Learning Goal 7.1 Study Guide

The goal: Integrate by using substitution techniques, including both definite and indefinite integrals.

Why do we need substitution? Some anti-derivatives cannot be found by using the power rule or basic trig rules alone.

The process:

1) Choose an expression to substitute (call it u)

Example: Evaluate

$$\int_1^2 (12x+8)e^{3x^2+4x}\,dx$$

2) If it is a definite integral, find new bounds by substituting.

Choose $u = 3x^2+4x$

$u = 3(1)^2+4(1) = 7$

$u = 3(2)^2+4(2) = 20$

3) Find $\frac{du}{dx}$, then solve for dx and substitute

$$\frac{du}{dx} = 6x+4$$

$$dx = \frac{du}{(6x+4)}$$

4) Simplify! If you did it correctly, there will be no more x's!

$$\int_7^{20} (12x+8)e^u \frac{du}{(6x+4)} = \int_7^{20} 2(6x+4)e^u \frac{du}{(6x+4)}$$

5) Find the anti-derivative with respect to u and evaluate using FTC

If there are no bounds, sub in expression for u and add +C)

$$\int_7^{20} 2e^u\,du =$$

$$2e^u\Big|_7^{20} = 2e^{20} - 2e^7$$