

Trigonometry 2 - Marking Scheme



Q1.

- 2 Use correct $\cos 2A$ formula and obtain an equation in $\sin \theta$ M1
 Obtain $4\sin^2 \theta + \sin \theta - 3 = 0$, or equivalent A1
 Make reasonable attempt to solve a 3-term quadratic in $\sin \theta$ M1
 Obtain answer 48.6° A1
 Obtain answer 131.4° and no others in the given range A1 ✓
 Obtain answer 270° and no others in the given range A1 [6]
 [Treat the giving of answers in radians as a misread. Ignore answers outside the given range.]

Q2.

- 3 (i) State or imply $\sin a = 4/5$ B1
 Use $\sin(A - B)$ formula and substitute for $\cos a$ and $\sin a$ M1
 Obtain answer $\frac{1}{10}(4\sqrt{3} - 3)$, or exact equivalent A1 [3]
- (ii) Use $\tan 2A$ formula and substitute for $\tan a$, or use $\sin 2A$ and $\cos 2A$ formulae, substitute $\sin a$ and $\cos a$, and divide M1
 Obtain $\tan 2a = -\frac{24}{7}$, or equivalent A1
 Use $\tan(A + B)$ formula with $A = 2a$, $B = a$ and substitute for $\tan 2a$ and $\tan a$ M1
 Obtain $\tan 3a = -\frac{44}{117}$ A1 [4]

Q3.

- 3 Attempt to use $\tan(A \pm B)$ formula and obtain an equation in $\tan x$ M1
 Obtain 3-term quadratic $2\tan^2 x + 3\tan x - 1 = 0$, or equivalent A1
 Solve a 3-term quadratic and find a numerical value of x M1
 Obtain answer 15.7° A1
 Obtain answer 119.3° and no others in the given interval A1 [5]
 [Ignore answers outside the given interval. Treat answers in radians, 0.274 and 2.08, as a misread.]

Q4.

- 3 Attempt use of $\cos(A + B)$ formula to obtain an equation in $\cos \theta$ and $\sin \theta$ M1
 Use trig formula to obtain an equation in $\tan \theta$ (or $\cos \theta$, $\sin \theta$ or $\cot \theta$) M1
 Obtain $\tan \theta = 1/(4 + \sqrt{3})$ or equivalent (or find $\cos \theta$, $\sin \theta$ or $\cot \theta$) A1
 Obtain answer $\theta = 9.9^\circ$ A1
 Obtain $\theta = 189.9^\circ$, and no others in the given interval A1 [5]
 [Ignore answers outside the given interval. Treat answers in radians as a misread (0.173, 3.31).]

[The other solution methods are *via* $\cos \theta = \pm(4 + \sqrt{3}) / \sqrt{(1 + (4 + \sqrt{3})^2)}$ or

$\sin \theta = \pm 1 / \sqrt{(1 + (4 + \sqrt{3})^2)}$.]

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Q5.

- 8 (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. $\pm 41.41^\circ$ A1
 Use $\frac{1}{2}\theta - \alpha = \cos^{-1}\left(\frac{3}{R}\right)$ to find θ M1
 Obtain 21.7 A1 [4]

Q6.

- 9 (i)** Express $\cos 4\theta$ as $2 \cos^2 2\theta - 1$ or $\cos^2 2\theta - \sin^2 2\theta$ or $1 - 2 \sin^2 2\theta$ B1
 Express $\cos 4\theta$ in terms of $\cos \theta$ M1
 Obtain $8 \cos^4 \theta - 8 \cos^2 \theta + 1$ A1
 Use $\cos 2\theta = 2 \cos^2 \theta - 1$ to obtain given answer $8 \cos^4 \theta - 3$ AG A1 [4]
- (ii) (a)** State or imply $\cos^4 \theta = \frac{1}{2}$ B1
 Obtain 0.572 B1
 Obtain -0.572 B1 [3]
- (b)** Integrate and obtain form $k_1 \theta + k_2 \sin 4\theta + k_3 \sin 2\theta$ M1
 Obtain $\frac{3}{8}\theta + \frac{1}{32}\sin 4\theta + \frac{1}{4}\sin 2\theta$ A1
 Obtain $\frac{3}{32}\pi + \frac{1}{4}$ following completely correct work A1 [3]

Q7.

- 3** Use correct trig formula (or formulae) and obtain an equation in $\cos \theta$ M1
 Obtain $8 \cos^2 \theta + \cos \theta - 7 = 0$, or equivalent A1
 Solve a 3-term quadratic in $\cos \theta$ and reach $\theta = \cos^{-1}(a)$ M1
 Obtain answer 29.0° A1
 Obtain answer 180° and no others A1 [5]
 [Ignore answers outside the given interval. Treat answers in radians (0.505 and 3.14 or π) as a misread.]
 [SR: The answer 180° found by inspection can earn B1.]

Trigonometry 2 - Marking Scheme



Q8.

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|----------|-------------|--|-----|-----|
| 4 | (i) | Use $\tan(A \pm B)$ formula correctly at least once and obtain an equation in $\tan\theta$ | M1 | |
| | | Obtain a correct horizontal equation in any form | A1 | |
| | | Use $\tan 60^\circ = \sqrt{3}$ throughout | M1 | |
| | | Obtain the given equation correctly | A1 | [4] |
| | (ii) | Set $k = 3\sqrt{3}$ and obtain $\tan^2\theta = \frac{1}{11}$ | B1 | |
| | | Obtain answer 16.8° | B1√ | |
| | | Obtain answer 163.2° | B1√ | [3] |
| | | [Ignore answers outside the given interval. Treat answers in radians (0.293 and 2.85) as a misread.] | | |

Q9.

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|----------|-------------|--|-----|-----|
| 6 | (i) | State or imply $R = \sqrt{10}$ | B1 | |
| | | Use trig formulae to find α | M1 | |
| | | Obtain $\alpha = 71.57^\circ$ 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. ($50.7684\dots^\circ$) (Allow 50.7° here) | B1√ | |
| | | Carry out an appropriate method to find a value of 2θ in $0^\circ < 2\theta < 180^\circ$ | M1 | |
| | | Obtain an answer for θ in the given range, e.g. $\theta = 61.2^\circ$ | A1 | |
| | | Use an appropriate method to find another value of 2θ in the above range | M1 | |
| | | Obtain second angle, e.g. $\theta = 10.4^\circ$, 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).] | | |

Q10.

3	(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]