

November 6,

# EXPONENTIAL & POLY

Example!

1  $\int x e^x dx$

u	u'
x	$e^x$
1	$e^x$
0	$e^x$

$$= x e^x - e^x + C$$

$$= e^x(x-1) + C$$

2  $\int x^2 e^{-2x} dx$

u	u'
$x^2$	$e^{-2x}$
$2x$	$-\frac{1}{2} e^{-2x}$
2	$\frac{1}{4} e^{-2x}$
0	$-\frac{1}{8} e^{-2x}$

$$= C - \left( \frac{x^2}{2} + \frac{2x}{4} + \frac{2}{8} \right) e^{-2x}$$

$$= C - \frac{x^2 + x + \frac{1}{2}}{2 e^{2x}}$$

3  $\int x^3 e^{5x} dx$

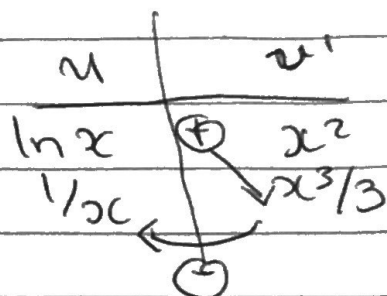
u	u'
$x^3$	$e^{5x}$
$3x^2$	$\frac{1}{5} e^{5x}$
$6x$	$\frac{1}{25} e^{5x}$
6	$\frac{1}{625} e^{5x}$
0	$\frac{1}{625} e^{5x}$

$$= e^{5x} \left( \frac{x^3}{5} - \frac{3x^2}{25} + \frac{6x}{125} - \frac{6}{625} \right) + C$$

# LOG (or Inv. Trig) & POLY

Example

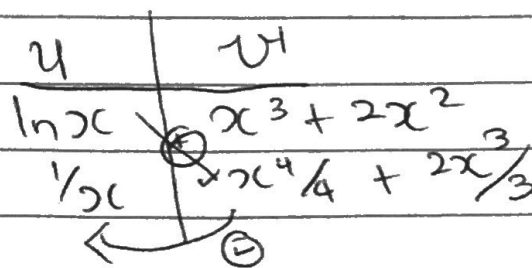
1.  $\int x^2 \ln x dx$



$$= \frac{x^3 \ln x}{3} - \int \frac{1}{x} \cdot \frac{x^3}{3} dx$$

$$= \frac{x^3 \ln x}{3} - \frac{1}{3} \int x^2 dx = \frac{x^3 \ln x}{3} - \frac{1}{9} x^3 + C$$

2.  $\int (x^3 + 2x^2) \ln x dx$



$$= \left( \frac{x^4}{4} + \frac{2x^3}{3} \right) \ln x - \int \frac{1}{x} \left( \frac{x^4}{4} + \frac{2x^3}{3} \right) dx$$

$$= \left( \frac{x^4}{4} + \frac{2x^3}{3} \right) \ln x - \frac{1}{4} \int x^3 dx - \frac{2}{3} \int x^2 dx$$

$$= \left( \frac{x^4}{4} + \frac{2x^3}{3} \right) \ln x - \frac{x^4}{16} - \frac{2x^3}{9} + C$$

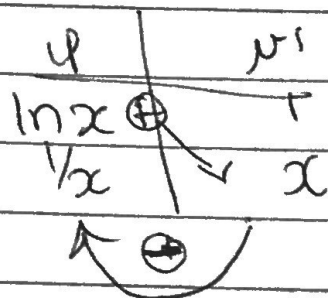
3.  $\int x \ln x dx = \int (1) \ln x dx$

$$= x \ln x - \int \frac{1}{x} \cdot x dx$$

$$= x \ln x - \int dx$$

$$= x \ln x - x + C$$

$$= x(x \ln x - 1) + C$$



# EXPONENTIAL & WAVE (OR 2 WAVES)

$$1 \quad I = \int \sin(2x) \cos x \, dx$$

	$u$	$u'$
	$\sin(2x)$	$\oplus \cos x$
	$2 \cos(2x)$	$\ominus \sin x$
	$-4 \sin(2x)$	$\ominus -\cos x$
		$\oplus$

$$I = \sin x \sin(2x) + 2 \cos x \cos(2x) + 4 \int \sin(2x) \cos x \, dx$$

$$I = \sin x \sin(2x) + 2 \cos x \cos(2x) + 4I$$

$$I - 4I = \sin x \sin(2x) + 2 \cos x \cos(2x)$$

$$-3I = \sin x \sin(2x) + 2 \cos x \cos(2x)$$

$$I = C - \frac{1}{3} \sin x \sin(2x) - \frac{2}{3} \cos x \cos(2x)$$