

Math1210
u-substitution for integrals

Which of these is done correctly (circle all that are correct)? And, if it's not correct, point out the error.
Let's start with this integral that needs u-sub.

$$\int_{\frac{\pi}{8}}^{\frac{\pi}{4}} 12 \sin^2(4x + \pi) \cos(4x + \pi) dx$$

$$\begin{aligned} u &= \sin(4x + \pi) \\ du &= 4 \cos(4x + \pi) dx \\ 3 du &= 12 \cos(4x + \pi) dx \end{aligned}$$

<p>(a) $\int_{\frac{\pi}{8}}^{\frac{\pi}{4}} 12 \sin^2(4x + \pi) \cos(4x + \pi) dx$</p> $= \int_{\frac{\pi}{8}}^{\frac{\pi}{4}} 3u^2 du = (u^3) \Big _{\frac{\pi}{8}}^{\frac{\pi}{4}} = (\sin^3(4x + \pi)) \Big _{\frac{\pi}{8}}^{\frac{\pi}{4}}$ $= \sin^3(2\pi) - \sin^3\left(\frac{3\pi}{2}\right) = 0 - (-1) = 1$	<p>(b) $\int_{\frac{\pi}{8}}^{\frac{\pi}{4}} 12 \sin^2(4x + \pi) \cos(4x + \pi) dx$</p> $= \int_{\frac{\pi}{8}}^{\frac{\pi}{4}} 3u^2 du = (u^3) \Big _{\frac{\pi}{8}}^{\frac{\pi}{4}}$ $= \left(\frac{\pi}{4}\right)^3 - \left(\frac{\pi}{8}\right)^3 = \frac{7\pi^3}{512}$
<p>(c) $\int_{\frac{\pi}{8}}^{\frac{\pi}{4}} 12 \sin^2(4x + \pi) \cos(4x + \pi) dx$</p> $= \int_{-1}^0 3u^2 du = (u^3) \Big _{-1}^0 = (\sin^3(4x + \pi)) \Big _{-1}^0$ $= \sin^3(\pi) - \sin^3(-4 + \pi) = -\sin^3(-4 + \pi)$	<p>(d) $\int_{\frac{\pi}{8}}^{\frac{\pi}{4}} 12 \sin^2(4x + \pi) \cos(4x + \pi) dx$</p> $= \int_{-1}^0 3u^2 du = (u^3) \Big _{-1}^0 = 0^3 - (-1)^3 = 1$
<p>(e) $\int 12 \sin^2(4x + \pi) \cos(4x + \pi) dx$</p> $= \int 3u^2 du = u^3 + C = (\sin^3(4x + \pi)) \Big _{\frac{\pi}{8}}^{\frac{\pi}{4}}$ $= \sin^3(2\pi) - \sin^3\left(\frac{3\pi}{2}\right) = 0 - (-1) = 1$	<p>(f) $\int 12 \sin^2(4x + \pi) \cos(4x + \pi) dx$</p> $= \int 3u^2 du = u^3 + C = \sin^3(4x + \pi) + C$ $\int_{\frac{\pi}{8}}^{\frac{\pi}{4}} 12 \sin^2(4x + \pi) \cos(4x + \pi) dx$ $= (\sin^3(4x + \pi)) \Big _{\frac{\pi}{8}}^{\frac{\pi}{4}}$ $= \sin^3(2\pi) - \sin^3\left(\frac{3\pi}{2}\right) = 0 - (-1) = 1$