

Homework 8

Additional problems
due October 28, 2014

In addition to

3.6: 2, 4, 6, 9, 12, 14, 16, 18, 20, 48, 49 (for 48 and 49, $\frac{d}{dx} \sec x = \sec x \tan x$)

3.7: 2, 4, 6, 10, 12, 20, 22, 24, 26, 30, 32, 34, 36, 40, 42, 44, 46, 48

complete the following problems.

1. An ellipse: Use implicit differentiation to find the points on the ellipse

$$\frac{x^2}{4} + \frac{y^2}{9} = 1$$

at which the slope is $-1/2$.

2. At 9A.M., car B is 25 km west of another car A. Car A then travels to the south at 30 km/h and car B travels east at 40 km/h. When will they be the closest to each other and what is this distance? (Tip: draw it out to help visualize).

3. Motion of a cell In the study of cell motility, biologists often investigate a type of cell called a keratocyte, an epidermal cell that is found in the scales of fish. This flat, elliptical cell crawls on a flat surface, and is known to be important in healing wounds. The 2D outline of the cell can be approximated by the ellipse

$$\frac{x^2}{100} + \frac{y^2}{25} = 1$$

where x and y are distances in μm (Note: $1\mu\text{m}$, often called “1 micron”, is 10^{-6} meters). When the motion of the cell is filmed, it is seen that points on the “leading edge” (top arc of the ellipse) move in a direction perpendicular to the edge. Determine the direction of motion of the point (x_p, y_p) on the leading edge.