Point - Slope

$y - y_1 = m(x - x_1) \rightarrow \boxed{y = y_1 + m(x - x_1)}$

Tangent Line * Find slope at the given point - Take derivative * Find the point of tangency - Plug x into the original eq.	Find the equation for the tangent line at the given point Q) $y = \frac{x^5 + 2x}{x^2}$ at x = 1 $\quad (1, 3)$ with x_1, y_1 $y = \frac{x^5+2x}{x^2}$ $\frac{dy}{dx} = \frac{x^2(5x^4+2) - (x^5+2x)(2x)}{(x^2)^2}$ $\frac{dy}{dx}\Big\vert_{x=1} = \frac{(5+2) - (1+2)(2)}{1} = 1$ $\frac{dy}{dx}\Big\vert_{x=1} = 1 \leftarrow m$ $\boxed{y = 3 + 1(x-1)}$ R) $y = 5x^2 + 3$ at x = 3 $y = 5x^2 + 3 \quad x = 3$ $(3, 48)$ with x_1, y_1 $\frac{dy}{dx} = 10x$ $\frac{dy}{dx}\Big\vert_{x=3} = 10(3) = 30$ $\boxed{y = 48 + 30(x-3)}$
	S) Find an equation of the line perpendicular to the tangent to the curve y =4x^3 - 6x + 2 at the point (2, 22). x_1, y_1 (normal) slope opposite reciprocal $\frac{dy}{dx} = 12x^2 - 6$ $\frac{dy}{dx}\Big\vert_{x=2} = 12(2)^2 - 6 = 42$ $\boxed{y = 22 - \frac{1}{42}(x-2)}$
Horizontal Tangents (slope = 0)	T) Find the points on the curve y = x^3 - 3x^2 - 9 where the tangent is parallel to the x-axis plug into original $y = x^3 - 3x^2 - 9$ $\frac{dy}{dx} = 3x^2 - 6x$ $0 = 3x^2 - 6x$ $0 = 3x(x-2)$ $x = 0$ $(0, -9)$ $x = 2$ $(2, -13)$ $2^3 - 3(2)^2 - 9$ $8 - 12 - 9$

U) Suppose u and v are differentiable functions at x = 2 and $u(2) = 3$, $u'(2) = 3$, $v(2) = 1$, $v'(2) = 2$

i) Find $\frac{d}{dx}(uv)$ $= u\left(\frac{dv}{dx}\right) + v\left(\frac{du}{dx}\right) = u \cdot v' + v(u')$

$u(2) \cdot v'(2) + v(2)\,u'(2)$

$(3)\ (2) + (1)(3)$

9

$\boxed{\frac{d}{dx}(uv) = 9}$

ii) Find $\frac{d}{dx}\left(\frac{u}{v}\right)$ $= \frac{v(u') - u(v')}{v^2} = \frac{(1)(3) - 3(2)}{1^2}$

iii) Find $\frac{d}{dx}(3u - 2v + 2uv)$

V) Find the derivative of y = x with respect to x

W) Find the derivative of y = x with respect to t

X) Find the derivative of y = x with respect to P