

Unit #2: Methods of Integration

Topic: U-Substitution with Definite Integrals

Objective: *SWBAT evaluate a definite integral using a u-substitution.*

Warm Up #4:

Evaluate each of the following:

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

b) $\int \frac{dx}{\sqrt{9-x^2}}$

By changing the interval of integration to match the u -substitution in the integrand, we can avoid the “resubstitution” step.

Example #1: Evaluate $\int_0^1 -12x^2(4x^3 - 1)^3 dx$ from $u(a)$ to $u(b)$.

Example #2: Evaluate $\int_1^e \frac{dx}{x(1 + (\ln x)^2)}$ from $u(a)$ to $u(b)$.

Problem Set #4: Evaluate each of the following definite integrals from $u(a)$ to $u(b)$.

1) $\int_{-1}^1 \frac{5r}{(4 + r^2)^2} dr$

2) $\int_0^{3\pi/2} \frac{\cos x}{\sqrt{4 + 3\sin x}} dx$

$$3) \int_0^2 x e^{x^2} dx$$

$$4) \int_0^{\pi/2} e^{-\cos\theta} \sin\theta d\theta$$

$$5) \int_1^8 \frac{e^{\sqrt[3]{x}}}{\sqrt[3]{x^2}} dx$$

$$6) \int_{\pi/4}^{3\pi/4} \frac{6\cos x - 2\sin x}{6\sin x + 2\cos x} dx$$

$$7) \int_0^{\pi/2} \sin^2 \frac{\theta}{3} \cos \frac{\theta}{3} d\theta$$

$$8) \int_0^1 \frac{1 + e^{3x}}{e^{3x} + 3x} dx$$

9) $\int_0^3 (2x^2 - 5) dx$

10) $\int_0^{\pi/4} \frac{2e^{\tan x} + 5}{\cos^2 x} dx$

11) $\int_1^e \frac{(1+2\ln x)^3}{x} dx$

12) $\int_{-1}^1 (1+x)(2x+x^2)^5 dx$

Answer Key:

1) 0	2) $-\frac{2}{3}$	3) $\frac{1}{2}e^4 - \frac{1}{2}$	4) $1 - \frac{1}{e}$	5) $3e^2 - 3e$	6) $-\ln 2$
7) $\frac{1}{8}$	8) $\frac{1}{3}\ln(e^3 + 3)$	9) 18	10) $2e + 3$	11) 10	12) $\frac{182}{3}$