7.

$\sin x + 2 = 3\cos 2x$

$\sin x + 2 = 3(1 - 2\sin^2 x)$

$\sin x + 2 = 3 - 6\sin^2 x$

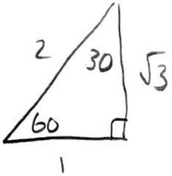
$6\sin^2 x + \sin x - 1 = 0$

$(3\sin x - 1)(2\sin x + 1) = 0$

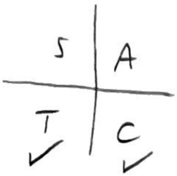
$3\sin x - 1 = 0$ $\quad$ $2\sin x + 1 = 0$

$\sin x = \frac{1}{3}$ $\quad$ $\sin x = -\frac{1}{2}$

$x = 19.5°, 160.5°$ $\quad$ $x = 210°, 330°$



$\sin^{-1}(\frac{1}{2}) = 30°$



Question			Generic scheme	Illustrative scheme	Max mark
7.			$\bullet^1$ use double angle formula to express equation in terms of $\sin x^\circ$	$\bullet^1$ $\ldots = 3\left(1-2\sin^2 x^\circ\right)$	5
			$\bullet^2$ arrange in standard quadratic form	$\bullet^2$ $6\sin^2 x^\circ + \sin x^\circ - 1 = 0$	
			$\bullet^3$ factorise or use quadratic formula	$\bullet^3$ $\left(3\sin x^\circ - 1\right)\left(2\sin x^\circ + 1\right)\left(=0\right)$ or $\sin x^\circ = \frac{-1\pm\sqrt{25}}{12}$	
			$\bullet^4$ solve for $\sin x^\circ$	$\bullet^4$ $\bullet^5$ $\bullet^4$ $\sin x^\circ = \frac{1}{3}$, $\sin x^\circ = -\frac{1}{2}$	
			$\bullet^5$ solve for x	$\bullet^5$ 19.47…, 160.52…, 210, 330	

Notes:

1. Substituting $1-2\sin^2 A$ or $1-2\sin^2 \alpha$ for $\cos 2x^\circ$ at the $\bullet^1$ stage should be treated as bad form provided the equation is written in terms of x at $\bullet^2$ stage. Otherwise, $\bullet^1$ is not available.
2. Do not penalise the omission of degree signs.
3. '$=0$' must appear by $\bullet^3$ stage for $\bullet^2$ to be awarded. However, for candidates using the quadratic formula to solve the equation, '$=0$' must appear at $\bullet^2$ stage for $\bullet^2$ to be awarded.
4. Candidates may express the equation obtained at $\bullet^2$ in the form $6S^2+S-1=0$, $6x^2+x-1=0$ or using any other dummy variable at the $\bullet^3$ stage. In these cases, award $\bullet^3$ for $(3S-1)(2S+1)$ or $(3x-1)(2x+1)$.

   However, $\bullet^4$ is only available if $\sin x^\circ$ appears explicitly at this stage - see Candidate A.
5. The equation $1-6\sin^2 x^\circ - \sin x^\circ = 0$ does not gain $\bullet^2$ unless $\bullet^3$ has been awarded.
6. $\bullet^3$ is awarded for identifying the factors of the quadratic obtained at $\bullet^2$ eg "$3\sin x^\circ - 1 = 0$ and $2\sin x^\circ + 1 = 0$".
7. $\bullet^4$ and $\bullet^5$ are only available as a consequence of trying to solve a quadratic equation - see Candidate B.
8. $\bullet^3$, $\bullet^4$ and $\bullet^5$ are not available for any attempt to solve a quadratic equation written in the form $ax^2+bx=c$ - see Candidate C.
9. $\bullet^5$ is only available where at least one of the equations at $\bullet^4$ leads to two solutions for x.
10. Do not penalise additional (correct) solutions at $\bullet^5$. However see Candidates E and F.
11. Accept answers which round to 19, 19.5 and 161.

Question	Generic scheme	Illustrative scheme	Max mark
7.	(continued)		

Commonly Observed Responses:

Candidate A
$\vdots$ $\bullet^1$ ✓ $\bullet^2$ ✓
$6S^2+S-1=0$
$(3S-1)(2S+1)=0$ $\bullet^3$ ✓
$S=\frac{1}{3},\quad S=-\frac{1}{2}$ $\bullet^4$ ^
$x=19.5,\ 160.5,\ 210,\ 330$ $\bullet^5$ $\boxed{\checkmark_1}$

Candidate B - not solving a quadratic
$\vdots$ $\bullet^1$ ✓
$6\sin^2 x°+\sin x°-1=0$ $\bullet^2$ ✓
$7\sin x°-1=0$ $\bullet^3$ ✗
$\sin x°=\frac{1}{7}$ $\bullet^4$ $\boxed{\checkmark_2}$
$x=8.2$ $\bullet^5$ $\boxed{\checkmark_2}$

Candidate C - not in standard quadratic form
$\sin x°+2=3-6\sin^2 x°$ $\bullet^1$ ✓
$6\sin^2 x°+\sin x°=1$ $\bullet^2$ $\boxed{\checkmark_2}$
$\sin x°(6\sin x°+1)=1$ $\bullet^3$ $\boxed{\checkmark_2}$
$\sin x°=1 \qquad 6\sin x°+5=1$
$\Rightarrow \sin x=-\frac{4}{6}$ $\bullet^4$ ✗
$90,\ 221.8,\ 318.2$ $\bullet^5$ ✗

Candidate D - reading $\cos 2x°$ as $\cos^2 x°$
$\sin x°+2=3\cos^2 x°$ $\bullet^1$ ✗
$\sin x°+2=3(1-\sin^2 x°)$
$3\sin^2 x°+\sin x°-1=0$ $\bullet^2$ $\boxed{\checkmark_1}$
$\sin x°=\frac{-1\pm\sqrt{13}}{6}$ $\bullet^3$ $\boxed{\checkmark_1}$
$\sin x°=0.434...,\quad \sin x°=-0.767...$ $\bullet^4$ $\boxed{\checkmark_1}$
$25.7,\ 154.3,\ 230.1,\ 309.9$ $\bullet^5$ $\boxed{\checkmark_1}$

Candidate E
$\vdots$ $\bullet^1$ ✓ $\bullet^2$ ✓
$(3\sin x°-1)(2\sin x°+1)=0$ $\bullet^3$ ✓
$\sin x°=\frac{1}{3},\quad \sin x°=-\frac{1}{2}$ $\bullet^4$ ✓
$x=19,\ x=161 \qquad x=30$
$x=210,\ x=330$ $\bullet^5$ ✗

However, where the final solution(s) are clearly identified by the candidate award $\bullet^5$

Candidate F
$\vdots$ $\bullet^1$ ✓ $\bullet^2$ ✓
$(3\sin x°-1)(2\sin x°+1)=0$ $\bullet^3$ ✓
$\sin x°=\frac{1}{3},\quad \sin x°=-\frac{1}{2}$ $\bullet^4$ ✓
$x=19,\ 161,\ 30,\ 210,\ 330$ $\bullet^5$ ✗