

~~01/21/2020~~

Last Time: Nothing

Today: Introductions  
u-sub, §5.5

Integration by Parts, IBP (easy)

Future: Learning Modules  
HW00  
HW01

---

Syllabus

Schedule

Class Structure

5 Keys to Success

↳ When you get a chance to work.... work!

↳ Turn your phones off + put them away.

↳ If something doesn't make sense, get help ASAP.

↳ Algebra is not an excuse.

↳ Do math within 2 hours of class.

$$\int 3xe^{x^2} dx \Rightarrow \int 3e^u \cdot \frac{du}{2x} = \frac{3}{2} \int e^u du =$$

$$u = x^2$$

$$du = 2x dx$$

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

$$= \frac{3}{2} e^u + C$$

$$= \frac{3}{2} e^{x^2} + C$$

$$\int_0^2 \sqrt{6x+4} dx = \int_4^{16} \sqrt{u} \cdot \frac{du}{6} = \frac{1}{6} \int_4^{16} u^{1/2} du = \frac{1}{6} \cdot \frac{u^{3/2}}{3/2} \Big|_4^{16}$$

$$u = 6x + 4$$

$$du = 6 dx$$

$$dx = \frac{du}{6}$$

$$x=0 \Rightarrow u=4$$

$$x=2 \Rightarrow u=16$$

$$= \frac{1}{6} \cdot \frac{2}{3} \cdot u^{3/2} \Big|_4^{16}$$

$$= \frac{1}{9} [16^{3/2} - 4^{3/2}]$$

$$= \frac{1}{9} [64 - 8] =$$

$$= \boxed{\frac{56}{9}}$$

$$\int x^2 \sin(2x^3) dx = \int x^2 \cdot \sin(u) \cdot \frac{du}{6x^2} = \frac{1}{6} \int \sin(u) du$$

$$= -\frac{1}{6} \cos(u) + C$$

$$= -\frac{1}{6} \cos(2x^3) + C$$

$$u = 2x^3$$

$$du = 6x^2 dx$$

$$dx = \frac{du}{6x^2}$$

$$\int_{\frac{\pi^2}{4}}^{\pi^2} \frac{\cos(\sqrt{x})}{\sqrt{x}} dx = \int_{\frac{\pi}{2}}^{\pi} \frac{\cos(u)}{u} \cdot 2\sqrt{x} dx = 2 \int_{\frac{\pi}{2}}^{\pi} \cos(u) du$$

$$u = x^{1/2}$$

$$du = \frac{1}{2} x^{-1/2} dx = \frac{1}{2\sqrt{x}} dx$$

$$dx = 2\sqrt{x} du$$

$$x = \frac{\pi^2}{4} \Rightarrow u = \frac{\pi}{2}$$

$$x = \pi^2 \Rightarrow u = \pi$$

$$= 2 \cdot \sin(u) \Big|_{\frac{\pi}{2}}^{\pi}$$

$$= 2 [\sin(\pi) - \sin(\frac{\pi}{2})]$$

$$= 2 [0 - 1] = \boxed{-2}$$

$$\int \frac{x}{x+4} dx = \int \frac{x}{u} du = \int \frac{u-4}{u} du = \int \left(1 - \frac{4}{u}\right) du$$

$$\begin{cases} u = x+4 \\ du = dx \\ \rightarrow x = u-4 \end{cases}$$

$$\begin{aligned} & u - 4 \ln|u| + C \\ &= x+4 - 4 \ln|x+4| + C \\ &= x - 4 \ln|x+4| + C \end{aligned}$$

$$\int x\sqrt{x-1} dx = \int x\sqrt{u} du = \int (u+1)\sqrt{u} du$$

$$\begin{cases} u = x-1 \\ du = dx \\ \rightarrow x = u+1 \end{cases}$$

$$\begin{aligned} &= \int u^{3/2} + u^{1/2} du \\ &= \frac{u^{5/2}}{5/2} + \frac{u^{3/2}}{3/2} + C \end{aligned}$$

$$\int x \sin(x^2) dx \quad u = x^2$$

$$= \frac{2}{5}(x-1)^{5/2} + \frac{2}{3}(x-1)^{3/2} + C$$

$$\int x \sin(x) dx \leftarrow \text{I.B.P.}$$

$$= 2(x-1)^{3/2} \left[ \frac{1}{5}(x-1) + \frac{1}{3} \right] + C$$