$\boxed{17}$ $\int e^{2\theta} \sin 3\theta \, d\theta$

L
I
A
T $\to$ U
E

$\underline{u = \sin 3\theta}$ $v = \frac{1}{2} e^{2\theta}$

$du = 3\cos 3\theta \, d\theta$ $\underline{dv = e^{2\theta} d\theta}$

$uv - \int v \, du$

$\sin 3\theta \cdot \frac{1}{2} e^{2\theta} - \int \frac{1}{2} e^{2\theta} \cdot 3\cos 3\theta \, d\theta$

$u = 2\theta$

$\frac{du}{2} = \frac{\cancel{2} d\theta}{\cancel{2}}$

$\frac{1}{2} \sin 3\theta \, e^{2\theta} - \frac{3}{2} \int e^{2\theta} \cos 3\theta \, d\theta$

$u = \cos 3\theta$ $v = \frac{1}{2} e^{2\theta}$

$du = 3 \sin 3\theta \, d\theta$ $dv = e^{2\theta} d\theta$

$\frac{1}{2} \sin 3\theta \, e^{2\theta} - \frac{3}{2} \left[ \cos 3\theta \cdot \frac{1}{2} e^{2\theta} - \int \frac{1}{2} e^{2\theta} \cdot (-3\sin 3\theta) \, d\theta \right.$

$\int e^{2\theta} \sin 3\theta \, d\theta = \frac{1}{2} e^{2\theta} \sin 3\theta - \frac{3}{4} e^{2\theta} \cos 3\theta - \frac{9}{4} \int e^{2\theta} \sin 3\theta \, d\theta$

$+\frac{9}{4} \int e^{2\theta} \sin 3\theta \, d\theta$ $\qquad +\frac{9}{4} \int e^{2\theta} \sin 3\theta \, d\theta$

$$\frac{\cancel{\frac{13}{4}} \int e^{2\theta} \sin 3\theta \, d\theta}{\cancel{\frac{13}{4}}} = \frac{\frac{1}{2} e^{2\theta} \sin 3\theta - \frac{3}{4} e^{2\theta} \cos 3\theta}{\frac{13}{4}}$$

$$\boxed{= \frac{2}{13} e^{2\theta} \sin 3\theta - \frac{3}{13} e^{2\theta} \cos 3\theta + C}$$

9 $\int \ln(2x+1)\,dx$

L
I
A
T
E

$u = \ln(2x+1)$

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

$dv = dx$

$v = x$

$$\int \ln(2x+1)\,dx = \ln(2x+1)\cdot x - \int x \cdot \frac{2}{2x+1}\,dx$$

$$= x\ln(2x+1) - \int \frac{2x}{2x+1}\,dx$$

$\neq \frac{2x}{2x} + \frac{2x}{1}$

$$= x\ln(2x+1) - \int \frac{2x+1-1}{2x+1}\,dx$$

$\int \frac{1}{2x+1}\,dx$

$u = 2x+1$

$\frac{du}{2} = \frac{\cancel{2}\,dx}{\cancel{2}}$

$$= x\ln(2x+1) - \int \frac{2x+1}{2x+1}\,dx + \int \frac{1}{2x+1}\,dx$$

$$= \boxed{x\ln(2x+1) - x + \ln|2x+1| \cdot \frac{1}{2}}\ \boxed{+C}$$

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

To get the answer in the back:

1. Factor ln(2x + 1) $\quad \ln(2x+1)\cdot\left(x+\frac{1}{2}\right) - x + C$
2. Factor 1/2 $\quad \boxed{\frac{1}{2}(2x+1)\ln(2x+1) - x + C}$

(23) $\displaystyle\int_1^2 \frac{\ln x}{x^2}\,dx = \int_1^2 \ln x \cdot x^{-2}\,dx$

L $\quad u = \ln x$

I $\quad du = dx/x$

A $\quad dv = x^{-2}\,dx$

T $\quad V = \dfrac{x^{-1}}{-1}$.

E $\quad V = -\dfrac{1}{x}$

$u \quad v \quad -\int v\,du$

$$\ln x \cdot \left(-\frac{1}{x}\right)\Big|_1^2 - \int_1^2 -\frac{1}{x}\cdot\frac{dx}{x}$$

$$\ln 2\left(-\frac{1}{2}\right) - \ln 1\left(-\frac{1}{1}\right) + \int_1^2 x^{-2}\,dx$$

$$-\frac{\ln 2}{2} + 0 + {}^{-}x^{-1}\Big|_1^2$$

$$-\frac{\ln 2}{2} - \left(\frac{1}{2} - \frac{1}{1}\right) = -\frac{\ln 2}{2} + \frac{1}{2} = \boxed{\frac{1-\ln 2}{2}}$$