Activity 8.6[†‡] – Integration by Substitution

FOR DISCUSSION: *In your own words, describe the two methods for u-substitution.*

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1. Evaluate each indefinite integral by using an appropriate u-substitution. Be sure to explicitly write down u and du.

(a) $\int e^{4x+5} dx =$

$u =$

$du =$

(b) $\int x^2 e^{x^3} dx =$

(c) $\int \frac{1}{9t+4} dt =$

[†] This activity is referenced in Lesson 8.6.
[‡] This activity has supplemental exercises.

(d) $\int \frac{x+6}{x^2+12x+10}\,dx =$

(e) $\int \sin^5\theta\ \cos\theta\,d\theta =$

2. Practice "Method 1" for *u*-substitution of definite integrals. That is, change the limits of integration from *x*-limits to *u*-limits. Then use the FTC to evaluate the integral in terms of *u*.

(plug *u*-limits into antiderivative)

(a) $\int_0^1 x^3\left(1+2x^4\right)^3 dx = \int_{\_\_\_\_}^{\_\_\_\_}$ ________________ $du =$

$u =$ ____________

$du =$ ____________

$x^3 dx =$ ____________

$x = 0 \;\rightarrow\; u =$ ________

$x = 1 \;\rightarrow\; u =$ ________

(b) $\int_1^2 x \cdot \sqrt[3]{5 - x^2}\, dx$

(Follow the procedure shown in Part (a).)

(c) $\int_0^{\pi/4} e^{\sin 2x} \cos 2x\, dx$

3. Practice "Method 2" for u-substitution of definite integrals. That is, first evaluate the indefinite integral using u-substitution to get the antiderivative in terms of x. Then use the FTC to evaluate the integral in terms of x.

(a) $\int_0^1 \frac{3x^7}{(x^8+1)^2}\,dx$

$u =$ __________

$du =$ __________

(find the antiderivative in terms of x)

$\int \frac{3x^7}{(x^8+1)^2}\,dx = \int$ ______________ $du =$

(use your antiderivative from above and plug in x-limits)

$\int_0^1 \frac{3x^7}{(x^8+1)^2}\,dx =$

(b) $\int_1^3 \frac{(\ln x)^2}{x}\,dx$

(Follow the procedure shown in Part (a).)