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## Harmonic form $A\sin(x)+B\cos(x)$ | Past Paper Question | C3 OCR June 2012 Q8(ii)(b)

(i) Express  $3\sin\theta + 4\cos\theta$  in the form  $R\sin(\theta + \alpha)$ , where  $R > 0$  and  $0^\circ < \alpha < 90^\circ$ . [3]

(ii) Hence

Answer:  $5\sin(\theta + 53.1^\circ)$

(b) find the values of the positive constants  $k$  and  $c$  such that

$$-37 \leq k(3\sin\theta + 4\cos\theta) + c \leq 43$$

for all values of  $\theta$ .

[4]

$$-37 \leq k(3\sin\theta + 4\cos\theta) + c \leq 43$$

$$\therefore -37 \leq 5k\sin(\theta + 53.1^\circ) + c \leq 43$$

$$\text{when } \sin(\theta + 53.1^\circ) = 1$$

$$\therefore 5k + c = 43 \quad \textcircled{1}$$

$$\text{when } \sin(\theta + 53.1^\circ) = -1$$

$$\therefore -5k + c = -37 \quad \textcircled{2}$$

$\textcircled{1} + \textcircled{2}$  gives

$$\therefore 2c = 6 \Rightarrow c = 3$$

Sub  $c = 3$  in  $\textcircled{1}$

$$\therefore 5k + 3 = 43$$

$$\therefore 5k = 40$$

$$\therefore k = 8$$

$$\therefore c = 3, k = 8$$

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