Gyan Ganga Institute of Technology & Sciences, Jabalpur Gyan Ganga College of Technology, Jabalpur Imp Questions of Engineering Mathematics-I (BT-202) Unit-1

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

2. Solve
$$(1 + e^y)\cos x dx + e^y \sin x dy = 0$$

$$3. Solve (xy^5 + y)dx - dy = 0$$

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

5. Solve
$$2ydx + (2xlogx - xy)dy = 0$$

6. Solve
$$\frac{d^3y}{dx^3} + 3\frac{d^2y}{dx^2} + 2\frac{dy}{dx} = x^2$$

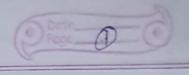
7. Solve
$$(D^2 - 2D + 2)y = x$$
, $\frac{d}{dx} = D$

8. Solve
$$(D^3 - D^2 - 6D)y = 1 + x^2$$

9. Solve
$$(D^2 - 2D + 1)y = e^x + \sin x$$
, $\frac{d}{dx} = D$

10. Solve
$$\frac{d^2y}{dx^2} + 4y = \sin^2 x$$

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Let to = tany

dt = 1

dy = (1+y2) dt

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

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

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

which is a linear differential equation in x

in On comparing with dx Px + ?

$$P = 1$$

$$1 + y^2$$

$$Q = \frac{1}{1 + y^2}$$

$$1 + y^2$$

Integrating factor i.e IF =
$$e^{\int P dy} = e^{\int \frac{1}{1+g^2} dy}$$

 $\left[IF = e^{\tan^2 \theta} \right]$

The complete solution is

$$x e^{ton^{-1}y} = \int \frac{ton^{-1}y}{1+y^{2}} e^{ton^{-1}y} dy + ($$

$$x e^{ton^{-1}y} = \int \frac{t}{1+y^{2}} e^{ton^{-1}y} dt + ($$

$$x e^{ton^{-1}y} = + e^{t} - \int 1 e^{t} dt + ($$

$$x e^{\tan^{-1}g} = + e^{t} - \int ! e^{t} dt + C$$

$$=$$
 $e^{t}(t-1) + ($

$$= \underbrace{e^{t}(t-1) + (t-1)}_{e^{tan^{-1}y}}$$

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

Solve $\frac{dy}{dx} = \frac{x^3 + y^3}{2x^3}$
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On Comparing with $\frac{dx}{dx} + \frac{Ndy}{dx} = 0$

On Comparing with $\frac{dx}{dx} + \frac{Ndy}{dx} = 0$
 $\frac{dx}{dx} = \frac{3y^2}{2x}$
 $\frac{\partial M}{\partial x} = \frac{3y^2}{2x}$
 $\frac{\partial M}{\partial x} = \frac{3y^2}{2x}$

If $\frac{dx}{dx} = \frac{1}{2x^3 + y^3} = 0$
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Multiplying I.f. in eq. (1)

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 $\frac{dx}{dx} = \frac{1}{2x^3 + y^3} = 0$

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 $\frac{dx}{dx} = \frac{3y^2}{2x^3} = 0$
 $\frac{dx}{dx} = 0$
 \frac

Now the eqn is exact diff eqn

Complete Soln is
$$\int_{y=const}^{\infty} M \, dx + \int_{y=const}^{\infty} N \, dy$$
 (free from x) = (

$$\int_{x}^{\infty} \left(\frac{1}{x} + \frac{y^{3}}{y^{4}} \right) \, dx + \int_{y}^{\infty} 0 \, dy = C$$

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$$\int_{y=const}^{\infty} \left(\frac{1}{x} + \frac{y^{4}}{y^{4}} \right) \, dx + \int_{y}^$$

(25) Solve 2ydx + (2xlogx -xy) dy = 0 Sol 2y doc + (2x logx - x(y) dy = 0 -0 On Comparing with Mdx + Ndy = 0 M=2y, $M=2\times\log x-xy$ $\frac{\partial M}{\partial y} = \frac{1}{2} \left[\frac{1}{x} + \log x \right] - \frac{1}{2}$ $\frac{\partial N}{\partial N} = 2\left(1 + \log_{2} C\right) - \log_{2} C$ JA + DX The given egn is not exact diff egn but it is reducable to exact diff egn $\frac{1}{N} \left(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x} \right) = \frac{1}{2x \log x - xy} \left[2 - \left(2 \left(\frac{1 + \log x}{y} \right) - \frac{y}{y} \right) \right]$ $= \chi - \chi - 2\log x + y$ 2x logx -xy $= -2\log x + y$ $-\chi \left(-2\log\chi+y\right)$ $\frac{1}{N}\left(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x}\right) = -\frac{1}{x}$ f(x) = -1

$$m (m+1) (m+2) = 0$$

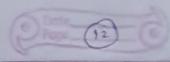
 $-m = 0, -1, -2$

roots are teal and unequal $CF = C_1 e^{m_1 x} + C_2 e^{m_2 x} + C_3 e^{m_3 x}$...

$$CF = C_1 + C_2 e^{-x} + C_3 e^{-2x}$$

$$y = c_1 + c_2 e^{-x} + c_3 e^{-2x} + 1 \left[\frac{x^3 - 3x^2 + 7x}{3} \right] A$$

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Q \neq Solve (D^2 - 2D + 2) y = x, dx = 0
Sol (D^2 - 2D + 2) y = x
        The complete sol is ly = C.F. + P.I. - ()
        For CF Put D=m, y=1
Auxillary eqn is m^2-2m+2=0
                                   m = -6 \pm \sqrt{6^2 - 4ac} = 2 \pm \sqrt{4 - 8}
                                  m = 2 \pm \sqrt{-4} = 1 \pm 2i
                         : a=1, B=1
           CF = exx [C1 cos Bx + C2 sin Bx]
         : CF = Ex [C1 cos x + C2 sinx]
       For PI = 1 Y (D^2-2D+2)
                    = \frac{2\left(1+\left(0^2-20\right)\right)}{2\left(\frac{2}{2}-\frac{20}{2}\right)}
                   = \frac{1}{2} \left[ 1 + \left( \frac{D^2}{2} - D \right) \right]^{-1} \propto
      [(1+x)^{-1}=1-x+x^2-x^3+---]
               PI = \int \left[ -\frac{D^2 - D}{2} + \left( \frac{D^2 - D}{2} \right)^2 - - - \right] x
        PI = \int_{2}^{2} \left[ x - D^{2}x + Dx + D^{4}x + D^{2}x - D^{3}x \right]
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For CF Pot
$$D=m$$
, $y=1$

Auxillory eg^{h} is $m^{2}-2m+1=0$
 $m^{2}-m-m+1=0$
 $m(m-1)-1(m-1)=0$
 $m=1,1$
 $toots$ one real d equal

 $CF=e^{mx}$ $C_{1}+c_{1}x$
 $CF=e^{x}$ $C_{1}+x(c_{2})$

For $PT=1$ C_{2} C_{2} C_{3} C_{4} C_{5} C_{5} C_{6} C_{7} C_{7}

FI =
$$\int \cos ax = \frac{x}{\cos ax} = \frac{x}{\cos ax}$$
, $\int (-a^2) + \delta \cos ax$, $\int (-a^2)$