5. Find $\int \cot^3 x \, dx = \int \cot x \left(\csc^2 x - 1 \right) dx = \int \cot x \csc^2 x - \frac{\cos x}{\sin x} \, dx$

$= \boxed{-\frac{\cot^2 x}{2} - \ln|\sin x| + c}$

$\checkmark: \frac{d}{dx}(PA) = +\cot x \csc^2 x \qquad - \frac{\cos x}{\sin x}$

$\cot x \left(\csc^2 x - 1 \right)$

$= \cot^3 x \ \checkmark$

6. Find $\int x \arctan x \, dx = \frac{x^2}{2} \arctan x \quad \frac{1}{2} \int \frac{x^2}{1+x^2} \, dx = \frac{x^2}{2} \arctan x - \frac{1}{2} \int 1 \ \frac{+1..}{1+x^2}$

$\uparrow$

$u = \arctan x \qquad v = \frac{x^2}{2}$

$du = \frac{1}{1+x^2} dx \qquad dv = x \, dx$

$= \boxed{\frac{x^2}{2} \tan^{-1} x - \frac{1}{2} \left(x - \tan^{-1} x \right) + c}$

$\checkmark \quad \frac{d}{dx}(PA) \qquad \frac{x^2}{2} \frac{1}{1+x^2} + x \tan^{-1} x \quad -\frac{1}{2} + \frac{1}{2} \frac{1}{1+x^2}$

$= x \tan^{-1} x \quad + \frac{1}{2(1+x^2)} \left(x^2 - (1+x^2) + 1 \right)$

$= x \tan^{-1} x \ \checkmark$