

STEP II, 2018, Q4

- 4 In this question, you may use the following identity without proof:

$$\cos A + \cos B = 2 \cos \frac{1}{2}(A + B) \cos \frac{1}{2}(A - B).$$

- (i) Given that $0 \leq x \leq 2\pi$, find all the values of x that satisfy the equation

$$\cos x + 3 \cos 2x + 3 \cos 3x + \cos 4x = 0.$$

- (ii) Given that $0 \leq x \leq \pi$ and $0 \leq y \leq \pi$ and that

$$\cos(x + y) + \cos(x - y) - \cos 2x = 1,$$

show that either $x = y$ or x takes one specific value which you should find.

- (iii) Given that $0 \leq x \leq \pi$ and $0 \leq y \leq \pi$, find the values of x and y that satisfy the equation

$$\cos x + \cos y - \cos(x + y) = \frac{3}{2}.$$



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