

Warm-up. Differentiate the functions below, assuming that f is differentiable.

1. $F(x) = x^2 - (f(x))^2$

2. $G(x) = x^2 + x(f(x)) + (f(x))^2$

Concept: What is the idea behind implicit differentiation?

Steps for implicit differentiation.

1. Sub in $y = f(x)$.
2. Differentiate both sides with respect to x .
3. Un-sub: put y back in, and put in $\frac{dy}{dx}$ in place of $f'(x)$.
4. Solve for $\frac{dy}{dx}$.

Exercises.

1. Determine $\frac{dy}{dx}$ for $x^2 - y^2 = 1$.

(a) What is the slope of the tangent line at the point $(\sqrt{2}, 1)$?

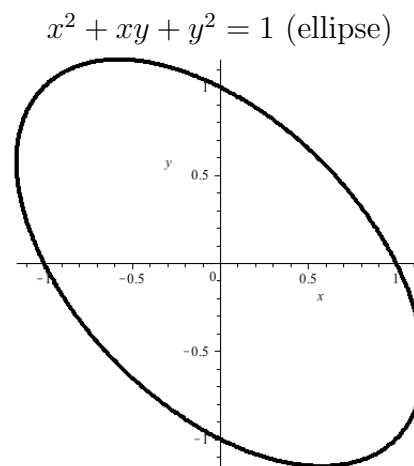
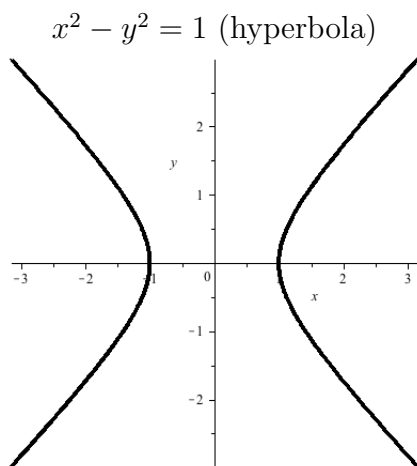
(b) Determine all points at which the curve has a *vertical tangent*.

2. Determine $\frac{dy}{dx}$ for $x^2 + xy + y^2 = 1$. Then determine all points where the curve has a horizontal tangent.

3. Determine $\frac{dy}{dx}$ for $x^3 - 3xy + y^3 = 0$.

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

5. Determine $\frac{dy}{dx}$ for $e^{2x+3y} = \sin(x)$.



$x^3 - 3xy + y^3 = 0$ (folium of Descartes)

