(1) $x^2 = \frac{x+y}{x-y}$

$x^3 - x^2 y = x + y$ cross multiply

$3x^2 \quad (-x^2)\left(\frac{dy}{dx}\right) + (y)(-2x) = 1 + \frac{dy}{dx}$ derivatives

$3x^2 - x^2\frac{dy}{dx} - 2xy = 1 + \frac{dy}{dx}$ clean up

$3x^2 - 2xy - 1 = \frac{dy}{dx} + x^2\frac{dy}{dx}$ Sort to correct sides

$3x^2 - 2xy - 1 = \frac{dy}{dx}\left(1 + x^2\right)$ factor

$\frac{3x^2 - 2xy - 1}{1 + x^2} = \frac{dy}{dx}$ divide

(2) $\cos(xy) = y$

$(-\sin(xy))\left((x)\left(\frac{dy}{dx}\right) + (y)(1)\right)$ chain rule $= \frac{dy}{dx}$

$-\sin(xy)\left(x\frac{dy}{dx} + y\right) = \frac{dy}{dx}$ ← distribute

$-x\sin(xy)\frac{dy}{dx} - y\sin(xy) = \frac{dy}{dx}$

$-y\sin(xy) = \frac{dy}{dx} + x\sin(xy)\frac{dy}{dx}$ sort to correct sides

$-y\sin(xy) = \frac{dy}{dx}\left(1 + x\sin(xy)\right)$ Factor

$\frac{dy}{dx} = \frac{-y\sin(xy)}{1 + x\sin(xy)}$ Divide

(3) $x^3y^2 + y = 5$

$a\,b' + b\,a'$

$(x^3)(2y\frac{dy}{dx}) + (y^2)(3x^2) + 1\frac{dy}{dx} = 0$ Derivative

$2x^3y\frac{dy}{dx} + 3x^2y^2 + 1\frac{dy}{dx} = 0$ Clean-up

$2x^3y\frac{dy}{dx} + 1\frac{dy}{dx} = -3x^2y^2$ Sort to correct side

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

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

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

x^3y^2 | $-2xy$ | $= 4x$

$a\,b' + b\,a'$ | $ab' + ba'$

$(x^3)(2y\frac{dy}{dx}) + (y^2)(3x^2)$ | $(-2x)(\frac{dy}{dx}) + y(-2)$ | $= 4$ Derivative

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

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

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

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

(5) $x^3 + 2y^4 = 3$ @ $(1, -1)$

$3x^2 + 8y^3 \frac{dy}{dx} = 0$ Derivative

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

$\frac{dy}{dx} = \frac{-3x^2}{8y^3}$ Divide ← This is the slope! (m)

$y - y_1 = m(x - x_1)$

$y - -1 = \frac{-3x^2}{8y^3}(x - 1)$

$y + 1 = \frac{-3(1)^2}{8(-1)^3}(x - 1)$ Plug point to give value of m

$y + 1 = \frac{3}{8}(x - 1)$

(6) $x^2y + 7y = 2x$ @ $(3, 2)$

ab' + ba'

$(x^2)(\frac{dy}{dx}) + (y)(2x) + 7\frac{dy}{dx} = 2$ Derivative

$x^2 \frac{dy}{dx} + 2xy + 7\frac{dy}{dx} = 2$ Clean up

$x^2 \frac{dy}{dx} + 7\frac{dy}{dx} = 2 - 2xy$ Sort

$\frac{dy}{dx}(x^2 + 7) = 2 - 2xy$ Factor

$\frac{dy}{dx} = \frac{2 - 2xy}{x^2 + 7}$ Divide ← This is the slope! (m)

$y - y_1 = m(x - x_1)$

$y - 2 = \frac{2 - 2xy}{x^2 + 7}(x - 3)$

$y - 2 = \frac{2 - 2(3)(2)}{(3)^2 + 7}(x - 3)$ Plug in point to find value of m

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