Notes and Learning Goals

Math 170
Lesson 15-2: Substitution II

In the previous lesson you learned a process for transforming antiderivatives and integrals. In every homework problem you were given:

\[ u = \text{formula with } x \]

Today you have to think of your own formulas.

1. Learn to make good choices for \( u = \text{formula with } x \).

2. Know that any choice is allowed. But not all choices are useful.

   Here are some suggestions for how to make useful choices.

   • If any part of the problem is a function with insides, consider:
     \[ u = \text{insides} \]
     
     **Example:** \( \int x \sqrt{4 - x^2} \, dx \) The insides are \( u = 4 - x^2 \).

   • If there is a denominator more complicated than \( x \) or \( x^n \), consider:
     \[ u = \text{denominator} \]
     
     **Example:** \( \int \frac{x^2}{3x + 4} \, dx \) The denominator is \( u = 3x + 4 \).

   • If some stuff looks like the derivative of some other stuff, consider:
     \[ u = \text{the other stuff} \]
     
     **Example:** \( \int \frac{1}{x} \ln x \, dx \) The derivative of \( \ln x \) is \( \frac{1}{x} \), so try \( u = \ln x \).

3. Know that these are not rules. They are suggestions for what work.

   Many WebAssign exercises are set up so that you get immediate feedback on whether or not you make a good choice, but this is only in WebAssign. On a test, or in Calculus II, you have to judge whether you made a good choice.

   The only way to do this is to complete the transformation and decide if the new integral or antiderivative is better than the original.