

You have 20 minutes to take this quiz. Each problem will be graded for clarity of work as well as correctness, so show all work **clearly and in order**. Circle or otherwise indicate your final answers. Please note that there are problems on both the front and the back of this page.

**1. (6 points) [Similar to #7 and #8, 5.7 and #25, 5.8]**

Suppose  $f(x)$  is a continuous function on  $[a, b]$  and that

$$\int_a^b f(x) dx = 0.$$

(a) Is it necessarily true that  $f(x) = 0$  for all  $x \in [a, b]$ ? If so, prove it. If not, sketch a function  $f(x)$  that is a counterexample (and clearly explain how it is a counterexample).

(b) Is it necessarily true that  $f(x) = 0$  for *some*  $x \in [a, b]$ ? If so, prove it. If not, sketch a function  $f(x)$  that is a counterexample (and clearly explain how it is a counterexample).

*Hint: Use the Mean Value Theorem for integrals.*

*Turn over for more...*

**2.** (6 points) [Similar to #31, 5.6]

Calculate the exact value of  $\int x\sqrt{x+1} dx$ . (Hint: This is a non-traditional  $u$ -substitution.)

**3.** (8 points) [Similar to #35, 5.5]

An object moves along a coordinate line with velocity  $v(t) = 6t^2 - 6$  units per second. Its initial position (*i.e.* its position at time  $t = 0$ ) is 2 units to the left of the origin.

(a) Find the position of the object 3 seconds later.

(b) Find the total distance traveled by the object during those 3 seconds.