DIFFERENTIAL EQUATIONS

OBJECTIVES

1. **The degree of the differential equation** $\frac{d^2y}{dx^2}+\sqrt{1+\left(\frac{dy}{dx}\right)^3}=0$ **is**

   (a) 1 (b) 2

   (c) 3 (d) 6

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

   (a) 2, 2 (b) 3, 3

   (c) 2, 3 (d) 3, 2

3. **The order of the differential equation** $y\left(\frac{dy}{dx}\right)=x\Big/\frac{dy}{dx}+\left(\frac{dy}{dx}\right)^3$ **is**

   (a) 1 (b) 2

   (c) 3 (d) 4

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

   (a) 2, 2 (b) 2, 3

   (c) 2, 1 (d) None of these

5 **The order and degree of the differential equation** $\left(\frac{d^2y}{dx^2}\right)^3+\left(\frac{dy}{dx}\right)^4-xy=0$ **are respectively**

   (a) 2 and 4 (b) 3 and 2

   (c) 4 and 5 (d) 2 and 3

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

   (a) $\frac{1}{3}$ (b) 4

   (c) 9 (d) $\frac{3}{4}$

7 The degree of the differential equation $y(x)=1+\frac{dy}{dx}+\frac{1}{1.2}\left(\frac{dy}{dx}\right)^2+\frac{1}{1.2.3}\left(\frac{dy}{dx}\right)^3+...$ **is**

(a) 2 (b) 3

(c) 1 (d) None of these

8 Which of the following differential equations has the same order and degree

(a) $\frac{d^4y}{dx^4}+8\left(\frac{dy}{dx}\right)^6+5y=e^x$

(b) $5\left(\frac{d^3y}{dx^3}\right)^4+8\left(1+\frac{dy}{dx}\right)^2+5y=x^8$

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

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

9. The order of the differential equation of a family of curves represented by an equation containing four arbitrary constants, will be

(a) 2 (b) 4

(c) 6 (d) None of these

10. Order and degree of differential equation $\frac{d^2y}{dx^2}=\left\{y+\left(\frac{dy}{dx}\right)^2\right\}^{1/4}$ **are**

(a) 4 and 2 (b) 1 and 2

(c) 1 and 4 (d) 2 and 4

11. 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

12. Family $y=Ax+A^3$ **of curve represented by the differential equation of degree**

(a) Three (b) Two

(c) One (d) None of these

13. 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

14. The order of the differential equation whose solution is $x^2 + y^2 + 2gx + 2fy + c = 0$ **, is**

(a) 1 (b) 2

(c) 3 (d) 4

15. The order of the differential equation whose solution is $y = a\cos x + b\sin x + ce^{-x}$ **is**

(a) 3 (b) 2

(c) 1 (d) None of these

16. The order of the differential equation of all circles of radius *r*, having centre on *y*-axis and passing through the origin is

(a) 1 (b) 2

(c) 3 (d) 4

17. The differential equation of the family of curves represented by the equation $x^2 + y^2 = a^2$ **is**

(a) $x + y\frac{dy}{dx} = 0$ (b) $y\frac{dy}{dx} = x$

(c) $y\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 = 0$ (d) None of these

18. The differential equation for the line $y = mx + c$ **is (where *c* is arbitrary constant)**

(a) $\frac{dy}{dx} = m$ (b) $\frac{dy}{dx} + m = 0$

(c) $\frac{dy}{dx} = 0$ (d) None of these

19. The differential equation for all the straight lines which are at a unit distance from the origin is

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

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

20. The differential equation of all circles which passes through the origin and whose centre lies on *y*-axis, is

(a) $(x^2 - y^2)\frac{dy}{dx} - 2xy = 0$ (b) $(x^2 - y^2)\frac{dy}{dx} + 2xy = 0$ (c) $(x^2 - y^2)\frac{dy}{dx} - xy = 0$ (d) $(x^2 - y^2)\frac{dy}{dx} + xy = 0$

21. The differential equation corresponding to primitive $y = e^{cx}$ is

or

The elimination of the arbitrary constant m from the equation $y = e^{mx}$ gives the differential equation is

(a) $\frac{dy}{dx} = \left(\frac{y}{x}\right)\log x$ (b) $\frac{dy}{dx} = \left(\frac{x}{y}\right)\log y$

(c) $\frac{dy}{dx} = \left(\frac{y}{x}\right)\log y$ (d) $\frac{dy}{dx} = \left(\frac{x}{y}\right)\log x$

22. The differential equation whose solution is $y = A\sin x + B\cos x$, is

(a) $\frac{d^2y}{dx^2} + y = 0$ (b) $\frac{d^2y}{dx^2} - y = 0$

(c) $\frac{dy}{dx} + y = 0$ (d) None of these

23. If $y = ce^{\sin^{-1}x}$, then corresponding to this the differential equation is

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

(c) $\frac{dy}{dx} = \frac{x}{\sqrt{1-x^2}}$ (d) None of these

24. $y = ae^{mx} + be^{-mx}$ satisfies which of the following differential equations

(a) $\frac{dy}{dx} - my = 0$ (b) $\frac{dy}{dx} + my = 0$

(c) $\frac{d^2y}{dx^2} + m^2y = 0$ (d) $\frac{d^2y}{dx^2} - m^2y = 0$

25. The differential equation of all straight lines passing through the point $(1, -1)$ is

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

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

26. The differential equation of all parabolas whose axes are parallel to *y*-axis is

(a) $\frac{d^3y}{dx^3} = 0$ (b) $\frac{d^2x}{dy^2} = c$

(c) $\frac{d^3y}{dx^3} + \frac{d^2x}{dy^2} = 0$ (d) $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} = c$

27. The differential equation of the family of curves represented by the equation $x^2y = a$, is

(a) $\frac{dy}{dx} + \frac{2y}{x} = 0$ (b) $\frac{dy}{dx} + \frac{2x}{y} = 0$

(c) $\frac{dy}{dx} - \frac{2y}{x} = 0$ (d) $\frac{dy}{dx} - \frac{2x}{y} = 0$

28. Differential equation whose solution is $y = cx + c - c^3$, is

(a) $\frac{dy}{dx} = c$ (b) $y = x\frac{dy}{dx} + \frac{dy}{dx} - \left(\frac{dy}{dx}\right)^3$

(c) $\frac{dy}{dx} = c - 3c^2$ (d) None of these

29. The differential equation whose solution is $y = c_1 \cos ax + c_2 \sin ax$ is

(Where c_1, c_2 are arbitrary constants)

(a) $\frac{d^2y}{dx^2} + y^2 = 0$ (b) $\frac{d^2y}{dx^2} + a^2y = 0$

(c) $\frac{d^2y}{dx^2} + ay^2 = 0$ (d) $\frac{d^2y}{dx^2} - a^2y = 0$

30. Family of curves $y = e^x(A\cos x + B\sin x)$, represents the differential equation

(a) $\frac{d^2y}{dx^2} = 2\frac{dy}{dx} - y$ (b) $\frac{d^2y}{dx^2} = 2\frac{dy}{dx} - 2y$

(c) $\frac{d^2y}{dx^2} = \frac{dy}{dx} - 2y$ (d) $\frac{d^2y}{dx^2} = 2\frac{dy}{dx} + y$

31. If $y = ax^{n+1} + bx^{-n}$, then $x^2\frac{d^2y}{dx^2}$ equals to

(a) $n(n-1)y$ (b) $n(n+1)y$

(c) ny (d) n^2y

32. Differential equation of $y = \sec(\tan^{-1} x)$ is

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

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

33. If $x = \sin t$, $y = \cos pt$, then

(a) $(1-x^2)y_2 + xy_1 + p^2y = 0$

(b) $(1-x^2)y_2 + xy_1 - p^2y = 0$

(c) $(1+x^2)y_2 - xy_1 + p^2y = 0$

(d) $(1-x^2)y_2 - xy_1 + p^2y = 0$

34. The differential equation for which $\sin^{-1} x + \sin^{-1} y = c$ is given by

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

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

(c) $\sqrt{1-x^2}\; dy - \sqrt{1-y^2}\; dx = 0$

(d) $\sqrt{1-x^2}\; dx - \sqrt{1-y^2}\; dy = 0$

35. The solution of the differential equation $\frac{dy}{dx} + \frac{1+x^2}{x} = 0$ is

(a) $y = -\frac{1}{2}\tan^{-1} x + c$ (b) $y + \log x + \frac{x^2}{2} + c = 0$

(c) $y = \frac{1}{2}\tan^{-1} x + c$ (d) $y - \log x - \frac{x^2}{2} = c$

36. The solution of the differential equation $\frac{dy}{dx} = e^x + \cos x + x + \tan x$ is

(a) $y = e^x + \sin x + \frac{x^2}{2} + \log\cos x + c$

(b) $y = e^x + \sin x + \frac{x^2}{2} + \log\sec x + c$

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

(d) $y = e^x - \sin x + \frac{x^2}{2} + \log\sec x + c$

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

(a) $\tan(x+y) + \sec(x+y) = x + c$

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

(c) $\tan(x+y) + \sec(x+y) + x + c = 0$

(d) None of these

38. The solution of the differential equation $\frac{dy}{dx}=(1+x)(1+y^2)$ **is**

(a) $y=\tan(x^2+x+c)$ (b) $y=\tan(2x^2+x+c)$

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

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

(a) $x\sqrt{1-y^2}-y\sqrt{1-x^2}=c$

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

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

(d) None of these

40. Solution of the equation $\cos x\cos y\frac{dy}{dx}=-\sin x\sin y$ **is**

(a) $\sin y+\cos x=c$ (b) $\sin y-\cos x=c$

(c) $\sin y.\cos x=c$ (d) $\sin y=c\cos x$

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

(a) $\log\left(\frac{x}{y}\right)=\frac{1}{x}+\frac{1}{y}+c$ (b) $\log\left(\frac{y}{x}\right)=\frac{1}{x}+\frac{1}{y}+c$

(c) $\log(xy)=\frac{1}{x}+\frac{1}{y}+c$ (d) $\log(xy)+\frac{1}{x}+\frac{1}{y}=c$

42. The solution of the differential equation $\frac{dy}{dx}=\sec x(\sec x+\tan x)$ **is**

(a) $y=\sec x+\tan x+c$ (b) $y=\sec x+\cot x+c$

(c) $y=\sec x-\tan x+c$ (d) None of these

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

(a) $\log xy+x+y=c$ (b) $\log\left(\frac{x}{y}\right)+x-y=c$

(c) $\log xy+x-y=c$ (d) None of these

44. The solution of $\frac{dy}{dx} = \sin(x+y) + \cos(x+y)$ **is**

(a) $\log\left[1+\tan\left(\frac{x+y}{2}\right)\right] + c = 0$

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

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

(d) None of these

45. The solution of the differential equation $\frac{dy}{dx} = \frac{x-y+3}{2(x-y)+5}$ **is**

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

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

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

(d) None of these

46. Solution of the equation $(e^x + 1)ydy = (y+1)e^x dx$ **is**

(a) $c(y+1)(e^x+1) + e^y = 0$ (b) $c(y+1)(e^x-1) + e^y = 0$

(c) $c(y+1)(e^x-1) - e^y = 0$ (d) $c(y+1)(e^x+1) = e^y$

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

(a) $(x+y)^2 = \frac{a^2}{2}x + c$ (b) $(x+y)^2 = a^2 x + c$

(c) $(x+y)^2 = 2a^2 x + c$ (d) None of these

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

(a) $\sqrt{1+x^2} + \sqrt{1+y^2} = c$

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

(c) $(1+x^2)^{3/2} + (1+y^2)^{3/2} = c$

(d) None of these

49. The general solution of the differential equation $ydx + (1+x^2)\tan^{-1} xdy = 0,$ **is**

(a) $y\tan^{-1} x = c$ (b) $x\tan^{-1} y = c$

(c) $y + \tan^{-1} x = c$ (d) $x + \tan^{-1} y = c$

50 .The solution of the differential equation $(1+x^2)(1+y)dy+(1+x)(1+y^2)dx=0$ **is**

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

(b) $\tan^{-1}x-\frac{1}{2}\log(1+x^2)+\tan^{-1}y-\frac{1}{2}\log(1+y^2)=c$

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

(d) None of these

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

(a) $y=vx$ (b) $y=4x+v$

(c) $y=4x$ (d) $y+4x+1=v$

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

(a) $\frac{e^{by}}{b}=\frac{e^{ax}}{a}+c$ (b) $\frac{e^{-by}}{-b}=\frac{e^{ax}}{a}+c$

(c) $\frac{e^{-by}}{a}=\frac{e^{ax}}{b}+c$ (d) None of these

53. The solution of the differential equation $(x-y^2x)dx=(y-x^2y)dy$ **is**

(a) $(1-y^2)=c^2(1-x^2)$ (b) $(1+y^2)=c^2(1-x^2)$

(c) $(1+y^2)=c^2(1+x^2)$ (d) None of these

54. The general solution of the differential equation $\log\left(\frac{dy}{dx}\right)=x+y$ **is**

(a) $e^x+e^y=c$ (b) $e^x+e^{-y}=c$

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

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

(a) $\tan^{-1}x+\cot^{-1}x=c$ (b) $\sin^{-1}x+\sin^{-1}y=c$

(c) $\sec^{-1}x+\operatorname{cosec}^{-1}x=c$ (d) None of these

56. The number of solutions of $y'=\frac{y+1}{x-1}, y(1)=2$ **is**

(a) None (b) One

(c) Two (d) Infinite

57. The solution of the differential equation $\cos y\log(\sec x+\tan x)dx=\cos x\log(\sec y+\tan y)dy$ **is**

(a) $\sec^2x+\sec^2y=c$ (b) $\sec x+\sec y=c$

(c) $\sec x-\sec y=c$ (d) None of these

58. The solution of $e^{2x-3y}dx+e^{2y-3x}dy=0$ **is**

(a) $e^{5x}+e^{5y}=c$ (b) $e^{5x}-e^{5y}=c$

(c) $e^{5x+5y}=c$ (d) None of these

59. The solution of $(\operatorname{cosec} x \log y)dy+(x^2y)dx=0$ **is**

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

(b) $\left(\frac{\log y}{2}\right)^2+(2-x^2)\cos x+2x\sin x=c$

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

(d) None of these

60 . The solution of the equation $\frac{dy}{dx}=\frac{y^2-y-2}{x^2+2x-3}$ **is**

(a) $\frac{1}{3}\log\left|\frac{y-2}{y+1}\right|=\frac{1}{4}\log\left|\frac{x+3}{x-1}\right|+c$ (b) $\frac{1}{3}\log\left|\frac{y+1}{y-2}\right|=\frac{1}{4}\log\left|\frac{x-1}{x+3}\right|+c$

(c) $4\log\left|\frac{y-2}{y+1}\right|=3\log\left|\frac{x-1}{x+3}\right|+c$ (d) None of these

61. Solution of the differential equation $\frac{dy}{dx}\tan y=\sin(x+y)+\sin(x-y)$ **is**

(a) $\sec y+2\cos x=c$ (b) $\sec y-2\cos x=c$

(c) $\cos y-2\sin x=c$ (d) $\tan y-2\sec y=c$

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

62. 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) $y\sin y=x\log x+c$

63. The solution of $e^{dy/dx}=(x+1)$**,** $y(0)=3$ **is**

(a) $y=x\log x-x+2$

(b) $y=(x+1)\log|x+1|-x+3$

(c) $y=(x+1)\log|x+1|+x+3$

(d) $y=x\log x+x+3$

(e) $y=-(x+1)\log|x+1|+x+3$

64. The solution of the differential equation $(x^2+y^2)dx = 2xydy$ **is**

(a) $x = c(x^2+y^2)$ (b) $x = c(x^2-y^2)$

(c) $x + c(x^2-y^2) = 0$ (d) None of these

65. $(x^2+y^2)dy = xydx$ **. If** $y(x_0) = e$ **,** $y(1) = 1$ **, then value of** $x_0 =$

(a) $\sqrt{3}e$ (b) $\sqrt{e^2-\frac{1}{2}}$

(c) $\sqrt{\frac{e^2-1}{2}}$ (d) $\sqrt{\frac{e^2+1}{2}}$

66. The solution of $ye^{-x/y}dx - (xe^{-x/y}+y^3)dy = 0$ **is**

(a) $\frac{y^2}{2}+e^{-x/y} = k$ (b) $\frac{x^2}{2}+e^{-x/y} = k$

(c) $\frac{x^2}{2}+e^{x/y} = k$ (d) $\frac{y^2}{2}+e^{x/y} = k$

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

(a) $\log y = cx$ (b) $-\frac{1}{xy}+\log y = c$

(c) $-\frac{1}{xy}+\log y = c$ (d) $-\frac{1}{xy}+\log y = c$

68. Solution of the differential equation, $y\,dx - x\,dy + xy^2dx = 0$ **can be**

(a) $2x + x^2y = \lambda y$ (b) $2y + y^2x = \lambda y$

(c) $2y - y^2x = \lambda y$ (d) None of these

69 .If $xdy = y(dx + ydy), y > 0$ **and** $y(1) = 1,$ **then** $y(-3)$ **is equal to**

(a) 1 (b) 3

(c) 5 (d) –1

70. The solution of $(x-y^3)dx + 3xy^2dy = 0$ **is**

(a) $\log x + \frac{x}{y^3} = k$ (b) $\log x + \frac{y^3}{x} = k$

(c) $\log x - \frac{x}{y^3} = k$ (d) $\log xy - y^3 = k$

71. The solution of the differential equation $(3xy+y^2)dx + (x^2+xy)dy = 0$ **is**

(a) $x^2(2xy+y^2) = c^2$ (b) $x^2(2xy-y^2) = c^2$

(c) $x^2(y^2-2xy) = c^2$ (d) None of these

72. The solution of the differential equation $x^2\frac{dy}{dx}=x^2+xy+y^2$ **is**

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

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

73. The solution of the differential equation $x\,dy-y\,dx=(\sqrt{x^2+y^2})dx$ **is**

(a) $y-\sqrt{x^2+y^2}=cx^2$ (b) $y+\sqrt{x^2+y^2}=cx^2$

(c) $y+\sqrt{x^2+y^2}+cx^2=0$ (d) None of these

74. The solution of the equation $\frac{dy}{dx}=\frac{x+y}{x-y}$ **is**

(a) $c(x^2+y^2)^{1/2}+e^{\tan^{-1}(y/x)}=0$

(b) $c(x^2+y^2)^{1/2}=e^{\tan^{-1}(y/x)}$

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

(d) None of these

75. The solution of the equation $\frac{dy}{dx}=\frac{y}{x}\left(\log\frac{y}{x}+1\right)$ **is**

(a) $\log\left(\frac{y}{x}\right)=cx$ (b) $\frac{y}{x}=\log y+c$

(c) $y=\log y+1$ (d) $y=xy+c$

76. The solution of the differential equation $\frac{dy}{dx}=\frac{xy}{x^2+y^2}$ **is**

a) $ay^2=e^{x^2/y^2}$ (b) $ay=e^{x/y}$

(c) $y=e^{x^2}+e^{y^2}+c$ (d) $y=e^{x^2}+y^2+c$

77. Integrating factor of equation $(x^2+1)\frac{dy}{dx}+2xy=x^2-1$ **is**

(a) x^2+1 (b) $\frac{2x}{x^2+1}$

(c) $\frac{x^2-1}{x^2+1}$ (d) None of these

78. The solution of the equation $x\frac{dy}{dx}+3y=x$ **is**

(a) $x^3y+\frac{x^4}{4}+c=0$ (b) $x^3y=\frac{x^4}{4}+c$

(c) $x^3y+\frac{x^4}{4}=0$ (d) None of these

79 .The solution of the differential equation $x\log x\frac{dy}{dx}+y=2\log x$ **is**

(a) $y=\log x+c$ (b) $y=\log x^2+c$

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

80 .Solution of the differential equation $\frac{dy}{dx}+y\sec^2 x=\tan x\sec^2 x$ **is**

(a) $y=\tan x-1+ce^{-\tan x}$

(b) $y^2=\tan x-1+ce^{\tan x}$

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

(d) $ye^{-\tan x}=\tan x-1+c$

81. Integrating factor of the differential equation $\frac{dy}{dx}+P(x)y=Q(x)$ **is**

(a) $\int P\,dx$ (b) $\int Q\,dx$

(c) $e^{\int P\,dx}$ (d) $e^{\int Q\,dx}$

82. The solution of the equation $(x+2y^3)\frac{dy}{dx}-y=0$ **is**

(a) $y(1-xy)=Ax$ (b) $y^3-x=Ay$

(c) $x(1-xy)=Ay$ (d) $x(1+xy)=Ay$

Where A is any arbitrary constant

83. The solution of $\frac{dy}{dx}+2y\tan x=\sin x$**, is**

(a) $y\sec^3 x=\sec^2 x+c$ (b) $y\sec^2 x=\sec x+c$

(c) $y\sin x=\tan x+c$ (d) None of these

84. The solution of $dy=\cos x(2-y\operatorname{cosec} x)dx$ **where** $y=2$ **when** $x=\frac{\pi}{2}$ **is**

(a) $y=\sin x+\operatorname{cosec} x$

(b) $y=\tan\frac{x}{2}+\cot\frac{x}{2}$

(c) $y=\frac{1}{\sqrt{2}}\sec\frac{x}{2}+\sqrt{2}\cos\frac{x}{2}$

(d) None of these

85. The solution of the differential equation $\frac{dy}{dx}+\frac{3x^2}{1+x^3}y=\frac{\sin^2 x}{1+x^3}$ **is**

(a) $y(1+x^3)=x+\frac{1}{2}\sin 2x+c$

(b) $y(1+x^3)=cx+\frac{1}{2}\sin 2x$

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

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

86. The solution of the differential equation $\frac{dy}{dx}+\frac{y}{x}=x^2$ **is**

(a) $4xy=x^4+c$ (b) $xy=x^4+c$

(c) $\frac{1}{4}xy=x^4+c$ (d) $xy=4x^4+c$

87. The equation of the curve passing through the origin and satisfying the equation $(1+x^2)\frac{dy}{dx}+2xy=4x^2$ **is**

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

(c) $3(1+x^2)=x^3$ (d) None of these

88. The integrating factor of the differential equation $(x\log x)\frac{dy}{dx}+y=2\log x$ **is**

(a) $\log x$ (b) $\log(\log x)$

(c) e^x (d) x

89. Solution of the equation $(x+\log y)dy+y\,dx=0$ **is**

(a) $xy+y\log y=c$ (b) $xy+y\log y-y=c$

(c) $xy+\log y-x=c$ (d) None of these

90. An integrating factor of the differential equation $x\frac{dy}{dx}+y\log x=xe^x x^{-\frac{1}{2}\log x}$**,** $(x>0)$ **is**

(a) $x^{\log x}$ (b) $(\sqrt{x})^{\log x}$

(c) $(\sqrt{e})^{\log x}$ (d) e^{x^2}

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

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

92. A particle starts at the origin and moves along the *x*–axis in such a way that its velocity at the point (*x*, 0) is given by the formula $\frac{dx}{dt} = \cos^2 \pi x.$ Then the particle never reaches the point on

(a) $x = \frac{1}{4}$ (b) $x = \frac{3}{4}$

(c) $x = \frac{1}{2}$ (d) $x = 1$

93. The differential equation $y\frac{dy}{dx} + x = a$ (*a* is any constant) represents

(a) A set of circles having centre on the *y*-axis

(b) A set of circles centre on the *x*-axis

(c) A set of ellipses

(d) None of these

94. The equation of the curve which passes through the point (1, 1) and whose slope is given by $\frac{2y}{x}$, is

(a) $y = x^2$ (b) $x^2 - y^2 = 0$

(c) $2x^2 + y^2 = 3$ (d) None of these

95.A function $y = f(x)$ has a second order derivatives $f''(x) = 6(x-1)$. If its graph passes through the point (2, 1) and at that point the tangent to the graph is $y = 3x - 5$, then the function is

(a) $(x+1)^3$ (b) $(x-1)^3$

(c) $(x+1)^2$ (d) $(x-1)^2$

96. The equation of the curve through the point (1,0) and whose slope is $\frac{y-1}{x^2+x}$ is

(a) $(y-1)(x+1) + 2x = 0$ (b) $2x(y-1) + x + 1 = 0$

(c) $x(y-1)(x+1) + 2 = 0$ (d) None of these

97. The slope of the tangent at (*x*, *y*) to a curve passing through a point (2, 1) is $\frac{x^2+y^2}{2xy}$, then the equation of the curve is

(a) $2(x^2 - y^2) = 3x$ (b) $2(x^2 - y^2) = 6y$

(c) $x(x^2 - y^2) = 6$ (d) $x(x^2 + y^2) = 10$

98. The solution of $\dfrac{d^2y}{dx^2} = \sec^2 x + xe^x$ **is**

(a) $y = \log(\sec x) + (x-2)e^x + c_1x + c_2$

(b) $y = \log(\sec x) + (x+2)e^x + c_1x + c_2$

(c) $y = \log(\sec x) - (x+2)e^x + c_1x + c_2$

(d) None of these

99. The solution of the differential equation $x\dfrac{dy}{dx} = y(\log y - \log x + 1)$ **is**

(a) $y = xe^{cx}$ (b) $y + xe^{cx} = 0$

(c) $y + e^x = 0$ (d) None of these

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

(a) $\tan^{-1}\left(\dfrac{x}{y}\right) + \log y + c = 0$

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

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

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

101. The differential equation of the family of curves $y = Ae^{3x} + Be^{5x}$, **where** A **and** B **are arbitrary constants, is**

(a) $\dfrac{d^2y}{dx^2} + 8\dfrac{dy}{dx} + 15y = 0$ (b) $\dfrac{d^2y}{dx^2} - 8\dfrac{dy}{dx} + 15y = 0$

(c) $\dfrac{d^2y}{dx^2} - \dfrac{dy}{dx} + y = 0$ (d) None of these

102. The order of the differential equation whose general solution is given by $y = C_1e^{2x+C_2} + C_3e^x + C_4\sin(x + C_5)$ **is**

(a) 5 (b) 4

(c) 3 (d) 2

103. The differential equation of the family of parabolas 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) $y\left(\frac{dy}{dx}\right)^2 + 2xy\frac{dy}{dx} + y = 0$

DIFFERENTIAL EQUATIONS

HINTS AND SOLUTIONS

1. (b) $\frac{d^2y}{dx^2} = -\sqrt{1+\left(\frac{dy}{dx}\right)^3} \Rightarrow \left(\frac{d^2y}{dx^2}\right)^2 = 1+\left(\frac{dy}{dx}\right)^3$

degree is 2.

2. (c) Here power on the differential coefficient is fractional, therefore change it into positive integer, so

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

3. (a) order is 1.

4. (a) order = 2, degree = 2.

5. (d) Clearly, order = 2, degree = 3.

6. (b) degree is 4.

7. (c) $y = 1+t+\frac{t^2}{2!}+\frac{t^3}{3!}+...+\infty$ where $t = \frac{dy}{dx}$

$\Rightarrow y = e^t$, $\therefore$ $t = \log y \Rightarrow \frac{dy}{dx} = \log y$. Hence degree is 1.

8. (c)

9. (b)

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

Obviously, order is 2 and degree is 4.

11. (a) $(x-h)^2+(y-k)^2 = r^2$. Here r is arbitrary constant

$\therefore$ order of differential equation = 1.

12. (a) Differentiating the given equation, we get $\frac{dy}{dx} = A$

$\therefore y = x\left(\frac{dy}{dx}\right)+\left(\frac{dy}{dx}\right)^3$ which is of degree 3.

13. (b) $y^2 = \pm 4a(x-h)$

$\Rightarrow 2yy_1 = \pm 4a \Rightarrow yy_1 = \pm 2a \Rightarrow y_1^2 + yy_2 = 0$

Hence degree = 1, order = 2.

14. (c) order of the differential equation is 3.

15. (a)

16. (a) The equation of a family of circles of radius r passing through the origin and having centre on y-axis is $(x-0)^2+(y-r)^2=r^2$ or $x^2+y^2-2ry=0$.(a) Given equation $x^2+y^2=a^2$. Differentiate it *w.r.t. x*,

we get $2x+2y\frac{dy}{dx}=0 \Rightarrow x+y\frac{dy}{dx}=0$.

17. (a) Differentiate it *w.r.t. x*, we get $\frac{dy}{dx}=m$.

18. (c)

19. (a) The system of circles pass through origin and centre lies on y-axis is $x^2+y^2-2ay=0$

$\Rightarrow 2x+2y\frac{dy}{dx}-2a\frac{dy}{dx}=0 \Rightarrow 2a=2y+2x\frac{dx}{dy}$

Therefore, the required differential equation is

20. (a) $x^2+y^2-2y^2-2xy\frac{dx}{dy}=0 \Rightarrow (x^2-y^2)\frac{dy}{dx}-2xy=0$.

21. (c) $y=e^{mx} \Rightarrow \log y=mx \Rightarrow m=\frac{\log y}{x}$

Now $y=e^{mx} \Rightarrow \frac{dy}{dx}=me^{mx}=\frac{\log y}{x}.y=\left(\frac{y}{x}\right)\log y$.

22. (a) standard problem

23. (a) $y=ce^{\sin^{-1}x}$. Differentiate it *w.r.t. x*, we get

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

24. (d) standard problem.

25. (d) Since the equation of line passing through (1,–1) is $y+1=m(x-1)$

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

26. (a) standard problem

27. (a) $x^2y=a$

$x^2\frac{dy}{dx}+y\frac{d}{dx}(x^2)=0 \Rightarrow x^2\frac{dy}{dx}+2xy=0$

$\Rightarrow \frac{dy}{dx}+\frac{2y}{x}=0$.

28. (b) Differentiating, we have $\frac{dy}{dx}=c$

Hence differential equation is, $y=x\frac{dy}{dx}+\frac{dy}{dx}-\left(\frac{dy}{dx}\right)^3$.

29. (b) Differentiate 2 times *w.r.t. x*

30. (b) standard problem

31. (b) standard problem

32. (c) $y = \sec(\tan^{-1} x)$

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

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

33. (d) $x = \sin t$, $y = \cos pt$

$$\frac{dx}{dt} = \cos t \text{ ; } \frac{dy}{dt} = -p\sin pt \text{ ; } \frac{dy}{dx} = \frac{-p\sin pt}{\cos t}$$

$$\frac{d^2y}{dx^2} = \frac{-\cos t\, p^2 \cos pt(dt/dx) - p\sin pt \sin t(dt/dx)}{\cos^2 t}$$

$$\Rightarrow (1-x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} + p^2y = 0$$

or $(1-x^2)y_2 - xy_1 + p^2y = 0$.

34. (b) $\sin^{-1} x + \sin^{-1} y = c$

On differentiating *w.r.t.* to *x*, we get d.eq

35. (b) $\frac{dy}{dx} + \frac{1+x^2}{x} = 0 \Rightarrow dy + \left(\frac{1}{x} + x\right)dx = 0$

36. (b) $\frac{dy}{dx} = e^x + \cos x + x + \tan x$

37. (b) Here $\frac{dy}{dx} = \sin(x+y)$

38. Now put $x+y = v$ (d) $\frac{dy}{dx} = (1+x)(1+y^2) \Rightarrow \frac{dy}{1+y^2} = (1+x)dx$

39. (b) $\frac{dy}{dx} + \sqrt{\frac{1-y^2}{1-x^2}} = 0 \Rightarrow \int \frac{dy}{\sqrt{1-y^2}} = -\int \frac{dx}{\sqrt{1-x^2}}$

40. (d) $\cos x \cos y \frac{dy}{dx} = -\sin x \sin y$

$$\Rightarrow \frac{\cos y}{\sin y}dy = -\frac{\sin x}{\cos x}dx \Rightarrow \cot y dy = -\tan x dx$$

41. (a) $(x^2 - yx^2)\frac{dy}{dx} + y^2 + xy^2 = 0 \Rightarrow \frac{1-y}{y^2}dy + \frac{1+x}{x^2}dx = 0$

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

42. (a) $\frac{dy}{dx} = \sec x(\sec x + \tan x) \Rightarrow \frac{dy}{dx} = \sec^2 x + \sec x \tan x$

43. (c) $\frac{dy}{dx} = \frac{(1+x)y}{(y-1)x}$

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

44. (b) Put $x+y=v$

45. (c) Let $x-y=v$

46. (d) $(e^x+1)ydy = (y+1)e^x dx$

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

47. (d) Put $x+y=v$

48. (a) $x\sqrt{1+y^2}dx = -y\sqrt{1+x^2}dy$

$$\Rightarrow \int \frac{x}{\sqrt{1+x^2}}dx + \int \frac{y}{\sqrt{1+y^2}}dy = c$$

49. (a) $ydx + (1+x^2)\tan^{-1}xdy = 0$

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

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

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

51. (d) Put $y+4x+1=v$.

52. (b) $\log\left(\frac{dy}{dx}\right) = ax+by \Rightarrow \frac{dy}{dx} = e^{ax+by} = e^{ax}.e^{by}$

$$\Rightarrow e^{-by}dy = e^{ax}dx \Rightarrow \frac{e^{-by}}{-b} = \frac{e^{ax}}{a} + c.$$

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

54. (b) $\log\left(\frac{dy}{dx}\right) = x+y \Rightarrow e^{x+y} = \frac{dy}{dx} \Rightarrow e^x e^y = \frac{dy}{dx}$

55. (b) $\int \frac{dy}{\sqrt{1-y^2}} + \int \frac{dx}{\sqrt{1-x^2}} = 0$

56. (a) $\frac{dy}{dx} = \frac{y+1}{x-1} \Rightarrow \frac{dy}{y+1} = \frac{dx}{x-1}$

57. (d) $\cos y \log(\sec x + \tan x)dx = \cos x \log(\sec y + \tan y)dy$

58. (a) $e^{2x-3y}dx + e^{2y-3x}dy = 0$

$$e^{3x+3y} \Rightarrow e^{5x}dx + e^{5y}dy = 0$$

59. (c) $(\operatorname{cosec} x \log y)dy + (x^2y)dx = 0 \Rightarrow \frac{1}{y}\log ydy = -x^2 \sin xdx$

60. (c) $\frac{dy}{dx}=\frac{y^2-y-2}{x^2+2x-3} \Rightarrow \frac{dy}{(y-2)(y+1)}=\frac{dx}{(x+3)(x-1)}$

61. (a) $\frac{dy}{dx}\tan y=\sin(x+y)+\sin(x-y)$

$\frac{dy}{dx}(\tan y)=2\sin x\cos y \Rightarrow \frac{\sin y}{\cos^2 y}dy=2\sin x dx$

62. (a) $\frac{dy}{dx}=\frac{x\log x^2+x}{\sin y+y\cos y}$.

63. (b) $\frac{dy}{dx}=\log(x+1) \Rightarrow dy=\log(x+1)dx$

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

put $y=vx$

65. (a) $x^2dy+y^2dy=xydx \Rightarrow x(xdy-ydx)=-y^2dy$

$\Rightarrow x\frac{(ydx-xdy)}{y^2}=dy \Rightarrow \frac{x}{y}d\left(\frac{x}{y}\right)=\frac{dy}{y}$

66. (a) $y\,e^{-x/y}dx-(xe^{-x/y}+y^3)dy=0$ $\quad e^{-x/y}(ydx-xdy)=y^3dy \Rightarrow e^{-x/y}\frac{(ydx-xdy)}{y^2}=ydy$

$e^{-x/y}d\left(\frac{x}{y}\right)=ydy$.

67. (b) $ydx+xdy=-x^2ydy \Rightarrow \frac{1}{(xy)^2}dxy=-\frac{dy}{y}$

68. (a) $\frac{ydx-xdy}{y^2}=-xdx \Rightarrow d\left(\frac{x}{y}\right)=-xdx$

69. (b) $xdy=y(dx+ydy) \Rightarrow \frac{xdy-ydx}{y^2}=dy \Rightarrow -d\left(\frac{x}{y}\right)=dy$

70. (b) $xdx-y^3dx+3xy^2dy=0$

Put $y^3=t \Rightarrow dt=3y^2dy$

$x\,dx-tdx+xdt=0 \Rightarrow xdx+xdt-tdx=0$

$\Rightarrow \frac{dx}{x}+d\left(\frac{t}{x}\right)=0$

71. (a) $\frac{dy}{dx}=-\frac{3xy+y^2}{x^2+xy}$ put $y=vx$

72. (a) $\frac{dy}{dx}=\frac{x^2+xy+y^2}{x^2}$ put $y=vx$

73. (b) put $y=vx$

74. (b) $\frac{dy}{dx} = \frac{x+y}{x-y}$ put $y = vx$

75. (a) $y = vx \Rightarrow \frac{dy}{dx} = v + x.\frac{dv}{dx}$

76. (a) $\frac{dy}{dx} = \frac{xy}{x^2+y^2}$. Put $y = vx$;

77. (a) $\frac{dy}{dx} + \frac{2x}{1+x^2}y = \frac{x^2-1}{x^2+1}$

I.F. $= e^{\int \frac{2x}{1+x^2}dx} = e^{\log(1+x^2)} = 1 + x^2$.

78. b) $x\frac{dy}{dx} + 3y = x \Rightarrow \frac{dy}{dx} + \frac{3y}{x} = 1$

79. (c) $x \log x \frac{dy}{dx} + y = 2\log x \Rightarrow \frac{dy}{dx} + \frac{1}{x \log x}y = \frac{2}{x}$

80. (a) I.F. = $e^{\int \sec^2 x\, dx} = e^{\tan x}$

81. (c)

82. (b) $(x+2y^3)\frac{dy}{dx} = y \Rightarrow \frac{dy}{dx} = \frac{y}{x+2y^3}$

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

83. (b) $\frac{dy}{dx} + 2y \tan x = \sin x$

84. (a) $\frac{dy}{dx} = 2\cos x - y \cot x \Rightarrow \frac{dy}{dx} + y \cot x = 2\cos x$

85. (d) $\frac{dy}{dx} + \frac{3x^2}{1+x^3}y = \frac{\sin^2 x}{1+x^3}$

86. (a) The given equation $\frac{dy}{dx} + \frac{y}{x} = x^2$

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

88. (a) I.F. $= e^{\int \frac{1}{x\log x}dx} = e^{\log(\log x)} = \log x$.

89. (b) $xdy + ydx + \log y dy = 0 \Rightarrow xdy + ydx = -\log y dy$

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

90. (b) $\frac{dy}{dx} + \left(\frac{\log x}{x}\right)y = e^x x^{-\frac{1}{2}\log x}$

91. (b) $\frac{d^2y}{dx^2} = e^{-2x}$

Integrate both sides 2times

92. (c) Given $\frac{dx}{dt} = \cos^2 \pi x$. Differentiate *w.r.t. t*,

$$\frac{d^2 x}{dt^2} = -2\pi \sin 2\pi x = -ve$$

$$\because \frac{d^2 x}{dt^2} = 0 \Rightarrow -2\pi \sin 2\pi x = 0 \Rightarrow \sin 2\pi x = \sin \pi$$

$$\Rightarrow 2\pi x = \pi \Rightarrow x = 1/2.$$

93. (b) We have $y\frac{dy}{dx} + x = a$ or $ydy + xdx = adx$

Integrating, we get $\frac{y^2}{2} + \frac{x^2}{2} = ax + c$

94. (a) Slope $\frac{dy}{dx} = \frac{2y}{x}$

$$\Rightarrow 2\int \frac{dx}{x} = \int \frac{dy}{y} \Rightarrow 2\log x = \log y + \log c \Rightarrow x^2 = yc$$

95. (b) verification

96. (a) Slope $= \frac{dy}{dx}$

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

97. (a) $\frac{dy}{dx} = \frac{x^2+y^2}{2xy}$. Put $y = vx$

98. (a) $\frac{d^2y}{dx^2} = \sec^2 x + xe^x$ Integrate both sides 2 times

99. (a) $\frac{dy}{dx} = \frac{y}{x}\left(\log\frac{y}{x} + 1\right)$ put $y = vx$

100. (a) $\frac{dx}{dy} + \frac{x^2 - xy + y^2}{y^2} = 0$

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

Put $v = x/y$

101. (b) $y = Ae^{3x} + Be^{5x}$

$$\Rightarrow \frac{dy}{dx} = 3Ae^{3x} + 5Be^{5x} \Rightarrow \frac{d^2y}{dx^2} = 9Ae^{3x} + 25Be^{5x}$$

$$\Rightarrow \frac{d^2y}{dx^2} - 8\frac{dy}{dx} + 15y = 0$$

102. (c) order = no. of arbitrary constants =3

103. (b) Given family of parabolas is $y^2 = 4a(x+a)$. Eliminate a from this equation.