Math 146 **Practice Problem List I**

Section 1.1: 1-19 odd, 25, 27, 31, 33, 37, 39, 43-49 odd

Section 1.2: 1-5 odd, 13-27 odd, 31

Extras:

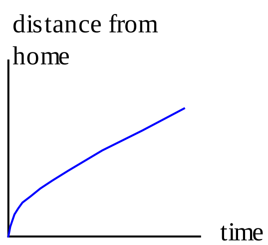
1.) Which of the graphs below best matches each of the following stories? Write a story for the remaining graph.

a.) I had just left home when I realized I had forgotten my books, and so I went back to pick them up.

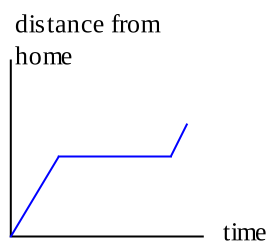
b.) Things went fine until I had a flat tire.

c.) I started out calmly but sped up when I realized I was going to be late.

(I)



(II)



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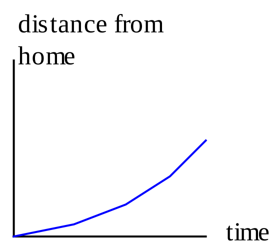
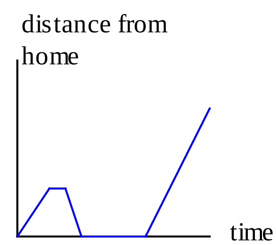


(IV)



2.) It warmed up throughout the morning, and then suddenly got much cooler around noon, when a storm came through. After the storm, it warmed up before cooling off after sunset. Sketch a possible graph of this day's temperature as a function of time.

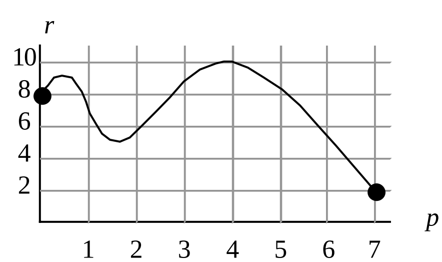
3.) Right after a certain drug is administered to a patient with a rapid heart rate, the heart rate plunges dramatically and then slowly rises again as the drug wears off. Sketch a possible graph of the heart rate against time from the moment the drug is administered.

4.) The graph of $r = f(p)$ is given to the right.

a.) What is the value of r when p is zero?

b.) What is $f(2)$?

c.) For what approximate values of p is $r = 8$?



Section 1.3: 1-35 odd, 43, 47, 49, 53-57 odd, 61-65 odd

Section 1.4: 1-27 odd, 33-37 odd, 45, 47, 55

Extras:

1.) The table below gives data for the demand curve for a certain product, where p is the price of the product and q is the quantity sold every month at that price. Assume the demand curve is a line. Find formulas for each of the following functions and interpret each of the slopes in terms of demand.

a.) q as a function of p b.) p as a function of q

p (dollars)	16	18	20	22	24
q (tons)	500	460	420	380	340

2.) A company has cost and revenue functions, in dollars, given by $C(q) = 6000 + 10q$ and $R(q) = 12q$.
   a.) Find the revenue and cost if the company produces 500 units. Does the company make a profit? What about 5000 units?
   b.) Sketch a graph of $R(q)$ and $C(q)$ on the same set of axes. Find the break-even level of production and illustrate graphically.

Section 2.1: 11, 13, 19-33 odd
Extras:
1.) In my spare time, I manufacture wicker chairs in my garage. Each month, it costs me $75 for electricity, heat, and similar things. Materials for a single chair cost $45, and I sell each chair for $90. I only make a chair if I have a buyer lined up, and I can make at most 10 chairs in a month.
   a.) Give a formula for $C(x)$, the cost of producing x chairs per month.
   b.) Give a formula for $R(x)$, the revenue earned selling x chairs per month.
   c.) Give a formula for $P(x)$, the profit earned selling x chairs per month.
   d.) What is the minimum number of chairs I must produce and sell in a month to guarantee I earn a profit?
   e.) What is the minimum number of chairs I must produce and sell in a month to generate a revenue of at least $500?
   f.) What is the minimum number of chairs I must produce and sell in a month to generate a profit of at least $200?

2.) Suppose the price at which x **hundred** staplers can be sold is given by the price-demand function

$$p(x) = 10 - .25x \quad \text{dollars per stapler,}$$

where $0 \le x \le 25$. In addition, the cost of producing x **hundred** staplers is given by the cost function

$$C(x) = 40 + 1.5x \quad \text{hundred dollars.}$$

   a.) Graph the cost and revenue functions in the same window, and copy down what you see.
   b.) Find the level of production (to the nearest stapler) that maximizes revenue.
   c.) What is the selling price (per stapler) that generates maximum revenue?
   d.) What is the maximum possible revenue?
   e.) Find all break-even points, to the nearest stapler.

Section 2.2: 33-49 odd, 53, 59-63 odd, 67-79 odd
Extras:
1.) The population of a city is 1000 and is growing at a rate of 5% per year.
   a.) Find a formula for the population of the city at time t years from now assuming that the 5% per year is an annual rate.
   b.) Find a formula for the population of the city at time t years from now assuming that the 5% per year is a continuous rate.
   c.) In each of the above, estimate that population of the city in 10 years.

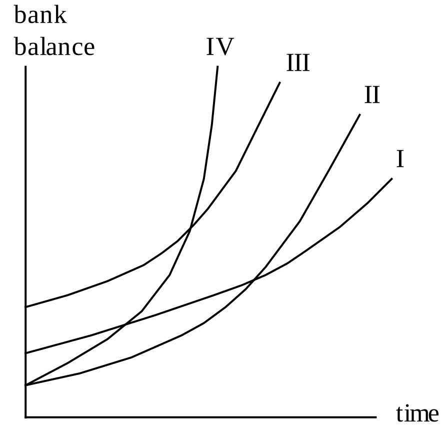
2.) The following formulas give the populations of four different towns, *A*, *B*, *C*, and *D*, with t representing the number of years from now.

$$P_A = 600e^{0.08t} \quad P_B = 1000e^{-0.02t} \quad P_C = 1200e^{0.03t} \quad P_D = 900e^{0.12t}$$

   a.) Which town is growing the fastest (has the largest percentage growth rate)?

b.) Which town is the largest now?
c.) Are any of the towns decreasing in size? If so, which one(s)?

3.) Each of the curves in the figure to the right represents the balance in a bank account into which a single deposit was made at time zero. Assuming interest is compounded annually, find
   a.) The curve representing the largest initial deposit.
   b.) The curve representing the largest interest rate.
   c.) Two curves representing the same initial deposit.
   d.) Two curves representing the same interest rate.



4.) Under certain circumstances, the velocity, V, of a falling raindrop is given by $V = V_0\left(1-e^{-t}\right)$, where t is time and V_0 is a positive constant.
   a.) Sketch a rough graph of V against t.
   b.) What does V_0 represent?

Section 2.3: 1-9 odd, 19 23-27 odd, 31-39 odd, 45
Extras:
1.) Convert the given exponential functions into the form $P = Ab^t$.
   a.) $P = 10e^{0.917t}$
   b.) $P = 8.5e^{-0.73t}$

2.) Convert the given exponential functions to the form $P = Ae^{rt}$.
   a.) $P = 10(1.7)^t$
   b.) $P = 5.23(0.2)^t$

3.) The population, P, in millions, of Nicaragua was 3.6 million in 1990 and growing at an annual rate of 3.4%.
   a.) Express P as a function in the form $P = Ab^t$.
   b.) Express P as an exponential function in the form $P = Ae^{rt}$.

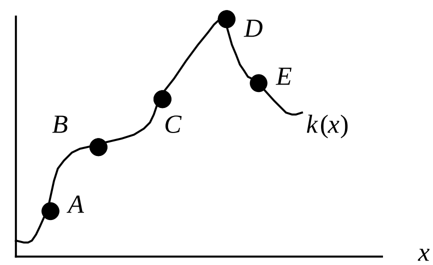
Section 3.1: 1-13 odd, 19, 21, 25-43 odd, 47

Extras

1.) To the right is the graph of a function k.

a.) Between which pair of consecutive points is the average rate of change of k greatest? Closest to zero?

b.) Between which two pairs of consecutive points are the average rates of change of k closest?



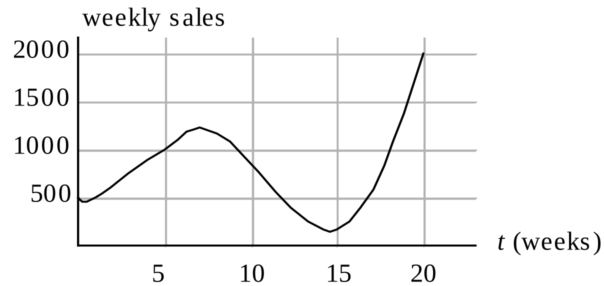
2.) Weekly sales for a company are shown to the right.

a.) During which of the following time intervals was the average rate of change larger?

i.) $0 \le t \le 5$ or $0 \le t \le 10$

ii.) $0 \le t \le 10$ or $0 \le t \le 20$

b.) Estimate the average rate of change between $t = 0$ and $t = 10$. Interpret your answer in terms of sales.



Section 3.2: 1-7 odd, 13-33 odd, 39-63 odd, 71-79 odd, 83-89 odd

Extras:

1.) A car is driven at a constant speed. Sketch a graph of the distance traveled as a function of time.

2.) A car is driven at an increasing speed. Sketch a graph of the distance traveled as a function of time.

3.) A car starts at a high speed, and its speed then decreases slowly. Sketch a graph of the distance the car has traveled as a function of time.

4.) The size, S, of a malignant tumor (in cubic millimeters) is given by $S = 2^t$, where t is the number of months since the tumor was discovered. Give units with your answers to the following questions.

a.) What is the total change in the size of the tumor during the first six months?

b.) What is the average rate of change in the size of the tumor during the first six months?

c.) Estimate the rate at which the tumor is growing when $t = 6$.

5.) A ball is tossed into the air from a bridge, and its height, h (in feet), above the ground t seconds after it is thrown is given by $h = f(t) = -16t^2 + 50t + 36$.

a.) How high above the ground is the bridge?

b.) What is the average velocity of the ball for the first second?

c.) What is the velocity of the ball at $t = 1$ second?

d.) What is the maximum height the ball will reach? What is the velocity of the ball at the time when the ball is at its peak?

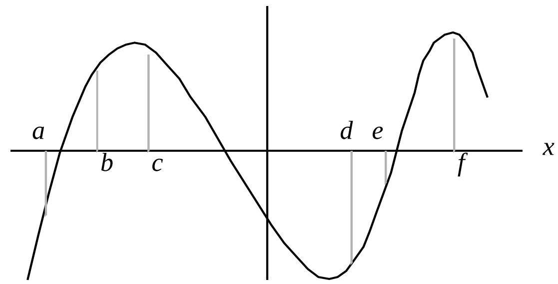
6.) In the graph of g to the right, at which of the labeled $x-$values is

a.) $g(x)$ greatest?

b.) $g(x)$ least?

c.) $g'(x)$ greatest?

d.) $g'(x)$ least?



7.) The line given by $y = 4x + 3$ is tangent to the curve $y = f(x)$ at $x = -2$. Find $f(-2)$ and $f'(-2)$.

8.) Let $f(x)$ be the elevation in feet of the Mississippi River x miles from it source. What are the units of $f'(x)$? What can you say about the sign of $f'(x)$ (positive or negative)?

9.) The temperature, T, in degrees Fahrenheit, of a cold yam placed in a hot oven is given by $T = f(t)$, where t is the time in minutes since the yam was put in the oven.

a.) What is the sign of $f'(t)$ (positive or negative)?

b.) What are the units of $f'(20)$? What is the practical meaning of the statement $f'(20) = 2$?

10.) An economist is interested in how the price of a certain item affects its sales. Suppose that at a price of $\$p$, a quantity, q, of the item is sold. If $q = f(p)$, explain the meaning of each of the following statements.

a.) $f(150) = 2000$

b.) $f'(150) = -25$

11.) Let $p(h)$ be the pressure in dynes per cm^2 on a diver at a depth of h meters below the surface of the ocean. What do each of the following quantities mean to the diver? Give the units for the quantities.

a.) $p(100)$

b.) h such that $p(h) = 1.2 \times 10^6$

c.) $p'(100)$

d.) h such that $p'(h) = 20$

12.) Let $f(t)$ be the number of centimeters of rainfall that has fallen since midnight, where t is the time in hours. Interpret the following in practical terms, giving units.

a.) $f(10) = 3.4$

b.) $f'(8) = 0.4$

13.) A company's revenue from car sales, C (measured in thousands of dollars), is a function of advertising expenditure, a, also measured in thousands of dollars. Suppose $C = f(a)$.

a.) What does the company hope is true about the sign of f' (positive or negative)?

b.) What does the statement $f'(100) = 2$ mean in practical terms? How about $f'(100) = 0.5$?

c.) Suppose the company plans to spend about \$100,000 on advertising. If $f'(100) = 2$, should the company spend more or less on advertising? What if $f'(100) = 0.5$?

Section 3.3: 1-17 odd, 25-31 odd, 37, 43-49 odd

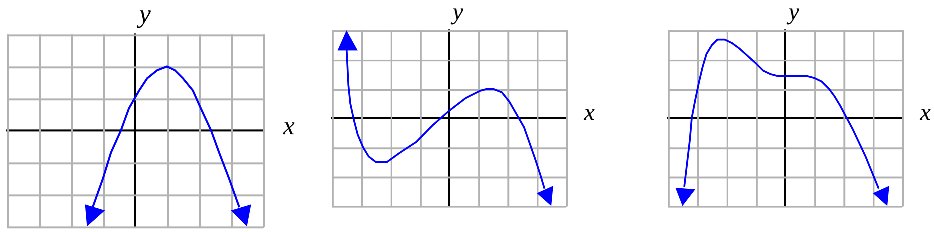
Section 3.4: 1-29 odd, 43, 47, 55, 63-71 odd, 75-81 odd, 89-95 odd

Extras

1.) Let $f(x) = 2^x$. Use graphs or numerical evidence to explain why $f'(x) \neq x2^{x-1}$.

2.) For each function given below, sketch a graph of the corresponding derivative function. Assume that gridlines each mark one unit.

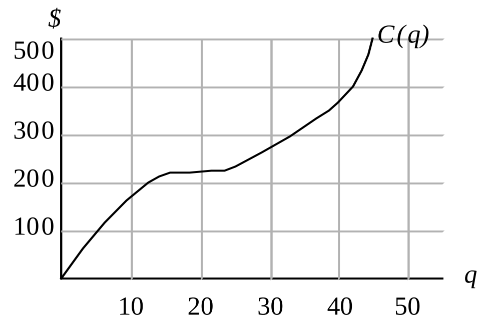
(I) (II) (III)



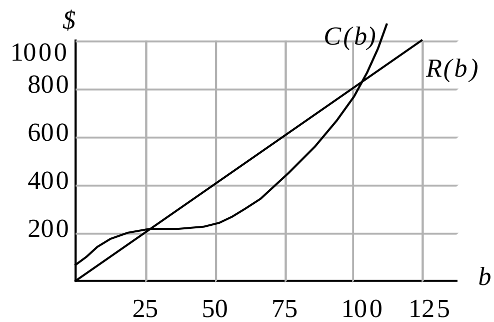
Section 3.5: 1-25 odd

Extras

1.) I n the figure to the right, is marginal cost greater at $q = 5$ or at $q = 30$? At $q = 20$ or $q = 40$? Explain.



2.) Cost and revenue functions for a charter bus company are shown to the right. Should the company add a 50th bus? How about a 100th? Explain your answers using marginal revenue and marginal cost.



Section 3.6: 1-11 odd, 17-35 odd

Section 3.7: 1-17 odd, 25, 27, 29

Section 3.8: 1-31 odd