

STEP III, 2003 Q6

6 Show that

$$2 \sin \frac{1}{2}\theta \cos r\theta = \sin \left(r + \frac{1}{2}\right)\theta - \sin \left(r - \frac{1}{2}\right)\theta .$$

Hence, or otherwise, find all solutions of the equation

$$\cos a\theta + \cos(a + 1)\theta + \cdots + \cos(b - 2)\theta + \cos(b - 1)\theta = 0 ,$$

where a and b are positive integers with $a < b - 1$.



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