Chapter 3 Project

The following table shows the atmospheric pressure p at the altitude of k feet above sea level (pressure is measured in mm Hg; note that this unit of pressure is approximately the pressure generated by a column of mercury 1 millimeter high).

k **(ft)**	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10,000
p **(mm Hg)**	760	733	707	681	656	632	609	586	564	543	523

1. Find the average rate of change of air pressure from sea level to 2000 feet of altitude.

2. Find the average rate of change of air pressure between the altitudes of 4000 and 10,000 feet.

3. Use a *symmetric difference quotient*

$$\frac{p(c+h)-p(c-h)}{2h}$$

to estimate the instantaneous rate of change of air pressure at 7000 ft by choosing $h = 1000$ ft.

4. Tell whether you expect the answer to Question 2 or 3 to better approximate the instantaneous rate of change of air pressure at altitude 7000 ft. Explain. (**Hint:** Plotting the data on paper may help.)

5.* Explain why you expect the symmetric difference quotient $\frac{f(c+h)-f(c-h)}{2h}$ in general to be a better approximation of the instantaneous rate of change of f at $x = c$ than the "regular" difference quotient $\frac{f(c+h)-f(c)}{h}$.

6. Use a graphing calculator or computer algebra system to find an exponential regression curve to the given data and plot the curve along with the data on the same screen.

7. Use the exponential function you found in Question 6 to estimate the instantaneous rate of change of air pressure at 7000 ft, and compare with your estimate given in Question 3.

8. Is the instantaneous rate of change increasing or decreasing with altitude? Explain.

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