Math 111 Homework for Friday, Week 6
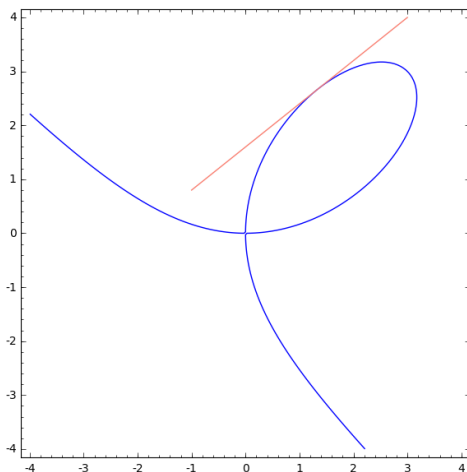
PROBLEM 1. Use linearity, the product rule, the quotient rule, and the chain rule to compute the derivatives of the following functions (using the essential derivatives handout, if necessary).

(i) $(6x + 5)^7(x + 4)^5$

(ii) $\sqrt{x}\sin(x)$

(iii) $\cos(x^4 + 3x + 4)$

(iv) $\frac{x+2}{x-5}$

(v) $\ln(\tan(x^4))$

(vi) $\cos^2(x) + \sin^2(x)$.

PROBLEM 2. Consider the curve in the plane defined as the set of points satisfying
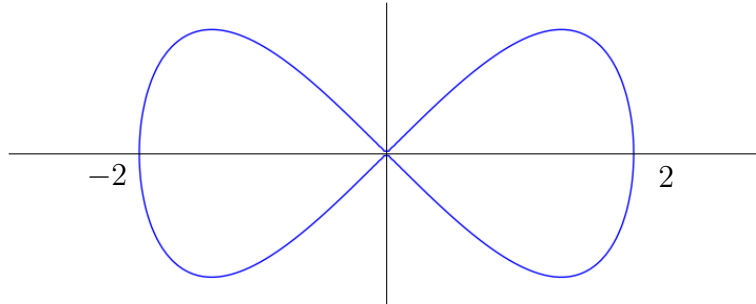
$$x^3 + y^3 - 6xy = 0.$$

The curve is pictured below:

The point $(4/3, 8/3)$ sits on the curve (i.e., $x = 4/3$ and $y = 8/3$ satisfies the equation). Find the equation of the tangent line at $(4/3, 8/3)$.

PROBLEM 3. Consider the figure eight curve, shown below, whose points (x, y) satisfy

$$x^4 = 4(x^2 - y^2).$$

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Find the coordinates of the four points on the curve where the tangent line is horizontal. (You can use the fact that the slope is not horizontal at the origin.)

PROBLEM 4. A person who is 6 feet tall walks at a rate of 4 feet per second away from a light that is 12 feet above the ground as shown below.

(a) At what rate is the tip of the person's shadow moving when the person is k feet from the light?

(b) As time goes on, is that rate constant? increasing? decreasing?

(c) At what rate is the length of the shadow increasing when the person is k feet from the light?

(d) As time goes on, is that rate constant? increasing? decreasing?