§8.1 # 34

$$\int t^3 e^{-t^2}\,dt = \int t^2 e^{-t^2}\,t\,dt$$

$$= \int u e^{-u}\cdot \tfrac{1}{2}\,du \quad : \quad u = t^2,\ du = 2t\,dt.$$

$$= \frac{-1}{2} u e^{-u} + \frac{1}{2}\int e^{-u}\,du \quad : \left[\begin{array}{ll} \bar{u} = u & d\bar{u} = du \\ d\bar{v} = \frac{1}{2}e^{-u}du & \bar{v} = \frac{-1}{2}e^{-u} \end{array}\right]$$

$$= \frac{-1}{2} u e^{-u} - \frac{1}{2}e^{-u} + C$$

$$= \boxed{\frac{-1}{2} t^2 e^{-t^2} - \frac{1}{2} e^{-t^2} + C}$$

§8.1 # 49 Assume $n \neq 1$ and ignore STEWART'S HINT SINCE THIS IS WAY EASIER ☺

$$\int \tan^n(x)\,dx = \int \tan^{n-2}(x)\tan^2(x)\,dx$$

$$= \int \tan^{n-2}(x)(\sec^2 x - 1)\,dx$$

$$= \int u^{n-2}\,du - \int \tan^{n-2}(x)\,dx \quad : \quad \begin{array}{l} u = \tan(x) \\ du = \sec^2 x\,dx \end{array}$$

$$= \underline{\frac{1}{n-1}\tan^{n-1}(x) - \int \tan^{n-2}(x)\,dx}.$$

§8.1 # 64

Suppose $f(0) = g(0) = 0$ and f'' & g'' are continuous,

$$\int_0^a \underbrace{f(x)}_{u}\,\underbrace{g''(x)\,dx}_{dv} = f(x)\,g'(x)\Big|_0^a - \int_0^a \underbrace{g'(x)\,dx}_{dv}\;\underbrace{f'(x)}_{u}$$

$$= f(x)\,g'(x)\Big|_0^a - f'(x)\,g(x)\Big|_0^a + \int_0^a g(x)\,f''(x)\,dx$$

$$= f(a)g'(a) - \underbrace{f(0)}_{0}g'(0) - f'(a)g(a) + f'(0)\underbrace{g(0)}_{0} - \int_0^a g(x)f''(x)\,dx$$

$$= \underline{f(a)g'(a) - f'(a)g(a) - \int_0^a g(x)f''(x)\,dx}.$$