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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	own PDF	
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	2	
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	

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CHAPTER 4 • KEY SKILLS

4

The Binomial Expansion

Specification P2: Binomial expansion • 10 questions • 65 marks • about 80 minutes

1 Binomial coefficients

$$\binom{n}{r} = {}^nC_r = \frac{n!}{r!(n-r)!}$$

e.g. $\binom{6}{2} = 15$

2 Expanding $(a + bx)^n$

$$(a + bx)^n =$$

$$a^n + \binom{n}{1}a^{n-1}(bx) + \binom{n}{2}a^{n-2}(bx)^2 + \dots$$

Keep bx in brackets, including its sign.

3 A single term

The term in x^r is $\binom{n}{r}a^{n-r}(bx)^r$. The *coefficient* is the number only.

4 Unknown constants

Write each given coefficient in terms of the unknown, form an equation and solve it. Use any given sign condition.

5 Unknown power n

$$\binom{n}{2} = \frac{n(n-1)}{2} \text{ and}$$

$$\binom{n}{3} = \frac{n(n-1)(n-2)}{6} \text{ give equations in } n.$$

6 Products of brackets

For the x^2 term of $(p + qx)(\dots)$:
 $p \times (\text{coefficient of } x^2) + q \times (\text{coefficient of } x)$.

7 Approximations

Choose x so the bracket equals the number, e.g. $0.99 = 1 - \frac{x}{4}$ gives $x = 0.04$. Higher powers of small x are tiny.

8 Powers of x and $\frac{1}{x}$

Write the general term as a single power x^k ; the constant term has $k = 0$.
 k must come from a whole number r .

9 Symmetry

In $(1+x)^n + (1-x)^n$ the odd powers cancel; in $(1+x)^n - (1-x)^n$ the even powers cancel.

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	4	5	5	4	8	8	8	9	10
1 Binomial coefficients		•	•				•	•		
2 Expanding $(a + bx)^n$	•			•		•			•	•
3 A single term		•	•			•		•		
4 Unknown constants			•			•				•
5 Unknown power n							•			
6 Products of brackets					•					•
7 Approximations				•						
8 Powers of x and $\frac{1}{x}$								•		
9 Symmetry									•	
Interleaved: surds and indices (P1)								•	•	
Interleaved: quadratics and hidden quadratics (P1)			•			•	•		•	
Interleaved: simultaneous equations (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. Put brackets round the whole of bx before raising it to a power. Give coefficients exactly (as fractions, not rounded decimals) unless told otherwise.



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1. Find the first 4 terms, in ascending powers of x , of the binomial expansion of

$$(2 + 3x)^5$$

giving each term in its simplest form.

(4)

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(Total for Question 1 is 4 marks)



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2. In the binomial expansion of $(3 - 2x)^7$, find

(a) the coefficient of x^3

(2)

(b) the coefficient of x^5

(2)

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(Total for Question 2 is 4 marks)



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3. In the binomial expansion of $(1 + kx)^8$, where k is a positive constant, the coefficient of x^2 is 112

(a) Find the value of k .

(3)

(b) Find the coefficient of x^3 in the expansion.

(2)

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Question 3 continued

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

4. (a) Find the first 3 terms, in ascending powers of x , of the binomial expansion of $\left(1 - \frac{x}{4}\right)^{10}$ giving each term in its simplest form. (3)
- (b) Use your expansion, with a suitable value of x , to find an estimate for 0.99^{10} State the value of x that you use. (2)

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Question 4 continued

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5. Find the coefficient of x^2 in the expansion of

$$(3+x)(1-2x)^5$$

(4)

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(Total for Question 5 is 4 marks)



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

The binomial expansion, in ascending powers of x , of $(2 + px)^6$, where p is a non-zero constant, can be written as

$$A + Bx + Cx^2 + Dx^3 + \dots$$

(a) Write down the value of A .

(1)

Given that $2D = 15B$ and that $p < 0$,

(b) find the value of p .

(4)

(c) Find the value of C .

(2)

(d) Write down the coefficient of x^6 in the expansion.

(1)

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Question 6 continued

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(Total for Question 6 is 8 marks)



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Solutions relying on calculator technology are not acceptable.

In the binomial expansion of $(1+ax)^n$, where a is a constant and n is an integer with $n > 2$, the coefficient of x is 20 and the coefficient of x^2 is 180

- (a) Show that $n = 10$, and find the value of a .
(5)
- (b) Find the coefficient of x^3 in the expansion.
(1)
- (c) Find the largest coefficient in the expansion, stating the power of x it belongs to.
(2)



Question 7 continued

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(Total for Question 7 is 8 marks)



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8.

$$\left(x^2 - \frac{2}{x}\right)^6 \quad x \neq 0$$

- (a) Show that the general term of the binomial expansion can be written as $\binom{6}{r}(-2)^r x^{12-3r}$ (2)
- (b) Find the term independent of x . (2)
- (c) Find the coefficient of x^3 (2)
- (d) Explain why there is no term in x^2 in the expansion. (2)

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Question 8 continued

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(Total for Question 8 is 8 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.

(a) Expand and simplify $(1+x)^5 + (1-x)^5$

(3)

(b) Hence show that $(1+\sqrt{2})^5 + (1-\sqrt{2})^5 = 82$

(2)

(c) Hence solve the equation

$$(1+y)^5 + (1-y)^5 = 242$$

(4)

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Question 9 continued

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Question 9 continued

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(Total for Question 9 is 9 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.**

- (a) Find the first 3 terms, in ascending powers of x , of the binomial expansion of $(2+ax)^5$, where a is a non-zero constant. Give each term in terms of a .

(3)

In the expansion of $(2+ax)^5(1-bx)$, where b is a constant, the coefficient of x is 16 and the coefficient of x^2 is 0

- (b) Show that $b = a$ and find the value of a .

(5)

- (c) Find the exact coefficient of x^3 in the expansion of $(2+ax)^5(1-bx)$

(2)

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Question 10 continued

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Question 10 continued

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(Total for Question 10 is 10 marks)**TOTAL FOR CHAPTER 4 IS 65 MARKS****Join students already acing their exams.**Book your FREE lesson at www.eclassroom.org.uk