(e)

$$\int e^x \cdot \cos x \, dx = \underline{e^x \cos x} + \int e^x \sin x \, dx$$

$u = \cos x \qquad v = e^x$

$du = -\sin x\,dx \qquad \int dv = \int e^x \, dx$

$u = \sin x \qquad v = e^x$

$du = \cos x \, dx \qquad dv = e^x \, dx$

$$\int e^x \cos x \, dx = e^x \cos x + e^x \sin x - \cancel{\int e^x \cos x \, dx}$$

$$+\int e^x \cos x \, dx \qquad\qquad +\cancel{\int e^x \cos x \, dx}$$

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

$$\int e^x \cos x \, dx = \underline{\frac{1}{2}\left(e^x \cos x + e^x \sin x\right) + C}$$

(j)

	u	dv
	x^4	$\sin 2x$
(-1)	$4x^3$	$-\frac{1}{2}\cos 2x$
	$12x^2$	$-\frac{1}{4}\sin 2x$
(-1)	$24x$	$\frac{1}{8}\cos 2x$
	24	$\frac{1}{16}\sin 2x$
	0	$-\frac{1}{32}\cos 2x$

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

Partial Fractions

Ex $\displaystyle\int \frac{dx}{2x^2-3x-2}$

$$\frac{1}{2x^2-3x-2} = \frac{A}{2x+1} + \frac{B}{x-2}$$

$$\frac{1}{2x^2-3x-2} = \frac{A}{2x+1} + \frac{B}{x-2}$$

Mult. by $2x^2-3x-2$ or $(2x+1)(x-2)$

$$1 = A(x-2) + B(2x+1)$$

Let $x=2$: $1 = \cancel{A(0)} + B(5)$

$$\boxed{B = \frac{1}{5}}$$

Let $x=-\frac{1}{2}$: $1 = A\left(-\frac{5}{2}\right) + \cancel{B(0)}$

$$\boxed{A = -\frac{2}{5}}$$

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

$$\int \frac{dx}{2x^2-3x-2} = \frac{1}{5}\int \frac{dx}{x-2} - \frac{1}{5}\int \frac{2\,dx}{2x+1}$$

$u = x-2$
$du = dx$

$u = 2x+1$
$du = 2\,dx$

$\ln a - \ln b = \ln \frac{a}{b}$

$$= \frac{1}{5}\ln|x-2| - \frac{1}{5}\ln|2x+1| + C$$

OR $$= \frac{1}{5}\ln\frac{|x-2|}{|2x+1|} + C$$

[j] $x^3 - x^2 - 6x = x(x^2 - x - 6)$

$$= x\,(x+2)(x-3)$$

$$\frac{1}{x^3 - x^2 - 6x} = \frac{A}{x} + \frac{B}{x+2} + \frac{C}{x-3}$$

$$1 = A(x+2)(x-3) + Bx(x-3) + Cx(x+2)$$

Let $x = 0$ $\quad 1 = A(0+2)(0-3) \longrightarrow A = -\frac{1}{6}$

Let $x = 3$ $\quad 1 = C(3)(3+2) \longrightarrow C = \frac{1}{15}$

Let $x = -2$ $\quad 1 = B(-2)(-2-3) \longrightarrow B = \frac{1}{10}$

$$\int \frac{dx}{x^3 - x^2 - 6x} = -\frac{1}{6}\int \frac{dx}{x} + \frac{1}{10}\int \frac{dx}{x+2} + \frac{1}{15}\int \frac{dx}{x-3}$$

$$= -\frac{1}{6}\ln|x| + \frac{1}{10}\ln|x+2| + \frac{1}{15}\ln|x-3|$$

$$+C$$

(c) $\displaystyle\int \frac{x^2}{x^2-6x+8}\,dx = \int 1\,dx + \int \frac{(6x-8)\,dx}{x^2-6x+8}$

$$\begin{array}{r|l} & 1 + \dfrac{6x-8}{x^2-6x+8} \\ \hline x^2-6x+8 & \cancel{x^2} \\ & \underline{-\cancel{x^2}+6x-8} \\ & \quad 6x-8 \end{array}$$