1. Q) $\int \frac{x^3}{\sqrt{x^2+4}} dx$

A) $\int \frac{x^3}{\sqrt{x^2+4}} dx = \int \frac{x^3}{\sqrt{x^2+2^2}} dx$

Let $x = 2\tan(\theta)$

$\therefore \sqrt{x^2+2^2} = \sqrt{2^2\tan^2(\theta)+2^2} = 2\sqrt{\tan^2(\theta)+1} = 2\sec(\theta)$

$\therefore \int \frac{x^3}{\sqrt{x^2+4}} dx = \int \frac{8\tan^3(\theta)}{2\sec(\theta)} dx = 4\int \frac{\tan^3(\theta)}{\sec(\theta)} dx$

$= 4\int \frac{\sin^3(\theta)}{\cos^2(\theta)} dx = 4\int \frac{\sin^3(\theta)}{\cos^2(\theta)} dx$