Warmup

② $\int \ln x \, dx$

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

$u = e^x \quad du = e^x dx$

$dv = \sin x dx \quad v = -\cos x dx$

$-\cos x e^x + \int \cos x e^x dx$

$u = e^x \quad du = e^x dx$

$dv = \cos x dx \quad v = \sin x$

$-\cos x e^x + e^x \sin x - \int \sin x e^x dx = \int e^x \sin x dx$

$= \frac{e^x(\sin x + \cos x)}{2} + C$

① $\int \cot^2 3x \, dx$

$-\frac{1}{3}\cot(3x) - x + C$

$\int (\csc^2 3x - 1) dx$

$u = 3x$

$du = 3 dx$

$\frac{1}{3} du = dx$

$\frac{1}{3}\int (\csc^2 u - 1) du$

$\frac{1}{3}(-\cot u - u) + C$

$\frac{1}{3}(-\cot 3x - 3x) + C$

$-\frac{1}{3}\cot 3x - x + C$

$x \ln x - x + C$

$\int \ln x \, dx \quad u = \ln x \quad dv = dx$

$du = \frac{1}{x} dx \quad v = x$

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

$= x \ln x - x + C$

More 6.3 Integration by Parts

Tabular Integration : If in format

$$\int f(x) \cdot g(x)\, dx$$

where derivatives of $f(x) \to 0$ and $g(x)$ can be integrated easily, use tabular.

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

$f(x)$ and derivatives		$g(x)$ and integrals
x^2	+ →	e^x
$2x$	− →	e^x
2	+ →	e^x
0		e^x

$$x^2e^x - 2xe^x + 2e^x + C$$

6.4 Separable Differential Equations

$$\frac{dy}{dx} = f(y) \cdot g(x)$$

$$\int \frac{dy}{f(y)} = \int g(x) \cdot dx$$

Ex 1) $\frac{dy}{dx} = x^2 y^2$ and $(1,1)$

HW: p 346 #10, 16, 21-31 odds