MAT 17A - DISCUSSION #4

Problem 1. Hypertension Drugs
The drug Fenoldopam is used intravenously to treat hypertensive crises. Suppose Fenoldopam is being administered to two patients, A and B. Five minutes after administration of the drug begins, you note that 100 micrograms of Fenoldopam has been delivered to both patients A and B and that the current rate of delivery of Fenoldopam is 3 micrograms/min.

(a) For patient A, you are told that the patients sensitivity to Fenoldopam at 100 micrograms is 1.5 mmHg per microgram (this is the rate of change of systolic blood pressure with changes in the drug dose). What is patient A's rate of decrease in blood pressure at this time?

(b) What differentiation rule is involved in (a)? Use Leibniz notation to express this rule in terms of the functions given to you in the problem. Make sure to clearly define variables.

(c) For patient B, you calculate that the rate of decrease in the patients blood pressure is 6 mmHg/min at this time. What is patient B's sensitivity of Fenoldopam at 100 micrograms?

Notes/Hints: Think about the units of your answers. It may help to write out units with your work.

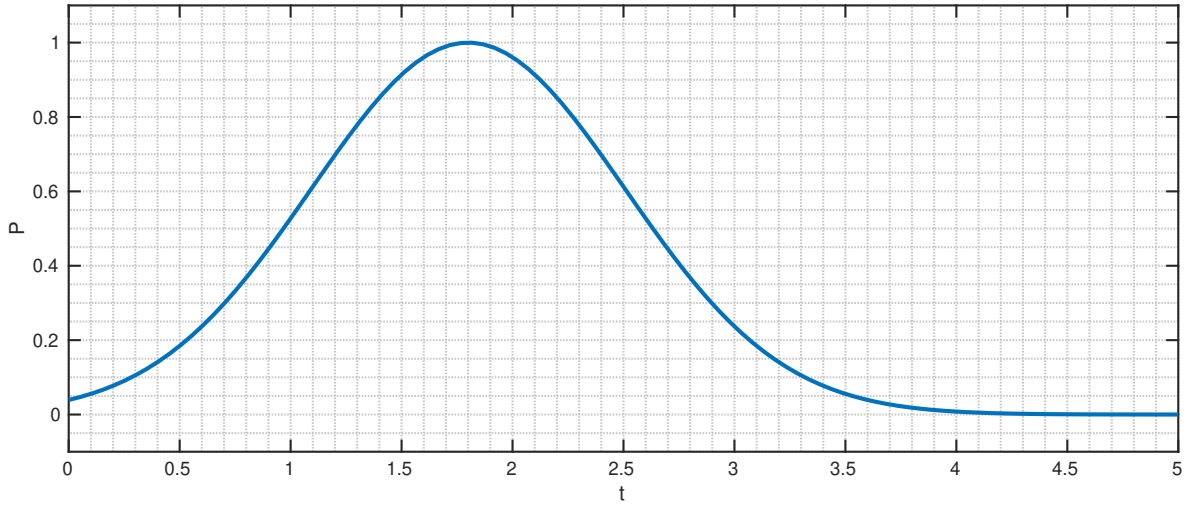
Problem 2. Population Density
Shenzhen, which is a major city in southern China's Guangdong Province, is one of the fastest growing cities in the world. In 1996, the area of Shenzhen was 600 km^2 and it was expanding at a rate of 40 km^2/year. The population of Shenzhen in 1996 was 5,000,000 people, and it was growing at a rate of 400,000 people/year. Include the appropriate units in your answers.

(a) Determine the population density of Shenzhen in 1996.

(b) Use the data above to determine how fast the population density of Shenzhen was growing in 1996.

(c) Use your answer from part (a) and (b) to estimate the population density of Shenzhen in 1998.

Problem 3. Estimating Derivatives from a Graph
Below is a graph of the function $P(t)$.



Use the graph to answer the questions below. Though your values will be approximate, make an effort to obtain quantitatively reasonable values. For parts (b) and (c), show work and explain how you estimated P'.

(a) At what value of t is $P'(t) = 0$?

(b) At what value of t is $P'(t)$ largest? What is the value of $P'(t)$ at this value of t?

(c) At what value of t is $P'(t)$ the most negative? What is the value of $P'(t)$ at this value of t?

(d) Sketch a graph of $P'(t)$ using the information from parts (a)-(c). Make sure to label your axes.