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Quiz – January 12, 2006

Find $\displaystyle\int_0^1 \frac{y^2 dy}{\sqrt{4-3y}}$.

Answer: Let $u = 4 - 3y$. It follows that $y = \frac{4-u}{3}$ and $dy = \frac{-du}{3}$. When $y = 0$, then $u = 4$. When $y = 1$, then $u = 1$. The original integral is equal to

$$\frac{-1}{27}\int_4^1 \frac{(4-u)^2 du}{\sqrt{u}} = \frac{-1}{27}\int_4^1 \frac{(16-8u+u^2)du}{\sqrt{u}}$$

$$= \frac{-1}{27}\int_4^1 (16u^{-1/2} - 8u^{1/2} + u^{3/2})du = \frac{-1}{27}\ 32u^{1/2} - \frac{16}{3}u^{3/2} + \frac{2}{5}u^{5/2}\Big|_4^1$$

$$= \frac{-1}{27}\left[32 - \frac{16}{3} + \frac{2}{5} - \left(32(2) - \frac{16}{3}(8) + \frac{2}{5}(32)\right)\right]$$

$$= \boxed{\frac{-1}{27}\left[-32 + \frac{7(16)}{3} - \frac{62}{5}\right]}$$