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Test 1 Crash Course

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Integration By Parts

$$\int u\,dv = uv - \int v\,du \ [Indefinite]$$

$$\int_a^b u\,dv = [uv]_a^b - \int_a^b v\,du \ [definite]$$

How do I choose *u* and *dv*? <u>In general</u>, you choose a *u* such that its derivative *du* is considered simpler.

Helpful Hint: LIATE: *u* is *typically* the first term from this list.

*L*ogarithm $(lnx, \log_5 x,$ etc)

*I*nverse Trig $(arctanx, arcsinx, \tan^{-1} x , etc)$

*A*lgebraic (polynomial) $(2x + 1, x^2 + 5x - 9, etc)$

*T*rig $(sinx, cosx, cotx, cotx,$ etc)

*E*xponential $(e^x, 2^x, etc)$

Example

$$\int xe^x dx$$

Example

$$\int_0^\pi 4x\sin(3x)dx$$

Integration By Parts

$$\int u\,dv = uv - \int v\,du \ [Indefinite]$$

$$\int_a^b u\,dv = [uv]_a^b - \int_a^b v\,du \ [definite]$$

Example

$$\int 4x^8 lnx\,dx$$

Example

$$\int (x^2 + 1)e^{4x}\,dx$$

Integration By Parts

Integration By Parts

$$\int u\,dv = uv - \int v\,du \; [Indefinite] \qquad \int_a^b u\,dv = [uv]_a^b - \int_a^b v\,du \; [definite]$$

TRICKY: Integration by parts when there is a trig and exponential present.

Example

$$\int e^x \sin(x)\,dx$$

Integration By Parts

Integration By Parts

$$\int u\,dv = uv - \int v\,du \ \left[Indefinite\right]$$

$$\int_a^b u\,dv = [uv]_a^b - \int_a^b v\,du \ \left[definite\right]$$

TRICKY: Integration by parts when there is a trig and exponential present.

Example

$$\int e^{3x} \cos(2x)\,dx$$

Integration By Parts

Integration By Parts

$$\int u\,dv = uv - \int v\,du \ [Indefinite] \qquad \int_a^b u\,dv = [uv]_a^b - \int_a^b v\,du \ [definite]$$

TRICKY: When there is a logarithm by itself.

Example

$$\int \ln x \, dx$$

Note:

$$\int \ln \sqrt[4]{x} \, dx$$

Integration By Parts

Integration By Parts

$$\int u\,dv = uv - \int v\,du \ [Indefinite] \qquad\qquad \int_a^b u\,dv = [uv]_a^b - \int_a^b v\,du \ [definite]$$

TRICKY: When there is an inverse trig by itself

Example

$$\int \arctan x\,dx$$

Integration By Parts

When to use substitution: Generally when it is a complicated composite function

When to use integration by parts: Generally, when it is simple functions. In general, if you can't go from dv to v then it was not meant to be integration by parts OR you chose the wrong u
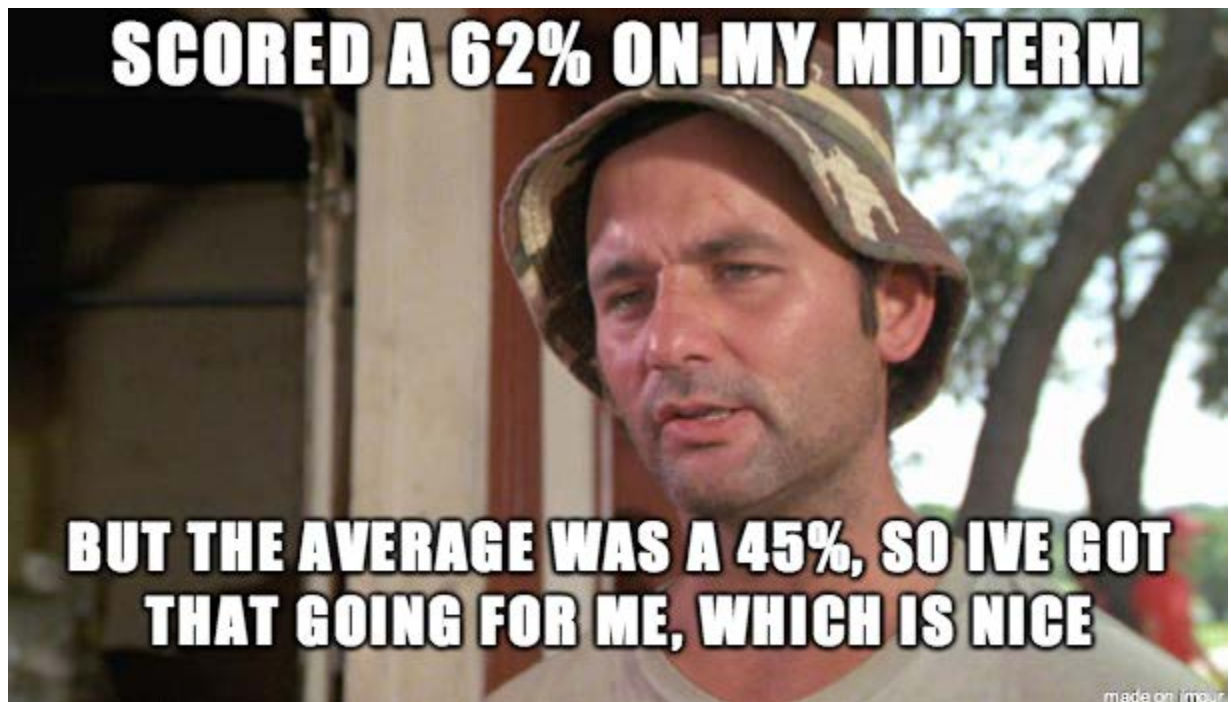
$$\int x^2 e^x \, dx \qquad\qquad \int x^2 e^{x^2} \, dx$$

$$\int x\cos x \, dx \qquad\qquad \int x\cos x^2 \, dx$$

$$\int \ln(x^2) \, dx \qquad\qquad \int \frac{(\ln x)^3}{x} \, dx$$

Sometimes, a question can be tackled in multiple different ways. It does not matter which technique you use as the final answer will be mathematically equivalent!

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