

Question	Scheme	Marks	AOs
12 (a)	$4\cos\theta - 1 = 2\sin\theta \tan\theta \Rightarrow 4\cos\theta - 1 = 2\sin\theta \times \frac{\sin\theta}{\cos\theta}$	M1	1.2

	$\Rightarrow 4\cos^2\theta - \cos\theta = 2\sin^2\theta$ oe	A1	1.1b
	$\Rightarrow 4\cos^2\theta - \cos\theta = 2(1 - \cos^2\theta)$	M1	1.1b
	$6\cos^2\theta - \cos\theta - 2 = 0$ *	A1*	2.1
		(4)	
(b)	For attempting to solve given quadratic	M1	1.1b
	$(\cos 3x) = \frac{2}{3}, -\frac{1}{2}$	B1	1.1b
	$x = \frac{1}{3} \arccos\left(\frac{2}{3}\right)$ or $\frac{1}{3} \arccos\left(-\frac{1}{2}\right)$	M1	1.1b
	$x = 40^\circ, 80^\circ, \text{awrt } 16.1^\circ$	A1	2.2a
		(4)	

(8 marks)

### Notes

(a)

**M1:** Recall and use the identity  $\tan\theta = \frac{\sin\theta}{\cos\theta}$

**Note that it cannot just be stated.**

**A1:**  $4\cos^2\theta - \cos\theta = 2\sin^2\theta$  oe.

This is scored for a correct line that does not contain any fractional terms.

It may be awarded later in the solution after the identity  $1 - \cos^2\theta = \sin^2\theta$  has been used Eg for  $\cos\theta(4\cos\theta - 1) = 2(1 - \cos^2\theta)$  or equivalent

**M1:** Attempts to use the correct identity  $1 - \cos^2\theta = \sin^2\theta$  to form an equation in just  $\cos\theta$

**A1\*:** Proceeds to correct answer through rigorous and clear reasoning. No errors in notation or bracketing. For example  $\sin^2\theta = \sin\theta^2$  is an error in notation

(b)

**M1:** For attempting to solve the given quadratic " $6y^2 - y - 2 = 0$ " where  $y$  could be  $\cos 3x$ ,  $\cos x$ , or even just  $y$ . When factoring look for  $(ay + b)(cy + d)$  where  $ac = \pm 6$  and  $bd = \pm 2$

This may be implied by the correct roots (even award for  $\left(y \pm \frac{2}{3}\right)\left(y \pm \frac{1}{2}\right)$ ), an attempt at factorising, an attempt at the quadratic formula, an attempt at completing the square and even  $\pm$  the correct roots.

**B1:** For the roots  $\frac{2}{3}, -\frac{1}{2}$  oe

**M1:** Finds at least one solution for  $x$  from  $\cos 3x$  **within the given range** for their  $\frac{2}{3}, -\frac{1}{2}$

**A1:**  $x = 40^\circ, 80^\circ, \text{awrt } 16.1^\circ$  **only** Withhold this mark if there are **any** other values even if they are outside the range. Condone 40 and 80 appearing as 40.0 and 80.0