Section 5.1

After viewing the lecture videos and reading the textbook, you should be able to answer the following questions:

1. In general, how will we estimate the area under the graph of a nonnegative continuous function, \( y = f(x) \), over a closed interval, \([a, b]\)?

2. To estimate the area under the graph of a positive continuous function, \( y = f(x) \), over a closed interval, \([a, b]\), we use the formula
   \[ A \approx f(c_1) \cdot \Delta x + f(c_2) \cdot \Delta x + f(c_3) \cdot \Delta x + \cdots + f(c_n) \cdot \Delta x. \]
   a. What does \( A \) represent?
   b. What does the symbol \( \approx \) mean?
   c. What does \( n \) represent?
   d. What does \( \Delta x \) represent? How can we calculate \( \Delta x \)?
   e. What do we mean when we talk about the \( k \)-th subinterval of \([a, b]\)?
   f. What does \( c_k \) represent?
   g. Other than “the value of \( f(x) \) at \( x = c_k \)”, what does \( f(c_k) \) represent?

3. Suppose an object is moving only forwards in a straight line and that its velocity at a time \( t \) is given by \( v(t) \). To find the total distance traveled over the time interval \([a, b]\) we (select one):
   a. Calculate \( v'(b) - v'(a) \).
   b. Find the area under the graph of \( y = v(t) \) over the interval \([a, b]\).
   c. Find the area under the graph of \( y = v'(t) \) over the interval \([a, b]\).
   d. Calculate \( v(b) - v(a) \).

4. What is the difference between displacement and total distance traveled?

5. What is the average value of a nonnegative continuous function, \( y = f(x) \), over a closed interval, \([a, b]\)?
6. You want to use finite approximations to estimate the area under the curve \( y = f(x) \) between \( x = 1 \) and \( x = 2 \) using the left endpoint method with 5 rectangles of equal width. What are the values of \( c_1, c_2, c_3, c_4 \) and \( c_5 \)?

7. You want to use finite approximations to estimate the area under the curve \( y = f(x) \) between \( x = 1 \) and \( x = 2 \) using the right endpoint method with 6 rectangles of equal width. What are the values of \( c_1, c_2, c_3, c_4, c_5 \) and \( c_6 \)?

8. You want to use finite approximations to estimate the area under the curve \( y = f(x) \) between \( x = 1 \) and \( x = 2 \) using the midpoint method with 4 rectangles of equal width. What are the values of \( c_1, c_2, c_3 \) and \( c_4 \)?