ALEVEL P3

MARKING SCHEME

T1 TRIG RSIN/ RCOS

1	State or imply that $R = 10$ or $R = -10$	B1		
	Use trig formula to find α	M1		
	Obtain $\alpha = 36.9°$ if $R = 10$ or $\alpha = 216.9°$ if $R = -10$, with no errors seen	A1		
	Carry out evaluation of $\sin^{-1}(\frac{7}{10})$ $(\approx 44.427...°)$	M1		
	Obtain answer 81.3°	A1		
	Carry out correct method for second answer	M1		
	Obtain answer 172.4° and no others in the range	A1		**[7]**
	[Ignore answers outside the given range.]			

2	(i) State answer $R = 25$	B1		
	Use trig formula to find α	M1		
	Obtain $\alpha = 73.74°$	A1		3
	(ii) Carry out evaluation of $\cos^{-1}(15/25)$ $(\approx 53.1301...°)$	M1		
	Obtain answer 126.9°	A1		
	Carry out correct method for second answer	M1		
	Obtain answer 20.6° and no others in the range	A1√		4
	[Ignore answers outside the given range.]			

3	**(i)** State or imply at any stage answer $R = 13$	B1		
	Use trig formula to find α	M1		
	Obtain $\alpha = 67.38°$ with no errors seen	A1		[3]
	[Do not allow radians in this part. If the only trig error is a sign error in $\sin(x + \alpha)$ give M1A0.]			
	(ii) Evaluate $\sin^{-1}\left(\frac{11}{13}\right)$ correctly to at least 1 d.p (57.79577…°)	B1√		
	Carry out an appropriate method to find a value of 2θ in $0° < 2\theta < 360°$	M1		
	Obtain an answer for θ in the given range, e.g. $\theta = 27.4°$	A1		
	Use an appropriate method to find another value of 2θ in the above range	M1		
	Obtain second angle, e.g. $\theta = 175.2°$ and no others in the given range	A1		[5]
	[Ignore answers outside the given range.]			
	[Treat answers in radians as a misread and deduct A1 from the answers for the angles.]			
	[SR: The use of correct trig formulae to obtain a 3-term quadratic in $\tan\theta$, $\sin 2\theta$, $\cos 2\theta$, or $\tan 2\theta$ earns M1; then A1 for a correct quadratic, M1 for obtaining a value of θ in the given range, and A1 + A1 for the two correct answers (candidates who square must reject the spurious roots to get the final A1).]			

4	**(i)** Obtain or imply $R = 4$	B1		
	Use appropriate trigonometry to find α	M1		
	Obtain $\alpha = 52.24$ or better from correct work	A1		[3]
	(ii) **(a)** State or imply $\theta - \alpha = \cos^{-1}(-4 \div R)$	M1		
	Obtain 232.2 or better	A1		[2]
	(b) Attempt at least one value using $\cos^{-1}(3 \div R)$	M1		
	Obtain one correct value e.g. ± 41.41°	A1		
	Use $\frac{1}{2}\theta - \alpha = \cos^{-1}\left(\frac{3}{R}\right)$ to find θ	M1		
	Obtain 21.7	A1		[4]

5 **(i)** State or imply $R = \sqrt{10}$ B1
Use trig formulae to find α M1
Obtain $\alpha = 71.57°$ with no errors seen A1 [3]
[Do not allow radians in this part. If the only trig error is a sign error in $\cos(x - \alpha)$ give M1A0]

(ii) Evaluate $\cos^{-1}(2/\sqrt{10})$ correctly to at least 1 d.p. (50.7684…°) (Allow 50.7° here) B1√
Carry out an appropriate method to find a value of 2θ in $0° < 2\theta < 180°$ M1
Obtain an answer for θ in the given range, e.g. $\theta = 61.2°$ A1
Use an appropriate method to find another value of 2θ in the above range M1
Obtain second angle, e.g. $\theta = 10.4°$, and no others in the given range A1 [5]
[Ignore answers outside the given range.]
[Treat answers in radians as a misread and deduct A1 from the answers for the angles.]
[SR: The use of correct trig formulae to obtain a 3-term quadratic in tan θ, sin 2θ, cos 2θ,or tan 2θ earns M1; then A1 for a correct quadratic, M1 for obtaining a value of θ in the given range, and A1 + A1 for the two correct answers (candidates who square must reject the spurious roots to get the final A1).]

6	**(i)**	State or imply $R = 17$	B1	
		Use correct trigonometric formula to find α	M1	
		Obtain 61.93° with no errors seen	A1	[3]
	(ii)	Evaluate $\cos^{-1}\frac{12}{R}$ (= 45.099)	M1	
		Obtain answer 107.0°	A1	
		Carry out correct method for second answer	M1	
		Obtain answer 16.8° and no others between 0° and 360°	A1	[4]

7 **(i)** State or imply $R = 25$ B1
Use correct trigonometric formula to find α M1
Obtain 16.26° **with no errors seen** A1 [3]

(ii) Evaluate of $\sin^{-1}\frac{17}{R}$ (= 42.84…°) M1
Obtain answer 59.1° A1 [2]

8 **(i)** Use $\sec\theta = \frac{1}{\cos\theta}$ and $\text{cosec}\,\theta = \frac{1}{\sin\theta}$ B1

Use $\sin 2\theta = 2\sin\theta\cos\theta$ and to form a horizontal equation in $\sin\theta$ and $\cos\theta$ or fractions with common denominators M1

Obtain given equation $2\sin\theta + 4\cos\theta = 3$ correctly A1 [3]

(ii) State or imply $R = \sqrt{20}$ or 4.47 or equivalent B1

Use correct trigonometry to find α M1

Obtain 63.43 or 63.44 with no errors seen A1 [3]

(iii) Carry out a correct method to find one value in given range M1

Obtain 74.4° (or 338.7°) A1

Carry out a correct method to find second value in given range M1

Obtain 338.7° (or 74.4°) and no others between 0° and 360° A1 [4]

9 **(i)** State $R = \sqrt{13}$ B1

Use trig formula to find α M1

Obtain $\alpha = 33.69°$ with no errors seen A1 **[3]**

(ii) Evaluate $\sin^{-1}(1/\sqrt{13})$ to at least 1 d.p. (16.10° to 2 d.p) B1√

Carry out an appropriate method to find a value of θ in the interval $0° < \theta < 180°$ M1

Obtain answer $\theta = 130.2°$ and no other in the given interval A1 **[3]**

[Ignore answers outside the given interval.]

[Treat answers in radians as a misread and deduct A1 from the marks for the angles.]

10 **(i)** State answer $R = 3$ **B1**

Use trig formula to find **M1**

Obtain $\alpha = 41.81°$ with no errors seen **A1**

[3]

(ii) Evaluate $\cos^{-1}(0.4)$ to at least 1 d.p. (66.42°to 2 d.p.) **B1**√

Carry out an appropriate method to find a value of x in the given range **M1**

Obtain answer 216.5° only **A1**

[Ignore answers outside the given interval.] [3]

11(i)	Use $\sin(A-B)$ formula and obtain an expression in terms of $\sin x$ and $\cos x$	**M1**
	Collect terms and reach $\sqrt{3}\sin x - 2\cos x$, or equivalent	**A1**
	Obtain $R = \sqrt{7}$	**A1**
	Use trig formula to find α	**M1**
	Obtain $\alpha = 49.11°$ with no errors seen	**A1**
	Total:	**5**

11(ii)	Evaluate $\sin^{-1}(1/\sqrt{7})$ to at least 1 d.p. (22.21° to 2 d.p.)	**B1 FT**
	Use a correct method to find a value of x in the interval $0° < x < 180°$	**M1**
	Obtain answer 71.3°	**A1**
	[ignore answers outside given range.]	
	Total:	**3**

12(i)	Rearrange in the form $\sqrt{3}\sin x - \cos x = \sqrt{2}$	**B1**
	State $R = 2$	**B1**
	Use trig formulae to obtain α	**M1**
	Obtain $\alpha = 30°$ with no errors seen	**A1**
		4

12(ii)	Evaluate $\sin^{-1}\left(\frac{\sqrt{2}}{\quad}\right)$	**B1ft**
	Carry out a correct method to find a value of x in the given interval	**M1**
	Obtain answer $x = 75°$	**A1**
	Obtain a second answer e.g. $x = 165°$ and no others [Treat answers in radians as a misread. Ignore answers outside the given interval.]	**A1ft**
		4

13(i)	State $R = \sqrt{7}$	**B1**
	Use correct trig formulae to find α	**M1**
	Obtain $\alpha = 22.208°$	**A1**
		3

13(ii)	Evaluate $\sin^{-1}\left(\frac{2}{\sqrt{7}}\right)$	**B1FT**
	Use correct method to find a value of θ in the interval	**M1**
	Obtain answer, e.g. $13.4°$	**A1**
	Obtain second answer, e.g. $54.3°$ and no extras in the given interval	**A1**
		4