3.1. Integration By Parts Thursday, February 8, 2018 1:02 PM

$$\frac{1}{2} \left(2x \right) \sin \left(x^2 \right) \left(dx \right)$$
 Let $u = x^2 \cdot \left(du \right) = 2x dx$

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

$$\int x \sin(x) dx + \int x dx \cdot \int \sin(x) dx$$

Integration by parts.

Integration by parts Formula

Where u = f(x); v = g(x) are continuously

différentiable function

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$$\int_{u}^{3c} \sin x \, dx \qquad \text{Let} \quad dv = \sin x \, dx$$

$$du = 1 dx = dx \qquad v = \int \sin x dx = -\cos x$$

$$\int x \sin x dx = x \cdot (-\cos x) - \int (-\cos x) dx$$

$$\left(x \sin x dx = -x \cos x + \int \cos x dx\right)$$

Check the answer:

$$\frac{d}{dx}\left(-x\cos x + \sin x + C\right) = -\left(x\cdot(-\sin x) + \cos x\right)$$
+ conx

Where does the integration by parts firmula come from?

from?

d(uv) = udv + vdu = product rule from (al 1)

$$\int d(uv) = \int udv + \int vdu$$

$$uv = \int udv + \int vdu$$

E.g. $\int x e^{2x} dx$ $\int u dv$ $\begin{cases} u = x \\ dv = e^{2x} dx \end{cases} \qquad \begin{cases} du = dx \\ v = \int e^{2x} dx = \frac{1}{2}e^{2x} dx \end{cases}$

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$$\int_{\mathbf{u}}^{2\times} \frac{2\times}{dx} = \frac{1}{2} \times e^{2\times} - \int_{\mathbf{u}}^{2\times} \frac{2\times}{dx} dx$$

$$= \frac{1}{2} \times e^{2\times} - \frac{1}{2} \int_{\mathbf{u}}^{2\times} dx$$

$$= \frac{1}{2} \times e^{2\times} - \frac{1}{4} e^{2\times} + C.$$

How do we know how to choose u and dv?

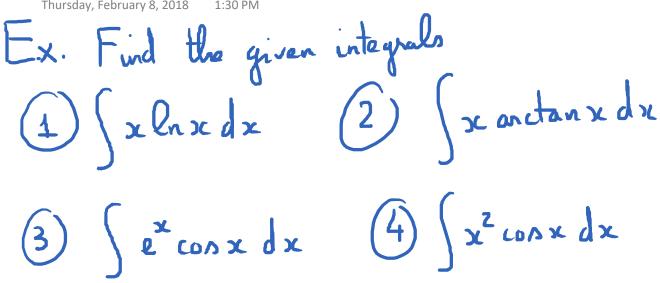
LIATE rule.

L: Logarithmic Functions. (lnx; log2x,...)

I: Inverse Trig Functions (ancsinx,...)

A: Algabraic Functions (polynomials, radials,

T: Trig Function (sinx, cosx, ...) E: Exponential Function (ex, 2x, ...)



Short-cut to the integration by parts formula.

- Tabular method for Integration by ponts.

(4) (x2 conse dx u - x2 + conx Ammer: x2 conxdx 2 + - conx $= x^2 \sin x - 2x(-\cos x)$ O - sinx + 2 (- sinx) +C = x2 sinx + 2x cosx - 2 sinx + C

$$\int_{e^{x}} \cos x \, dx = e^{x} \cos x - e^{x} (-\sin x) + \int_{e^{x}} e^{x} (-\cos x) \, dx$$

$$\int_{e^{x}} \cos x \, dx = e^{x} \cos x + e^{x} \sin x - \int_{e^{x}} e^{x} \cos x \, dx$$

$$\int_{e^{\times} conxdx}^{e^{\times} conxdx} = \frac{e^{\times} conx + e^{\times} sinx}{2} + C$$