Differential Equations

Assignment no 1

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Reg no : SP20 - BSE - 024

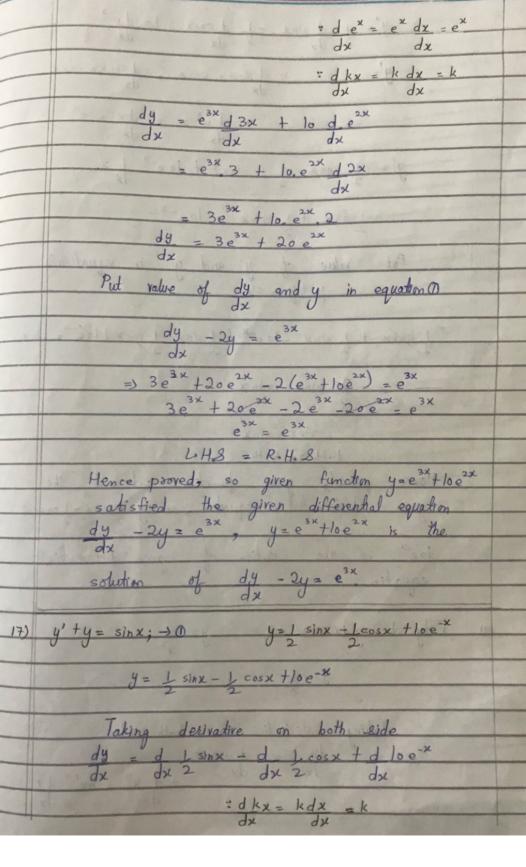
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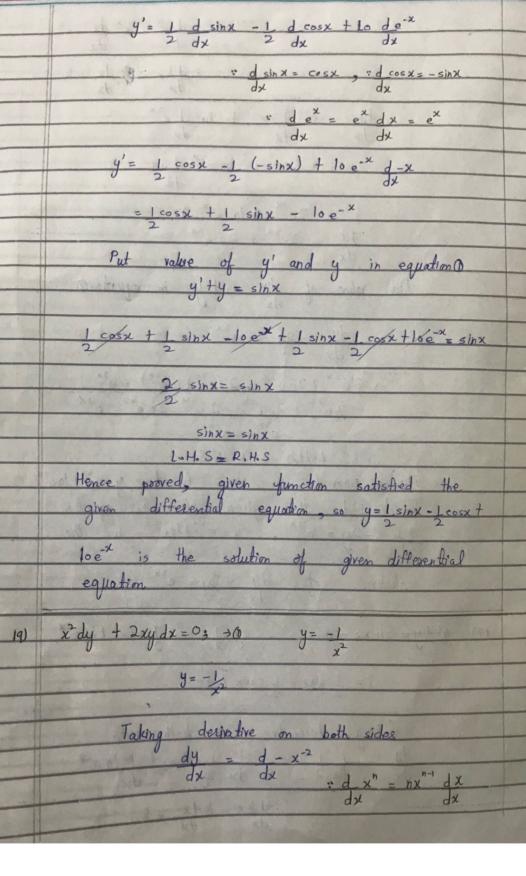
To : MUHAMMAD ILYAS

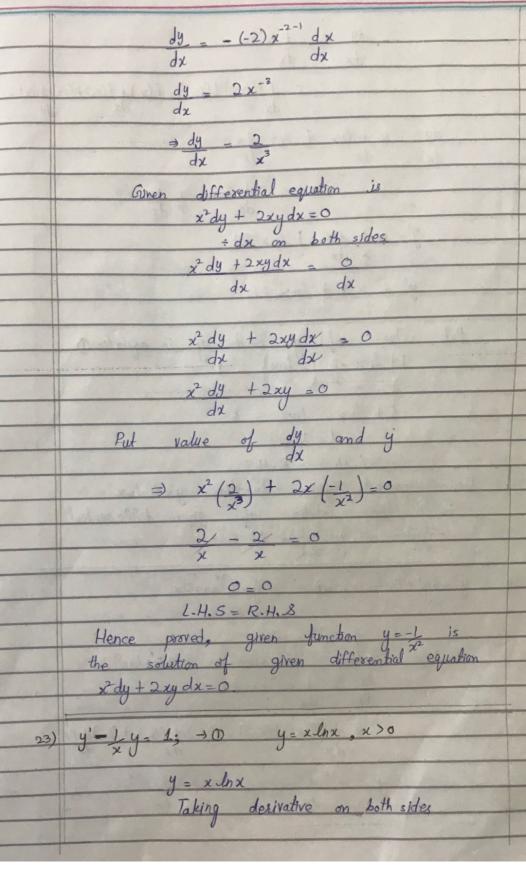
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	In Problem 1-10 state whether the given differential equations are linear or non-linear. Give the order of each equation
1)	Griven differential equation is linear, and is of second order.
3)	Given differential equation is non-linear because it contains product of dependent Variable, i-e; yy' It is of first order.
5)	3 y'4) - x²y" + 4xy' - 3y = 0 Given differential equation is linear. This differential equation contains fourth-order.
7)	$\frac{dy}{dx} = \frac{1 + (d^2y)^2}{dx^2}$ $\frac{dx}{dx} = \frac{1 + (d^2y)^2}{dx^2}$ $\frac{dy}{dx} = \frac{1 + (d^2y)^2}{dx^2}$ This differential equation is non-linear because of $\frac{d^2y}{dx^2}$, degree is greater than I, which makes it non-linear. It is of second-order.
	In Problems 11-40 verify that the indicated function is a solution of the given differential equation. Where appropriate, c, and

c, denote constants. 11) 2y'+y=0;+0 y=e-x/2 $y = e^{-\frac{x}{2}}$ Taking desivative on both side. $\frac{dy}{dx} = \frac{d}{dx} e^{-\frac{x}{2}}$ $\frac{dx}{dx} = \frac{d}{dx} e^{-\frac{x}{2}} \frac{d}{dx} - \frac{dx}{dx} = \frac{e^{x}}{dx} \frac{dx}{dx}$ $\frac{dx}{dx} = \frac{e^{-\frac{x}{2}}}{dx} \frac{d}{2} = \frac{e^{x}}{dx} \frac{dx}{dx}$ $y' = \frac{dx}{2} - \frac{1}{2} \frac{dx}{dx} = \frac{dx}{dx}$ y' = -1 e-x'2 Put value of y' and y' in equation O equation $O \Rightarrow 2y' + y = 0$ 2(-1 e-x2) + e-x2 = 0 -ex2+ ex/2=0 L.H.S = R.H.S So, hence proved, given function $y = e^{-\frac{x_1}{2}}$ is the solution of given differential equation 2y'ty=0 $\frac{dy}{dx} - 2y = e^{3x} \Rightarrow 0y = e^{3x} + 10e^{2x}$ 13) y = e3x + 10 e2x Taking derivation on both side $\frac{dy}{dx} = \frac{de^{3x} + d \log^{2x}}{dx}$







dy = d x lnx $\frac{d}{dx} \left[f(x_1) \right] \left[f(x_2) \right] = f(x_1) d f(x_2) + f(x_2) d f(x_1)$ dy = x d lnx + lnx dx $d \ln x = 1 dx$ y'= x 1 dx + lnxs y' = 1 + lnx Put value of y' and y in equation 1 1+lnx-1 (xlnx) = 1 1+ lnx - lnx = 1 L. H.S - R. H.S Hence proved, given function $y = x \ln x$ is the solution of given differential equation $y' - 1 \cdot y = 1$ 29) $y'' - 6y' + 13y = 0; \rightarrow 0$ $y = e^{3x} \cos 2x$ y= e3x cos2x Talying desivative on both sides

dy = d e 3x cos2x # d [f(x,)].[f(x,)] = f(x,) d f(x2) + f(x2)d f(x,) y'= e3x d cos 2x + cos 2x d e3x

" $\frac{1}{\sqrt{2}} \frac{1}{\sqrt{2}} \frac{1}{\sqrt{$ $d e^{x} = e^{x} dx$ $y' = e^{3x} - \sin(2x) d2x + \cos2x \cdot e^{3x} d3x$ $y' = -\sin(2x)e^{3x} \cdot 2 + \cos 2x e^{3x} \cdot 3$ = -2\sin(2x)e^{3x} + 3\cos2x e^{3x} $y''=d\left(-2\sin(2x)e^{3x}+3\cos2xe^{3x}\right)$ $\frac{d}{dx} = \frac{d}{dx} - 2\sin(2x)e^{3x} + \frac{d}{dx} \frac{3\cos 2x}{dx} e^{3x}$ $= -2 \frac{d}{dx} \sin(2x)e^{3x} + \frac{d}{3} \frac{d\cos(2x)e^{3x}}{dx}$ $= -2 \frac{d}{dx} \sin(2x)e^{3x} + \frac{d}{3} \frac{d\cos(2x)e^{3x}}{dx}$ $\Rightarrow y'' = -2 \left[\sin(2x) d e^{3x} + e^{3x} d \sin(2x) \right] + 3 \left[\cos(2x) d e^{3x} + e^{3x} d \cos(2x) \right]$ = -2 sin (2x) e. 3 + e cosbx/2 +3 [cos(2x) e 3 + e (-sin2x)2] $= -6e^{3x} \sin(2x) - 4e^{3x} \cos(2x) + 9e^{3x} \cos(2x) - 6e^{3x} \sin(2x)$ $= -12e^{3x} \sin(2x) + 5e^{3x} \cos(2x)$ Put value of y", y' and y in equation (1) -12e3x sin(2x) +5e3x cos(2x) -6 (-2sin(2x)e3x +3cos(2x)e3x)+ 13 (e3x cod22) = 0 =) $-12e^{3x} \sin(2x) + 5e^{3x} \cos(2x) + 12 \sin(2x)e^{3x} - 18 \cos(2x)e^{3x} +$ $-13\cos(2x)e^{3x} + 13\cos(2x)e^{3x} = 0$

	0=0	100
	1. H. S = R. H. S	
	Hence proved given function satisfied the	
	Hence proved, given function satisfied the given differential equation, so $y = e^{3x} \cos 2x$	
	is it's solution	
	and the second s	
31)	$y''=y \Rightarrow 0$ $y=\cosh x + \sinh x$	
	Markers & Landbell day a market	
	y = coshx + sinhx	
	Taling desirative on both sides	
	dy = d (coshx tsinhx) dx dx	
	(" derivative addition rule is	
36	applied)	
	y'= d coshx + d slnhx	
	y'= slnhx + coshx	
	Taking delivative on both sides	
	Taking derivative on both sides y"= d (sinhx + coshx) dx	
234		
	(r derivative addition rule is applied)	
	y"= d sinhx + d coshx	
1		
	= cosha f sinhx	
	Put value of y" and y in equation 1	i
	coshx + sinhx = coshx + sinhx	
	LH.S= R.H.S	
	Hence proved, given function satisfied the given differential equation, so $y = \cosh x + \sinh x$	
	given differential equation, so y = coshx tsinhx	-
	is the solution of y"=y.	-
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37) $x^2y'' - 3xy' + 4y = 0$ $y = x^2 + x^2 \ln x$, x > 0 $= \frac{d^2 + d^2 \ln x}{dx}$ $= 2x + \left[x^2 d \ln x + \ln x d x^2 \right]$ $=2x+\left[x^{2}\right]+\ln x \ 2x$ = 2x + x+ lnx2x y' = 3x + lnx2x y"= 3 d x + d [lnx.2x]

dx dx = 3 + [low d 2x + 2x d lox] = 3+ [2lnx + 2x] = 3+ [2 lnx +2] = 3 + 2lnx+2 Put y", y', y in requestion 1) x2 (2 lnx +5) -3x (3x + lnx 2x) +4(x2+x2 lnx)=0 222 lnx + 5x2 - 9x2 - 6x2 lnx + 4x2 + 4x2 lnx = 0 - 42 Inx - 42 + 4x + 4x Inx = 0 L. H. S = R. H. S

	Hence proved, given function satisfied the given differential equation $\Rightarrow y = x + x \ln x is the solution of \\ x^2y'' - 3xy' + 4y = 0$
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