



eClassroom

INTERNATIONAL A LEVEL MATHEMATICS • PURE 2

Pure Mathematics 2

Exam Questions by Topic

Pearson Edexcel International Advanced Level (WMA12/01) • Calculator allowed

Multi-step exam questions at the difficulty of the real WMA12 paper, with a full mark scheme

Chapters (tap a chapter to jump to it)	Qs	Marks	Page	My score
1 Algebraic Methods Algebraic fractions, the factor and remainder theorems, proof	10	66	2	
2 Coordinate Geometry in the (x, y) Plane Equations of circles, tangents, chords and intersections	10	68	own PDF	
3 Exponentials and Logarithms Laws of logarithms, exponential equations, modelling	10	68	own PDF	
4 The Binomial Expansion Expanding $(a + bx)^n$, coefficients and approximations	10	65	own PDF	
5 Sequences and Series Arithmetic and geometric series, sigma notation, recurrence	10	69	own PDF	
6 Trigonometric Identities and Equations $\tan \theta = \frac{\sin \theta}{\cos \theta}$, $\sin^2 \theta + \cos^2 \theta = 1$, solving equations	10	66	own PDF	
7 Differentiation Increasing and decreasing functions, stationary points, optimisation	10	67	own PDF	
8 Integration Definite integrals, areas under curves, the trapezium rule	10	67	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

Page 1 of 22

CHAPTER 1 • KEY SKILLS

1

Algebraic Methods

Specification P2: Proof, Algebra • 10 questions • 66 marks • about 80 minutes

1 Solving polynomial equations

Once $f(x)$ is factorised, set each factor equal to zero. Take out a common factor; never divide it away, or you lose a root.

2 Dividing polynomials

Divide by $(x \pm p)$ by long division or by inspection: $f(x) = (x - p)q(x) + r$.

3 The factor theorem

$f(a) = 0 \Leftrightarrow (x - a)$ is a factor.

For $(2x - 3)$ use $f\left(\frac{3}{2}\right) = 0$, and say so.

4 The remainder theorem

The remainder when $f(x)$ is divided by $(ax - b)$ is $f\left(\frac{b}{a}\right)$.

5 Unknown coefficients

Each factor or remainder gives one equation. Solve two equations simultaneously.

6 Factorising completely

Divide out the linear factor, then factorise the quadratic. If $b^2 - 4ac < 0$ it does not factorise.

7 Proof by deduction

Start from true facts, e.g. $(x - y)^2 \geq 0$, and give a reason for every step. State signs before dividing.

8 Proof by exhaustion

Check every possible case, then write a conclusion.

9 Disproof by counter-example

One example where the conditions hold but the statement is false. Show the working.

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	4	5	4	5	8	8	8	9	10
1 Solving polynomial equations							•			•
2 Dividing polynomials		•				•	•		•	
3 The factor theorem	•		•			•	•		•	•
4 The remainder theorem				•		•				•
5 Unknown coefficients	•		•	•		•				•
6 Factorising completely	•		•			•	•		•	•
7 Proof by deduction								•		
8 Proof by exhaustion					•					
9 Disproof by counter-example					•			•		
Interleaved: quadratics and the discriminant (P1)						•	•			•
Interleaved: sketching cubics, inequalities (P1)									•	
Interleaved: differentiation, surds (P1)								•		•

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 WMA12 paper, where one part leads into the next and skills from different topics are combined.

Must learn. A factor theorem answer needs “ $f(a) = 0$, so $(x - a)$ is a factor”. “Factorise completely” means write the full product. A proof needs a concluding statement.



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.

$$f(x) = x^3 + ax^2 + bx + 6$$

where a and b are constants. Given that $(x - 3)$ and $(x + 2)$ are factors of $f(x)$,

(a) find the value of a and the value of b ,

(4)

(b) hence write $f(x)$ as a product of three linear factors.

(1)

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 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. Find the quotient and the remainder when $2x^3 - 3x^2 - 11x + 7$ is divided by $(x - 3)$

(4)

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 4 marks)



Join students already acing their exams.

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

3. In this question you must show all stages of your working.
Solutions relying on calculator technology are not acceptable.

$$f(x) = 2x^3 + 3x^2 + ax - 6$$

where a is a constant. Given that $(2x + 1)$ is a factor of $f(x)$,

(a) use the factor theorem to show that $a = -11$ (2)

(b) Hence factorise $f(x)$ completely. (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 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.

$$f(x) = 2x^3 - x^2 + kx + 4$$

where k is a constant. When $f(x)$ is divided by $(x - 2)$ the remainder is 10

(a) Find the value of k .

(2)

(b) Find the remainder when $f(x)$ is divided by $(2x + 1)$

(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

(Total for Question 4 is 4 marks)



Join students already acing their exams.

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

5. (i) A student writes the statement

$n^2 + n + 11$ is a prime number for all positive integers n

Prove, by counter-example, that this statement is not true.

(2)

- (ii) Given that n is an integer with $1 \leq n \leq 5$, prove by exhaustion that $n^3 - n$ is a multiple of 6

(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 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

6. In this question you must show all stages of your working.
Solutions relying on calculator technology are not acceptable.

$$f(x) = (x + 1)(2x^2 - x + k) - 9$$

where k is a constant.

- (a) Write down the remainder when $f(x)$ is divided by $(x + 1)$ (1)

Given that $(2x - 1)$ is a factor of $f(x)$,

- (b) show that $k = 6$ (2)

- (c) (i) Write $f(x)$ in the form $(2x - 1)g(x)$, where $g(x)$ is a quadratic expression. (3)

- (ii) Hence show that the equation $f(x) = 0$ has only one real root. (2)



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 8 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.

$$f(x) = x^3 + 2x^2 - 5x - 6$$

- (a) Use the factor theorem to show that $(x - 2)$ is a factor of $f(x)$.

(2)

- (b) Factorise $f(x)$ completely.

(2)

- (c) Using your answer to part (b), solve the equation

$$f(x) = x + 3$$

giving your answers in exact form.

(4)

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 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 8 marks)



Join students already acing their exams.

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

DO NOT WRITE IN THIS AREA

(4)

(2)

(2)

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 8 marks)



Join students already acing their exams.

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

Solutions relying on calculator technology are not acceptable.

$$f(x) = x^3 - 3x^2 - 4x + 12$$

- (a) Use the factor theorem to show that $(x - 3)$ is a factor of $f(x)$. (2)
- (b) Factorise $f(x)$ completely. (2)
- (c) Sketch the curve with equation $y = f(x)$, showing clearly the coordinates of the points where the curve meets the coordinate axes. (3)
- (d) Using your answers to parts (b) and (c), find the set of values of x for which $f(x) \geq 0$ (2)

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

Solutions relying on calculator technology are not acceptable.

where p and q are constants. The curve with equation $y = f(x)$ touches the x -axis at the point $(2, 0)$.

- (c)** Write $f(x)$ as a product of linear factors. **(1)**

When $f(x)$ is divided by $(x - k)$, where k is a non-zero constant, the remainder is 12

- (d)** Find the exact possible values of k . **(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 1 IS 66 MARKS

Join students already acing their exams.

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