

1. For each of the following determine $y' = \frac{dy}{dx}$.

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

$$x + \sin(y) = xy$$

2. Determine all points where the tangent line to $x^4 + y^2 = 3$ is horizontal or vertical.

3. *Before the development of the Calculus, Fermat had developed a method of finding tangents. When Descartes was informed of Fermat's method, he didn't believe it and challenging Fermat to find the tangent to the curve $x^3 + y^3 = 2xy$, predicting that he would fail. Descartes was unable to solve the problem himself and was intensely irritated when Fermat solved it easily.*

Given $x^3 + y^3 = 2xy$ determine the equation of the tangent line at the point $(1, 1)$.

A normal line is defined to be the line perpendicular to the tangent line at the point of tangency. Find the normal line to $x^3 + y^3 = 2xy$ at the point $(1, 1)$.

4. Time permitting, determine $y'' = \frac{d^2y}{dx^2}$ for the equations in problem 1.