Implicit Differentiation Trick – for applied calculus students
(Note: Not really a trick but requires more advanced calculus to understand why it works)

This method greatly simplifies implicit differentiation.

You need to know how to take partial derivatives, F_x and F_y…very simple…treat everything as a constant except the variable of interest.

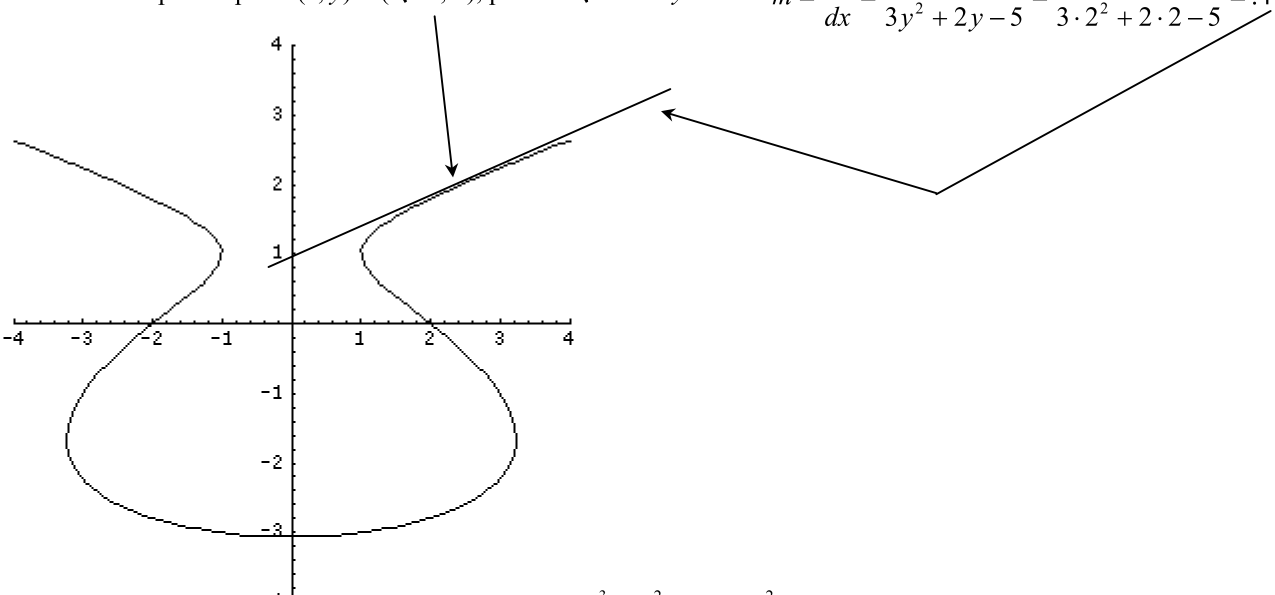
If $F(x, y) = x^2 + y^2 - 4$, then
$F_x(x, y) = 2x$ and $F_y(x, y) = 2y$.
For $F_x(x, y)$, treat everything in $x^2 + y^2 - 4$ except *x* as a constant.
For $F_y(x, y)$, treat everything in $x^2 + y^2 - 4$ except *y* as a constant.

Then $\frac{dy}{dx} = -\frac{F_x(x, y)}{F_y(x, y)} = -\frac{2x}{2y} = -\frac{x}{y}$.

Example: Find $\frac{dy}{dx}$ given $y^3 + y^2 - 5y = x^2 - 4$.

Set equal to 0. $0 = y^3 + y^2 - 5y - x^2 + 4$.
Define *F* as $F(x, y) = y^3 + y^2 - 5y - x^2 + 4$.
Then you have $F_x(x, y) = -2x$ and $F_y(x, y) = 3y^2 + 2y - 5$
and it follows that $\frac{dy}{dx} = -\frac{F_x(x, y)}{F_y(x, y)} = -\frac{-2x}{3y^2 + 2y - 5} = \frac{2x}{3y^2 + 2y - 5}$.

To find the slope at a point (*x*, *y*) = ($\sqrt{6}$, 2), put *x* = $\sqrt{6}$ and *y* = 2 in $m = \frac{dy}{dx} = \frac{2x}{3y^2 + 2y - 5} = \frac{2 \cdot \sqrt{6}}{3 \cdot 2^2 + 2 \cdot 2 - 5} = .445 = m$.



$y^3 + y^2 - 5y = x^2 - 4$

Graphed at:
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