Find dy/dx.

1) $4x^2y - 3y = x^3 - 1$

Method of Separating Variables:

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

$$y = \frac{x^3 - 1}{4x^2 - 3}$$

$$\frac{dy}{dx} = \frac{(4x^2 - 3) \cdot 3x^2 - (x^3 - 1) \cdot 8x}{(4x^2 - 3)^2}$$

Find dy/dx.

1) $4x^2y - 3y = x^3 - 1$

Method of Implicit Differentiation:

$-3 \cdot y$

$0 \cdot y - 3\frac{dy}{dx}$

$$8x \frac{dx}{dx} y + 4x^2 \frac{dy}{dx} - 3\frac{dy}{dx} = 3x^2 \frac{dx}{dx}$$

$$8xy + 4x^2 \frac{dy}{dx} - 3\frac{dy}{dx} = 3x^2$$

$$4x^2 \frac{dy}{dx} - 3\frac{dy}{dx} = 3x^2 - 8xy$$

$$\frac{dy}{dx}(4x^2 - 3) = 3x^2 - 8xy$$

$$\frac{dy}{dx} = \frac{3x^2 - 8xy}{4x^2 - 3}$$

Implicit Differentiation:
taking the derivative when there are multiple variables

$$\frac{d}{dx}$$

Ex.

$x \xrightarrow{Der.} \frac{dx}{dx} = 1$

$x^3 \xrightarrow{Der} 3x^2 \frac{\cancel{dx}}{\cancel{dx}}$

$y^3 \xrightarrow{Der.} 3y^2 \frac{dy}{dx}$
$\qquad\quad \underset{3}{\sim} \underset{y}{\sim}$

$\frac{dy}{dx} = $ derivative of y with respect to x

$\qquad\quad = $ slope at that point

2) $y^3 + 7y = x^3$

3) $1 = x^2 y + y$

$3y^2 \dfrac{dy}{dx} + 7\dfrac{dx}{dx} = 3x^2$

$\dfrac{dy}{dx}(3y^2 + 7) = 3x^2$

$\dfrac{dy}{dx} = \dfrac{3x^2}{3y^2 + 7}$

4) $4x^3 + 5xy^2 - 2y^2 = 6$

5) $y^3 - xy^2 + \cos(xy) = 2$