LECTURE: 5-5 THE SUBSTITUTION RULE (PART 3)

Example 1: Doing (some) substitutions quickly. In later Calculus courses (Calculus 2 especially) it is quite useful to be able to do some very simple substitutions without having to go through writing out u and du. Do the following integrals using substitution and then see if you can see the pattern well enough to not need to do all of the work.

(a) $\displaystyle\int e^{5x}dx$ (b) $\displaystyle\int \sin\left(\frac{\pi}{2}x\right)dx$ (c) $\displaystyle\int \sqrt{1-2x}dx$

Example 2: Integrate the following functions. Check your answers using a derivative.

(a) $\displaystyle\int \sec^2\left(\frac{\pi}{4}\theta\right)d\theta$ (b) $\displaystyle\int \sec(2x)\tan(2x)dx$ (c) $\displaystyle\int \sqrt{1+4x}dx$

Example 3: Evaluate the following indefinite integrals.

(a) $\displaystyle\int \tan^2 x\sec^2 xdx$ (b) $\displaystyle\int t^2\cos(1-t^3)dt$

Example 4: Evaluate $\int x^3(1-x^2)^{3/2}dx$

Example 5: Evaluate the following definite integrals.

(a) $\int_0^1 \cos(\pi t)dt$

(b) $\int_0^{\pi/4} \sin(4x)dx$

Example 6: Evaluate $\int_1^4 \frac{1}{x^2}\sqrt{1+\frac{1}{x}}dx$. In doing so, change the bounds.

Example 7: Evaluate the following integrals.

(a) $\displaystyle\int \frac{x}{x^2+4}dx$

(b) $\displaystyle\int \frac{x}{\sqrt{25-x^2}}dx$

Example 8: Evaluate the following integrals.

(a) $\displaystyle\int xe^{-x^2}dx$

(b) $\displaystyle\int_1^e \frac{(\ln x)^3}{x}dx$

Example 9: Evaluate $\int_{-3}^{3} (x+5)\sqrt{9-x^2}$.

Example 10: A model for the basal metabolic rate, in kcal/h, of a young man is $R(t) = 85 - 0.2\cos(\pi t/12)$, where t is the time in hours measured from 5:00 AM. What is the total basal metabolic rate of this man over a 24 hour time period?