

## STEP II, 2007, Q4

- 4 Given that  $\cos A$ ,  $\cos B$  and  $\beta$  are non-zero, show that the equation

$$\alpha \sin(A - B) + \beta \cos(A + B) = \gamma \sin(A + B)$$

reduces to the form

$$(\tan A - m)(\tan B - n) = 0,$$

where  $m$  and  $n$  are independent of  $A$  and  $B$ , if and only if  $\alpha^2 = \beta^2 + \gamma^2$ .

Determine all values of  $x$ , in the range  $0 \leq x < 2\pi$ , for which:

- (i)  $2 \sin(x - \frac{1}{4}\pi) + \sqrt{3} \cos(x + \frac{1}{4}\pi) = \sin(x + \frac{1}{4}\pi)$ ;
- (ii)  $2 \sin(x - \frac{1}{6}\pi) + \sqrt{3} \cos(x + \frac{1}{6}\pi) = \sin(x + \frac{1}{6}\pi)$ ;
- (iii)  $2 \sin(x + \frac{1}{3}\pi) + \sqrt{3} \cos(3x) = \sin(3x)$ .



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