In each problem make clear your choices of \( u, v, \) and any other stray letters your approach happens to drag in.

1. Compute \( \int x \ln x \, dx. \)

\[
\frac{d}{dx} (\ln x) = \frac{1}{x}
\]

\[
\int u \, dv = uv - \int v \, du
\]

\[
u = x^{1/2} \quad v = x^2/2
\]

\[
u = \ln x \quad du = \frac{1}{x} \, dx
\]

\[
dv = x \, dx
\]

\[
\int x \ln x \, dx = (\ln x) \left( \frac{x^{2}}{2} \right) - \int \frac{x^{2}}{2} \cdot \frac{1}{x} \, dx
\]

\[
= \frac{x^{2} \ln x}{2} - \frac{1}{2} \int x \, dx = \frac{x^{2} \ln x}{2} - \frac{1}{2} \left( \frac{x^{2}}{2} \right) + C
\]

\[
= \frac{x^{2} \ln x}{2} - \frac{x^{2}}{4} + C
\]

2. \( \int \sqrt{5y+1} \, dy \)

Let \( u = 5y+1 \)

\[
\frac{du}{dy} = 5
\]

\[
\int \sqrt{5y+1} \, dy = \int u^{1/2} \, du = \frac{1}{5} \int u^{1/2} \, du
\]

\[
= \frac{1}{5} \left( \frac{u^{3/2}}{3/2} \right) + C = \frac{1}{5} \times \frac{2}{3} \left( 5y+1 \right)^{3/2} + C = \frac{2}{15} \left( 5y+1 \right)^{3/2} + C
\]