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Test 1 Crash Course

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Trig Integrals

Must Know These Integrals!

$$\int \sin(ax)\,dx = -\frac{1}{a}\cos(ax) + C \qquad \int \cos(ax)\,dx = \frac{1}{a}\sin(ax) + C$$

$$\int \tan(ax)\,dx = \frac{1}{a}\ln|\sec(ax)| + C \qquad \int \sec(ax)\,dx = \frac{1}{a}\ln|\sec(ax) + \tan(ax)| + C$$

$$\int \sec^2 x\,dx = \tan x + C \qquad \int \csc^2 x\,dx = -\cot x + C$$

$$\int \sec x \tan x\,dx = \sec x + C \qquad \int \csc x \cot x\,dx = -\csc x + C$$

Trig Integrals

Integrals involving sine and cosine functions $\int sin^m x \cos^n x \, dx$

Case 1: The power of sine is odd and the power of cosine is even

a) Save one sine factor and convert the other sine's to cosines using $\sin^2 x = 1 - \cos^2 x$
b) Apply a simple 'u' substitution with u = cosx and solve

Case 2: The power of sine is even and the power of cosine is odd

a) Save one cosine factor and convert the other cosines to sines using $\cos^2 x = 1 - \sin^2 x$
b) Apply a simple 'u' substitution with u = sinx and solve

Case 3: The powers on both sine and cosine are even:

Use the half angle identities: $\sin^2 x = \frac{1}{2}(1 - \cos(2x))$ OR $\cos^2 x = \frac{1}{2}(1 + \cos(2x))$

You may also have to use $sinx \, cosx = \frac{1}{2}\sin(2x)$

Example

$\int \cos^3 x \, sin^4 x \, dx$

Trig Integrals

Integrals involving sine and cosine functions $\int sin^m x \cos^n x \, dx$

Case 1: The power of sine is odd and the power of cosine is even

a) Save one sine factor and convert the other sine's to cosines using $\sin^2 x = 1 - \cos^2 x$
b) Apply a simple 'u' substitution with u = cosx and solve

Case 2: The power of sine is even and the power of cosine is odd

a) Save one cosine factor and convert the other cosines to sines using $\cos^2 x = 1 - \sin^2 x$
b) Apply a simple 'u' substitution with u = sinx and solve

Case 3: The powers on both sine and cosine are even:

Use the half angle identities: $\sin^2 x = \frac{1}{2}(1 - \cos(2x))$ OR $\cos^2 x = \frac{1}{2}(1 + \cos(2x))$

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Example

$\int sin^5 x \cos^4 x \ dx$

Trig Integrals

Integrals involving sine and cosine functions $\int sin^m x \cos^n x \, dx$

Case 1: The power of sine is odd and the power of cosine is even

a) Save one sine factor and convert the other sine's to cosines using $\sin^2 x = 1 - \cos^2 x$
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Case 2: The power of sine is even and the power of cosine is odd

a) Save one cosine factor and convert the other cosines to sines using $\cos^2 x = 1 - \sin^2 x$
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Case 3: The powers on both sine and cosine are even:

Use the half angle identities: $\sin^2 x = \frac{1}{2}(1 - \cos(2x))$ OR $\cos^2 x = \frac{1}{2}(1 + \cos(2x))$

You may also have to use $sinx\, cosx = \frac{1}{2}\sin(2x)$

Example

$\int \frac{1}{\sec^2 x} dx$

Trig Integrals

Additional Integrals involving sine and cosine functions:

Case 1: $\int \sin mx \cos nx \, dx$

Use the identity $\sin A \cos B = \frac{1}{2}[\sin(A-B) + \sin(A+B)]$

Case 2: $\int \sin mx \sin nx \, dx$

Use the identity $\sin A \sin B = \frac{1}{2}[\cos(A-B) - \cos(A+B)]$

Case 3: $\int \cos mx \cos nx \, dx$

Use the identity $\cos A \cos B = \frac{1}{2}[\cos(A-B) + \cos(A+B)]$

Example

$\int \sin(2x)\cos(3x)dx$

Trig Integrals

Additional Integrals involving sine and cosine functions:

Case 1: $\int \sin mx \cos nx \, dx$

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Case 2: $\int \sin mx \sin nx \, dx$

Use the identity $\sin A \sin B = \frac{1}{2}[\cos(A-B) - \cos(A+B)]$

Case 3: $\int \cos mx \cos nx \, dx$

Use the identity $\cos A \cos B = \frac{1}{2}[\cos(A-B) + \cos(A+B)]$

Example

$\int x \sin(x) \cos(2x) dx$

Trig Integrals

Integrals involving tangent and secant functions $\int tan^m x \sec^n x \, dx$

Case 1: The power of tanx is odd and the power of secant x is even

a) Save one secxtanx and convert all other tanx's to secx using $\tan^2 x = \sec^2 x - 1$
b) Apply a simple 'u' substitution with u = secx and solve

Case 2: The power of tanx is even and the power of secant x is even

a) Save one $\sec^2 x$ and convert all other secx's to tanx using $\sec^2 x = \tan^2 x + 1$
b) Apply a simple 'u' substitution with u = tanx and solve

Case 3: Apply integration by parts usually, though other methods may also work.

Example

$\int \tan^5 x \sec^6 x \, dx$

Trig Integrals

Integrals involving tangent and secant functions $\int tan^m x \sec^n x \, dx$

Case 1: The power of tanx is odd and the power of secant x is even

a) Save one secxtanx and convert all other tanx's to secx using $\tan^2 x = \sec^2 x - 1$
b) Apply a simple 'u' substitution with u = secx and solve

Case 2: The power of tanx is even and the power of secant x is even

a) Save one $\sec^2 x$ and convert all other secx's to tanx using $\sec^2 x = \tan^2 x + 1$
b) Apply a simple 'u' substitution with u = tanx and solve

Case 3: Apply integration by parts usually, though other methods may also work.

Example

$$\int \frac{\tan^2 x}{\cos^4 x} dx$$

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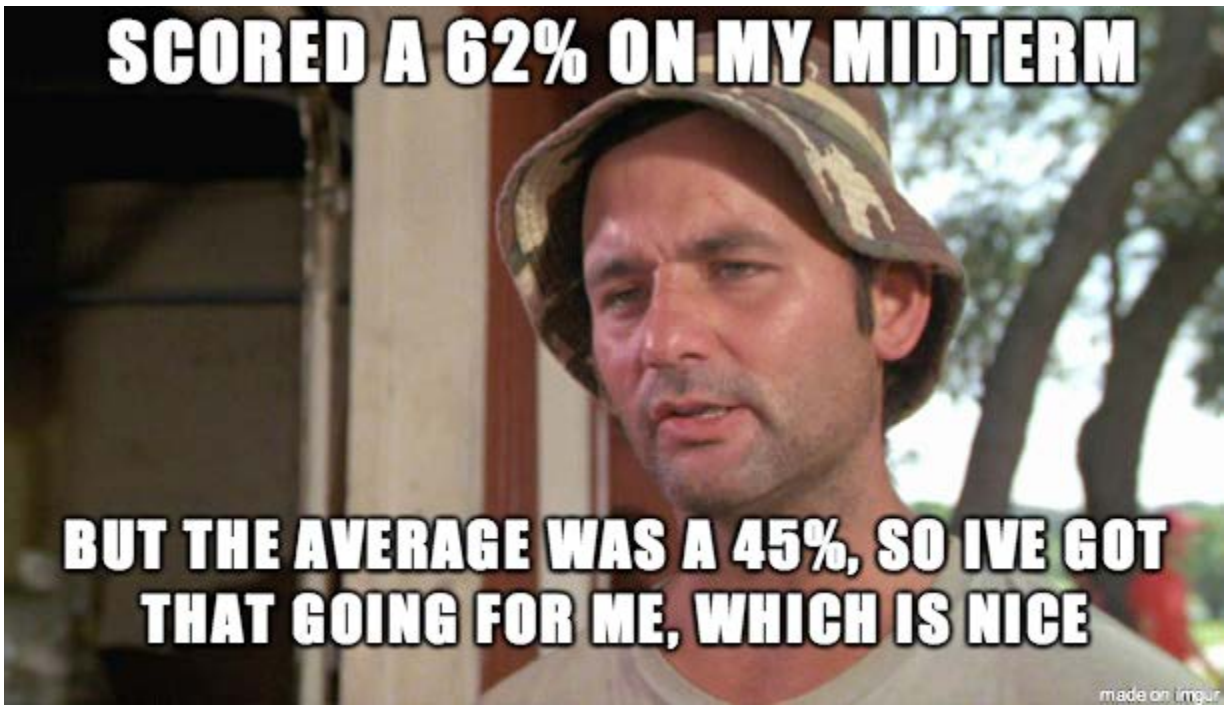

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