

Exam I covers 8.4-8.6. You should know/understand all of the following:

- The product rule:

$$\frac{d}{dx}fg = f'g + fg'$$

- The quotient rule:

$$\frac{d}{dx} \frac{f}{g} = \frac{f'g - fg'}{g^2}$$

- The definitions the average and marginal average revenue, cost, and profit functions:

- $C(q) = \text{fixed costs} + \text{variable costs}$

- $R(q) = \text{unit price} * q$

- $P(q) = R(q) - C(q)$

- $AP(q) = \frac{P(q)}{q}$

- $AR(q) = \frac{R(q)}{q}$

- $AC(q) = \frac{C(q)}{q}$

- $MAP(q) = \frac{d}{dq}AP(q)$

- $MAR(q) = \frac{d}{dq}AR(q)$

- $MAC(q) = \frac{d}{dq}AC(q)$

and how to find these functions given basic information about the costs and revenues associated with a product.

- How to interpret the meaning of particular values of the above functions (i.e. how to interpret a statement such as $MAP(1000) = 500$, $AR(305) = 44$, etc.)
- How to find the second, third, fourth, etc. derivatives
- How to interpret the second derivative in a word problem using analogy with acceleration
- How to determine when the quantity measured by a function is speeding up vs. slowing down by comparing the sign of the first and second derivative
- The chain rule:

$$\frac{d}{dx}f(g(x)) = f'(g(x))g'(x)$$

- How to use the chain rule multiple times in a single problem or in combination with the product or quotient rules:
 - How to break apart a function where multiple rules must be used (start with the arithmetic operation that is performed last, e.g. if you divide last when plugging a number into a function, you should use the quotient rule first when breaking it apart).
 - How to organize your work effectively (split each differentiation rule into a separate sub-problem and avoid reusing function names).
- How to find a derivative two separate ways and check that they give the same answer (e.g. using the product rule and simplifying or expanding the product and then using the power rule).