



eClassroom

INTERNATIONAL A LEVEL MATHEMATICS • PURE 3

Pure Mathematics 3

Exam Questions by Topic

Pearson Edexcel International Advanced Level (WMA13/01) • Calculator allowed

Multi-step exam questions at the difficulty of the real WMA13 paper, with a full mark scheme

Chapters (tap a chapter to jump to it)	Qs	Marks	Page	My score
1 Algebraic Methods Algebraic fractions, improper fractions and algebraic division	10	69	own PDF	
2 Functions and Graphs Modulus, composite and inverse functions, transformations	10	76	own PDF	
3 Trigonometric Functions sec, cosec, cot, identities, inverse trigonometric functions	10	72	own PDF	
4 Trigonometric Addition Formulae Addition and double-angle formulae, $R\cos(\theta \pm \alpha)$	10	75	2	
5 Exponentials and Logarithms e^x , $\ln x$, modelling, logarithmic graphs	10	78	own PDF	
6 Differentiation Chain, product and quotient rules, trigonometric and exponential functions	10	76	own PDF	
7 Integration Standard integrals, $f(ax+b)$, trigonometric identities, reverse chain rule	10	77	own PDF	
8 Numerical Methods Locating roots, iteration	10	77	own PDF	

[Full mark scheme](#)

[Free courses](#)

[More worksheets](#)

Name

Class

Date



Join students already acing their exams.

Book your FREE lesson at www.eclassroom.org.uk

CHAPTER 4 • KEY SKILLS

4

Trigonometric Addition Formulae

Specification P3: Trigonometry • 10 questions • 75 marks • about 90 minutes

1 Addition formulae

$$\sin(A \pm B) \equiv \sin A \cos B \pm \cos A \sin B$$

$$\cos(A \pm B) \equiv \cos A \cos B \mp \sin A \sin B$$

(all in the formula booklet)

2 Exact values

Split an angle into known ones:
 $75^\circ = 45^\circ + 30^\circ$. Use right-angled triangles when $\tan A$ is given.

3 Double angles

$$\sin 2A \equiv 2 \sin A \cos A$$

$$\cos 2A \equiv \cos^2 A - \sin^2 A \equiv 2 \cos^2 A - 1 \equiv 1 - 2 \sin^2 A$$
4 Proving identities

Choose the form of $\cos 2A$ that cancels. Work from one side to the other, showing each step.

5 Equations

Replace $\cos 2x$ so that only $\sin x$ (or only $\cos x$) remains, then factorise.

6 R forms

$a \sin x + b \cos x \equiv R \sin(x + \alpha)$ with
 $R = \sqrt{a^2 + b^2}$, $\tan \alpha = \frac{b}{a}$: expand and compare coefficients.

7 Maxima and minima

$R \cos(x + \alpha)$ lies between $-R$ and R .
 For $\frac{k}{c + R \cos(\dots)}$, the maximum uses the *minimum* of the denominator.

8 Solving with R forms

Solve $R \cos(x + \alpha) = c$: adjust the interval for $x + \alpha$ first, then subtract α .

9 Modelling

Interpret R as the amplitude; convert the angle back to time and answer in context (e.g. a clock time).

Skills map every skill above is tested at least once; interleaved skills come from GCSE or other chapters

Skill	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Marks	5	5	5	5	5	10	10	10	10	10
1 Addition formulae	•				•		•			
2 Exact values	•			•			•		•	•
3 Double angles		•		•			•		•	
4 Proving identities				•			•		•	
5 Equations		•			•	•	•		•	•
6 R forms			•			•		•		•
7 Maxima and minima			•			•		•		
8 Solving with R forms						•		•		•
9 Modelling								•		
Interleaved: sec, cosec, cot and their identities (Chapter 3)									•	
Interleaved: range and number of solutions (Chapter 2)						•				•
Interleaved: quadratics, cubics and surds (P1, P2)		•			•		•		•	

Exam difficulty. Questions 1 to 5 check each skill on its own. Questions 6 to 10 are multi-step questions built like the last questions on a real WMA13 paper, where one part leads into the next and skills from different topics are combined.

Must learn. Give R exactly (a surd if needed) and α to the accuracy asked. Check the sign in $\tan \alpha$ by expanding your form, and use “hence” results rather than starting again.



Join students already acing their exams.

Book your FREE lesson at www.eclassroom.org.uk

1. In this question you must show all stages of your working.

Solutions relying on calculator technology are not acceptable.

(a) Show that $\sin 75^\circ = \frac{\sqrt{6} + \sqrt{2}}{4}$

(2)

The angles A and B are acute, with $\tan A = \frac{3}{4}$ and $\tan B = \frac{5}{12}$

(b) Find the exact value of $\sin(A - B)$.

(3)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Question 1 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 1 is 5 marks)



Join students already acing their exams.

Book your FREE lesson at www.eclassroom.org.uk

2. Solve, for $0 \leq x < 360^\circ$,

$$2 \cos 2x + 5 \sin x = 3$$

giving your answers to one decimal place where appropriate.

(5)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Join students already acing their exams.

Book your FREE lesson at www.eclassroom.org.uk

Question 2 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 2 is 5 marks)**Join students already acing their exams.**Book your FREE lesson at www.eclassroom.org.uk

3. (a) Express $5\sin x - 12\cos x$ in the form $R\sin(x - \alpha)$, where $R > 0$ and $0 < \alpha < 90^\circ$. Give the value of α to 2 decimal places.

(3)

- (b) Write down the maximum value of $5\sin x - 12\cos x$ and find the value of x , for $0 \leq x < 360^\circ$, at which it occurs.

(2)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Question 3 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 3 is 5 marks)**Join students already acing their exams.**Book your FREE lesson at www.eclassroom.org.uk

4. In this question you must show all stages of your working.

Solutions relying on calculator technology are not acceptable.

(a) Prove that $\frac{1 - \cos 2\theta}{\sin 2\theta} \equiv \tan \theta$

(3)

(b) Hence find the exact value of $\tan 15^\circ$

(2)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Join students already acing their exams.

Book your FREE lesson at www.eclassroom.org.uk

Question 4 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 4 is 5 marks)**Join students already acing their exams.**Book your FREE lesson at www.eclassroom.org.uk

5. Solve, for $0 \leq x < \pi$,

$$\tan\left(x - \frac{\pi}{4}\right) = 6 \tan x$$

giving your answers to 3 significant figures.

(5)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Question 5 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 5 is 5 marks)**Join students already acing their exams.**Book your FREE lesson at www.eclassroom.org.uk

$$f(x) = 2 \cos x - 3 \sin x$$

(3)

$$g(x) = \frac{12}{10 + f(x)}$$

(2)

(2)

(3)

Question 6 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

**Join students already acing their exams.**Book your FREE lesson at www.eclassroom.org.uk

Question 6 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 6 is 10 marks)**Join students already acing their exams.**Book your FREE lesson at www.eclassroom.org.uk

7. In this question you must show all stages of your working.

Solutions relying on calculator technology are not acceptable.

(a) Using $\cos 3x = \cos(2x + x)$, prove that $\cos 3x \equiv 4\cos^3 x - 3\cos x$ (4)

(b) Hence solve, for $0 \leq x \leq \pi$, $\cos 3x + 2\cos x = 0$, giving your answers as exact multiples of π . (4)

(c) Given that $\cos \alpha = \frac{1}{3}$, find the exact value of $\cos 3\alpha$. (2)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Join students already acing their exams.

Book your FREE lesson at www.eclassroom.org.uk

Question 7 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

**Join students already acing their exams.**Book your FREE lesson at www.eclassroom.org.uk

Question 7 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 7 is 10 marks)**Join students already acing their exams.**Book your FREE lesson at www.eclassroom.org.uk

- (3)**

$$H = 10 + 3 \sin\left(\frac{\pi t}{6}\right) - 4 \cos\left(\frac{\pi t}{6}\right) \quad 0 \leq t \leq 12$$

(3)

- (4)

Question 8 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

**Join students already acing their exams.**Book your FREE lesson at www.eclassroom.org.uk

Question 8 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 8 is 10 marks)**Join students already acing their exams.**Book your FREE lesson at www.eclassroom.org.uk

Solutions relying on calculator technology are not acceptable.

- (4)

- $$\operatorname{cosec} 4\theta + \cot 4\theta = \sqrt{3}$$

(3)

- (3)**



Question 9 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

**Join students already acing their exams.**Book your FREE lesson at www.eclassroom.org.uk

Question 9 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 9 is 10 marks)



Join students already acing their exams.

Book your FREE lesson at www.eclassroom.org.uk

Solutions relying on calculator technology are not acceptable.

- (a) Express $\sqrt{3}\cos x + \sin x$ in the form $R\cos(x - \alpha)$, where $R > 0$ and $0 < \alpha < \frac{\pi}{2}$. Give the exact values of R and α . (3)
- (b) Hence solve, for $0 \leq x \leq \pi$, $\sqrt{3}\cos 2x + \sin 2x = -1$, giving your answers as exact multiples of π . (4)
- (c) Find the set of values of k for which the equation $\sqrt{3}\cos x + \sin x = k$ has exactly two solutions for $0 \leq x < 2\pi$. Give a reason for your answer. (3)

Question 10 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

**Join students already acing their exams.**Book your FREE lesson at www.eclassroom.org.uk

Question 10 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 10 is 10 marks)**TOTAL FOR CHAPTER 4 IS 75 MARKS****Join students already acing their exams.**Book your FREE lesson at www.eclassroom.org.uk