

Math 130 Day 20

Office Hours (LN 301/301.5): M 3:30-4:30, Tu 11:00-1:00, W 12:15-1:15, F 1:30-2:30. Other times by appointment. **Math Intern:** Sun through Thurs: 3:00–6:00, 7:00–10:00pm. **Website:** Use the links at the course homepage on **Canvas** or go to my course Webpage: <http://math.hws.edu/~mitchell/Math130F16/index.html>.

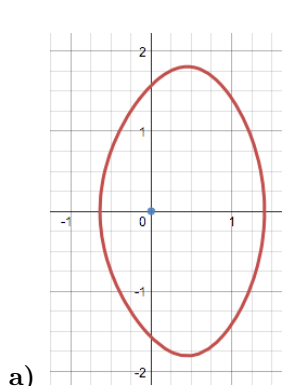
Today we will examine the implicit differentiation. The chain rule is the key. Next time we will determine the derivatives of the natural log function ($y = \ln x$) and general exponential functions ($y = a^x$).

Reading and Practice

1. Read Section 3.8 on Implicit Differentiation. Then read the first few pages (203–205) of Section 3.9. This section develops the derivative formula for the natural log function and then for an arbitrary exponential function $f(x) = b^x$. These are fun results.
2. a) Implicit differentiation practice: Page 200 #7, 9, 17, 21, 25, 27.
b) Use the chain rule: #35 and 37.
c) Try #49. When $x = 1$ you will need to find the two y -values on the curve (substitute $x = 1$ into the equation $x^2 + y^2 - y = 1$ and solve for y). Then find the tangents at each.

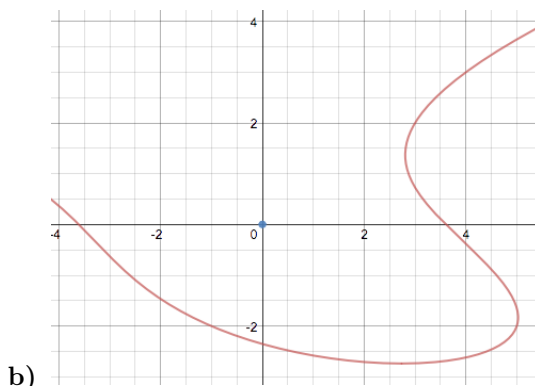
Some graphs of implicitly defined functions

Try finding $\frac{dy}{dx}$ for any of these that we do not discuss today.



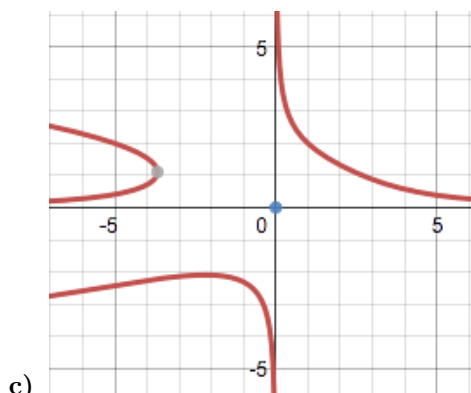
a)

a) $\cos(y) + \sin(x) = x^2$



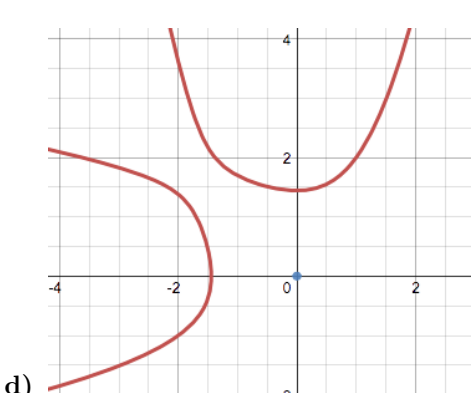
b)

b) $x^2 + 2xy = 13 + y^3$



c)

c) $xy^3 + x^2y = 10$



d)

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

☛ Solution (to question on bottom of next page): $\frac{d}{dx}(xy^2 - x^3y) = \frac{d}{dx}(20) \implies y^2 + 2xy\frac{dy}{dx} - 3x^2y - x^3\frac{dy}{dx} = 0$. So

$$2xy\frac{dy}{dx} - x^3\frac{dy}{dx} = 3x^2y - y^2 \implies (2xy - x^3)\frac{dy}{dx} = 3x^2y - y^2 \implies \frac{dy}{dx} = \frac{3x^2y - y^2}{2xy - x^3}.$$

Math 130. Day 20 Hand In. Name: _____

0. a) WeBWork Set Day 20 on implicit differentiation. Due Monday evening. Many are identical to the hand-in problems.
b) WeBWork Set Day20ChainRuleReview. Lots of problems. Due Wednesday evening. Try them sooner. Good review.
1. Page 200 #8. Show your work. (WeBWork Day 20 Problem 3. Check your answer!)

2. Page 200 #9 Check answer in the back of text. Show your work.

Before doing the next problems try this one—the answer is at the bottom of page 1. Find $\frac{dy}{dx}$ given that $xy^2 - x^3y = 20$. Be careful using the product rule.

3. Page 200 #14. Be careful taking the derivative and then solving for $\frac{dy}{dx}$. (WeBWorK Day 20 Problem 4. Check your answer!) Show your work.

4. Page 200 #26. Read the instructions. (WeBWorK Day 20 Problem 6. Check your answer!) Show your work.

5. Page 200 #28. Show your work. (WeBWorK Day 20 Problem 7. Check your answer!)

6. An easy one to finish: Find dy/dx if $x^2y - x - 8y - 11 = 0$. (Very similar to WeBWorK Day 20 Problem 8.)