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Computer Science

$$\int \frac{dx}{x^2+7}$$

$$\text{Let } u = \frac{x}{\sqrt{7}} \rightarrow \frac{du}{dx} = \frac{1}{\sqrt{7}} \rightarrow dx = \sqrt{7} du$$

$$= \int \frac{1}{x^2+7} = \int \frac{\sqrt{7}}{7u^2+7} du$$

$$= \frac{1}{7} \int \frac{1}{u^2+1} dx$$

$\int \frac{1}{u^2+1} du$ is a standard integral

$$= \arctan u$$

$$= \frac{\arctan u}{\sqrt{7}}$$

$$u = \frac{x}{\sqrt{7}} = \frac{\arctan\left(\frac{x}{\sqrt{7}}\right) + C}{\sqrt{7}}$$

$$2. \int \frac{dx}{x^2+64}$$

$$\text{Let } u = \frac{x}{8} \rightarrow \frac{du}{dx} = \frac{1}{8} \rightarrow dx = 8 du$$

$$\int \frac{dx}{x^2+64} = \int \frac{8}{64u^2+64} du$$

$$= \frac{1}{8} \int \frac{1}{u^2+1} du$$

Also $\int \frac{1}{u^2+1} du$ is standard for arctan(u)

$$\frac{1}{8} \int \frac{1}{u^2+1} = \frac{\arctan u}{8}$$

$$\text{recall } u = \frac{x}{8}$$

$$\frac{\arctan u}{8} = \frac{\arctan\left(\frac{x}{8}\right)}{8}$$

$$\text{Thus } \int \frac{dx}{x^2+64} = \frac{\arctan\left(\frac{x}{8}\right) + C}{8}$$