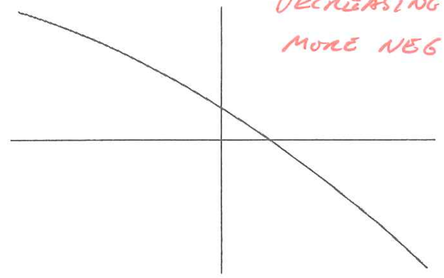
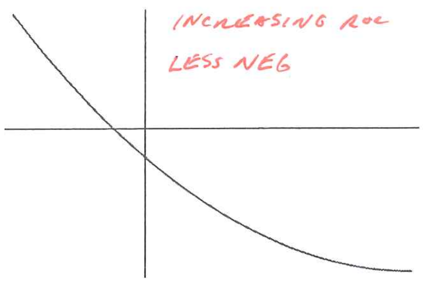
Sec 2.5 Concavity

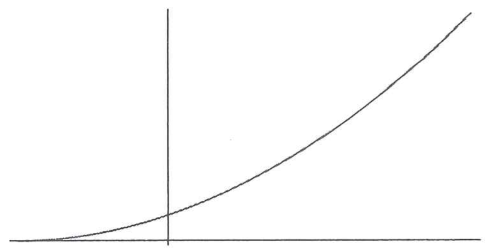
Increasing and Concave Down



Decreasing and Concave Down



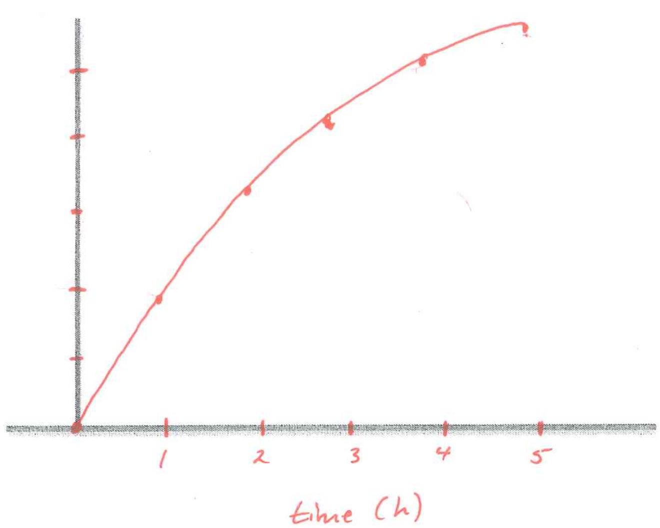
Decreasing and Concave Up



Increasing and Concave Up

Ex. The following table gives the distance traveled by a cyclist, Karim, as a function of time. Graph the data. What is the concavity of the graph? Was Karim's speed (that is, the rate of change of distance with respect to time) increasing, decreasing, or constant?

T, time (hours)	D, distance (miles)	Average Speed
0	0	0
1	20	20 m/h
2	35	15 m/h
3	45	10 m/h
4	52	7 m/h
5	57	5 m/h



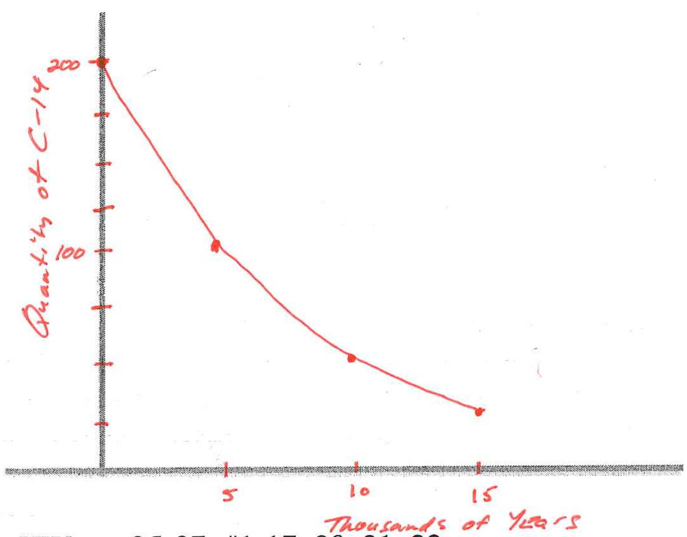
Rate of Change is decreasing

If f is a function whose rate of change increases (gets less negative or more positive as we move from left to right), then the graph of f is **concave up.** That is, the graph bends upward.

- If f is a function whose rate of change decreases (gets less positive or more negative as we move from left to right), then the graph of f is **concave down.** That is, the graph bends downward.
  - If a function has a constant rate of change, its graph is a line and it is neither concave up nor concave down.

Ex. The following table shows Q, the quantity of carbon-14 in a sample remaining after t thousand years. Graph the data. What can we say about the concavity of the graph and what does this mean about the rate of change of the function?

T, thousands of years	Q, quantity	Rate of change
0	200	—
5	109	-18.2
10	60	-9.8
15	33	-5.4



$$\frac{109-200}{5-0} = -\frac{91}{5} = -18.2$$

$$\frac{60-109}{10-5} = -\frac{49}{5} = -9.8$$

$$\frac{33-60}{15-10} = -\frac{27}{5} = -5.4$$

Rate of Change is increasing or becoming less negative → Concave Up

HW: pg 95-97, #1-17, 20, 21, 22