Math 145 - Calculus I   Name_____

Revenue - Day 16

In Economics, a *demand curve* shows the relationship between the price of an item, p, and the number of items that consumers are wanting to buy given that price, d. Be sure to consider units when answering.

1. Which of the two curves in this graph, $f(p)$ or $g(p)$, makes more sense as a demand curve? Explain why in a sentence or two. (Economists often use price on the vertical axis, but for this revenue example we will use price as the independent variable on the horizontal axis.)
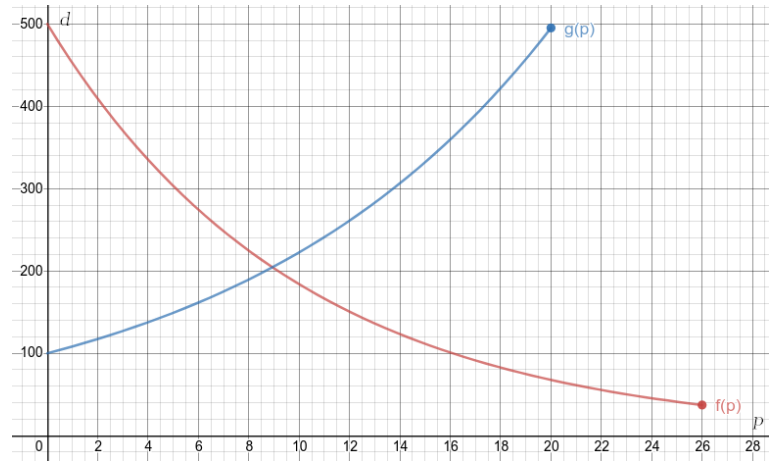
2. A function like $d(p) = 500e^{-0.1p}$ is a good model for a demand curve. Suppose this equation gives the demand for large cheese pizzas at Augie's Pizza Pies.

   If the price is set at $16, how many pizzas will the customers want to buy (demand)?

3. Label the point from the previous problem on the demand curve above.

4. Augie's interest is in making money. The term *revenue* refers to the amount of money they take in from customers. What is Augie's revenue if they set the price at $16? (In this activity we will always assume that the pizza shop is ready to sell enough pizzas to meet the demand.)

5. Show this revenue as an appropriate shaded region on the graph above. (*Hint: The shaded region should be a rectangle whose area equals the revenue.*)

6. Using the function from 2., write a formula for $R(p)$, Augie's revenue, if the price is set at p.

7. Use Desmos to sketch a graph of $R(p)$ for $0 \le p \le 25$. Label axes and important points.

8. As we said, Augie's want to make as much money as possible, so they are interested in *maximizing* their revenue. Use your graph to estimate the price that gives the maximum revenue. Let's call this price p_{max}.

9. Go back to the demand graph in 1. and sketch in the maximum revenue rectangle in a different color. Does the area of the maximum revenue rectangle look greater than the area of the rectangle from 5.?

10. Go back to your graph of revenue in 7. and let's think about some calculus. Based on the graph only, what can you say about the derivative of $R(p)$ at p_{max}?

11. Based on the graph only, what can you say about $R'(p)$ for $p < p_{max}$? What about for $p > p_{max}$? *(This is important.)*

12. Calculate and simplify $R'(p)$. *(Factoring is important here.)*

13. Keep going with the calculations to determine the point of maximum revenue exactly. What is the amount of the maximum revenue? How can you demonstrate that you have found a maximum? *(If unsure, check your answers in 10. and 11.)*