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Exa. Solve $\frac{dy}{dx} = -\frac{4x^3y^2 + y\cdot\cos(xy)}{2x^4y + x\cdot\cos(xy)}$

Solution: Given D.E. is, $\frac{dy}{dx} = -\left[\frac{4x^3y^2 + y\cdot\cos(xy)}{2x^4y + x\cdot\cos(xy)}\right]$

$$(2x^4y + x\cdot\cos(xy))dy = -(4x^3y^2 + y\cdot\cos(xy))dx$$

$$(4x^3y^2 + y\cdot\cos(xy))dx + (2x^4y + x\cdot\cos(xy))dy = 0$$

Here, $M = 4x^3y^2 + y\cdot\cos(xy)$, $N = 2x^4y + x\cdot\cos(x$

$$M_y = 8x^3y + \cos(xy) - y\sin(xy)x$$

$$N_x = 8x^3y + \cos(xy) - x\cdot\sin(xy)y$$

$\therefore$ $M_y = N_x$

$\therefore$ Given D.E is exact D.E.

General solution for given D.E. is,

$$\int_{y=c} M\,dx + \int(\text{Terms in 'N' does not contain } x)dy$$

$$\int[4x^3y^2 + y\cdot\cos(xy)]dx + \int 0\,dy = c$$

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

$$\boxed{x^4y^2 + \sin(xy) = c}$$