9. $\cos 2x - 5\cos x + 3 = 0$

$2\cos^2 x - 1 \quad - 5\cos x + 3 = 0$

$2\cos^2 x - 5\cos x + 2 = 0$

$(2\cos x - 1)(\cos x - 2)$

$\cos x = \frac{1}{2}$ $\qquad$ $\cos x = 2$

no solutions

$x = 60$

$x = 360 - 60 = 300$

$x = 60^\circ, 300^\circ$

Question			Generic Scheme	Illustrative Scheme	Max Mar
9.			•[1] substitute for $\cos 2x°$ into equation	•[1] $2\cos^2 x° - 1...$	**5**
			•[2] express in standard quadratic form	•[2] $2\cos^2 x° - 5\cos x° + 2 = 0$	
			•[3] factorise	•[3] $(2\cos x° - 1)(\cos x° - 2) = 0$	
				•[4] •[5]	
			•[4] solve for $\cos x°$	•[4] $\cos x° = \frac{1}{2}$ $\cos x° = 2$	
			•[5] solve for x	•[5] $x = 60,\ 300$ 'no solutions'	

Notes:

1. •[1] is not available for simply stating $\cos 2x° = 2\cos^2 x° - 1$ with no further working.
2. In the event of $\cos^2 x° - \sin^2 x°$ or $1 - 2\sin^2 x°$ being substituted for $\cos 2x°$, •[1] cannot be awarded until the equation reduces to a quadratic in $\cos x°$.
3. Substituting $2\cos^2 A - 1$ or $2\cos^2 \alpha - 1$ for $\cos 2x°$ at the •[1] stage should be treated as bad form provided the equation is written in terms of x at •[2] stage. Otherwise, •[1] is not available.
4. Do not penalise the omission of degree signs.
5. '$= 0$' must appear by •[3] stage for •[2] to be awarded. However, for candidates using the quadratic formula to solve the equation, '$= 0$' must appear at •[2] stage for •[2] to be awarded.
6. $\cos x° = \frac{5 \pm \sqrt{9}}{4}$ gains •[3].
7. Candidates may express the equation obtained at •[2] in the form $2c^2 - 5c + 2 = 0$ or $2x^2 - 5x + 2 = 0$. In these cases, award •[3] for $(2c-1)(c-2) = 0$ or $(2x-1)(x-2) = 0$.
   However, •[4] is only available if $\cos x°$ appears explicitly at this stage. See Candidate A.
8. The equation $2 + 2\cos^2 x° - 5\cos x° = 0$ does not gain •[2] unless •[3] has been awarded.
9. •[4] and •[5] are only available as a consequence of trying to solve a quadratic equation. See Candidate B. However, •[5] is not available if the quadratic equation has repeated roots.
10. •[3], •[4] and •[5] are not available for any attempt to solve a quadratic equation written in the form $ax^2 + bx = c$. See Candidate C.
11. •[5] is only available for 2 valid solutions within the stated range. Ignore 'solutions' outwith the range. However, see Candidate E.
12. Accept ~~$\cos x° = 2$~~ for •[5]. See Candidate A.

Question	Generic Scheme	Illustrative Scheme	Max Mark
9.	(continued)		

Commonly Observed Responses:

Candidate A $2\cos^2 x^\circ - 1 = 5\cos x^\circ - 3$ •¹ ✓ $2c^2 - 5c + 2 = 0$ •² ✓ $(2c-1)(c-2) = 0$ •³ ✓ $c = \frac{1}{2},\ c = 2$ •⁴ ✗ $x = 60,\ 300$ ~~$\cos x^\circ = 2$~~ •⁵ ☑ 1	**Candidate B - not solving a quadratic** $2\cos^2 x^\circ - 1 = 5\cos x^\circ - 3$ •¹ ✓ $2\cos^2 x^\circ - 5\cos x^\circ + 2 = 0$ •² ✓ $-3\cos x^\circ + 2 = 0$ •³ ✗ $\cos x^\circ = \frac{2}{3}$ •⁴ ☑ 2 •⁵ ^
Candidate C - not in standard quadratic form $2\cos^2 x^\circ - 1 = 5\cos x^\circ - 3$ •¹ ✓ $2\cos^2 x^\circ - 5\cos x^\circ = -2$ •² ☑ 2 $\cos x^\circ(2\cos x^\circ - 5) = -2$ •³ ☑ 2 $\cos x^\circ = -2,\ 2\cos x^\circ - 5 = -2$ $\Rightarrow \cos x = \frac{3}{2}$ •⁴ ✗ No solutions •⁵ ✗	**Candidate D - reading $\cos 2x^\circ$ as $\cos^2 x^\circ$** $\cos^2 x^\circ = 5\cos x^\circ - 3$ •¹ ✗ $\cos^2 x^\circ - 5\cos x^\circ + 3 = 0$ •² ☑ 1 $\cos x^\circ = \frac{5 \pm \sqrt{13}}{2}$ •³ ☑ 1 •⁴ ^ •⁵ ^
Candidate E ⋮ •¹ ✓ •² ✓ $(\cos x^\circ - 1)(\cos x^\circ - 2) = 0$ •³ ✗ $\cos x^\circ = 1,\quad \cos x^\circ = 2$ •⁴ ☑ 1 $x = 0\quad$ No solutions •⁵ ☑ 1	