

Parts HW mmn

LIATE

(1)  $\int x \sin x \, dx$        $x - \cos x$   
 $dx \quad \sin x \, dx$

$$-x \cos x + \int \cos x \, dx$$

$$\boxed{-x \cos x + \sin x + C}$$

(2)  $\int x \cos 5x \, dx$        $x \quad \frac{1}{5} \sin 5x$   
 $dx \quad \cos 5x \, dx$

$$\frac{x}{5} \sin 5x - \frac{1}{5} \int \sin 5x \, dx$$

$$\boxed{\frac{x}{5} \sin(5x) + \frac{1}{25} \cos(5x) + C}$$

(3)  $\int x e^{8x} \, dx$        $x \quad \frac{1}{8} e^{8x}$   
 $dx \quad e^{8x} \, dx$

$$\frac{x}{8} e^{8x} - \frac{1}{8} \int e^{8x} \, dx$$

$$\boxed{\frac{x}{8} e^{8x} - \frac{1}{64} e^{8x} + C}$$

$$(4) \int (6x+2) e^{-3x} dx$$

$$6x+2 \quad -\frac{1}{3}e^{-3x}$$

$$6 dx \quad e^{-3x} dx$$

$$-\frac{6x+2}{3} e^{-3x} + 2 \int e^{-3x} dx$$

$$\boxed{-\frac{6x+2}{3} e^{-3x} - \frac{2}{3} e^{-3x} + C}$$

$$(5) \int x \csc^2 x dx$$

$$x \quad -\cot x$$

$$dx \quad \csc^2 x dx$$

$$-x \cot x + \int \cot x dx$$

$$\cot x \rightarrow \int \frac{\cos x}{\sin x} dx$$

$$u = \sin x$$

$$du = \cos x dx$$

$$\int \frac{1}{u} du$$

$$\ln |u|$$

$$\boxed{-x \cot x + \ln |\sin x| + C}$$

$$(6) \int \sqrt{x} \ln x dx$$

$$\ln x \quad \frac{2}{3} x^{\frac{3}{2}}$$

$$\frac{1}{x} dx \quad x^{\frac{1}{2}} dx$$

$$\frac{2}{3} x^{\frac{3}{2}} \ln x - \frac{2}{3} \int x^{\frac{1}{2}} dx$$

$$- \frac{2}{3} \cdot \frac{2}{3} x^{\frac{3}{2}}$$

$$\boxed{\frac{2}{3} x^{\frac{3}{2}} \ln x - \frac{4}{9} x^{\frac{3}{2}} + C}$$

$$(7) \int x e^{x^2} dx$$

$$u = x^2$$
$$du = 2x dx$$
$$\frac{1}{2} du = x dx$$

u sub  
only

$$\frac{1}{2} \int e^u du$$

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

$$(8) \int \frac{(\ln x)^4}{x} dx$$

$$u = \ln x$$
$$du = \frac{1}{x} dx$$

u sub only

$$\int u^4 du$$

$$\frac{1}{5} (\ln x)^5 + C$$

$$(9) \int x^3 \ln x dx$$

$$\ln x \quad \frac{1}{4} x^4$$
$$\frac{1}{x} \quad x^3 dx$$

$$\frac{1}{4} x^4 \ln x - \frac{1}{4} \int x^3 dx$$
$$-\frac{1}{4} \cdot \frac{1}{4} x^4$$

$$\frac{1}{4} x^4 \ln x - \frac{1}{16} x^4 + C$$

(10)  $\int \frac{4x}{e^{2x}} dx$       $4 \int x e^{-2x} dx$      LIATE

$4 \int x e^{-2x} dx$       $x \cdot \frac{-1}{2} e^{-2x}$   
 $dx \cdot e^{-2x} dx$

$-2 x e^{-2x} + \frac{1}{2} \int e^{-2x} dx$

$\frac{1}{2} \left( -\frac{1}{2} e^{-2x} \right)$

$-2 x e^{-2x} - \frac{1}{4} e^{-2x} + C$

(11)  $\int x \sqrt{x+1} dx$

~~$2 \int u du$~~

~~$2 \int u^2 du$~~

~~$\frac{2}{3} u^3 + C$~~

~~$u = \sqrt{x+1}$~~

~~$u^2 = x+1$~~

~~$2u du = 1 dx$~~

~~$\frac{2}{3} (\sqrt{x+1})^3 + C$~~

~~$\frac{2}{3} \left( 3 \left( (x+1)^{\frac{1}{2}} \right)^2 \left[ \frac{1}{2} (x+1)^{-\frac{1}{2}} \right] \right)$~~

~~$\frac{2}{3} \cdot 3(x+1) \left( \frac{1}{2\sqrt{x+1}} \right)$~~

(11)

$$\int x \sqrt{x+1} dx$$

$$u = \sqrt{x+1}$$

$$u^2 = x+1$$

$$u^2 - 1 = x$$

$$2u du = dx$$

$$2 \int (u^2 - 1) u du$$

$$2 \int u^3 - u du$$

$$2 \left[ \frac{1}{4} u^4 - \frac{1}{2} u^2 \right] \rightarrow \frac{1}{2} u^4 - u^2 + C$$

$$\frac{1}{4} (\sqrt{x+1})^4 - (\sqrt{x+1})^2 + C$$

$$\frac{1}{4} (x+1)^2 - (x+1) + C$$

$$\frac{1}{4} (x^2 + 2x + 1) - x - 1$$

$$\frac{1}{4} x^2 + \frac{1}{2} x + \frac{1}{4} - x - 1 + C$$

$$\frac{1}{4} x^2 - \frac{1}{2} x - \frac{3}{4} + C$$

(12)

$$\int \sin^{-1} x \, dx$$

LIATE

$\sin^{-1} x$	$x$
$\frac{1}{\sqrt{1-x^2}}$	$dx$

$$x \sin^{-1} x - \int \frac{x}{\sqrt{1-x^2}} \, dx$$

$$u = 1 - x^2$$

$$du = -2x \, dx$$

$$-\frac{1}{2} du = x \, dx$$

$$+\frac{1}{2} \int \frac{1}{\sqrt{u}} \, du$$

$$\int u^{-\frac{1}{2}} \, du \rightarrow 2u^{\frac{1}{2}} + C$$

$$\frac{1}{2} (2u^{\frac{1}{2}} + C)$$

$$\sqrt{u} + C$$

$$x \sin^{-1} x + \sqrt{1-x^2} + C$$

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

$$\begin{array}{l} \cos x \quad e^x \\ -\sin x \quad e^x dx \end{array}$$

$$e^x \cos x + \int e^x \sin x dx \quad \begin{array}{l} \sin x \quad e^x \\ \cos x \quad e^x dx \end{array}$$

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

$$e^x \cos x + e^x \sin x = 2 \int e^x \cos x dx$$

$$\frac{e^x \cos x + e^x \sin x}{2} + C = \int e^x \cos x dx$$

(14)  $\int e^{4x} \sin x$        $\begin{array}{l} \sin x \quad \frac{1}{4} e^{4x} \\ \cos x \quad e^{4x} dx \end{array}$

$$\frac{1}{4} e^{4x} \sin x - \frac{1}{4} \int e^{4x} \cos x dx \quad \begin{array}{l} \cos x \quad \frac{1}{4} e^{4x} \\ -\sin x \quad e^{4x} dx \end{array}$$

$$\frac{1}{4} e^{4x} \sin x - \frac{1}{16} e^{4x} \cos x + \frac{1}{4} \int e^{4x} \sin x dx = \int e^{4x} \sin x dx$$

$$\frac{1}{4} e^{4x} \sin x - \frac{1}{16} e^{4x} \cos x = \frac{3}{4} \int e^{4x} \sin x dx$$

$$\frac{4}{3} \left[ \frac{1}{4} e^{4x} \sin x - \frac{1}{16} e^{4x} \cos x \right] + C = \int e^{4x} \sin x dx$$

$$\frac{1}{3} e^{4x} \sin x - \frac{1}{12} e^{4x} \cos x + C = \int e^{4x} \sin x dx$$

$$(15) \int x^5 \cos(x^3) dx \quad \text{Liare}$$

$$x^5 \cos(x^3) dx$$

$$x^3 \cdot x^2 \cos(x^3) dx$$

$$\frac{1}{3} \int u \cos u du$$

$u$

$du$

$$\int \sin u du$$

$$\int \cos u du$$

$$\frac{1}{3} [u \sin u - \int \sin u du]$$

$$\frac{1}{3} [u \sin u + \cos u] + C$$

$$\frac{1}{3} x^3 \sin(x^3) + \frac{1}{3} \cos(x^3) + C$$



(16)

$$\int x^4 e^{\frac{1}{2}x} dx$$

$$\begin{array}{r} x^4 + e^{\frac{1}{2}x} \\ \swarrow \searrow \\ 4x^3 \quad 2e^{\frac{1}{2}x} \\ \swarrow \searrow \\ 12x^2 \quad 4e^{\frac{1}{2}x} \\ \swarrow \searrow \\ 24x \quad 8e^{\frac{1}{2}x} \\ \swarrow \searrow \\ 24 \quad 16e^{\frac{1}{2}x} \\ \swarrow \searrow \\ 0 \quad 32e^{\frac{1}{2}x} \end{array}$$

$$2x^4 e^{\frac{1}{2}x} - 16x^3 e^{\frac{1}{2}x} + 96x^2 e^{\frac{1}{2}x} - 384x e^{\frac{1}{2}x} + 768 e^{\frac{1}{2}x} + C$$

(17)

$$\begin{array}{r} x^3 + \cos 3x \\ \swarrow \searrow \\ 3x^2 \quad \frac{1}{3} \sin(3x) \\ \swarrow \searrow \\ 6x \quad -\frac{1}{9} \cos(3x) \\ \swarrow \searrow \\ 6 \quad -\frac{1}{27} \sin(3x) \\ \swarrow \searrow \\ 0 \quad \frac{1}{81} \cos(3x) \end{array}$$

$$\frac{1}{3} x^3 \sin(3x) + \frac{1}{3} x^2 \cos(3x) - \frac{2}{9} x \sin(3x) - \frac{2}{27} \cos(3x) + C$$

$$\textcircled{18} \int_1^e 4x \ln x \, dx$$

$$4 \int_1^e x \ln x \, dx \quad \begin{array}{l} \ln x \quad x^2 \\ \frac{1}{x} \quad x \, dx \end{array}$$

$$x^2 \ln x - \int x \, dx$$

$$4 \left[ x^2 \ln x - \frac{1}{2} x^2 \right]_1^e$$

$$4 \left[ e^2(1) - \frac{1}{2} e^2 - \left[ 0 - \frac{1}{2} \right] \right]$$

$$4 \left[ \frac{1}{2} e^2 + \frac{1}{2} \right]$$

$$\boxed{2e^2 + 2}$$

What does fn INT say?

$$(19) \int_0^1 x \ln(1+x^2) dx \quad u = 1+x^2$$

$$du = 2x dx$$

$$\frac{1}{2} du = x dx$$

$$\frac{1}{2} \int_1^2 \ln u du$$

$$\ln u \quad u$$

$$\frac{1}{u} \quad du$$

$$u(1) = 2$$

$$u(0) = 1$$

$$u \ln u - \int du$$

$$\frac{u \ln u - u}{2} \Big|_1^2$$

$$\frac{2 \ln 2 - 2}{2} + \frac{+1}{2}$$

$$\ln 2 - 1 + \frac{1}{2}$$

$$\boxed{\ln 2 - \frac{1}{2}}$$