Slides Question 1

For which of the following integrals is integration by parts a reasonable choice?

Write down your response on paper, and discuss it with a few neighbors.

a) $\int x^{10} \ln x \, dx$

b) $\int \sin(x^2) \, dx$

c) both of the above

d) none of the above

Slides Question 2

For which of the following integrals is integration by substitution a reasonable choice?

Write down your response on paper, and discuss it with a few neighbors.

a) $\displaystyle \int \frac{\sin(x)}{x} dx$

b) $\displaystyle \int \frac{e^x - e^{-x}}{(e^x - e^{-x})^3} dx$

c) Both of the above

d) None of the above

The difference between integrating...

Is the integral a *w*-subs, parts, both, or neither?

- $\int xe^{-x^2}\,dx$

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  w-subs: $w = -x^2, dw = -2x\,dx$ which we have up to a constant. The integral converts to $\int e^w \frac{dw}{-2}$. not parts as *w*-subs already works (and because we can't integrate $v' = e^{-x^2}$ from detail)

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  Both: parts because it is a product of two different functions (algebraic and exponential) where $w-$subs doesn't initially apply, and after applying detail (with $v' = e^{-5x}$, integrate by *w*-subs), we get $\int u' v\,dx$ that we can integrate

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- $\int e^{-x^2}dx$ not elementary, later we'll see numerical methods and Taylor series approximations

History and Applications

Integration by Parts is attributed to Brook Taylor (1685-1731)
Parts is useful when...

- deriving the Euler-Lagrange equation—how a physical system evolves through time from Hamilton's Least Action Principle
- CRC Handbook of Chemistry and Physics
- Engineering
- Journal of Geology and Geophysics. Earthquakes
- Image processing
- ... integrals made up of function products: *When in doubt, integrate by parts* [Micah Milinovich]