I. General Concepts: This part of the course is all about derivatives!

- \( f'(m) \) is the slope of the tangent line to \( f(x) \) at \( x = m \)
- The derivative of distance is the instantaneous speed. That is, instantaneous speed is the slope of a tangent line to the graph of distance.
- The derivative of TR is MR. That is, you can think of MR as the slope of a tangent line to the graph of TR.
- The derivative of TC is MC.

II. We have two methods for computing derivatives. You must be able to do both!

- The long way:
  To compute \( f'(m) \), compute the slope of the secant line through \( f(x) \) at \( x = m \) & \( x = m+h \).
  \[
  \text{slope of secant} = \frac{f(m+h) - f(m)}{h}.
  \]
  Simplify this expression and let \( h \) go to 0 to get the slope of the tangent line, \( f'(m) \).
- Using the derivative rules. Review all the rules we learned and have them handy on your sheet of notes. (This should be your default method — do this unless you’re told otherwise.)

III. Relationship between graphs of \( f(x) \) and \( f'(x) \)

Given the graph of \( f(x) \), you should be able to determine the general shape of the graph of \( f'(m) \):

- If \( f(x) \) is increasing, then \( f'(x) \) is positive (the graph of \( f'(x) \) is above the x-axis).
- If \( f(x) \) is decreasing, then \( f'(x) \) is negative (the graph of \( f'(x) \) is below the x-axis).
- If \( f(x) \) has a horizontal tangent, then \( f'(x) = 0 \) (the graph of \( f'(x) \) is crossing the x-axis).

Viceversa, given the graph of \( f'(x) \), you should be able to determine the general shape of \( f(x) \):

- If \( f'(x) \) is positive, then \( f(x) \) is increasing.
- If \( f'(x) \) is negative, then \( f(x) \) is decreasing.
- If \( f'(x) = 0 \), then \( f(x) \) has a horizontal tangent line at \( x \).

Rules for Exponents:

- \( x^a x^b = x^{a+b} \)
- \( \frac{x^a}{x^b} = x^{a-b} \)
- \( x^{-a} = \frac{1}{x^a} \), \( \frac{1}{x^{-a}} = x^a \)
- \( x^{a/b} = \sqrt[b]{x^a} \)
- \( (x^a)^b = x^{ab} \)
- \( x^0 = 1 \)
- \( x^1 = x \)