Worksheet for Sections 4.6
Integration by Substitution

Math S-1ab
Calculus I and II

July 18, 2007

Find the following integrals. In the case of an indefinite integral, your answer should be the most general antiderivative. In the case of a definite integral, your answer should be a number.

In these problems, a substitution is given.

1. $\int (3x-5)^{17}\,dx$, $u = 3x - 5$

2. $\int_0^4 x\sqrt{x^2+9}\,dx$, $u = x^2 + 9$

3. $\int \dfrac{e^{\sqrt{x}}}{\sqrt{x}}\,dx$, $u = \sqrt{x}$.

4. $\int \dfrac{\cos 3x\,dx}{5 + 2\sin 3x}$, $u = 5 + 2\sin 3x$

In these problems, you need to determine the substitution yourself.

5. $\int (4-3x)^7\,dx$.

6. $\int_{\pi/4}^{\pi/3} \csc^2(5x)\,dx$

7. $\int x^2 e^{3x^3-1}\,dx$

Sometimes there is more than one way to skin a cat:

8. Find $\displaystyle\int \frac{x}{1+x}\,dx$, both by long division and by substituting $u = 1 + x$.

9. Find $\displaystyle\int \frac{2z\,dz}{\sqrt[3]{z^2+1}}$, both by substituting $u = z^2 + 1$ and $u = \sqrt[3]{z^2+1}$.

Use the trigonometric identity

$$\cos 2\alpha = \cos^2\alpha - \sin^2\alpha = 2\cos^2\alpha - 1 = 1 - 2\sin^2\alpha$$

to find

10. $\displaystyle\int \sin^2 x\,dx$

11. $\displaystyle\int \cos^2 x\,dx$

12. Find

$$\int \sec x\,dx$$

by multiplying the numerator and denominator by $\sec x + \tan x$.