

Homework #2: Sections 5.3, 5.4, and 5.5

Complete each question below. Answers should be carefully written up, showing all necessary work for each step to complete each problem. Your turned-in work should be neat and legible. If I cannot understand or follow your work you will not get credit for it. You may discuss these problems with myself, the TAs and Math Center tutors, and your classmates, but once you start writing up the problem to turn in, you must complete the write-up on your own. This assignment is out of **36 points**. It is due at the **start of class on Tuesday, September 8**.

1. (5 points) Find the derivative of the function

$$g(x) = \int_{\sec(x)}^{x^3} \frac{1}{\sqrt{1+t^2}} dt.$$

Show your work.

2. (5 points) Evaluate the following limit:

$$\lim_{n \rightarrow \infty} \sum_{i=1}^n \frac{2}{n} \sqrt{1 + \frac{2i}{n}}.$$

(Hint: You will need to use the Fundamental Theorem of Calculus.)

3. A vehicle moves with an acceleration of $a(t) = \sin(t)$ m/s² from $t = 0$ s to $t = 2\pi$ s. It initially has a speed of $-\frac{1}{2}$ m/s.
- (a) (3 points) Find the velocity of the vehicle as a function of time.
 - (b) (3 points) Find the net change in the vehicle's position over the time interval.
 - (c) (4 points) Find the total distance traveled by the vehicle during the time interval.
4. (5 points) Find the integral: $\int_0^1 x^3 \sqrt{x^2 + 1} dx$. (Hint: make a u -sub and be sure to convert the entire integral.)
5. (5 points) Explain in your own words what it means to say that the derivative and the integral are inverse processes and why it is true.
6. (3 points each) Decide whether each statement below is true or false and justify your answer.
- (a) All continuous functions have derivatives.
 - (b) All continuous functions have antiderivatives.