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Computer Science
MAI 104 classwork

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

$$\int \frac{dx}{x^2+7} = \int \frac{dx}{7\left(\frac{x^2}{7}+1\right)} = \frac{1}{7} \int \frac{dx}{\frac{x^2}{7}+1} = \frac{1}{7} \int \frac{dx}{\left(\frac{x}{\sqrt{7}}\right)^2+1}$$

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

$$u = \frac{x}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}} = \frac{\sqrt{7}x}{7}$$

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

$$dx = \frac{7}{\sqrt{7}} du$$

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

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

$$\therefore = \frac{7}{7\sqrt{7}} \arctan(u) + C$$

$$\text{N.B. } u = \frac{\sqrt{7}x}{7}$$

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

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

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

$$\int \frac{dx}{x^2+64} = \int \frac{dx}{64\left(\frac{x^2}{64}+1\right)} = \frac{1}{64} \int \frac{dx}{\frac{x^2}{64}+1} = \frac{1}{64} \int \frac{dx}{\left(\frac{x}{8}\right)^2+1}$$

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

$$\frac{du}{dx} = \frac{1}{8}$$

$$dx = 8 du$$

$$= \frac{1}{64} \int \frac{1}{u^2+1} dx = \frac{1}{64} \int \frac{1}{u^2+1} \cdot 8 du = \frac{8}{64} \int \frac{1}{u^2+1} du$$

$$= \frac{1}{8} \int \frac{1}{u^2+1} du = \frac{1}{8} \arctan(u), \quad u = \frac{x}{8}$$

$$\therefore \frac{\arctan(x/8)}{8} + C$$