DR OYELAMI
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OLAWUYI FAWAZ OLOLADE
MECHATRONIC ENGINEERING
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(1) $\int \frac{dx}{x^2+7}$

(ii) $\int \frac{dx}{x^2+64}$

Soln

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

$x = \sqrt{7}\tan\theta$

$\frac{dx}{d\theta} = \sqrt{7}\sec^2\theta$

$dx = \sqrt{7}\sec^2\theta\, d\theta$

$(\sqrt{7})^2 + x^2 = 7\tan^2\theta + 7$

$= 7(\tan^2\theta + 1)$

$= 7\sec^2\theta$

$\Rightarrow \int \frac{\sqrt{7}\sec^2\theta}{7\sec^2\theta}\, d\theta$

$\frac{\sqrt{7}}{7}\int d\theta$

$\frac{\sqrt{7}}{7}[\theta] + C$

$\frac{\sqrt{7}}{7}\tan^{-1}\frac{x}{7} + C$

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

$x = 8\tan\theta$

$\frac{dx}{d\theta} = 8\sec^2\theta$

$dx = 8\sec^2\theta\, d\theta$

$x^2 + 8^2 = 8^2\tan^2\theta + 8^2$

$x^2 + 8^2 = 8^2(\tan^2\theta + 1)$

$x^2 + 8^2 = 8^2\sec^2\theta$

$\Rightarrow \int \frac{8\sec^2\theta}{8^2\sec^2\theta}\, d\theta$

$\frac{8}{8^2}\int d\theta$

$\frac{1}{8}\int d\theta$

$\frac{1}{8}[\theta]$

$\frac{1}{8}\tan^{-1}\frac{x}{8} + C$