In Tutorial 11 Q3, one will end up with the double integral

$$\int_0^2 \int_0^{(6-3u)/2} (3v + 2u^2 + (6-3u-2v)^2)\, dv\, du.$$

Some of your classmates asked if it is possible to integrate without expanding $(6-3u-2v)^2$, which will lead to 9 terms. **The answer is yes.**

First we evaluate the inner integral:

$$\begin{aligned}
&\int_0^{(6-3u)/2} 3v + 2u^2 + (6-3u-2v)^2\, dv \\
&= \left[ \frac{3v^2}{2} + 2u^2 v + \frac{(6-3u-2v)^3}{3(-2)} \right]_{v=0}^{v=(6-3u)/2} \\
&= \frac{3}{2}\left(\frac{6-3u}{2}\right)^2 + \frac{2u^2(6-3u)}{2} + 0 - 0 - 0 - \frac{(6-3u)^3}{-6} \\
&= \frac{3}{8}(6-3u)^2 + u^2(6-3u) + \frac{1}{6}(6-3u)^3.
\end{aligned}$$

Then

$$\begin{aligned}
&\int_0^2 \frac{3}{8}(6-3u)^2 + 6u^2 - 3u^3 + \frac{1}{6}(6-3u)^3\, du \\
&= \left[ \frac{3}{8}\frac{(6-3u)^3}{3(-3)} + \frac{6u^3}{3} - \frac{3u^4}{4} + \frac{1}{6}\frac{(6-3u)^4}{4(-3)} \right]_{u=0}^{u=2} \\
&= 4 - (-27) \\
&= 31.
\end{aligned}$$