

Math 1210-2

Friday Sept. 28

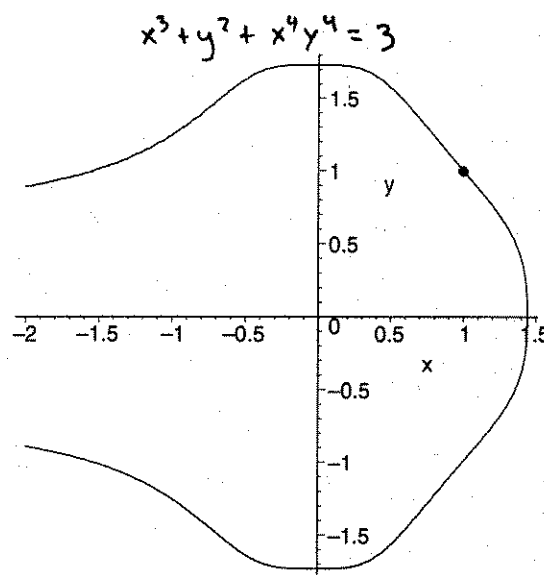
§2.7-2.8 implicit differentiation and related rates

• Finish Exercise 3 Wednesday

Exercise 1 Consider the graph of the equation $x^3 + y^2 + x^4 y^4 = 3$.

1a) Verify that $(1, 1)$ is on the graph.

1b) From the plot it appears that the portion of the graph in the first quadrant is the graph of some function $y = f(x)$, for which the explicit formula would be messy. Use implicit differentiation to find $f'(1)$ (which will be the slope of the graph at $(1, 1)$.)



Related rates 62.8

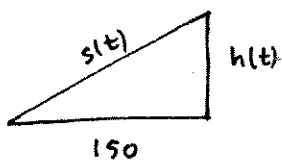
2

A very important application of implicit differentiation and the chain rule. These are problems involving several related functions of time, in which you must find how fast one of them is changing from given function values and (other) given rates.

Exercise 2 (p. 135) A balloon is released 150' away from an observer and rises 8'/sec (' means feet)

When the height of the balloon is 50', how fast is the distance from the observer changing?

①



④

②

⑤

③

- steps
- ① construct diagram with relevant functions (and constants) labeled
 - ② what is known, what is wanted? express mathematically
 - ③ relate the known & unknown functions with an equation (or more than one equation)
 - ④ differentiate with respect to time, in ③
 - ⑤ substitute known function values and rates into ④; deduce desired result.

(3)

practice!

Exercise 3 a disk is growing, and when $r = 10$ cm the radius is increasing at a rate of 2 cm/min



How fast is the area growing at that instant?

Exercise 4 A conical tank is leaking water. The tank is 12 ft high, its horizontal cross sections are disks, and the disk at the top has radius 6 ft.

Suppose that when the water depth is 8 feet it is decreasing at a rate of $\frac{1}{10}$ ft/min.

How fast is water leaking out of the tank?

