

# Electromagnetics Problem 1

Innova Lee(이상훈)  
gcccompil3r@gmail.com

## 균일한 선밀도를 가진 선전하의 전기장 문제

$$\int \frac{1}{(a^2 + u^2)^{\frac{3}{2}}} du$$

$$\sin^2 x + \cos^2 x = 1 \Leftrightarrow a^2 \tan^2 x + a^2 = \frac{a^2}{\cos^2 x} = a^2 \sec^2 x$$

$$u^2 = a^2 \tan^2 x$$

$$u = a \tan x, \quad du = a \sec^2 x dx$$

$$\frac{d}{dx} \left\{ \frac{f(x)}{g(x)} \right\} = \frac{f'(x)g(x) - f(x)g'(x)}{g(x)^2}$$

$$\frac{d}{dx} \{ \tan(x) \} = \frac{d}{dx} \left\{ \frac{\sin(x)}{\cos(x)} \right\} = \frac{\cos^2(x) + \sin^2(x)}{\cos^2(x)} = \sec^2(x)$$

$$\int \frac{1}{(a^2 + u^2)^{\frac{3}{2}}} du = \int \frac{a \sec^2 x}{(a^2 + a^2 \tan^2 x)^{\frac{3}{2}}} dx$$

$$a^2(1 + \tan^2 x) = a^2 \sec^2 x \quad \left( \because 1 + \tan^2 x = \frac{\cos^2 x + \sin^2 x}{\cos^2 x} = \sec^2 x \right)$$

$$\int \frac{1}{(a^2 + u^2)^{\frac{3}{2}}} du = \int \frac{a \sec^2 x}{(a^2 + a^2 \tan^2 x)^{\frac{3}{2}}} dx = \int \frac{a \sec^2 x}{(a^2 \sec^2 x)^{\frac{3}{2}}} dx = \int \frac{a \sec^2 x}{a^3 \sec^3 x} dx = \int \frac{1}{a^2} \frac{1}{\sec(x)} dx = \frac{1}{a^2} \int \cos(x) dx = \frac{\sin(x)}{a^2}$$

$$\frac{1}{a^2} \sin \left( \tan^{-1} \left( \frac{u}{a} \right) \right) \quad \left( \because \frac{u}{a} = \tan(x), \quad x = \tan^{-1} \left( \frac{u}{a} \right) \right)$$

$$\frac{1}{a^2} \sin(\theta) = \frac{1}{a^2} \frac{u}{\sqrt{u^2 + a^2}} = \frac{1}{a^2} \frac{u}{\sqrt{u^2 + a^2}}$$

