A#17 HARMONIC FORM

AEM questions are taken from past exam papers - they have been carefully chosen to represent a typical exam question at each level of difficulty. If you can do these questions, you’re ready to move onto past papers for this topic.

APPRENTICE

a. Express $2 \cos x - 5 \sin x$ in the form $R \cos(x + \alpha)$, where $R > 0$ and $0 < \alpha < \frac{\pi}{2}$, giving your value of $\alpha$, in radians, to three significant figures.

b. i. Hence find the value of $x$ in the interval $0 < x < 2\pi$ for which $2 \cos x - 5 \sin x$ has its maximum value. Give your value of $x$ to three significant figures.

ii. Use your answer to part (a) to solve the equation $2 \cos x - 5 \sin x + 1 = 0$ in the interval $0 < x < 2\pi$, giving your solutions to three significant figures.

EXPERT

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

b. Hence solve, for $0 \leq \theta < 360^\circ$, $\frac{2}{2 \cos \theta - \sin \theta - 1} = 15$. Give your answers to one decimal place.

c. Deduce the smallest positive value (to 1 dp) of $\theta$ for which $\frac{2}{2 \cos \theta + \sin \theta - 1} = 15$.

MASTER

a. Express $3 \sin 2\theta \sec \theta + 4 \sin 2\theta \csc \theta$ in the form $R \sin(\theta + \alpha)$, where $R > 0$ and $0^\circ < \alpha < 90^\circ$.

b. Solve the equation $3 \sin(2\beta + 20^\circ)\sec(\beta + 10^\circ) + 4 \sin(2\beta + 20^\circ)\csc(\beta + 10^\circ) = 3$ for $0^\circ < \beta < 360^\circ$. 

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