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Trig Identities $R\cos(x-a)$ | Past Paper Question | C3 Edexcel June 2013 Q8(a)

- (a) Express $24\sin\theta + 7\cos\theta$ in the form $R\cos(\theta - \alpha)$, where R and α are constants and where $R > 0$ and $0 < \alpha < 90^\circ$, giving the value of α to 2 decimal places. (3)

$$24\sin\theta + 7\cos\theta \equiv R\cos(\theta - \alpha)$$

$$\therefore 7\cos\theta + 24\sin\theta \equiv R\cos(\theta - \alpha)$$

$$\text{Let } A = 7, B = 24$$

$$\therefore R = \sqrt{7^2 + 24^2} \\ = 25$$

$$\alpha = \tan^{-1} \frac{B}{A} \\ = \tan^{-1} \frac{24}{7} \\ = 73.739\dots^\circ \\ = 73.74^\circ \text{ (2dp)}$$

$$\begin{aligned} A\sin x + B\cos x &\equiv R\sin(x + \alpha) \\ A\sin x - B\cos x &\equiv R\sin(x - \alpha) \\ A\cos x + B\sin x &\equiv R\cos(x - \alpha) \\ A\cos x - B\sin x &\equiv R\cos(x + \alpha) \end{aligned}$$

where $R = \sqrt{A^2 + B^2}$ and $\alpha = \tan^{-1} \frac{B}{A}$

$$\therefore 24\sin\theta + 7\cos\theta \equiv 25\cos(\theta - 73.74^\circ)$$

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