\left(1+xy\right)$
2. $y + x = c\left(1+xy\right)$
3. $y = \left(1+2x\right)c$
4. $xy = x^2 + x + x$

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

1. $e^y = c\left(x^2 + x\right)$
2. $y = x\left(x+1\right) + c$
3. $y = \left(1+2x\right) + c$
4. $xy = x^2 + x + c$

80. The solution of $x + y\frac{dy}{dx} = 5$ is

1. $x^2 - 10x + y^2 = c$
2. $x^2 - 5x + y^2 = c$
3. $\frac{y^2}{2} = 10x + x^2 + c$
4. $y^2 = 10x + x^2 + c$

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

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

Integrating factors of differential equations:

82. I.F of $\frac{dy}{dx}-y\cot x=\operatorname{cosec} x$ is

1. $\sin x$
2. $\tan x$
3. $\sec x$
4. $\operatorname{cosec} x$

83. I.F of $y\log y\frac{dx}{dy}+x=\log y$ is

1. $\log(\log y)$
2. $\frac{1}{\log y}$
3. $\log y$
4. $\frac{1}{\log(\log y)}$

84. I.F of $\sin x\frac{dy}{dx}+y\cos x=2\sin^{2}x\cos x$

1. $\sin x$
2. $\cos x$
3. $\cot x$
4. $\sec x$

85. I.F of $\frac{dy}{dx}+\frac{y}{x}=x^{2}$ is

1. $\frac{1}{x}$
2. x
3. $\cos x$
4. x^{2}

86. I.F of $(1+x^{3})\frac{dy}{dx}+3x^{2}y=\sin^{2}x$

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

87. I.F of $x\log x\frac{dy}{dx}+y=2\log x$ is

1. x
2. $\log x$
3. $\log(\log x)$
4. $\frac{2}{x}$

88. I.F of $\frac{dy}{dx}+y\sec x=\tan x$ is

1. $\sec x$
2. $\tan x$
3. $\sec x+\tan x$
4. $\cos x$

89. I.F of $\frac{dy}{dx}+\frac{4x}{x^{2}+1}y=\frac{1}{(x^{2}+1)^{2}}$ is

1. $x^{2}+1$
2. $\frac{1}{x^{2}+1}$
3. $(x^{2}+1)^{2}$
4. $\frac{1}{(x^{2}+1)^{2}}$

90. I.F of $\cos^{2}x\frac{dy}{dx}+y=\tan x$

1. $e^{\sec x}$
2. $e^{\tan x}$
3. $e^{\sin x}$
4. $e^{\cos x}$

91. I.F of $\frac{dy}{dx}+y=\frac{y+1}{x}$ is

1. $\frac{x}{e^{x}}$
2. $\frac{e^{x}}{x}$
3. xe^{x}
4. e^{x}

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

1. $x=X+1, y=Y$
2. $x=X, y=Y+1$
3. $x=X+1, y=Y+1$
4. $x=X+2, y=Y+2$

93. The type of the differential equation $x\frac{dy}{dx}+y=y^{2}\log x$ is

1. Linear
2. Bernoulli
3. Exact
4. Homogenious

94. The type of D.E $(1+y^{2})dx=(\tan^{-1}y-x)dy$ is

1. Linear in x
2. Bernoulli
3. Linear in y
4. Homogenious

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

1. $\tan\left(\frac{y}{2x}\right)-cx=0$
2. $\tan\left(\frac{y}{x}\right)-cx=0$
3. $\tan\left(\frac{y}{x}\right)+cx-x=0$
4. $\sin\left(\frac{y}{2x}\right)-cx=0$

96. By substituting $y=vx$, the transformed equation of $(x+y)dx+(y-x)dy=0$

1. $\frac{dv}{dx}=\frac{1+v^2}{x(1-v)}$
2. $\frac{dy}{dx}=\frac{1+v^2}{1-v}$
3. $\frac{dv}{dx}=\frac{1-v}{1+v^2}$
4. $\frac{dv}{dx}=\frac{1+v^2}{1-v}$

97. By substituting $x=vy$ the transformed equation of $\left(1+e^{x/y}\right)dx+e^{x/y}\left(1-\frac{x}{y}\right)dy=0$ is

1. $y\frac{dv}{dy}-\left(\frac{1+e^v}{1-e^v}\right)=0$
2. $y\frac{dy}{dv}+\left(\frac{v+e^v}{1+e^v}\right)=0$
3. $y\frac{dv}{dy}+x\left(v+e^v\right)=0$
4. $y\frac{dy}{dv}+x\left(v+e^v\right)=0$

98. By replaceing $x=X+h$, $y=Y+K$ where $h=1, K=0$. The transformed equation of $\frac{dy}{dx}+\frac{3y-7x+7}{7y-3x+3}=0$ is

1. $\frac{dY}{dX}=\frac{7X+3Y}{3X-7Y}$
2. $\frac{dY}{dX}=\frac{-7X+3Y}{3X-7Y}$
3. $\frac{dY}{dX}=\frac{7X-3Y}{3X-7Y}$
4. $\frac{dY}{dX}=\frac{7X+3Y}{3X+7Y}$

99. When $x=0, y=-1$ the particular solution of the D.E $\left(1+y^2\right)dx+\left(1+x^2\right)dy=0$ is

1. $x+y+xy=1$
2. $x+y+1=xy$
3. $x+y+xy+1=0$
4. $x-y+xy=1$

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

1. $x+e^{x^3}=cy$
2. $x+ye^{x^3}-cy=0$
3. $x-ye^{x^3}+c=0$
4. $x+ye^{x^3}+cy^2=0$

KEY

1. 2	2. 3	3. 1	4. 3	5. 3
6. 3	7. 4	8. 4	9. 1	10. 3
11. 1	12. 2	13. 3	14. 3	15. 1
16. 3	17. 2	18. 3	19. 1	20. 3
21. 2	22. 1	23. 2	24.1	25. 2
26. 3	27. 3	28. 1	29. 1	30. 1
31. 1	32. 1	33. 1	34. 1	35. 3
36. 2	37. 3	18. 1	39. 3	40. 3
41. 4	42. 2	43. 2	44. 2	45. 3
46. 3	47. 2	48. 3	49. 4	50. 2
51. 1	52 .3	53. 2	54. 2	55. 2
56. 1	57. 1	58. 2	59. 3	60. 1
61. 1	62. 1	63. 4	64. 1	65. 2
66. 1	67. 1	68. 4	69. 3	70. 1
71. 1	72. 2	73. 3	74. 2	75. 1
76. 1	77. 1	78. 1	79. 1	80. 1
81.1	82. 4	83 3	84. 1	85. 2
86. 1	87. 2	88. 3	89. 3	90. 2
91. 2	92.1	93. 2	94. 1	95. 1
96. 1	97. 2	98. 2	99. 2	100. 2

Level - II

Order and degree of Differential equation:

1. Order of $\left(\frac{dy}{dx}+3x\right)^{3/2}=x+\frac{3dy}{dx}$ is

1. 3 2. 2 3. 1 4. 4

2. Order of D.E $1+\left(\frac{d^2y}{dx^2}\right)^2=\left[2+\left(\frac{dy}{dx}\right)\right]^{3/2}$ is

1. 4 2. 3 3. 2 4. 1

3. Degree of $\left(\frac{dy}{dx}\right)^2+3\frac{d^2y}{dx^2}=\sqrt{1+\left(\frac{dy}{dx}\right)^2}$ is

1. 1 2. 2 3. 3 4. 4

4. Degree of D.E of $y=x\frac{dy}{dx}-\sqrt{1+\left(\frac{dy}{dx}\right)^2}$ is

1. 2 2. 4 3. 1 4. 3

5. The order and degree of $\left[5+y_1^{\,2}\right]^{5/3}=9y_2$ is

1. 3,3 2. 1,5 3. 2,3 4. 1,10

6. The order and drgree of D.E $\left[1+\frac{d^3y}{dx^3}\right]^{1/2}=\frac{d^2y}{dx^2}$ is

1. 3,1 2. 4,1 3. 3,2 4. 3,3

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

1. 2,3 2. 2,2 3. 1,3 4. 1,2

8. The order and degree of $\frac{d^2y}{dx^2}+\sqrt{1+\left(\frac{dy}{dx}\right)^3}=0$ is

1. 2,2 2. 2,1 3. 2,3 4. 2,4

9. Degree of $\left[2+\left(\frac{dy}{dx}\right)^2\right]^{3/2}=a\frac{d^2y}{dx^2}$ is

1. 3 2. 4 3. 1 4. 2

10. Degree of $\left[1+\left(\frac{d^2y}{dx^2}\right)^2\right]=\left[2+\left(\frac{dy}{dx}\right)^2\right]^{3/2}$ is

1. 4 2. 2 3. 1 4. 3

11. Degree of $\left[\frac{d^2y}{dx^2}+\left(\frac{dy}{dx}\right)^2\right]^{3/2}=K\frac{d^2y}{dx^2}$ is

1. 4 2. 3 3. 2 4. 1

12. Order and degree of $\sqrt{1+\left(\frac{d^2y}{dx^2}\right)^3}=\left(2+\frac{dy}{dx}\right)^{1/3}$ is

1. 2,3 2. 2,9 3. 2,6 4. 2,2

13. The degree of $\frac{d^2y}{dx^2}+\left(1+\left(\frac{dy}{dx}\right)\right)^{3/2}=0$ is

1. 2 2. 1 3. 4 4. 6

14. Degree of $\left(\frac{dy}{dx}+4x\right)^{3/2}=x+5\frac{dy}{dx}$ is

1. 4 2. 3 3. 2 4. 1

15. Degree of D.E $\left[5+\left(\frac{dy}{dx}\right)^2\right]^{3/2}=6\frac{d^2y}{dx^2}$ is

1. 1 2. 2 3. 3 4. 6

16. Degree of $y\frac{d^2y}{dx^2}=\left[5+\left(\frac{dy}{dx}\right)^2\right]^{4/3}$ is

1. 4 2. 3 3. 2 4. 1

17. Order and degree of $\left[1+\left(\frac{dy}{dx}\right)^2\right]^{2/3}=x\frac{d^2y}{dx^2}$ is

1. 3,3 2. 2,2 3. 2,1 4. 2,3

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

1. 1,2 2. 3,1 3. 3,2 4. 2,4

19. The order and degree of $\left[1+\left(\frac{dy}{dx}\right)^2\right]^{1/3}=a^2\left(\frac{d^2y}{dx^2}\right)^2$ is

1. 2,1 2. 2,3 3. 2,6 4. 2,2

20. The order and degree of $\left(\frac{d^2y}{dx^2}\right)^{1/3}=10+9x\frac{dy}{dx}$ is

1. 2,3 2. 2,1 3. 1,3 4. 1,1

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

1. 1,2 2. 2,4 3. 2,2 4. 2,3

22. The order and degree of D.E

$$\left[1+\left(\frac{dy}{dx}\right)^2\right]^{3/2}=8\frac{d^2y}{dx^2}$$ is

1. 2,2 2. 3,2 3. 3,4 4. 3,3

23. The order and degree of $x=\dfrac{\dfrac{d^3y}{dx^2}}{\sqrt{1-\left(\dfrac{dy}{dx}\right)^4}}$ is

1. 1,4 2. 4,3 3. 3,2 4. 3,4

24. Order and degree of the D.E

$$\left[\left(\frac{dy}{dx}\right)^2+\frac{d^2y}{dx^2}\right]^{5/4}=K\frac{d^3y}{dx^3}$$

1. 4,5 2. 5,3 3. 3,2 4. 3,4

25. If *m,n* are the order and degree of

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

1. $m=n$ 2. $m<n$
3. $m>n$ 4. $2m=n$

26. The D.E whose solution is $y=c^2+\dfrac{c}{x}$ is

1. $y=x^4y_1-xy_1^{\,2}$ 2. $y=x^4y_1^{\,2}+xy_1$
3. $y=x^4y_1^{\,2}-xy_1$ 4. $y=x^4y_1^{\,2}-xy_1$

27. The D.E whose solution is $y=mx+f(m)$ is

1. $y=x\dfrac{dy}{dx}+f\left(\dfrac{dy}{dx}\right)$
2. $y=xy+f\left(\dfrac{dy}{dx}\right)$
3. $y=x\dfrac{dy}{dx}+f(y)$ 4. $y=x\dfrac{dy}{dx}+f(y)$

28. The D.E whose solution is $y=a\cos(nx+b)$ where *a,b* are arbitrary constants is

1. $y_2+n^2y=0$ 2. $y_2-n^2y=0$
3. $y_2+n^2y_1=0$ 4. $y_2+ny_1=0$

29. The D.E whose solution is $y=c_1+c_2e^x$ is

1. $y_2=y$ 2. $y_2=y_1$
3. $y_2+y=0$ 4. $y_2+y_1=0$

30. The D.E whose solution is $y^2=4a(x+a)$ is

1. $\left(y_1^{\,2}-1\right)y^2+2xyy_1=0$
2. $\left(y_1^{\,2}+1\right)y_1^{\,2}+2xyy_1=0$
3. $\left(y^2-2\right)y_1^{\,2}+2xyy_1=0$
4. $\left(y^2-1\right)y_1^{\,2}+2xyy_1=0$

31. The D.E whose solution is $y=c(x-c)^2$ is

1. $\left(\dfrac{dy}{dx}\right)^3=4y\left(x\dfrac{dy}{dx}-2y\right)$
2. $y_1^{\,3}=2y(xy_1-y)$
3. $\left(\dfrac{dy}{dx}\right)^3=4y\left(2x\dfrac{dy}{dx}-y\right)$
4. $\left(\dfrac{dy}{dx}\right)^3=2y\left(x\dfrac{dy}{dx}-4y\right)$

32. The D.E whose solution is $y=ax+be^x$ is

1. $(x-1)y_2-xy_1+y=0$
2. $(x-1)y_2+xy_1=y$
3. $x^2y_2-xy_1+y=0$
4. $x^2y_2+xy_1-y=0$

33. The D.E whose solution is $y=c_1e^{2x}+c_2e^{-2x}$ is

1. $y_2=2y$ 2. $y_2=y$
3. $y_2=3y$ 4. $y_2=4y$

34. The D.E whose solution is $xy=ae^x+be^{-x}$ is

1. $xy_2+2y_1=xy$
2. $xy_2-2y_1=xy$
3. $xy_2-2y_1+xy=0$
4. $xy_2+2y_1+xy=0$

35. The D.E whose solution is $xy=ae^x+be^{-x}+x^2$ is

1. $xy_2+y_1+xy=0$
2. $xy_2+2y_1=xy+2-x^2$
3. $xy_2+2y=xy$
4. $xy_2+2y_1+xy+2=0$

36. The D.E whose solution is

$y = c_1e^x + c_2e^{-x} + c_3 \sin x + c_4 \cos x$ is

1. $y_4 = y_2$ 2. $y_4 = y_3$

3. $y_4 = y_1$ 4. $y_4 = y$

37. The D.E whose solution is

$y = (a+bx)\cos x + (c+dx)\sin x$ is

1. $y_4 = y$ 2. $y_4 + 2y_2 + y = 0$

3. $y_4 = 2y_2$ 4. $y_4 - 2y_2 + 4y = 0$

38. The D.E whose solution is

$y = a\cos(\log x) + b\sin(\log x)$ is

1. $x^2y_2 - xy_1 + y = 0$

2. $x^2y_2 + xy_1 - y = 0$

3. $x^2y_2 + xy_1 + y = 0$

4. $x^2y_2 - xy_1 - y = 0$

39. The D.E whose solution is $y = a\cos nx$ where a is arbitrary constant is

1. $y_1 + ny\tan nx = 0$

2. $y_1 + ny\cos ec\, nx = 0$

3. $y_1 + ny\sin x = 0$

4. $y_1 + ny\sec x = 0$

40. The D.E whose solution is $y = a\cos(3x+b)$ is

1. $y_2 + 3y = 0$ 2. $y_2 + y = 0$

3. $y_2 + 9y = 0$ 4. $y_2 + 6y = 0$

41. The D.E whose solution is $y = c_1\cos(4x + c_2)$ is

1. $y_3 - 16y_1 = y$ 2. $y_1 - 4y_1 + 4 = 0$

3. $y_2 + 16y = 0$ 4. $y_2 = 16y$

42. The D.E whose solution is $y = A\sin(2x+B) + 5$ is

1. $y_2 = 4y + 5$ 2. $y_2 + 20 = 4y$

3. $y_2 + 4y = 0$ 4. $y_2 + 4y = 20$

43. The D.E whose solution is $y = 2(x^2 - 1) + ce^{-x^2}$ is

1. $y_1 + xy = x^3$ 2. $y_1 + 2xy = 4x^3$

3. $y_1 + 2xy = 2x^3$ 4. $y_1 + 2xy = 3x^3$

44. The D.E whose solution is $a^2y - ax + 8 = 0$ is

1. $8y_1^2 + xy_1 + y = 0$ 2. $8y_1^2 - xy_1 + y = 0$

3. $8y_1^2 - xy_1 - y = 0$ 4. $8y_1^2 + xy_1 - y = 0$

45. The D.E whose solution is $x^3 = c(y+c)^2$ is

1. $8xy_1^3 - 4yy_1^2 = 27x$

2. $8xy_1^3 = 12yy_1^2 + 27x$

3. $8xy_1^2 - 12yy_1^3 = 9y$

4. $8xy_1^3 = 3(yy_1^2 + 4x)$

46. The D E whose solution is $y = ax^2 + bx$ is

1. $x^2y_2 + 2xy_1 + 2y = 0$

2. $x^2y_2 - 2xy_1 + 2y = 0$

3. $x^2y_2 - 2xy_1 - 2y = 0$

4. $x^2y_2 + 2xy_1 - 2y = 0$

47. The D.E whose solution is $y = c_1e^{2x} + c_2e^{-x/2}$ is

1. $2y_2 - 3y_1 - 2y = 0$ 2. $3y_2 - 2y_1 - y = 0$

3. $y_2 - 3y_1 + y = 0$ 4. $y_2 - 3y_1 - y = 0$

48. The D.E whose solution is $y = c_1e^{3x} + c_2e^{5x}$ is

1. $y_2 + 2y_1 + 15y = 0$ 2. $y_2 + 8y_1 + 15y = 0$

3. $y_2 + 8y_1 - 15y = 0$ 4. $y_2 - 8y_1 + 15y = 0$

49. The D.E whose solution is $y = Ae^{5x} + Be^{-2x}$ is

1. $y_2 - 3y_1 - 10y = 0$ 2. $y_2 + 3y_1 - 10y = 0$

3. $y_2 + 3y_1 + 10y = 0$ 4. $y_2 - 3y_1 + 10y = 0$

50. The D.E whose solution is $y = ae^{2x} + be^{3x}$ is

1. $y_2 + 5y_1 + 6y = 0$ 2. $y_2 - 5y_1 - 6y = 0$

3. $y_2 + 5y_1 - 6y = 0$ 4. $y_2 - 5y_1 + 6y = 0$

51. The D.E whose solution is

$y = a\cos x + b\sin x + x\sin x$ is

1. $y_2 + y = \cos x$ 2. $y_2 + y = \sin x$

3. $y_2 + y = 2\sin x$ 4. $y_2 + y = 2\cos x$

52. The D.E whose solution is $xy = ax^2 + \frac{b}{x}$ is

1. $x^2y_2 + 2xy_1 = 2y$ 2. $x^2y_2 - xy_1 + 2y = 0$

3. $x^2y_2 + xy_1 + y = 0$ 4. $x^2y_2 + xy_1 + 2y = 0$

53. Equation of the curve passing through $(1,3)$ having slope $\frac{y}{x}$ at any point is

1. $y=3x$ 2. $y=3x^2$
3. $x^2=3y$ 4. $x=3y$

54. The solution of $\frac{dy}{dx}=\frac{x^2+4x-9}{x+2}$ is

1. $y=(x+2)^2-13\log|x+2|+c$
2. $y=(x+2)^2-5\log|x+2|+c$
3. $y=\frac{x^2}{2}+2x+13\log|x+2|+c$
4. $y=\frac{x^2}{2}+2x-13\log|x+2|+c$

55. The solution of $e^x\tan ydx+(1-e^x)\sec^2 ydy=0$ is

1. $\tan y=c(1-e^x)$
2. $\sec y=c(1-e^x)$
3. $\tan y(1-e^x)=c$
4. $\sec y=1-e^x$

56. The solution of $e^{x-y}dx+e^{y-x}dy=0$ is

1. $e^x+e^y=c$ 2. $e^{2x}+e^{2y}=c$
3. $e^{x+y}+e^{x-y}=c$ 4. $e^x-e^y=c$

57. The solution of $\frac{dy}{dx}=e^{x-y}+e^{2\log x-y}$

1. $e^y=e^x+\frac{x^2}{3}+c$ 2. $e^{x-y}=\frac{x^3}{3}+c$
3. $e^y=e^x+\log x+c$
4. $y=\frac{e^{3x+y}}{3}$

58. The solution of $\frac{dy}{dx}=e^{3x+y}$ given $y=0$ when $x=0$

1. $e^{3x}+3e^{-y}=4$ 2. $e^{-y}=e^{3x}+4$
3. $3e^{-y}=e^{3x}+12$ 4. $y=\frac{e^{3x+y}}{3}$

59. The solution of $\tan xdy+\tan ydx=0$

1. $\tan x\tan y=c$
2. $\sec^2 x+\sec^2 y=c$
3. $\sin x\sin y=c$ 4. $\cot x.\cot y=c$

60. The solution of $ydx+xdy=dx+dy$

1. $xy=x+y+c$ 2. $x-y\frac{x}{y}+c=0$
3. $xy-x+y=c$ 4. $x+y\frac{x}{y}+c=0$

61. $\sqrt{1+x^2}dx+\sqrt{1+y^2}dy=0$

1. $x\sqrt{1+x^2}+y\sqrt{1+y^2}$
$+\log\left[\left(x+\sqrt{1+x^2}\right)\left(y+\sqrt{1+y^2}\right)\right]=c$
2. $\sqrt{1+x^2}+\sqrt{1+y^2}=c$
3. $\frac{1}{\sqrt{1+x^2}}+\frac{1}{\sqrt{1+y^2}}=c$
4. $\log\left\{\left(\sqrt{1+x^2}\right)+\left(\sqrt{1+y^2}\right)\right\}=c$

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

1. $\sin^{-1}x+\sin^{-1}y=c$
2. $\sqrt{1-x^2}+\sqrt{1-y^2}=c$
3. $\sqrt{1-x^2}.\sqrt{1-y^2}=c$ 4. $\sqrt{\frac{1-x^2}{1-y^2}}=c$

63. If $\frac{dy}{dx}=x^2+1$ and y=12 when x=3. Then the function is

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

64. The solution of $(x^2-yx^2)\frac{dy}{dx}+(y^2+x^2y^2)=0$

1. $\log(xy)=\frac{1}{x}+\frac{1}{y}+c$
2. $\log y+\frac{1}{y}=x-\frac{1}{x}+c$
3. $y-\frac{1}{y}=x-\frac{1}{x}+c$ 4. $\log x+\frac{1}{x}=y-\frac{1}{y}+c$

65. The solution of $x\cos^2 ydx + \tan ydy = 0$

1. $x^2 + \sec^2 y = c$ 2. $x^2 + \cot^2 y = c$
3. $x^2 + \sin^2 y = c$ 4. $x^2 + \cos^2 y = c$

66. The solution of $xdx + ydy + \left(x^2 + y^2\right)dy = 0$

1. $\left(x^2 + y^2\right)e^{2y} = c$ 2. $\left(x^2 + y^2\right) = cxy$
3. $\left(x^2 + y^2\right) = cx^2$ 4. $\left(x^2 + y^2\right)e^{2x} = c$

67. Equation of the curve passing through $(1,1)$ and having gradient $\frac{2y}{x}(x > 0, y > 0)$ is

1. $xy = 1$ 2. $2x + y = 3$
3. $x = y^2$ 4. $y = x^2$

68. $\frac{dy}{dx} = e^{x+y}, x = 1 \Rightarrow y = 1$ then $x = -1 \Rightarrow y =$

1. -1 2. e 3. 1 4. $e + \frac{1}{e}$

69. Equation of the curve passing through the point $(3,9)$ and which satisfies $y_1 = x + \frac{1}{x^2}$

1. $6xy = 3x^3 - 6x + 29$
2. $6xy = 3x^3 - 29x + 6$
3. $6xy = 3x^3 + 29x - 6$
4. $6xy = 3x^3 - 29x - 6$

70. The solution of

$3e^x \cos^2 ydx + \left(1 - e^x\right)\cot ydy = 0$

1. $\tan y = c\left(e^x - 1\right)$ 2. $\tan^2 y = \left(e^x - 1\right)c$
3. $\cot y = c\left(e^x - 1\right)^2$ 4. $\tan y = c\left(e^x - 1\right)^3$

71. Solution of $\left(e^x + 1\right)ydy + \left(y + 1\right)dx = 0$

1. $\left(y + 1\right)\left(1 + e^{-x}\right) = ce^y$
2. $\left(e^x + 1\right)y = c$ 3. $\left(1 + e^x\right)\left(y + 1\right) = c$
4. $\left(e^x + 1\right)x = c$

72. The solution of $\frac{dy}{dx} = e^{2x-y} + x^3e^{-y}$

1) $e^y = e^{2x} + 3x^2 + c$ 2) $e^y = e^{2x} + \frac{x^4}{4} + c$
3) $4e^y = 2e^{2x} + x^4 + c$ 4) $2e^y = e^{2x} + 3x^4 + c$

73. The solution of $\frac{dy}{dx} = e^{3x-2y} + x^2e^{-2y}$

1) $y = \log\left(e^{3x} + x^2\right) + c$
2) $y = 2\log\left(e^{3x} + x^2\right) + c$
3) $2e^{2x} = 3\left(e^{3y} + y^3\right) + c$
4) $3e^{2y} = 2\left(e^{3x} + x^3\right) + c$

74. Solution of $\tan y \sec^2 xdx + \tan x.\sec^2 ydy = 0$

1) $\sec x \sec y = c$ 2) $\tan x.\tan y = c$
3) $\sin x . \sin y = c$ 4) $\cos x \cos y = c$

75. The solution iof $x\cos^2 y\,dx = y\cos^2 x\,dy$

1) $\tan x \tan y = c$ 2) $y \tan y = x \tan x + c$
3) $\tan x . \cos y = \tan y \cos x + c$
4) $y\tan y - x\tan x + \log\left(\frac{\cos y}{\cos x}\right) = c$

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

1) $\sinh^{-1} x + \sinh^{-1} y = c$
2) $\sqrt{1+x^2} + \sqrt{1+y^2} = c$
3) $\left(1+x^2\right)\left(1+y^2\right) = c$ 4) $\sqrt{\frac{1+x^2}{1+y^2}} = c$

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

1) $\sqrt{1+x^2} + \sqrt{1+y^2} = c$
2) $\left(\sqrt{1+x^2}\right) \times \left(\sqrt{1+y^2}\right) = c$
3) $\left(1+x^2\right)^{\frac{3}{2}} + \left(1+y^2\right)^{\frac{3}{2}} = c$
4) $\frac{x}{\sqrt{1+x^2}} + \frac{y}{\sqrt{1+y^2}} = c$

78. Solution of $\left(xy^2+x\right)dx+\left(yx^2+y\right)dy=0$

1) $\left(x^2+1\right)\left(y^2+1\right)=c$ 2) $\left(xy+1\right)\left(xy-1\right)=c$

3) $\left(x^3+1\right)\left(y^3+1\right)=c$ 4) $\left(1-x^2\right)\left(1-y^2\right)=c$

79. The solution of

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

1) $x+y+\frac{1}{x}+\frac{1}{y}=c$

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

3) $2\left(x-y\right)+\left(\frac{1}{x}-\frac{1}{y}\right)=c$

4) $x-y-\left(\frac{1}{x}+\frac{1}{y}\right)=c$

80. The solution of $\left(x^2-ay\right)dx=\left(ax-y^2\right)dy$

1) $y=x^2+y^2-a\left(x-y\right)$

2) $x^2+y^2+a\left(x-y\right)=c$

3) $x^3+y^3=3axy+c$

4) $\left(x^2-ay\right)\left(ax-y^2\right)=c$

81. The solution of $x\frac{dy}{dx}=2\sqrt{y-1}$

1) $e^{\sqrt{y-1}}=cx$ 2) $\sqrt{y-1}=ex$

3) $\frac{1}{\sqrt{y-1}}=cx$ 4) $x\left(\sqrt{y-1}\right)=c$

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

1) $\sin^{-1}\left(\frac{y}{2}\right)+\frac{1}{x}=c$ 2) $\frac{x^3}{3}+\sin^{-1}\left(\frac{y}{4}\right)=c$

3) $\sin^{-1}\left(\frac{y}{2}\right)+2x=c$ 4) $\sqrt{4-y^2}+2x=c$

83. The solution of $\operatorname{cosec}^2x\frac{dy}{dx}=\frac{1}{y}$

1) $y^2=x-\sin x\cos x+c$

2) $y^2=\frac{x^2}{2}-\sin 2x+c$

3) $2y^2=x+\sin 2x+c$

4) $y^2=\frac{x^2}{2}+\sin x+c$

84. The solution of $y\,dx+\left(1+x^2\right)\tan^{-1}x\,dy=0$

1) $y\tan^{-1}x=c$ 2) $x\tan^{-1}x=c$

3) $y\left(1+x^2\right)=c$ 4) $y^2\left(1+x^2\right)=c$

85. The Solution of $\sqrt{1-x^2}\sin^{-1}xdy+ydx=0$

1) $y\tan^{-1}x=c$ 2) $y\sin^{-1}x=c$

3) $y\cos^{-1}x=c$ 4) $x\sin^{-1}y=c$

86. The solution of $\left(5x^2-y\right)dx+x\,dy=o$

1) $5x^2+3xy=c$ 2) $y+5x^2=cx$

3) $\frac{y}{x}+5x^2=cx$ 4) $\frac{5}{3}x^3+xy=c$

87, The solution of $e^y\left(1+x^2\right)\frac{dy}{dx}=2x\left(1+e^y\right)$

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

3) $\left(1+e^y\right)+\left(1+x^2\right)=c$

4) $\left(e^y+1\right)x^2=c$

88. The solution of $\log\left[\frac{dy}{dx}\right]=ax+by$

1) $b\,e^{ax}+ae^{-by}=k$ 2) $e^{ax}+e^{-by}=c$

3) $e^{ax+by}=c$ 4) $\left(ax+by\right)=cxy$

89. The solution of $\log\left[\frac{dy}{dx}\right]=3x+4y$ given that $y\left(0\right)=0$

1) $4e^{3x}-3e^{-4y}=1$ 2) $3e^{3x}+4e^{4y}=7$

3) $4e^{3x}+3e^{-4y}=7$ 4) $3e^{3x}+4e^{-y}=1$

90. The solution of $\frac{dy}{dx} = x\log x$

1) $2y = x^2\left[\log x + \frac{1}{2}\right] + c$

2) $2y = x^2\left[\log x - \frac{1}{2}\right] + c$

3) $y = \frac{x^2}{2}(\log 2 - x) + c$

4) $y^2 = x^2\log x + x + c$

91. The solution of $\frac{dy}{dx} = y\sin(2x)$ given that $y(0) = 1$

1) $\log|y| = \sin^2 x$ 2) $\log|y| = \sin x$

3) $\log|y| = \sin 2x$ 4) $\log|y| = \cos^2 x$

92. $\frac{dy}{dx} = e^{-2y}, x = 5 \Rightarrow y = 0, then\ y = 3 \Rightarrow 2x =$

1) $e^5 + 9$ 2) $e^6 + 9$ 3) $e^8 + 9$ 4) $e^4 + 9$

93. On substituing y = vx the equation $\frac{dy}{dx} = \frac{2xy - y^2}{2xy - x^2}$ reduces to

1) $x(2v-1)dv = 3v(v-1)dx$

2) $x(2v-1)dv = 3v(1-v)dx$

3) $x(1-2v)dv = (v^2 - 2v)dx$

4) $x(1-2v)dv = (2v - v^2)dx$

94. Solution of $\frac{dy}{dx} = \frac{x-y}{x+y}$

1) $x^2 + 2xy - y^2 = C$

2) $x^2 - 2xy - y^2 = C$

3) $x^2 - y^2 + xy = c$ 4) $x^2 - xy - y^2 = c$

95. The solution of $\frac{dy}{dx} = \frac{\sqrt{x^2 - y^2} + y}{x}$

1) $\tan^{-1}\left(\frac{y}{x}\right) = \log(cx)$ 2) $\sin^{-1}\left(\frac{y}{x}\right) = \log(cx)$

3) $\cos^{-1}\left(\frac{y}{x}\right) = \log(cy)$ 4) $\sec^{-1}\frac{y}{x} = \log(cy)$

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

1) $y + \sqrt{x^2 + y^2} = cx^2$ 2) $x + \sqrt{x^2 + y^2} = cy^2$

3) $y + \sqrt{x^2 + y^2} = cx$ 4) $x + \sqrt{x^2 + y^2} = cy$

97. I. F of $\frac{dy}{dx} + y\tan x = x^2\cos^2 x$

1) $\sec x$ 2) $\cos x$ 3) $\sec^2 x$ 4) $\cos^2 x$

98. I.F of $x\frac{dy}{dx} = (2y + 2x^4 + x^2)$

1) x^{-2} 2) x^{-1} 3) x 4) x^2

99. I.F. of $(1+x^2)\frac{dy}{dx} + 2xy = 4x^2$

1) 2x 2) $\frac{1}{1+x^2}$ 3) $1 + x^2$ 4) x^2

100. I.F of $(x+1)\frac{dy}{dx} - y = e^{2x}(x+1)^2$

1) $\log(x+1)$ 2) $\frac{e^{2x}}{2}$

3) $-(x+1)$ 4) $\frac{1}{x+1}$

101. I. F of $\frac{dy}{dx} = \frac{x+y+1}{x+1}$

1) $\frac{1}{y+1}$ 2) $\frac{1}{x+1}$

3) $\log(x+1)$ 4) $\log(y+1)$

102. I.F of $x\frac{dy}{dx} + y(1+x) = 1$

1) $x.e^x$ 2) $\frac{e^x}{x}$

3) $x + \log x$ 4) $x\log x$

103. I.F of x sin $x\frac{dy}{dx} + y(x\cos x + \sin x) = \sin x$

1) $x\cos x$ 2) $x\sec x$

3) $x\sin x$ 4) $x\cos ecx$

104 I.F of $\left(1+x^2\right)\frac{dy}{dx}+y=e^{\tan^{-1}x}$

1) $\tan^{-1}x$ 2) $e^{\tan^{-1}x}$

3) $\frac{1}{1+x^2}$ 4) Tan x

105. I.F of $\left(1+y^2\right)dx=\left(\tan^{-1}y-x\right)dy$

1) $e^{\tan^{-1}x}$ 2) $\tan^{-1}x$

3) $\tan^{-1}y$ 4) $e^{\tan^{-1}y}$

106. I . F of $\left(x^3+5\right)\frac{dy}{dx}+3x^2y=\cos^2 x$

1) e^{5+x^3} 2) $5+x^3$

2) $\log\left(5+x^3\right)$ 4) $\frac{3x^2}{5+x^3}$

107. I.F fo $\frac{dy}{dx}+y\cos x=\sin x.\cos x$

1) $e^{\cos x}$ 2) $e^{\sin x}$

3) $e^{\tan x}$ 4) $e^{\sec x}$

108. I.F of $\frac{dy}{dx}+y\tan x=\cos^3 x$

1) $\sec^2 x$ 2) $\cos x$

3) $\cot x$ 4) $\sec x$

109. I.F of secx $\frac{dy}{dx}=y+\sin x$

1) $\sec x$ 2) $e^{-\cos x}$ 3) $e^{-\sec x}$ 4) $e^{-\sin x}$

110. I. F of $\frac{dy}{dx}=y\tan x+2\sin x$

1) sec x 2) sin x 3) cosec x 4) cos x

111. I. F of $\left(1-x^2\right)\frac{dy}{dx}-xy=1$

1) $1-x^2$ 2) $\sqrt{1-x^2}$

3) $\frac{1}{1-x^2}$ 4) $\frac{1}{\sqrt{1-x^2}}$

112. I.F of $\frac{dy}{dx}+2xy=e^{-x^2}$

1) 2x 2) x^2 3) e^{x^2} 4) e^{-x^2}

113. Linear form of $\frac{dy}{dx}+x\sin 2y=x^3\cos^2 y$

1) $\frac{du}{dx}+\frac{u}{x^2}=x$ 2) $\frac{du}{dx}+ux=\frac{x^3}{2}$

3) $\frac{du}{dx}+2ux=x^3$ 4) $\frac{du}{dx}+\frac{u}{x}=x^2$

114. The transformed equation of

$\frac{dy}{dx}-y\tan x=\frac{\sin x.\cos^2 x}{y^2}$

1) $\frac{dz}{dx}-y\tan z=\sin z\cos^2 z$

2) $\frac{dz}{dx}+3z\tan x=3\sin x\cos^2 x$

3) $\frac{dz}{dx}-3z\tan x=3\sin x\cos^2 x$

4) $\frac{dz}{dx}-z\tan x=\sin x\cos^2 x$

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

1) $y=\sin x+\cos x+c$

2) $y=\sin x+c\sec x$

3) $y=\sin x+c\cos x$

4) $y=\sin x+\tan x+c$

116. The solution of $\frac{dy}{dx}+y\cot x=2\cos x$

1) $y\sin x+\cos^2 x=c$

2) $y\cos x+\sin^2 x=c$

3) $y\sin^2 x-\cos^2 x=c$

4) $y\cos^2 x-\sin x=c$

117. The solution of $2y\cot x\frac{dy}{dx}=1+y^2$

1) $y=c\tan x$ 2) $\sec y=c\left(1+x^2\right)$

3) $\sec x=c\left(1+y^2\right)$

4) $y^2=\sec x.\tan x+c$

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

1) $y\sec^2 x=c+\sin x$

2) $y\sec x=c+\cos x$

3) $y\sec^2 x=c+\cos x$

4) $y\sec x=c+\sin x$

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

1) $ye^x=\frac{e^x}{2}[\sin x-\cos x]+c$

2) $e^x y=\frac{e^x}{2}[\cos x+\sin x]+C$

3) $y=e^x(\sin x-\cos x)+c$

4) $y=e^x(\sin x+\cos x)+c$

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

1) $y(1+x^2)=\cos x+c$

2) $(1+x^2)\cos x=y+c$

3) $(1+x^2)y=\sin x+c$

4) $y(1+x^2)+\sec x=c$

121. The solution of $(x+2y^3)\frac{dy}{dx}=y$

1) $y=x^3+cx$ 2) $x=y^3+cy$

3) $x=y^2+cy$ 4) $y=x^3+cy^2$

122. The solution of $2\cos x\frac{dy}{dx}+4y\sin x=\sin 2x$

1) $2y\cos x=\sec x+c$ 2) $y\sec^2 x=\sec x+c$

3) $2y\sec x=\sec x+c$ 4) $y\sec x=\sec^2 x+c$

123. The solution of $sin2x\left(\frac{dy}{dx}\right)-y=\tan x$

1) $x-y\sin x=c$ 2) $xy\tan x=c$

3) $y=\tan x+c$ 4) $y=\tan x+c\sqrt{\tan x}$

KEY

1. 3	2. 3	3. 2	4. 1	5. 3
6. 1	7. 1	8. 1	9. 4	10. 1
11. 2	12. 2	13. 1	14. 2	15. 2
16. 2	17. 4	18. 3	19. 3	20. 2
21. 2	22. 1	23. 3	24.4	25. 2
26. 3	27. 1	28. 1	29. 2	30. 1
31. 1	32. 1	33. 4	34. 1	35. 2
36. 4	37. 2	38. 3	39. 1	40 .3
41. 3	42. 4	43 .2	44.2	45. 2
46. 2	47. 1	48. 4	49. 1	50. 4
51. 4	52. 1	53.1	54. 4	55. 1
56. 2	57. 1	58. 1	59. 3	60. 1
61. 1	62. 2	63. 2	64. 2	65. 1
66. 1	67. 4	68. 1	69. 3	70. 4
71. 1	72. 3	73.4	74. 2	75. 4
76. 2	77. 3	78. 1	79. 4	80. 3
81. 1	82. 1	83. 1	84. 1	85. 2
86. 2	87. 1	88. 1	89. 3	90. 2
91. 1	92. 2	93. 2	94. 2	95. 2
96. 1	97. 1	98. 1	99. 3	100. 4
101. 2	102. 1	103. 3	104. 2	105. 4
106. 2	107. 2	108. 4	109. 4	110. 4
111. 2	112. 3	113. 3	114. 3	115. 3
116. 1	117. 3	118. 4	119. 1	120. 3
121. 2	122. 2	123. 4		

HINTS

40. D.E of $y=A\sin(nx+b)$ or $y=A\cos(nx+b)$ is $y_2+n^2y=0$

46. D.E of $y=Ax^m+Bx^n$ is $x^2y_2-(m+n-1)xy_1+mny=0$

48. D.E of $y=Ae^{\alpha x}+Be^{\beta x}$ is $y_2-(\alpha+\beta)y_1+\alpha\beta y=0$

52. After dividing by x, apply the formula $y=Ax^m+Bx^n\Rightarrow x^2y_2-(m+n-1)xy_1+mny=0$

85. $\int\frac{dy}{y}=-\int\frac{dx}{\sqrt{1-x^2\sin^{-1}x}}$

110. $p=-\frac{x}{1-x^2}\Rightarrow I.F=\sqrt{1-x^2}$

112. $Sec^2y\frac{dy}{dx}+2x\tan y=x^3;\ put\ \tan y=u$

113. multiply the equations with y^2 and put $y^3=z$

$\frac{dy}{dx}-Co\sec 2xy=\frac{1}{2}Sec^2y$

122. $I.F=e^{-\int Co\sec 2xdx}=\frac{1}{\sqrt{\tan x}}$