

Past-paper walk-through

Trigonometry ■ 3.3

eXercise

Questions in this set

- 9709/31 N25 Q3 ■ 8 marks
- 9709/31 J25 Q7 ■ 8 marks
- 9709/32 J25 Q4 ■ 6 marks
- 9709/32 J25 Q7 ■ 7 marks

Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- **//** separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = “or words to that effect” – the wording need not match.

Question 3

9709/31 N25 ■ Q3 ■ 8 marks

(a) Express $3\sqrt{2}\sin(x + 45) + \cos x$ in the form $R\cos(x - \alpha)$, where $R > 0$ and $0 < \alpha < 90$. **[4]**

(b) Hence solve the equation $3\sqrt{2}\sin(3\theta + 45) + \cos 3\theta = -4$ for $0 < \theta < 180$. **[4]**

Solution 3

(a)

Mark scheme

- $3\sqrt{2}\sin(x + 45) = 3(\sin x + \cos x)$, so the expression
 $= 3\sin x + 4\cos x = R\cos(x - \alpha)$ with $R = 5$ and $\tan \alpha = \frac{3}{4} \Rightarrow \alpha = 36.9$. So
 $5\cos(x - 36.9)$.

Solution 3

(b)

Mark scheme

- $5 \cos(3\theta - 36.87) = -4 \Rightarrow \cos(3\theta - 36.87) = -0.8 \Rightarrow 3\theta - 36.87 = 143.13$ or 216.87 . So $\theta = 60.0$ and $\theta = 84.6$.

Question 7

9709/31 J25 ■ Q7 ■ 8 marks

- (a)** Express $5 \sin\left(x + \frac{1}{6}\pi\right) - 4 \cos x$ in the form $R \sin(x - \alpha)$, where $R > 0$ and $0 < \alpha < \frac{1}{2}\pi$. State the exact value of R and give the value of α correct to 3 decimal places. **[4]**
- (b)** Hence solve the equation $5 \sin\left(2\theta + \frac{1}{6}\pi\right) - 4 \cos 2\theta = \sqrt{7}$ for $0 \leq \theta \leq \pi$. Give your answers correct to 2 decimal places. **[4]**

Solution 7

(a)

Mark scheme

■ $5 \sin\left(x + \frac{1}{6}\pi\right) - 4 \cos x = \frac{5\sqrt{3}}{2} \sin x - \frac{3}{2} \cos x = R \sin(x - \alpha)$ with $R = \sqrt{21}$
and $\tan \alpha = \frac{3}{5\sqrt{3}} \Rightarrow \alpha = 0.333$.

Solution 7

(b)

Mark scheme

■ $\sqrt{21} \sin(2\theta - 0.333) = \sqrt{7} \Rightarrow \sin(2\theta - 0.333) = \frac{1}{\sqrt{3}}; \theta = 0.47 \text{ and } \theta = 1.43.$

Question 4

9709/32 J25 ■ Q4 ■ 6 marks

Solve the equation $3 \cot x - 4 \cot 2x = 3$ for $0 \leq x \leq 180$.

[6]

Solution 4

Mark scheme

- Using $\cot 2x = \frac{\cot^2 x - 1}{2 \cot x}$: $\cot^2 x - 3 \cot x + 2 = 0 \Rightarrow \cot x = 1$ or $2 \Rightarrow \tan x = 1$ or $\frac{1}{2}$. So $x = 45$ and $x = 26.6$.

Question 7

9709/32 J25 ■ Q7 ■ 7 marks

- (a)** Express $7 \sin \theta + 24 \cos \theta$ in the form $R \cos(\theta - \alpha)$, where $R > 0$ and $0 < \alpha < \frac{1}{2}\pi$.
Give the value of α correct to 4 decimal places. **[3]**
- (b)** Hence solve the equation $7 \sin \frac{1}{3}x + 24 \cos \frac{1}{3}x = 24.5$ for $0 < x < \pi$. **[4]**

Solution 7

(a)

Mark scheme

■ $R = \sqrt{7^2 + 24^2} = 25$; $\tan \alpha = \frac{7}{24} \Rightarrow \alpha = 0.2838$. So $25 \cos(\theta - 0.2838)$.

Solution 7

(b)

Mark scheme

- $25 \cos\left(\frac{1}{3}x - 0.2838\right) = 24.5 \Rightarrow \frac{1}{3}x - 0.2838 = \pm 0.1997$. So $x = 0.252$ and $x = 1.451$.