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INTERNATIONAL A LEVEL MATHEMATICS • PURE 1

Pure Mathematics 1

Exam Questions by Topic

Pearson Edexcel International Advanced Level (WMA11/01) • Calculator allowed

Multi-step exam questions at the difficulty of the real WMA11 paper, with a full mark scheme

Chapters (tap a chapter to jump to it)	Qs	Marks	Page	My score
1 Algebraic Expressions Indices, surds, expanding and factorising	10	57	2	
2 Quadratics Completing the square, the discriminant, quadratic graphs	10	65	own PDF	
3 Equations and Inequalities Simultaneous equations, inequalities, regions	10	69	own PDF	
4 Graphs and Transformations Cubic and reciprocal graphs, intersections, transformations	10	68	own PDF	
5 Straight-line Graphs Gradients, equations of lines, parallel and perpendicular	10	68	own PDF	
6 Trigonometric Ratios Sine and cosine rules, area of a triangle, trig graphs	10	66	own PDF	
7 Radians Radian measure, arc length, sector and segment areas	10	71	own PDF	
8 Differentiation Gradients, second derivatives, tangents and normals	10	71	own PDF	
9 Integration Integrating x^n , finding $y = f(x)$ from $f'(x)$	10	67	own PDF	

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CHAPTER 1 • KEY SKILLS

1

Algebraic Expressions

Specification P1: 1.1, 1.2, 1.10 • 10 questions • 57 marks • about 70 minutes

1 Laws of indices

$$a^m \times a^n = a^{m+n}, \quad a^m \div a^n = a^{m-n},$$

$$(a^m)^n = a^{mn}$$

e.g. $\frac{6x^5}{2x^2} = 3x^3$

2 Negative, zero, fractional indices

$$a^{-n} = \frac{1}{a^n}, \quad a^0 = 1, \quad a^{\frac{m}{n}} = (\sqrt[n]{a})^m$$

e.g. $8^{-\frac{2}{3}} = \frac{1}{4}$

3 Expanding brackets

Multiply two brackets, then the third, and collect like terms.

e.g. $(x+2)(x-1)(x+3)$
 $= x^3 + 4x^2 + x - 6$

4 Factorising completely

Common factor first, then the quadratic or the difference of two squares.

e.g. $x^3 - 9x = x(x-3)(x+3)$

5 Writing as $Ax^p + Bx^q$

Write $\sqrt{x}$ as $x^{\frac{1}{2}}$ and divide every term by the denominator.

e.g. $\frac{x^2+3}{\sqrt{x}} = x^{\frac{3}{2}} + 3x^{-\frac{1}{2}}$

6 Simplifying surds

$\sqrt{ab} = \sqrt{a}\sqrt{b}$: take out the largest square factor.

e.g. $\sqrt{12} + \sqrt{27} = 5\sqrt{3}$

7 Rationalising the denominator

Multiply top and bottom by the conjugate.

e.g. $\frac{1}{3+\sqrt{2}} = \frac{3-\sqrt{2}}{9-2} = \frac{3-\sqrt{2}}{7}$

8 Hidden quadratics

$$4^x = (2^x)^2, \text{ so let } p = 2^x.$$

e.g. $4^x - 5 \times 2^x + 4 = 0$ gives

$$p^2 - 5p + 4 = 0, \text{ so } p = 1, 4 \text{ and } x = 0, 2$$

9 Equating powers

Write both sides as powers of the same prime, then equate the indices.

e.g. $4^x = 8\sqrt{2}$ gives $2^{2x} = 2^{\frac{7}{2}}$, so $x = \frac{7}{4}$

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	4	6	5	5	6	6	6	7	6	6
1 Laws of indices	•			•		•	•			
2 Negative, zero and fractional indices	•			•			•			
3 Expanding brackets		•		•	•				•	•
4 Factorising completely		•				•				
5 Writing as $Ax^p + Bx^q$				•						
6 Simplifying surds			•		•				•	
7 Rationalising the denominator			•		•			•	•	•
8 Hidden quadratics						•				
9 Equating powers						•	•			
Interleaved: Pythagoras' theorem (GCSE)					•					
Interleaved: simultaneous linear equations (GCSE)							•			
Interleaved: gradients, perpendicular lines (Chapter 5)								•		

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 WMA11 paper, where one part leads into the next and skills from different topics are combined.

Must learn. Nothing in this chapter is in the formula booklet. “Hence” means use the result you have just found. “Show that” means every step must be written down. “Exact” means leave surds and fractions in your answer.



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

Solutions relying on calculator technology are not acceptable.

(a) Find the value of $27^{-\frac{2}{3}}$

(2)

(b) Simplify fully $\frac{(27x^6)^{\frac{2}{3}}}{(3x)^2}$

(2)

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(Total for Question 1 is 4 marks)



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2. (a) Factorise completely $2x^3 - 7x^2 - 15x$

(3)

- (b) Expand $(x+3)(2x-1)(4-x)$
giving your answer as a polynomial in x in simplest form.

(3)

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Question 2 continued

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(Total for Question 2 is 6 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.

(a) Simplify $\sqrt{50} - \sqrt{18}$

giving your answer in the form $a\sqrt{2}$, where a is an integer.

(2)

(b) Hence, or otherwise, express $\frac{\sqrt{50} - \sqrt{18}}{3\sqrt{2} - 4}$ in the form $p + q\sqrt{2}$, where p and q are integers.

(3)

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Question 3 continued

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(Total for Question 3 is 5 marks)



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

Given that $x > 0$,

- (a) expand and simplify $(3 - 2\sqrt{x})^2$ (2)

- (b) Hence write $\frac{(3 - 2\sqrt{x})^2}{\sqrt{x}}$ in the form $Ax^p + B + Cx^q$
where A , B , C , p and q are constants to be found. (3)

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Question 4 continued

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(Total for Question 4 is 5 marks)



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

Solutions relying on calculator technology are not acceptable.

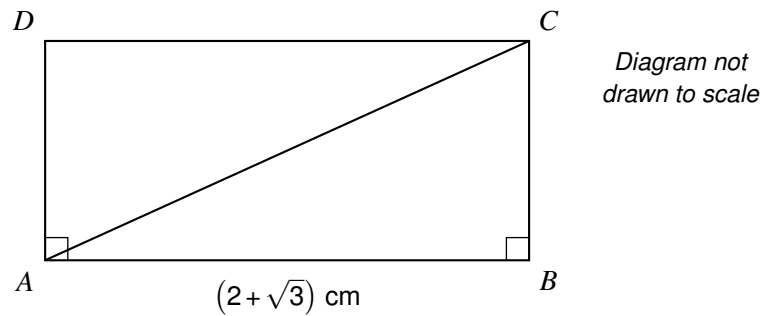


Figure 1

Figure 1 shows a rectangle $ABCD$.

The length of AB is $(2 + \sqrt{3})$ cm.

The area of the rectangle is $(13 + 7\sqrt{3})$ cm².

(a) Find the exact length of BC , giving your answer in the form $a + b\sqrt{3}$ cm, where a and b are integers.

(3)

(b) Show that $AC^2 = 7(5 + 2\sqrt{3})$

(3)



Question 5 continued

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(Total for Question 5 is 6 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.

(a) By substituting $p = 2^x$, show that the equation

$$2^{2x+1} + 8 = 2^{x+4} + 2^x$$

can be written in the form

$$2p^2 - 17p + 8 = 0$$

(3)

(b) Hence solve $2^{2x+1} + 8 = 2^{x+4} + 2^x$

(3)

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Question 6 continued

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(Total for Question 6 is 6 marks)



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

Solutions relying on calculator technology are not acceptable.

Solve the simultaneous equations

$$2^x \times 4^{y+1} = 32\sqrt{2}$$

$$\frac{27^x}{9^y} = 729\sqrt{3}$$

(6)

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Question 7 continued

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(Total for Question 7 is 6 marks)



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Solutions relying on calculator technology are not acceptable.

(a) Show that the gradient of AB can be written in the form $p + q\sqrt{3}$, where p and q are integers to be found.

(3)

The line l crosses the x -axis at the point C .

(b) Find the exact x coordinate of C , giving your answer in the form $a + b\sqrt{3}$, where a and b are integers.

(4)

Question 8 continued

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(Total for Question 8 is 7 marks)



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

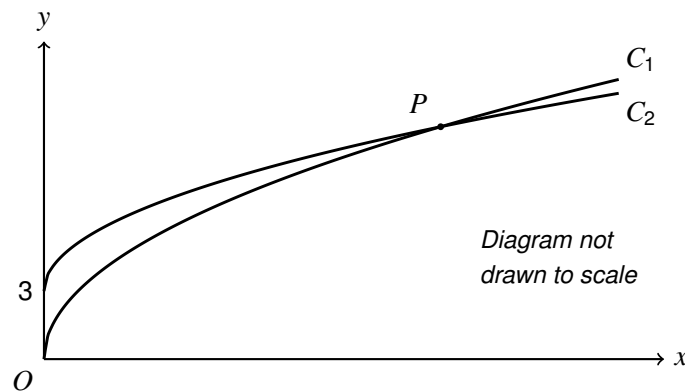


Figure 2

Figure 2 shows a sketch of part of the curve C_1 with equation

$$y = \sqrt{2x} \quad x \geq 0$$

and part of the curve C_2 with equation

$$y = \sqrt{x} + 3 \quad x \geq 0$$

The curves meet at the point P .

- (a) Show that the x coordinate of P satisfies $\sqrt{x} = 3(\sqrt{2} + 1)$ (3)
- (b) Hence find the exact coordinates of P , giving each coordinate in the form $a + b\sqrt{2}$, where a and b are integers. (3)



Question 9 continued

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(Total for Question 9 is 6 marks)



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

Solutions relying on calculator technology are not acceptable.

Given that k is a positive constant,

(a) show that $(\sqrt{k+2} - \sqrt{k})(\sqrt{k+2} + \sqrt{k}) = 2$ (1)

(b) Hence show that $\frac{1}{\sqrt{k} + \sqrt{k+2}} = \frac{\sqrt{k+2} - \sqrt{k}}{2}$ (2)

(c) Use the result of part (b) to show that

$$\frac{1}{\sqrt{1} + \sqrt{3}} + \frac{1}{\sqrt{3} + \sqrt{5}} + \frac{1}{\sqrt{5} + \sqrt{7}} + \cdots + \frac{1}{\sqrt{47} + \sqrt{49}} = 3$$
 (3)

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Question 10 continued

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(Total for Question 10 is 6 marks)**TOTAL FOR CHAPTER 1 IS 57 MARKS****Join students already acing their exams.**Book your FREE lesson at www.eclassroom.org.uk