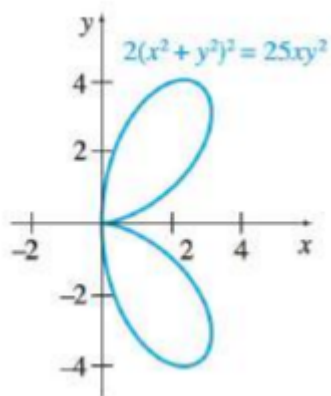# Discussion Problems Week 13

November 17, 2020
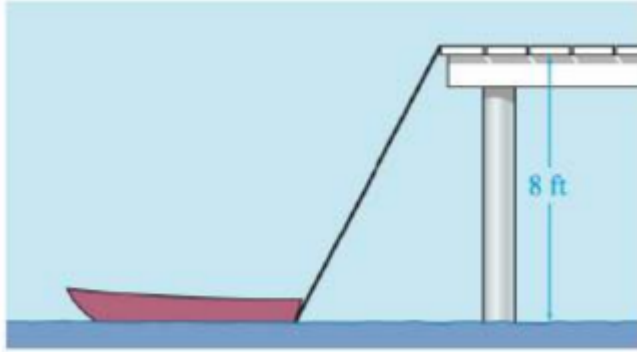
Group 1

The graph of $2(x^2 + y^2)^2 = 25xy^2$, shown below, is a *double folium*. Find the equation of the tangent line at the point $(2, 1)$.

Group 2

A pulley is on the edge of a dock, 8 ft above the water level. (See the figure below.) A rope is being used to pull in a boat. The rope is attached to the boat at water level, and is being retracted at a rate of 1 ft per second. Find the rate at which the boat is approaching the dock when it is 8 ft from the dock.

Group 3

Use the differential to approximate each quantity below. Then use a calculator to find the actual value, and write the absolute value of the difference to four decimal places.

1. $\sqrt{145}$

2. $e^{0.01}$

3. $\ln 0.98$

Group 4

Drug Concentration: The concentration of a certain drug in the bloodstream t hours after being administered is

$$C(t) = \frac{5t}{9 + t^2}$$

Use the differential to approximate the changes in concentration for the following changes in t.

1. 1 to 1.5

2. 2 to 2.25

Group 5

Find the antiderivatives of the following functions up to some constant C:

1. $5x^2 - 6x + 3$

2. $\frac{7}{z+1}$

3. $v^2 - e^{3v}$

Extra Problems

1. Biology: If the rate of excretion of a biochemical compound by an organism is given by
$$f'(t) = 0.01e^{-0.01t}$$
the total amount secreted after t minutes is $f(t)$.

   (a) Find an expression for $f(t)$, assuming that 0 units are excreted at time $t = 0$.

   (b) How many units will have been excreted after 10 minutes?

2. Respiratory Rate: Researchers have found a correlation between respiratory rate and body mass in the first three years of life. This correlation can be expressed by the function
$$\log R(w) = 1.83 - 0.43 \log(w)$$

   (a) Find $R'(w)$ using implicit differentiation.

   (b) Find $R'(w)$ by first solving the equation for $R(w)$.