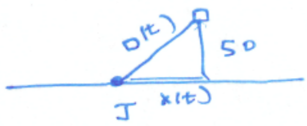
3450:221 Calculus I, Kreider, Summer 2010

Homework 12, Section 3.8, due on Monday 7 June

$x' = 25$

23. (5 pts) John stands on the shore of a river watching his house float downstream, parallel to the shore 50 ft from shore, at the rate of 25 ft/sec. How fast is the rate of change of the distance between John and his house changing? First write the general formula for the rate of change and then evaluate the formula when the house is 100 ft downstream from his position.



$$D^2(t) = x^2(t) + 50^2$$

$$2D\frac{dD}{dt} = 2x\frac{dx}{dt} + 0$$

instant:

$x = 100$

$\frac{dx}{dt} = 25$

$$D = \sqrt{100^2 + 50^2} = \sqrt{12500}$$

$$\frac{dD}{dt} = \frac{x}{D}\frac{dx}{dt} = \frac{100 \cdot 25}{\sqrt{12500}} = 22.36 \ \frac{\text{ft}}{\text{sec}}$$

24. (5 pts) The brain weight of fish is modeled by the function $B = .007W^{2/3}$, with B, the brain weight, and W, the total body weight, measured in grams. The body weight depends on the length L, measured in cm, according to $W = .12L^{2.53}$. If the average length of a species of fish, the Spiny Kreiderian Hogfish, evolved from 15 cm to 20 cm over 1 million years at a constant rate, how fast was the brain growing at the instant when the average length was 17 cm?

$$\frac{dB}{dt} = \frac{dB}{dW} \cdot \frac{dW}{dL} \cdot \frac{dL}{dt}$$

$$= \left[.007 \cdot \tfrac{2}{3} W^{-1/3}\right]\left[.12 \cdot 2.53 L^{1.53}\right]\left[5 \times 10^{-6}\right]$$

$$= .1 \times 10^{-6} \ \text{gr}/\text{yr}$$

$W = 155.67$

$\frac{dB}{dW} = .00087$

$\frac{dW}{dL} = 23.17$

$\frac{dL}{dt} = 5E-6$