

Exercise 1 Find $\frac{dy}{dx}$ by implicit differentiation.

(a) $x^3 - xy^2 + y^3 = 1$

(b) $\cos(xy) = 1 + \sin(y)$

(c) $xy = \sqrt{x^2 + y^2}$

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

Exercise 2 Use implicit differentiation to find an equation of the tangent line to the curve

$$x^{2/3} + y^{2/3} = 4$$

at the point $(-3\sqrt{3}, 1)$. The curve is called the astroid.

Exercise 3 The curve with equation $y^2 = x^3 + 3x^2$ is called the Tschirnhausen cubic.

(a) Find an equation of the tangent line to this curve at the point $(1, -2)$.

(b) At what points does this curve have horizontal tangents?

(c) Illustrate parts (a) and (b) by graphing the curve and the tangent lines.

Exercise 4 Find y'' by implicit differentiation.

(a) $x^2 + xy + y^2 = 3$

(b) $x^3 - y^3 = 7$