LESSON 34

MA 16100 · FALL 2022

DR. HOOD

WARM UP

@ $x=0$ $\quad u = 4\cdot 0^2+1 = 1$

@ $x=1$ $\quad u = 4\cdot 1^2+1 = 5$

Use u-substitution to transform the integral:

$$\int_0^1 (4x^2+1)^3 x\,dx$$

$u = 4x^2+1$ $\qquad \frac{du}{8} = x\,dx$

$du = 8x\,dx$

a) $\frac{1}{4}\int_0^1 u^3\,du$ $\qquad$ b) $4\int_1^5 u^3\,du$ $\qquad$ c) $\frac{1}{8}\int_1^5 u^3\,du$

ANNOUNCEMENTS

- Dr. Hood's Office Hours in Math 844
  - Mon, Wed: 3:30-4:30pm
  - Fri: 2:30-3:30pm

- TA's Office Hours in Math Resource Room (WTHR 313)
  - Mon – Thu: 9:30am – 8:30pm
  - Fri: 9:30am – 3:30pm

ANNOUNCEMENTS

- Exam 3 Scores
  - Hope to post most of the scores by 5pm Today, Mon Nov 28
- Final Exam
  - Tuesday Dec 13 at 8:00 am - 10:00 am

POLL 1

What is $\int \sin(2x)\, dx$?

a) $\cos(2x) + C$

b) $-\frac{1}{2}\cos(2x) + C$

c) $-2\cos(2x) + C$

$u = 2x$

$du = 2dx$

$\frac{du}{2} = dx$

$\frac{1}{2}\int \sin(u)\, du$

$= \frac{1}{2}\left[-\cos(u)\right] + C$

$= -\frac{1}{2}\cos(2x) + C$

POLL 2

Which u-substitution is better for:

$$\int \frac{1}{\sqrt{1-4x^2}}\,dx$$

a) $u = 1 - 4x^2$

b) $u = 2x$

$-\frac{1}{8}\frac{du}{\sqrt{1-u}} = dx$ ←

a) $u = 1 - 4x^2$

$du = -8x\,dx$

no x term in integral

$4x^2 = 1 - u$

$x = \frac{\sqrt{1-u}}{2}$

$u^2 = (2x)^2 = 4x^2$

$1 - u^2 = 1 - 4x^2$

as bad as original →

$$\int \frac{1}{u^{1/2}}\left(\frac{-du}{4\sqrt{1-u}}\right)$$

b) $u = 2x$

$du = 2dx$

$\frac{du}{2} = dx$

$$\frac{1}{2}\int \frac{du}{\sqrt{1-u^2}} = \frac{1}{2}\sin^{-1}(u) + C$$

$$= \frac{1}{2}\sin^{-1}(2x) + C$$

POLL 3

Which u-substitution is "better" for:

$$\int_{e^4}^{e^9} \frac{1}{x\sqrt{\ln(x)}}\,dx$$

a) $u = \ln(x)$ ←

b) $u = \sqrt{\ln(x)}$

} Both work equally good

POLL 4

Which u-substitution transformation is "better" for:

$$\int \frac{e^{3x}}{e^{3x}+1}\,dx$$

a) $u = e^{3x}+1$

$du = 3e^{3x}\,dx$

b) $u = e^{3x}$

$du = 3e^{3x}\,dx$

a) $\frac{1}{3}\int \frac{du}{u}$

faster

b) $\frac{1}{3}\int \frac{du}{u+1}$

this works

another subst.

$v = u+1$

$dv = du$

$\frac{1}{3}\int \frac{dv}{v}$