1			$1 - \cos^2 x = 3\cos x - 2$ oe	M1*		
			$\cos^2 x + 3\cos x - 3\ [= 0]$	M1*dep	or $-\cos^2 x - 3\cos x + 3 = 0$	condone one sign error *or* constant term of -1 (in LH version) or $+1$ (in RH version)
			$\cos x = $ their $\dfrac{-3 + \sqrt{21}}{2}$ or $\cos x = $ their 0.79 to 0.7913 soi	M1	dependent on award of previous method mark, must be correct for their quadratic	ignore other values (eg –3.79...); condone recovery from $x = 0.791287847\ldots$ but M0 if no recovery
			$[x =]$ 0.6578 to 0.66 isw cao	A1	A0 for eg 0.66π if 0.66 not seen separately	NB $x = 0.65788395\ldots$
			$[x =]$ 5.625 to 5.63 isw cao	A1	if A1A1 extra values in range incur a penalty of 1; ignore extra values outside range	NB $x = 5.625301357\ldots$
					if A0A0 allow SC1 for 37.69 to 37.7° *and* 322 to 322.31° *or* for $(0.209$ to $0.21)\pi$ *and* $(1.79$ to $1.791)\pi$	no SC mark available if extra values in range
				[5]		

2	(i)		$[\cos A =]\dfrac{20^2 +13^2 -8^2}{2\times 13\times 20}$	M1*	or $8^2 = 20^2 +13^2 -2\times 13\times 20\times \cos A$	
			$[\cos A =]\dfrac{505}{520}$ oe soi	A1	or 0.971 to 0.9712	
			$A = $ 13.79 to 13.8° or 14°	A1	or 0.24077 to 0.241 or 0.24 (radians); allow **B3** if given to 3sf or more unsupported	or 15.32 (grad)
			$[$Area $=]$ ½ × 20 × 13 × sin *their A*	M1dep*	or **M1** for eg ½ × 20 × 8 × sin 22.8, as long as angle calculated correctly from their *A* (other angles are 22.79824…° and 143.40645..° or 36.59355..°)	or $\sqrt{\dfrac{41}{2}(\dfrac{41}{2}-8)(\dfrac{41}{2}-13)(\dfrac{41}{2}-20)}$
						NB 13sin*A* = 3.099899192 if ½×*b*×*h* used
			30.99 to 31.01 isw or $\dfrac{5\sqrt{615}}{4}$ oe isw	A1	allow **B2** for unsupported answer within range	
				[5]		

2	(ii)		$h = 4$ soi	**B1**		
			$\frac{\text{their } 4}{2} \times (0 + 0 + 2(1.45+1.56+1.27+1.04))$ *or* $\frac{\text{their } 4}{2} \times (0 + 0 + 2(\pm0.85\pm 0.76\pm 0.55\pm 0.30))$	**M1***	shape of formula correct with 2, 3 or 4 y-values in inner bracket with their h; allow recovery from bracket errors **M0** if any non-zero x-values used or if y-values used twice	eg $\frac{\text{their } 4}{2} \times \{1.45 + 1.04 + 2(1.56 + 1.27)\}$; signs must be consistent in 2nd alternative
				B1	all y-values correctly placed with their h, condone omission of zeros and/or omission of outer brackets	
			either 21.28 or ± 9.84	**A1**		or **B1** + **B3*** if area of 2 triangles and 3 trapezia calculated to give correct answer www The final **M1dep* A1** may then be earned. NB $2.9 + 6.02 + 5.66 + 4.62 + 2.08$ or
			their 21.28 + their 9.84	**M1dep***		$\pm 1.7 \pm 3.22 \pm 2.62 \pm 1.7 \pm 0.60$ with consistent signs throughout
			31.12	**A1**	ignore subsequent rounding, but **A0** if answer spoiled by eg multiplication by 20	

2	(ii)		*alternatively*			
			$h = 4$ soi	**B1**		
			attempt to find all y-values	**M1**	$y_{\text{upper}} - y_{\text{lower}}$	**M0** if values are added to obtain 0.60, 0.80 etc
			2.3, 2.32, 1.82, 1.34	**A1**	all y-values correct	
			$\frac{\text{their } 4}{2} \times (0 + 0 + 2(2.3+2.32+1.82+1.34))$	**M1**	shape of formula correct with 2, 3 or 4 of their y-values in inner bracket with their h; allow recovery from bracket errors **M0** if any non-zero x-values used or if y-values used twice	eg ½ × 4 × {2.3 + 1.34 + 2(2.32+1.82)}
				B1FT	all their y-values correctly placed, condone omission of zeros and/or omission of outer brackets	
			31.12	**A1**	ignore subsequent rounding, but **A0** if answer spoiled by eg multiplication by 20	or **B1M1A1** + **B3** if area of 2 triangles and 3 trapezia calculated to give correct answer www NB 4.6 + 9.24 + 8.28 + 6.32 + 2.68
				[6]		

| 3 | | | $\dfrac{\sqrt{\sin^2\theta}}{\dfrac{\sin\theta}{\cos\theta}}$ or $\dfrac{\cos\theta\sqrt{\sin^2\theta}}{\sin\theta}$

$\cos\theta$ cao | M1

M1

A1

[3] | correct substitution for numerator

correct substitution for denominator

A0 if follows wrong working
or B3 www or if unsupported | allow maximum of M1M1 if

$\pm\sqrt{\sin^2\theta}$ oe substituted

mark the final answer but ignore
attempts to solve for θ
allow recovery from omission of θ |

| 4 | | | 71.5(6505118..) soi

35.7 to 36

125.78..., 215.78..., 305.78... to 3 or more sf | M1

A1

A1

[3] | or 1.24(9045772..) (rad)
or 79.5(1672353..) (grad)

if A0, SC1 for all four answers in radians or grad r.o.t to 3 or more sf
0.62452286, 2.195319213, 3.76611554, 5.336911867 (rad), but 0 if extra values in range

if M1A0A0, SC1 for 251.565…, 431.565…, 611.565… | 39.75836177.., 139.75…, 239.75… 339.75…(grad)

for second A1, ignore extra values outside range, A0 if extra values in range |

5		0.775397.. soi	M1	or 44.427..°	if any of final answers not given to three sf deduct 1 mark from total A marks
		0.388, 1.18, 3.53, 4.32	A4	A1 each value	
		in degrees: 22.2, 67.8, 202, 248*		if A0 then B1 for at least two of 2.366…, 7.058…, 8.649…for 2θ or all of 135.57…, 404.427…, 495.57…	*if final answers in degrees deduct 1 from total A marks ignore extra values outside range if four correct answers in degrees or radians, deduct 1 for extra values in range
			[5]		

| 6 | $\dfrac{\sin\theta}{\cos\theta} = 2\sin\theta$
$2\cos\theta - 1 = 0$ *and* $\sin\theta = 0$
$[\theta =]$ 0, 180, 360,
$[\theta =]$ 60, 300

if 4 marks awarded, lose 1 mark for extra values in the range, ignore extra values outside the range | **M1**

A1
B1
B1 | *may* be implied by $2\cos\theta - 1 = 0$ or better | or, if to advantage of candidate
B4 for all 5 correct
B3 for 4 correct
B2 for 3 correct
B1 for 2 correct

if extra value(s) in range, deduct one mark from total

do not award if values embedded in trial and improvement approach |

7	Subst. of $1- \cos^2 \theta$ or $1 - \sin^2 \theta$	**M1**	
	$5 \cos^2 \theta = 1$ or $5 \sin^2 \theta = 4$	**A1**	
	$\cos \theta = \pm\sqrt{\text{their} \frac{1}{5}}$ or	**M1**	
	$\sin \theta = \pm\sqrt{\text{their} \frac{4}{5}}$ o.e.		
	63.4, 116.6, 243.4, 296.6	**B2**	Accept to nearest degree or better; **B1** for 2 correct (ignore any extra values in range).

8	use of $\cos^2 \theta = 1 - \sin^2 \theta$	M1	
	at least one correct interim step in obtaining $4 \sin^2 \theta - \sin \theta = 0$.	M1	NB answer given
	$\theta = 0$ and 180,	B1	
	14.(47…)	B1	r.o.t to nearest degree or better
	165 - 166	B1	-1 for extras in range	5

9	$2 (1 - \cos^2 \theta) = \cos \theta + 2$	M1	for $1 - \cos^2 \theta = \sin^2 \theta$ substituted
	$- 2 \cos^2 \theta = \cos \theta$ s.o.i.	A1	graphic calc method: allow M3 for
	valid attempt at solving their quadratic in $\cos \theta$	DM1	intersection of $y = 2 \sin^2 \theta$ and $y = \cos \theta + 2$ and A2 for all four roots.
	$\cos \theta = -\frac{1}{2}$ www	A1	All four answers correct but
	$\theta = 90, 270, 120, 240$	A1	unsupported scores B2. 120 and 240 only: B1.	5

10	(i) $2 \quad - \sin^2 \theta) + 7 \sin \theta = 5$	1	for $\cos^2 \theta + \sin^2 \theta = 1$ o.e. used	
	(ii) $(2 \quad \theta - 1)(\sin \theta - 3)$	M1	1st and 3rd terms in expansion correct	
	$\sin \theta = \frac{1}{2}$	DM1	f.t. facto	
	$30°$ and $150°$	A1	B1,B1 for each solution obtained by any	
		A1	valid method, ignore extra solns outside range, 30°, 150° plus extra soln(s) scores 1	5