

Math 1210-3

Friday March 7

93.4 Max-min problems

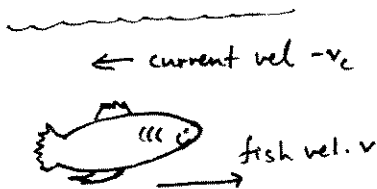
We should stop lecture by 10:05,
so you have time for make-up exam problems.
(We can't stay late today.)

Begin by doing #3 Wednesday - the cone with inscribed cylinder

Then do

Exercise 1 (Example 4 page 169) Suppose a fish swims upstream with velocity v relative to the water, and that the river current has velocity $-v_c$ relative to the shoreline (in the opposite direction the fish is swimming). Assume the energy expended by the fish to travel a distance d up the river is proportional to the time it takes to travel this distance and the cube of the fish's velocity v relative to the water.

What is the velocity v that minimizes the energy expended in swimming this distance? (do fish actually swim at this speed?)



Exercise 2 Derive Snell's law (for light) as the solution to the following minimization problem:

Suppose a particle can move at speed v_1 in medium 1, above the x -axis at speed v_2 in medium 2, below the x -axis

If the particle wishes to get from (x_1, y_1) to (x_2, y_2) , with $x_1 < x_2$
 $y_1 > 0$
 $y_2 < 0$

Which path takes the shortest time?

Answer: $\frac{\sin \theta_1}{\sin \theta_2} = \frac{v_1}{v_2}$ (Snell's Law!)

