Project 1: Deception Pass

For more information about this beautiful park, go to:
`http://www.parks.wa.gov/parkpage.asp?selectedpark=Deception%20Pass&pageno=1`

For this project, read through the introduction and answer Problems 2-5 (We'll answer the first question as a group). For some of the problems, you'll need to use the CD that was included with your textbook. *Please let me know as soon as possible* if you're having any trouble running the CD.

Turn in write ups of the answers to the questions- Please write your solutions using complete sentences, correct grammar, correct spelling, etc. Feel free to work in groups.

Once you've looked at the first problem, try writing your solution, then compare that to the sample solution on the next page.

Problem 1:

Let $x(t)$ be our position, measured in feet from the Deception Pass Bridge after t seconds. We will assume that positive values of x will be *East* of the bridge, negative values will be *West*. We are given a possible model for our velocity as:

$$\frac{dx}{dt} = \frac{v_0}{S(x)} \text{ where } S(x) = 1 + \frac{1}{200,000}(x-100)^2$$

The function $S(x)$ is a model of the *relative* size of the channel x feet from the bridge. We are told that the model is valid for x in the range -600 to $1,000$. For example, if we compute $S(0)$ we get 1.05- This is not an absolute measure of the distance, but relative (so that a measurement of $S = 3.15$ would be interpreted as 3 times farther than $S(0)$).

In this problem, we will make some sample velocity computations:

- If we suppose that the velocity v_0 is 7 miles per hour, convert the velocity to *feet per second*:

$$\frac{7 \text{ miles}}{1 \text{ hour}} \cdot \frac{5,280 \text{ feet}}{1 \text{ mile}} \cdot \frac{1 \text{ hour}}{60 \text{ minutes}} \cdot \frac{1 \text{ minute}}{60 \text{ seconds}} = \frac{154 \text{ feet}}{15 \text{ seconds}} \approx 10.267 \text{ feet/sec}$$

- Using this velocity in our model, we want to find the velocity of the current 600 feet to the west of the bridge.

  In this case, we use $v_0 = \frac{150}{15}$ and $x = -600$ in the formula for $S(x)$:

$$S(-600) = 1 + \frac{1}{200,000}(-700)^2 = \frac{69}{20} = 3.45$$

  We leave off the units for S, but assume that the units for x' are correct:

$$\left.\frac{dx}{dt}\right|_{x=-600} = \frac{\frac{154}{15}}{\frac{69}{20}} \approx 2.9758 \text{ feet/sec}$$

- Similarly, compute the velocity at 200 feet east (at $x = 200$) and at 800 feet east ($x = 800$) of the bridge:

$$S(200) = 1 + \frac{1}{200,000}(200-100)^2 = 1.05$$

$$S(800) = 1 + \frac{1}{200,000}(800-100)^2 = 3.45$$

  The velocity of the current at 200 feet and 800 feet west of the bridge is therefore given by:

$$\left.\frac{dx}{dt}\right|_{x=200} = \frac{\frac{154}{15}}{1.05} \approx 9.78 \text{ feet/sec}$$

$$\left.\frac{dx}{dt}\right|_{x=800} = \frac{\frac{154}{15}}{3.45} \approx 2.98 \text{ feet/sec}$$

As we expect, the velocity of the current is high close to the bridge, and gets slower as we move away from the bridge.