Homework Assignment 2: Due at the beginning of class 9/30/02

The specific learning goals of this assignment are for you to:

- Use data to create a continuous, smooth graph.
- Interpret the nature of the quantities represented and the effects of different tuna fishing methods as features (increasing/decreasing, concave up/down) of your graph.
- Locate the intervals on which a graph is concave up and concave down.
- Determine the impact of "Dolphin Safe" tuna fishing standards.

Table 1[1] gives the total number of dolphins killed as a direct result of tuna fishing in the Eastern Tropical Pacific Ocean from January 1. 1972 to January 1, 1997.

Date	Years since January 1, 1972 ("T")	Total number of dolphins killed by US tuna fishermen since January 1, 1972.
January 1, 1972	0	0
January 1, 1973	1	368600
January 1, 1974	2	575297
January 1, 1975	3	722734
January 1, 1976	4	889379
January 1, 1977	5	998119
January 1, 1978	6	1023571
January 1, 1979	7	1042937
January 1, 1980	8	1060875
January 1, 1981	9	1076180
January 1, 1982	10	1094960
January 1, 1983	11	1118227
January 1, 1984	12	1126740
January 1, 1985	13	1144472
January 1, 1986	14	1163677
January 1, 1987	15	1184369
January 1, 1988	16	1198361
January 1, 1989	17	1218073
January 1, 1990	18	1230716
January 1, 1991	19	1235799
January 1, 1992	20	1236801
January 1, 1993	21	1237240
January 1, 1994	22	1237355
January 1, 1995	23	1237461
January 1, 1996	24	1237461
January 1, 1997	25	1237461

Table 1: Estimated cumulative dolphin mortality as a direct result of tuna fishing in the Eastern Tropical Pacific, 1972-1997.

[1] Source: Buck, E. H. 1997. Dolphin protection and tuna seining. *Congressional Research Service Issue Brief* #96011.

1. Using a suitably large set of axes, plot a graph showing the relationship between "T" (the **independent** variable) and the total number of dolphins killed since January 1, 1972 (the **dependent** variable). Make sure that your axes have scales on them and that the axes are clearly labeled. Draw a smooth curve through the points that you have plotted to create a continuous graph.

2. The graph that you plotted in Question 1 will be an **increasing** graph. In terms of the quantities represented, explain (in a sentence or two) how you could have anticipated this feature.

3. Suppose that the tuna fishermen of the Eastern Tropical Pacific adopted fishing methods that were much more dangerous to dolphins. How would this development be reflected in the appearance of the graph that you plotted in Question 1? Now suppose that the fishermen adopted methods that were much safer for dolphins. How would this be reflected in the appearance of the graph from Question 1? In each case, explain your answer in a sentence or two.

4. Carefully examine the graph that you plotted in Question 1. Locate all of the intervals on which the graph is concave up. Locate all of the intervals on which the graph is concave down.

5. In 1990, Congress passed the Dolphin Protection Consumer Information Act (DPCIA)[2]. The DPCIA required that tuna labeled as "dolphin safe" meet certain standards. The DPCIA did *not* directly require tuna fishermen to use fishing methods that were safe for dolphins. Likewise, DPCIA did *not* directly require tuna canneries to only accept and process dolphin-safe tuna. Does the graph that you drew in Question 1 show any evidence to suggest that tuna fishermen switched to methods that were safer to dolphins when the Dolphin Protection Consumer Information Act was passed? In a few sentences, briefly explain how you can tell.

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[2] In 1997, the DPCIA was amended when Congress passed the International Dolphin Conservation Program Act (IDCPA). This piece of legislation sped through the Congress in record time. The new legislation changed the criteria for labeling tuna as "dolphin safe." Under the DPCIA, in order for any of the tuna caught during a particular fishing expedition to be labeled as "dolphin safe," all of the tuna caught during that particular fishing expedition had to have been caught using "dolphin safe" fishing methods. Under the new IDCPA, tuna fishermen were able to selectively label each tuna caught during a particular fishing expedition as either "dolphin safe" (if that particular tuna was caught using dolphin safe methods) or not. Although the National Marine Fisheries Service (NMFS) maintains that the change in legislation has not affected the *abundance* of dolphins in the Eastern Tropical Pacific Ocean fishery (ETP) each year, some environmental groups believe that the *number of dolphins killed* in the ETP has risen each year. Note that although the NMFS and the environmentalists are both talking about the dolphin population, they have each chosen to focus on ways of describing the status of the dolphin population (annual abundance versus number killed annually) that seem to strongly support their side of the issue.