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BS(CS)-2D

Question # 1

$$(x-y)\,dx + x\,dy = 0$$

$$(x-y)\,dx + x\,dy = 0 \quad \text{—} (1)$$

As the equation is homogenous, so we will make substitutions.

Let $x = vy$, then $dx = v\,dy + y\,dv$.

Putting the values in eq (1), we get

$$(x-y)\,dx + x\,dy = 0$$

$$(vy-y)(v\,dy + y\,dv) + vy\,dy = 0$$

$$v^2y\,dy + vy^2dv - \cancel{vy\,dy} - y^2dv + \cancel{vy\,dy} = 0$$

$$v^2y\,dy + vy^2dv - y^2dv = 0$$

$v^2 y\,dy + vy^2\,dv - y^2\,dv = 0$

$v^2 y\,dy + y^2(v-1)\,dv = 0$

$y\left[v^2\,dy + y(v-1)\,dv\right] = 0.$

$v^2\,dy + y(v-1)\,dv = 0$

$y(-1+v)\,dv + v^2\,dy = 0$

$-\left[y(1-v)\,dv - v^2\,dy\right] = 0$

$y(1-v)\,dv = v^2\,dy$

$\frac{1-v}{v^2}\,dv = \frac{1}{y}\,dy$

Taking integration on both sides.

$$\int \frac{1-v}{v^2}\,dv = \int \frac{1}{y}\,dy$$

$$\int \frac{1}{v^2}\,dv - \int \frac{v}{v^2}\,dv = \int \frac{1}{y}\,dy$$

$$\int \frac{1}{v^2}\,dv - \int \frac{1}{v}\,dv = \int \frac{1}{y}\,dy$$

$$\int v^{-2}\,dv - \ln v + C = \ln y$$

$$\frac{v^{-2+1}}{-2+1} - \ln v + C = \ln y$$

$$\frac{v^{-2+1}}{-2+1} - \ln v + C = \ln y$$

$$\frac{v^{-1}}{-1} - \ln v + C = \ln y$$

$$-\frac{1}{v} - \ln v + C = \ln y \quad \text{— (2)}$$

Put $v = \frac{x}{y}$ in eq (2)

$$-\frac{y}{x} - \ln\frac{x}{y} + C = \ln y$$

$$-\frac{y}{x} = \ln\frac{x}{y} + C + \ln y$$

$$-\frac{y}{x} = \left(\ln y + \ln\frac{x}{y}\right) + C$$

$$-\frac{1}{x}\cdot y = \left(\ln y + \ln\frac{x}{y}\right) + C$$

$$y = -x\left[\left(\ln y + \ln\frac{x}{y}\right) + C\right]$$

$$y = -x\left(\ln y + \ln\frac{x}{y}\right) + Cx$$

As $\ln a + \ln b = \ln ab$, so.

$$y = -x\left(\ln \cancel{y}\cdot\frac{x}{\cancel{y}}\right) + Cx$$

$y = -x \ln x + Cx$ Ans.

Question # 2

$x dx + (y - 2x) dy = 0$

$x dx + (y - 2x) dy = 0$ —— ①

As the equation is homogeneous, so we will make substitution.

Let $y = ux$

$$\frac{dy}{dx} = u + x\frac{du}{dx}$$

$$dy = u dx + x du$$

Putting the values in eq ①, we get.

$$x dx + (ux - 2x)(u dx + x du) = 0$$

$$x dx + [(u-2)x](u dx + x du) = 0$$

$$x dx + xu(u-2) dx + (u-2)x^2 du = 0$$

$$x[1 + u(u-2)] dx + (u-2)x^2 du = 0$$

$$x(1 + u^2 - 2u) dx + (u-2)x^2 du = 0$$

$$x(u-1)^2 dx + (u-2)x^2 du = 0$$

$$x(u-1)^2\,dx + (u-2)x^2\,du = 0$$

$$\frac{(u-2)}{(u-1)^2}\,du = -\frac{1}{x}\,dx$$

Taking integration on b/s.

$$\int \frac{u-1-1}{(u-1)^2}\,du = -\int \frac{1}{x}\,dx$$

$$\int \left(\frac{1}{u-1} - \frac{1}{(u-1)^2}\right) du = -\ln x + C$$

$$\int \frac{1}{u-1}\,du - \int \frac{1}{(u-1)^2}\,du = -\ln x + C$$

$$\ln(u-1) + \frac{1}{u-1} = -\ln x + c \quad -②$$

Putting $u = \frac{y}{x}$ in eq ②

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

$$\ln\left(\frac{y}{x} - 1\right) + \ln x + \frac{x}{y-x} = C$$

$$\ln\left[x\left(\frac{y}{x} - 1\right)\right] + \frac{x}{y-x} = C$$

$$\ln(y-x) + \frac{x}{y-x} = C$$

$$\left[(y-x)\ln(y-x) + x\right] \cdot \frac{1}{y-x} = C.$$

$$(y-x)\ln(y-x) + x = C(y-x). \text{ Ans.}$$

Question # 3

$$(y^2+yx)dx - x^2 dy = 0$$

$$(y^2+yx)dx - x^2 dy = 0 \quad — ①$$

As the equation is homogenous, so we will make substiutions.

Let $y = ux$

$$dy = udx + xdu$$

Putting the values in eq ①, we get.

$$[(ux)^2 + (ux)x]dx - x^2[udx + xdu] = 0$$

$$(u^2x^2 + ux^2)dx - x^2(udx + xdu) = 0$$

$$u^2x^2dx + \cancel{ux^2dx} - \cancel{ux^2dx} - x^3du = 0$$

$$u^2x^2dx - x^3du = 0$$

$$u^2x^2dx = x^3du$$

$$u^2 x^2 \, dx = x^3 \, du$$

$$\frac{x^2}{x^3} dx = \frac{1}{u^2} du.$$

$$\frac{1}{x} dx = \frac{1}{u^2} du$$

Taking integration on b/s.

$$\int \frac{1}{x} dx = \int u^{-2} du$$

$$\ln x + C = -u^{-1} du$$

$$\ln x + c = -\frac{1}{u} \quad \text{—— (2)}$$

Put $u = \frac{y}{x}$ in eq (2)

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

$$\ln x + c = -\frac{x}{y}$$

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

$$\frac{y}{x} = \frac{1}{c - \ln x}$$

$$y = \frac{x}{c - \ln x} \quad \text{Ans.}$$

Question # 4

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

$$\frac{dy}{dx} = \frac{y-x}{y+x} \quad \text{--- (1)}$$

As the equation is homogenous, so we will make substitutions.

Let $y = ux$

$$\frac{dy}{dx} = u + x\frac{du}{dx}$$

Putting the values in eq (1).

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

$$\boxed{u + x\frac{du}{dx}} = \frac{(ux) - x}{(ux) + x}$$

$$u + x\frac{du}{dx} = \frac{ux - x}{ux + x}$$

$$u + x\frac{du}{dx} = \frac{ux - x}{ux + x}$$

$$u + x\frac{du}{dx} = \frac{(u-1)x}{(u+1)x}$$

$$u + x\frac{du}{dx} = \frac{u-1}{u+1}$$

$$x\frac{du}{dx} = \frac{u-1}{u+1} - u$$

$$x\frac{du}{dx} = \frac{(u-1) - [u(u+1)]}{u+1}$$

$$x\frac{du}{dx} = \frac{(u-1) - (u^2+u)}{u+1}$$

$$x\frac{du}{dx} = \frac{\cancel{u} - 1 - u^2 - \cancel{u}}{u+1}$$

$$x\frac{du}{dx} = \frac{-u^2-1}{u+1}$$

$$x\frac{du}{dx} = \frac{-(u^2+1)}{(u+1)}$$

$$\frac{(u+1)}{(u^2+1)}\,du = -\frac{1}{x}\,dx$$

Taking integration on b/s.

$$\int \frac{u+1}{u^2+1}\,du = -\int \frac{1}{x}\,dx$$

$$\int \frac{u}{u^2+1}\,du + \int \frac{1}{u^2+1}\,du = -\ln x + C$$

$$\frac{2}{2}\int \frac{u}{u^2+1}\,du + \tan^{-1}u = -\ln x + C$$

$$\frac{1}{2}\int \frac{2u}{u^2+1}\,du + \tan^{-1}u = -\ln x + C$$

$$\frac{1}{2}\ln(u^2+1)\,du + \tan^{-1}u = -\ln x + C \quad \text{—— (2)}$$

Put $u = \frac{y}{x}$ in eq (2)

$$\frac{1}{2}\ln\left(\left(\frac{y}{x}\right)^2+1\right) + \tan^{-1}\left(\frac{y}{x}\right) = -\ln x + C$$

$$\frac{1}{2}\left[\ln\left[\left(\frac{y}{x}\right)^2+1\right] + 2\tan^{-1}\left(\frac{y}{x}\right)\right] = -\ln x + C$$

$$\ln\left[\left(\frac{y}{x}\right)^2+1\right] + 2\tan^{-1}\left(\frac{y}{x}\right) = -2\ln x + C$$

$$\ln\left(\left(\frac{y}{x}\right)^2+1\right) + 2\tan^{-1}\left(\frac{y}{x}\right) + 2\ln x = C$$

$$\ln\left(\left(\frac{y}{x}\right)^2+1\right)+\ln(x^2)+2\tan^{-1}\left(\frac{y}{x}\right)=C$$

$$\ln\left(\frac{y^2}{x^2}+1\right)+\ln(x^2)+2\tan^{-1}\left(\frac{y}{x}\right)=C.$$

$$\ln\left(\frac{x^2+y^2}{x^2}\right)+\ln(x^2)+2\tan^{-1}\left(\frac{y}{x}\right)=C$$

$$\ln(x^2+y^2)+2\tan^{-1}\left(\frac{y}{x}\right)=C \quad \text{Ans.}$$

Question #5

$$-y\,dx+(x+\sqrt{xy})\,dy=0$$

$$-y\,dx+(x+\sqrt{xy})\,dy=0 \quad -①$$

As the equation is homogeneous, so we will make substitution.

Let $x = vy$

$dx = v\,dy + y\,dv$

Putting the values in eq ①, we get

$$-y\,dx+(x+\sqrt{xy})\,dy=0$$

$$-y(v\,dy+y\,dv)+\left((vy)+\sqrt{(vy)(y)}\right)dy=0$$

$$-vy\cancel{dy} - y^2 dv + vy\cancel{dy} + y\sqrt{v}\,dy = 0$$

$$-y^2 dv + y\sqrt{v}\,dy = 0$$

$$y(-y\,dv + \sqrt{v}\,dy) = 0$$

$$-y\,dv + \sqrt{v}\,dy = 0$$

$$\frac{1}{\sqrt{v}}\,dv = \frac{1}{y}\,dy$$

Taking integration on b/s.

$$\int \frac{1}{\sqrt{v}}\,dv = \int \frac{1}{y}\,dy$$

$$\int (v)^{-1/2}\,dv = \ln y + c$$

$$2\sqrt{v} = \ln y + C. \quad \text{—(2)}$$

Put $v = \frac{x}{y}$ in eq (2), we get

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

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

$$4x = y(\ln y + c)^2 \text{ Ans.}$$

Question # 6

$$xy^2 \frac{dy}{dx} = y^3 - x^3 \quad , \quad y(1) = 2$$

$$xy^2 \frac{dy}{dx} = y^3 - x^3 \quad \text{--- (1)}$$

As the equation is homogeneous, so we will make substitutions.

Let $y = ux$

$$\frac{dy}{dx} = u + x\frac{du}{dx}$$

Putting the values in eq (1), we get.

$$xy^2 \frac{dy}{dx} = y^3 - x^3$$

$$x(ux)^2\left(u + x\frac{du}{dx}\right) = (ux)^3 - x^3$$

$$u^2x^3\left(u + x\frac{du}{dx}\right) = u^3x^3 - x^3$$

$$\cancel{u^3x^3} + u^2x^4\frac{du}{dx} = \cancel{u^3x^3} - x^3$$

$$u^2x^4\frac{du}{dx} = -x^3$$

$$u^2 x^4 \frac{du}{dx} = -x^3$$

$$u^2 x \frac{du}{dx} = -1$$

$$u^2 du = -\frac{1}{x} dx$$

Taking integration on b/s.

$$\int u^2 du = -\int \frac{1}{x} dx$$

$$\frac{1}{3} u^3 = -\ln x + C \quad \text{— (2)}$$

Put $u = \frac{y}{x}$ in eq (2), we get

$$\frac{1}{3}\left(\frac{y}{x}\right)^3 = -\ln x + C$$

$$\frac{1}{3} \frac{y^3}{x^3} = -\ln x + C.$$

$$y^3 = -3x^3 \ln x + 3Cx^3 \quad \text{— (3)}$$

Putting the initial condition in eq (3)

$$(2)^3 = -3(1)^3 \ln(1) + 3C(1)^3$$

$$8 = 0 + 3C$$

$$C = \frac{8}{3}$$

Put the value of c in eq 3

$$y^3 = -3x^3 \ln x + \cancel{3}\left(\frac{8}{\cancel{3}}\right)x^3$$

$$y^3 = -3x^3 \ln x + 8x^3.$$

$$8x^3 = y^3 + 3x^3 \ln x. \text{ Ans.}$$

Question # 7

$$(x + ye^{y/x})\,dx - xe^{y/x}\,dy = 0 \quad , \quad y(1) = 0$$

$$(x + ye^{y/x})\,dx - xe^{y/x}\,dy = 0 \quad — ①$$

As the equation is homogeneous, so we will make substitutions.

Let $y = ux.$

$$dy = u\,dx + x\,du.$$

Putting the values in eq ①, we get.

$$(x + ye^{y/x})\,dx - xe^{y/x}\,dy = 0$$

$$(x + (ux)e^{(ux)/x})\,dx - xe^{(ux)/x}(u\,dx + x\,du) = 0$$

$$(x + uxe^u)\,dx - xe^u(u\,dx + x\,du) = 0$$

$$x\,dx + \cancel{uxe^u\,dx} - \cancel{uxe^u\,dx} - x^2e^u\,du = 0$$

$x\,dx - x^2 e^u\,du = 0$

$x(dx - x e^u\,du) = 0$

$dx - x e^u\,du = 0$

$e^u\,du = \frac{1}{x}\,dx$

Taking integration on b/s.

$\int e^u\,du = \int \frac{1}{x}\,dx$

$e^u = \ln x + C$ — (2)

Putting the value of $u = \frac{y}{x}$ in eq (2).

$e^{y/x} = \ln x + C$. — (3)

Putting the initial condition in eq (3)

$e^{0/1} = \ln(1) + C$.

$1 = 0 + C$.

$C = 1$

Put C in eq (3)

$e^{y/x} = \ln x + 1$ Ans.

Question # 8

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

$$x\frac{dy}{dx} + y = \frac{1}{y^2} \quad \text{— (1)}$$

Dividing both sides by x and Multiplying both sides by y^2 to get the standard form.

i.e

$$\frac{dy}{dx} + P(x)y = f(x)y^n$$

$$y^2\frac{dy}{dx} + \frac{y^3}{x} = \frac{1}{x} \quad \text{— (2)}$$

Let $\quad u = y^3$

$$\frac{du}{dy} = 3y^2$$

$$\frac{dy}{du} = \frac{1}{3y^2}$$

To find the value of $\frac{dy}{dx}$ we will use chain rule

$$\frac{dy}{dx} = \frac{dy}{du}\frac{du}{dx}$$

$$\frac{dy}{dx} = \frac{dy}{du}\frac{du}{dx}.$$

$$\frac{dy}{dx} = \frac{1}{3y^2}\frac{du}{dx}$$

Putting the value of $\frac{dy}{dx}$ and y^3 in eq (2), we get

$$y^2\left[\frac{1}{3y^2}\cdot\frac{du}{dx}\right] + \frac{u}{x} = \frac{1}{x}$$

$$\frac{1}{3}\frac{du}{dx} = \frac{1}{x} - \frac{u}{x}$$

$$\frac{1}{3}\frac{du}{dx} = \frac{(1-u)}{x}$$

$$\frac{du}{1-u} = \frac{3}{x}dx$$

Taking integration on b/s.

$$\int\frac{du}{1-u} = \int\frac{3}{x}dx$$

$$-\ln(1-u) = 3\ln x \cancel{dx} + c$$

$$\ln\left(\frac{1}{1-u}\right) = \ln x^3 + c$$

$$\ln\left(\frac{1}{1-u}\right) = \ln x^3 + c$$

$$\ln\left(\frac{1}{1-u}\right) = \ln x^3 C$$

$$\frac{1}{1-u} = Cx^3.$$

$$1-u = \frac{1}{Cx^3}$$

$$u = 1 - \frac{1}{Cx^3} \quad \text{— (3)}$$

Put $u = y^3$ in eq (3)

$$y^3 = 1 - \frac{1}{Cx^3}$$

$$y^3 = 1 + Cx^{-3} \quad \text{Ans.}$$

Question # 9

$$\frac{dy}{dx} = y(xy^3 - 1)$$

$$\frac{dy}{dx} = y(xy^3 - 1) \quad \text{— (1)}$$

Arranging into standard form.

$$\frac{dy}{dx} = xy^4 - y$$

$$\frac{dy}{dx} = xy^4 - y$$

$$\frac{dy}{dx} + y = xy^4$$

Divide both sides by y^4

$$\frac{1}{y^4}\frac{dy}{dx} + \frac{1}{y^3} = x \quad \text{—(2)}$$

Let

$$u = \frac{1}{y^3}$$

$$\frac{du}{dy} = -\frac{3}{y^4}$$

$$\frac{dy}{du} = -\frac{y^4}{3}$$

To find the value of $\frac{dy}{dx}$ we will use chain rule

$$\frac{dy}{dx} = \frac{dy}{du}\frac{du}{dx}$$

$$\frac{dy}{dx} = -\frac{y^4}{3}\frac{du}{dx}$$

Putting the values in eq (2)

$$\frac{1}{y^4}\left(-\frac{y^4}{3}\frac{du}{dx}\right) + u = x$$

$$-\frac{1}{3}\frac{du}{dx} + u = x$$

$$\frac{du}{dx} - 3u = -3x$$

As we know that

integrating factor $= \mu(x) = e^{\int p(x)dx}$, so

$P(x) = -3$. so

$$e^{\int -3\,dx} = e^{-3x}$$

Multiplying both sides with the integrating factor.

$$e^{-3x}\left(\frac{du}{dx} - 3u\right) = e^{-3x}(-3x)$$

$$\cancel{e^{-3x}\frac{du}{dx}}$$

$$\frac{d}{dx}\left(e^{-3x}u\right) = -3xe^{-3x}$$

Taking integration on b/s.

$$\int \frac{d}{dx}(e^{-3x}u) = \int -3xe^{-3x}\,dx$$

$$e^{-3x}u = \int -3xe^{-3x}\,dx.$$

As we know that

$$\int AB\,dx = A\int B\,dx - \int (\textstyle\int B\,dx)\cdot A'\,dx \text{ , so.}$$

$$e^{-3x}u = -3\cdot x\int e^{-3x}\,dx - \int (\textstyle\int e^{-3x}\,dx)\cdot \frac{d}{dx}(x)\,dx$$

$$e^{-3x}u = \cancel{-3}x\cdot\frac{e^{-3x}}{\cancel{-3}} - \int\left(\frac{e^{-3x}}{-3}\right)\cdot 1\,dx$$

$$e^{-3x}u = xe^{-3x} + \frac{1}{3}e^{-3x} + C$$

$$e^{-3x}u = xe^{-3x} + \frac{1}{3}e^{-3x} + C.$$

$$u = x + \frac{1}{3}\cancel{e^{-3x}}\cdot\left(\frac{1}{\cancel{e^{-3x}}}\right) + \frac{C}{e^{-3x}}$$

$$u = x + \frac{1}{3} + Ce^{3x}$$

Put $u = \frac{1}{y^3}$

$$y^{-3} = x + \frac{1}{3} + Ce^{3x} \text{ Ans.}$$

Question # 10

$$t^2\frac{dy}{dt} + y^2 = ty$$

Dividing t^2 on both sides and (multiplying) rearrange to become standard form

$$\frac{dy}{dt} - \frac{y}{t} = -\frac{y^2}{t^2}$$

Now divide both sides by y^2

$$\frac{1}{y^2}\frac{dy}{dt} - \frac{1}{t}\frac{1}{y} = -\frac{1}{t^2} \quad -(1)$$

Let

$$u = \frac{1}{y}$$

$$\frac{du}{dy} = -\frac{1}{y^2}$$

$$\frac{dy}{du} = -y^2$$

To find $\frac{dy}{dt}$ we will use chain rule

$$\frac{dy}{dt} = \frac{dy}{du}\frac{du}{dt}$$

$$\frac{dy}{dt} = -y^2\frac{du}{dt}$$

$$\frac{1}{y^2}\left(-y^2\frac{du}{dt}\right)-\frac{1}{t}(u)=-\frac{1}{t^2}$$

$$\frac{du}{dt}+\frac{1}{t}u=\frac{1}{t^2}$$

Now we will find integrating factor.

$$e^{\int \frac{1}{t}dt}=e^{\ln t}=t.$$

Multiplying both sides by integrating factor

$$t\left(\frac{du}{dt}+\frac{1}{t}u\right)=t\left(\frac{1}{t^2}\right)$$

$$\frac{d}{dt}(tu)=\frac{1}{t}$$

Now taking integration on b/s.

$$\int\frac{d}{dt}(tu)=\int\frac{1}{t}dt$$

$$tu=\ln t+c.$$

Taking e on b/s.

$$e^{tu}=e^{\ln t}+c.$$

$$e^{tu}=Ce^{\ln t}$$

$$e^{tu} = Ce^{\ln t}$$

$$e^{tu} = Ct$$

Put $u = \frac{1}{y}$

$$e^{t(1/y)} = Ct$$

$$e^{(t/y)} = Ct \quad \text{Ans.}$$

Question # 11

$$x^2 \frac{dy}{dx} - 2xy = 3y \quad , \quad y(1) = \frac{1}{2}$$

$$x^2 \frac{dy}{dx} - 2xy = 3y \quad -(1)$$

Dividing both sides by x^2 to get the standard form

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

Divide both sides by y^4

$$\frac{1}{y^4}\frac{dy}{dx} - \frac{2}{x}\frac{1}{y^3} = \frac{3}{x^2} \quad -(2)$$

Let $u = \frac{1}{y^3}$

$$u = \frac{1}{y^3}$$

$$\frac{du}{dy} = \frac{-3}{y^4}$$

$$\frac{dy}{du} = -\frac{y^4}{3}.$$

To find the value of $\frac{dy}{dx}$ we will use chain rule.

$$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$$

$$\frac{dy}{dx} = -\frac{y^4}{3}\frac{du}{dx}$$

Putting the values in eq ② we get.

$$\frac{1}{\cancel{y^4}}\left(\frac{-\cancel{y^4}}{3}\frac{du}{dx}\right) \cancel{+} - \frac{2}{x}(u) = \frac{3}{x^2}$$

$$-\frac{1}{3}\frac{du}{dx} - \frac{2}{x}u = \frac{3}{x^2}$$

$$\frac{du}{dx} + \frac{6}{x}u = \frac{-9}{x^2}$$

Now we will find integrating factor.

$e^{\int \frac{6}{x} dx} = e^{6 \ln x} = e^{\ln x^6} = x^6$

Multiplying both side by integrating factor

$$x^6 \left(\frac{du}{dx} + \frac{6}{x} u \right) = x^6 \left(-\frac{9}{x^2} \right)$$

$$\frac{d}{dx} (x^6 u) = -9x^4$$

Taking integration on b/s.

$$\int \frac{d}{dx} (x^6 u) = -\int 9x^4 \, dx.$$

$$x^6 u = -\frac{9}{5} x^5 + C.$$

$$u = \frac{-9}{5x} + C x^{-6}$$

Put ~~y~~ $u = \frac{1}{y^3}$

$$\frac{1}{y^3} = \frac{-9}{5x} + C x^{-6}$$

Now substituting the initial condition $y(1) = \frac{1}{2}$

$$\left(\frac{1}{2}\right)^{-3} = -\frac{9}{5(1)} + C(1)^{-6}$$

$$C = \frac{49}{5}$$

$$y^{-3} = -\frac{9}{5x} + \frac{49}{5} x^{-6}$$ Ans.