

$$(ii) \int_1^e \ln x \, dx \quad \begin{array}{l} u = \ln x \\ \frac{du}{dx} = \frac{1}{x} \end{array} \quad \begin{array}{l} \frac{dv}{dx} = 1 \\ v = x \end{array}$$

$$\int_1^e \ln x \, dx = x \ln x - \int x \cdot \frac{1}{x} \, dx$$

$$= [x \ln x]_1^e - \int_1^e 1 \, dx$$

$$= [x \ln x - x]_1^e$$

$$= e - 1$$

$$= 0 - (-1) = 1$$