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Integration by parts

$$\int (x - 1)^3 e^{2x} dx$$

$$\int u dv = uv - \int v du$$

$(x - 1)^3$	$\exp(2x)$	
$3(x - 1)^2$	$\exp(2x)/2$	\oplus
$6(x - 1)$	$\exp(2x)/4$	\ominus
6	$\exp(2x)/8$	\oplus
0	$\exp(2x)/16$	\ominus

Poll

A

$$(uv)' = (uv' - vu')/v^2$$

B

$$(uv)' = (uv' + vu')$$

C

$$(uv)' = (uv' + vu')/v^2$$

D

$$(uv)' = (uv' - vu')$$

The Method

Integrate the **product rule**

$$(uv)' = uv' + vu'$$

$$\int (uv)' dx = \int uv' dx + \int vu' dx$$

the left hand side is uv .

Write $v' dx = dv$ and
 $u' dx = du$ and solve for

$$\int u dv = uv - \int v du$$

First Example

u

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

dv

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

BASIC EXAMPLES

A

$$\int x e^x dx$$

B

$$\int x \log(x) dx$$

C

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

First observations

We need to find a product of two functions.

Integrate what you can and differentiate the later.
As a general rule, the derivative should become simpler.

MORE ADVANCED

A

$$\int x^2 e^x dx$$

B

$$\int (x - 3) \cos(x + 5) dx$$

C

$$\int \log(x) dx$$

More observations

Sometimes, we have to go several times.

Sometimes, we have to invent a second function 1

TOUGH EXAMPLES

A

$$\int e^x \cos(x) dx$$

B

$$\int \arctan(x) dx$$

C

$$\int x^5 e^x dx$$

Mary
Go Round



$$\int \sin(3x)\cos(4x) dx$$

↓ ↑

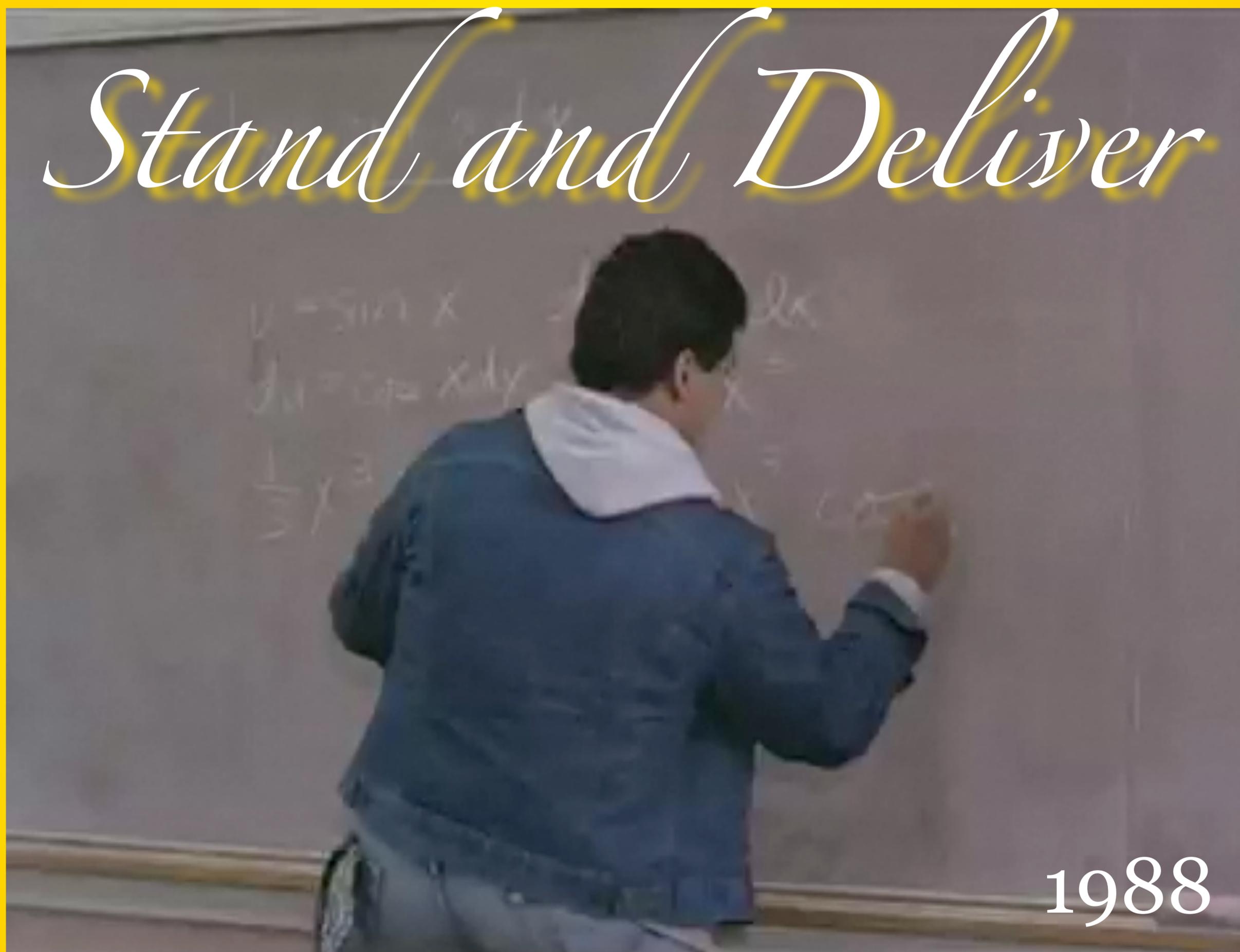
Tic Tac Toe

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

↓ ↑

	<i>T</i>	
<i>T</i>	<i>I</i>	<i>C</i>
<i>T</i>	<i>A</i>	<i>C</i>
	<i>O</i>	<i>E</i>

Stand and Deliver



1988

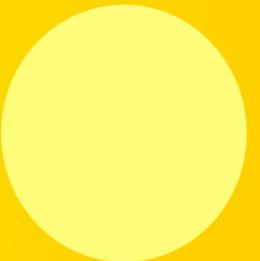
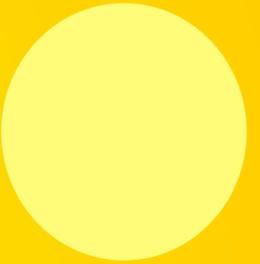
Jam

$$(x - 1)^3$$

$$e^{2x}$$

A) Solve

$$\int \log(2x)x \, dx$$



B) Solve

$$\int (x - 1)^3 e^{2x} \, dx$$

with Tic Tac Toe

The End