

### Homework Assignment 2: Solutions

1. The average amount of money spent on each recipient of Medicaid will be the total payments divided by the number of recipients. These numbers are shown in Table 1 below.

Year	Average amount of money spent on each recipient of Medicaid (\$)
1975	1205.53
1981	2948.03
1985	4605.03
1990	6717.05
1995	8867.93
1996	8622.40
1997	9539.96

Table 1

Plotting the data shown in Table 1 with “Year” as the independent variable and “Average spending” as the dependent variable gives the graph shown in Figure 1(a). If a smooth curve is drawn through these points, a graph resembling Figure 1(b) is obtained.

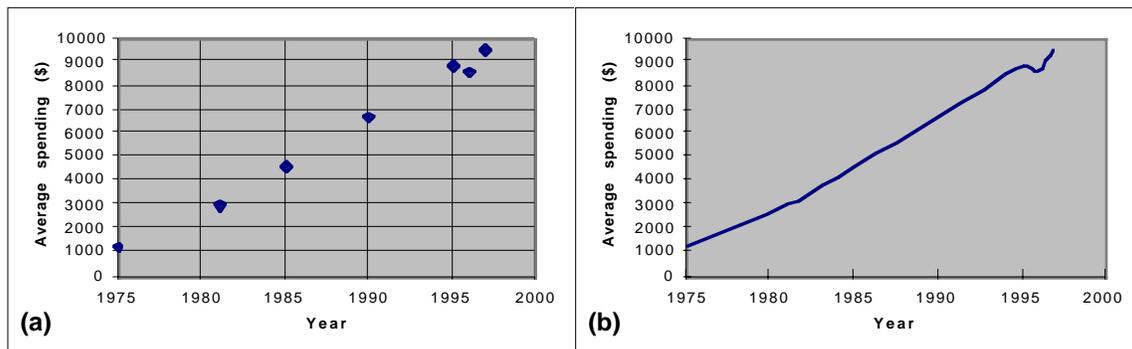


Figure 1: Graphs showing average Medicaid spending versus year for 1975-1997.

2. The graphs shown in Figure 1(a, b) show that the average amount of money spent on each recipient of Medicaid has risen between 1975 and 1997. Except for 1995-1996, the average spending has increased each year. During 1995-1996, the average spending decreased by \$245.53 for each recipient of Medicaid. In every other year, however, the average spending on each recipient of Medicaid increased dramatically, usually by well over \$250 each year. (For example from 1975 to 1997 the average rate of change was about \$378 per year.) Except for the dip in spending between 1995 and 1996, the average spending appears to have risen reasonably steadily. There is little evidence of any severe concavity in the curve shown in Figure 1(b). (A concave up graph would indicate that average spending was increasing at a faster and faster rate, for example.)

3. The completed table is shown below.

Time interval	1960-1970	1970-1980	1980-1990	1990-1995	1995-1998
Rate of change	0.48	0.04	0.03	0.14	0.4

Table 2.

**Increasing:** An increasing function has a positive rate of change. As all of the rates of change from Table 2 are positive, the percentage of women who never married is an increasing function of year over each of these time intervals.

**Decreasing:** In order for the function to decrease, the rate of change would have to be negative. As Table 2 shows no time intervals where the rate of change is negative, the percentage of women who never married is never a decreasing function of year (at least for the years between 1960 and 1998).

4. A concave up function has a rate of change that *increases* as you read from left to right. A concave down function has a rate of change that *decreases* as you read from left to right.

**Concave down:** From somewhere between 1960 and 1970 to somewhere between 1980 and 1990, Table 2 shows that the rate of change is decreasing.

Based on Table 2 alone, the function is concave down between points in the intervals:

- [1960, 1970] and [1980, 1990]

If you plot the points given on the homework assignment and draw a smooth curve through them, you get a graph resembling Figure 2 (below). Based on the appearance of Figure 2, the function is concave down between:

- 1960 and 1980<sup>1</sup>

**Concave up:** With similar reasoning to that employed in the concave down analysis, based on Table 2 alone, the function is concave up between points in the interval:

- [1980, 1990] and [1995, 1998].

Using Figure 2, the function is concave up between:

- 1980 and 1998<sup>2</sup>

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<sup>1</sup> Note that you need to use some judgement here to come up with where the graph switches over from a concave down to a concave up shape. As a result, your answer may differ slightly from the one given here.

<sup>2</sup> Ditto.

5. The plot of the data is shown in Figure 2 (below) along with the intervals showing increasing/decreasing and concave up/down.

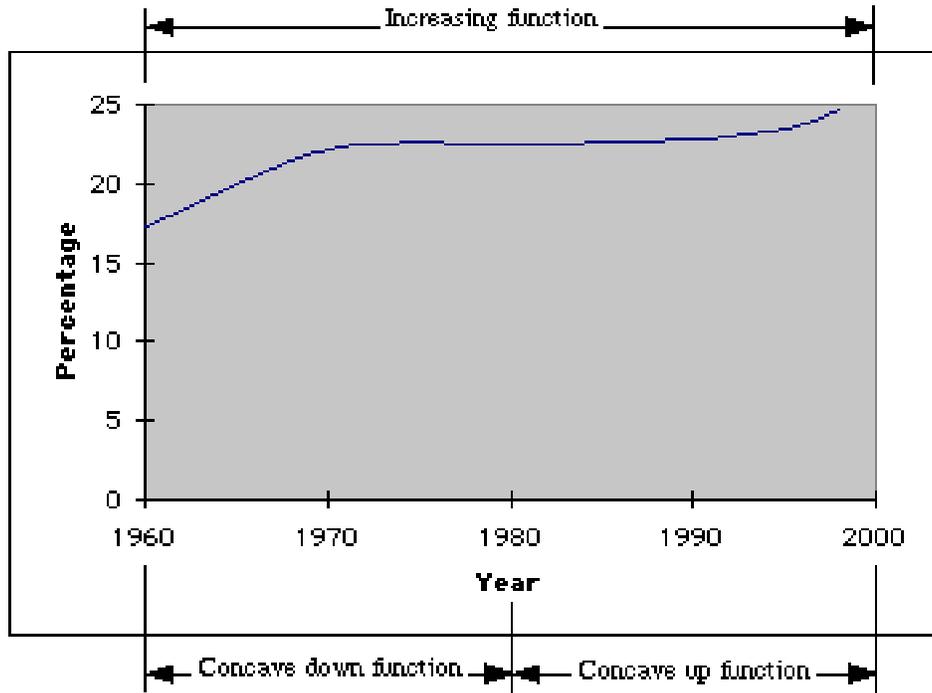


Figure 2.

The graph shows that the function is increasing between 1960 and 1998, but not always at a steady rate. For example, between 1960 and somewhere around 1980 the graph is concave down, showing that over this time interval the function is increasing but at a decreasing rate. From somewhere around 1980 to 1998, the graph shows a concave up shape indicating that during this period, the function is increasing at an increasing rate.