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Mechanics Engineering

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

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

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

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

$$x^2 + (\sqrt{7})^2 = (\sqrt{7})^2 \tan^2 \theta + (\sqrt{7})^2 = (\sqrt{7})^2 (\tan^2 \theta + 1)$$

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

$$= 7 \sec^2 \theta$$

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

$$\frac{\sqrt{7}}{7} [0] + C$$

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

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Mechatronics

$$\int \frac{dx}{x^2+8^2}$$

$$x = 8 \tan \theta$$

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

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

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

$$= 64 (\tan^2 \theta + 1)$$

$$= 64 \sec^2 \theta$$

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

$$= \frac{1}{8} \theta + C$$

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