

Take the Derivative of the function

M) $f(x) = \frac{x^4}{2-x^2}$

N) $f(x) = (5-x^2)(3-x)^{-1}$

O) $f(x) = \frac{(x+3)(x-4)}{(x+1)(x-3)}$

P) $f(x) = \frac{\sqrt[3]{x}+1}{\sqrt[3]{x}-1}$

$$f(x) = \frac{x^{1/3} + 1}{x^{1/3} - 1}$$

$$f'(x) = \frac{\left(x^{1/3} + 1\right)\left(\frac{1}{3}x^{-2/3}\right) - \left(x^{1/3} + 1\right)\left(\frac{1}{3}x^{-2/3}\right)}{\left(x^{1/3} - 1\right)^2}$$

$$\frac{1}{3}x^{1/3} - \frac{1}{3}x^{-2/3} - \frac{1}{3}x^{1/3} - \frac{1}{3}x^{-2/3}$$

$$f'(x) = \frac{-\frac{2}{3}x^{-2/3}}{\left(x^{1/3} - 1\right)^2} = \frac{-\frac{2}{3}x^{-2/3}}{\left(x^{1/3} - 1\right)^2}$$

$$\left(\frac{1}{25}\right)$$

$$\frac{2}{5} \div 7$$

$$\frac{2}{5} \cdot \frac{1}{7}$$

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$$\frac{-2}{3\sqrt[3]{x^2}(\sqrt[3]{x}-1)^2} = \frac{-2}{3x^{2/3}(x^{1/3}-1)^2}$$

$$\frac{y - y_1}{x - x_1} = m$$

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

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

Point Slope Equation

$$y = y_1 + \frac{dy}{dx}(x - x_1)$$

- Point
- derivative

Slope is
opposite reciprocal

Find the equation for the tangent line at the given point

Q) $y = \frac{x^5 + 2x}{x^2}$ at $x = 1$

(x_1, y_1)

$(1, 3)$

R) $y = 5x^2 + 3$ at $x = 3$

Point $(3, 48)$

Slope $= \frac{dy}{dx} = 10x$

$\left. \frac{dy}{dx} \right|_{x=3} = 30$

$y = 48 + 30(x - 3)$

Tangent Line

$$\frac{dy}{dx} = \frac{x^2(5x^4 + 2) - (x^5 + 2x)(2x)}{(x^2)^2}$$

$$\left. \frac{dy}{dx} \right|_{x=1} = \frac{(1) - 6}{1} = 1$$

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

S) Find an equation of the line perpendicular to the tangent to the curve $y = 4x^3 - 6x + 2$ at the point $(2, 22)$.

$$\frac{dy}{dx} = 12x^2 - 6$$

Tangent Line $y = 22 + 42(x - 2)$

$$\left. \frac{dy}{dx} \right|_{x=2} = 42$$

Perpendicular Line (Normal Line) $y = 22 - \frac{1}{42}(x - 2)$

T) Find the points on the curve $y = x^3 - 3x^2 - 9$ where the tangent is parallel to the x-axis

$$\frac{dy}{dx} = 0 \quad (\text{Horizontal Tangents})$$

$$0 = 3x^2 - 6x$$

$$x = 0 \quad x = 2$$

$$0 = 3x(x - 2)$$

$$(0, -9) \quad (2, -13)$$