

Unit #2: Methods of Integration

Topic: U-Substitution

Objective: *SWBAT find an indefinite integral of a composite function by using a u-substitution.*

Warm Up #1:

Which of the following integrals will require you to use a *u-substitution*? You do not have to evaluate the integrals, but explain your reasoning.

a) $\int \cos\theta \sin^{10}\theta d\theta$	b) $\int (x^2 - 3)^3 dx$
c) $\int \frac{x^2 + 2x}{x^2} dx$	d) $\int \frac{6x}{4 + x^2} dx$
e) $\int \frac{dx}{x \ln(4x)}$	f) $\int \frac{x}{\sqrt{1 - 4x^2}} dx$

The main challenge is to think of an appropriate substitution.

Example #1: Evaluate $\int 4\sec^4 x \tan^4 x \sec^4 x dx$



Example #2: Evaluate $\int 2xe^{(5x^2+1)} dx$

Problem Set #1: Evaluate each of the following integrals using an appropriate substitution.

1) $\int \frac{(5+\ln x)^5}{x} dx$

2) $\int x^2 \sec^2(x^3 + 1) dx$

$$3) \int \frac{\cos 4x}{e^{\sin 4x}} dx$$

$$4) \int \frac{dx}{\sqrt{x}(1-\sqrt{x})}$$

$$5) \int \frac{9x^2 dx}{\sqrt{1-x^3}}$$

$$6) \int \frac{e^{1/t}}{t^2} dt$$

$$7) \int 5x^4 \sqrt[3]{3-x^5} dx$$

$$8) \int \frac{5}{x\sqrt{\ln x}} dx$$

$$9) \int \frac{4x}{1+x^2} dx$$

$$10) \int 3x^2 \sin(5x^3) e^{\cos(5x^3)} dx$$

11) $\int \frac{e^{-x}}{e^{-x}+4} dx$	12) $\int \sin^2 3x \cos 3x dx$
13) $\int \frac{\tan^{-1} x}{1+x^2} dx$	14) $\int x \tan(x^2) \sec(x^2) dx$
15) $\int \frac{\sqrt[3]{\ln^2 x}}{4x} dx$	16) $\int \frac{2}{1+4x^2} dx$

Answer Key:

1) $\frac{1}{6}(5 + \ln x)^7 + C$	2) $\tan(x^3 + 1) + C$	3) $-\frac{1}{4e^{\sin 4x}} + C$	4) $-2\ln 1 - \sqrt{x} + C$
5) $-6\sqrt{1 - x^3} + C$	6) $-e^{1/t} + C$	7) $-\frac{3}{4}(3 - x^5)^{4/3} + C$	8) $10\sqrt{\ln x} + C$
9) $2\ln 1 + x^2 + C$	10) $-\frac{1}{5}e^{\cos x^3} + C$	11) $-\ln e^{-x} + 4 + C$	12) $\frac{1}{9}(\sin 3x)^3 + C$
13) $\frac{1}{2}(\tan^{-1} x)^2 + C$	14) $\frac{1}{2}\sec(x^2) + C$	15) $\frac{3}{20}(\ln x)^{5/3} + C$	16) $\tan 2x + C$