

## 13+ PAST PAPER PACK

# Eton College 13+ Maths 2019

## Complete Past Paper Pack

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# Eton College King's Scholarship Examination 2019

## MATHEMATICS A

(One and a half hours)

*Candidate Number:.....*

**Please write your candidate number on EVERY sheet.**

***Please answer on the paper in the spaces provided.***

*This paper is divided into two sections:*

*Section I (Short-answer questions) – 50 marks available*

*Section II (Extended questions) – 50 marks available*

*Answer all of Section I and as many questions as you can from Section II.*

*The marks for each part of each question are given in square brackets.*

*Show all your working.*

*No diagram is drawn to scale.*

***Neither calculators nor protractors may be used.***

**ADDITIONAL MATERIALS:    NONE**

**Do not turn over until told to do so.**

**Section I : Short-answer questions (50 marks)**

1. Find the value of the following, giving your answers as reduced, mixed fractions:

a)  $1\frac{2}{13} \times 1\frac{1}{25}$  [3]

b)  $1\frac{5}{12} \div 3\frac{13}{24}$  [3]

c)  $345\frac{2}{3} - 327\frac{7}{9}$  [3]

2. Find the value of the following, giving your answer as a decimal or whole number as appropriate:

a)  $3400 \times 0.003$  [3]

b)  $0.00396 \div 0.000003$  [3]

c)  $0.01^4$  [3]

3. The bearing of Blackburn from Burnley is  $257^\circ$ . What is the bearing of Burnley from Blackburn?

[2]

4. 6 children have a mean pocket money of £5. The four boys have a mean pocket money of £7; what is the girls' mean pocket money?

[3]

5. Solve the following equation and inequality, giving your final answers as a reduced, mixed fraction (where appropriate) and with  $x$  on the left-hand side:

a)  $3(x - 7) - 4(x - 8) = 7(x - 11)$

[3]

b)  $11(x + 3) \geq 19x - 9$

[3]

6. Find the length of the line segment joining the points  $(-3,13)$  and  $(2,1)$ . [3]

7. An alien fires a rocket upwards from the surface of his home planet;  $t$  seconds after it has left the ground, the height,  $h$  metres, of the rocket above the ground is given by the formula:

$$h = 2000t - 25t^2$$

Find, in metres, the distance the rocket travels

- a) over the first four seconds; [2]

- b) over the next four seconds. [3]

8. Evaluate the following, giving your answer in standard form:

a)  $7.41 \times 10^{21} - 6.82 \times 10^{21}$

[2]

b)  $9.2 \times 10^{-6} + 9.1 \times 10^{-7}$

[3]

9. Hubert is packing rulers into boxes. If he packs them into boxes of 12 each, all the boxes are full and no rulers are left over; similarly, he can pack them into boxes of 16 each, filling them all with none left over. However, if he packs them in boxes of 5, he has one ruler left over. Find the smallest number of rulers that Hubert could have.

[4]

10. Lara monetizes her social media accounts with both Facetube and Instachat. She posts a video on Facetube and earns a fixed amount for each 'like' she receives; also, she receives a fixed amount for every new friend acquired on Instachat. In the first week, she gets 5 likes for her video and gains 6 new friends on Instachat: she receives £1.13. The next week she gets 6 likes for her video, gains 7 new friends on Instachat and receives £1.33. If, in the third week, she gets 8 likes for her video and gains 8 new friends, how much money will she receive?

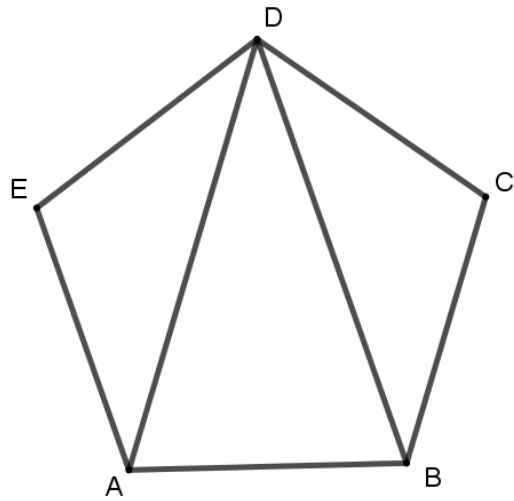
[4]

## Section II: Extended questions (50 marks)

11. *No credit will be given in this question if angles are measured or estimated.*

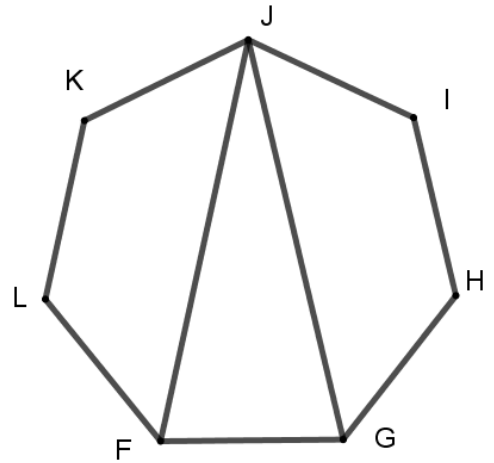
- a) The diagram on the right shows a regular pentagon  $ABCDE$  with two diagonals  $AD$  and  $BD$  drawn.

Show clearly that the ratio of angles  $\angle DAB : \angle ADB$  is  $2 : 1$ .



[3]

- b) The second diagram shows a regular heptagon  $FGHIJKL$  with two diagonals  $FJ$  and  $GJ$  drawn. Find the ratio of angles  $\angle JFG : \angle FJG$ .



[7]

12. In this question, the letters  $a$  and  $b$  represent digits in the normal decimal representation of a number. For example, '52ab' could represent any whole number from 5200 to 5299 inclusive.

a) The four-digit number '537a' is divisible by 4. Write down both possible four-digit numbers.

[2]

b) The five-digit number '7218a' is divisible by 9. Write down both possible five-digit numbers.

[2]

c) The four-digit number 'a37b' is divisible by 18. Find all possible four-digit numbers.

[3]

d) The seven-digit number '1a234b2' is divisible by 36. Find all possible seven-digit numbers.

[3]

13. On the right is an example of a *magic square*: each row, column and diagonal sum to the same value, called the *magic number*.

For example:

$$8 + 7 + 6 = 21 \text{ (row)}$$

$$9 + 8 + 4 = 21 \text{ (column)}$$

$$9 + 7 + 5 = 21 \text{ (diagonal)}$$

9	2	10
8	7	6
4	12	5

The magic number, in this case, is 21.

- a) Fill in the remaining gaps in the magic square below and state the magic number.

15	0	18
	22	7

[2]

- b) Below is an algebraic magic “square”; find the magic number (which will be an algebraic expression) and hence fill in the gaps:

$x - y$	$x + y - z$	$x + z$
$x + y + z$	$x$	
	$x - y + z$	

[3]

- c) Using the algebraic magic square or otherwise, fill in the remaining gaps in the magic square below:

		<i>25</i>
	<i>18</i>	<i>16</i>

[5]

14. Tom, Dick and Harry all have rather inaccurate digital watches, with times displayed in the 24-hour clock with seconds.

- Tom's watch loses five minutes every hour.
- Dick's watch gains an hour every day.
- Harry's watch gains 3 seconds every minute.

All three boys set their watches correctly at 6 o'clock on Monday morning.

a) When the correct time is exactly 7am, Tom's watch shows "06:55:00". What do Dick and Harry's watches show?

[2]

b) At 6am on Tuesday, Dick's watch shows "07:00:00". What do Tom and Harry's watches show?

[2]

c) Later on Tuesday, Dick's watch claims it is four hours later in the day than Tom's watch. What time does Tom's watch display?

[2]

- d) The following week, Tom and Harry's watches appear to be displaying the same time. On what day does this happen, and what time is displayed?

[4]

15. a) A triplet of positive whole numbers  $(a, b, c)$  is called a *Pythagorean triple* if

$$a^2 + b^2 = c^2$$

Complete the rows of examples of Pythagorean triples in the following table:

$a$	$b$	$c$
3	4	5
	12	13
8		17
	24	25
18		30
15	36	

[3]



# Paper Notes: 13+ Maths Question Paper (13+ Maths Past Paper (2019))

Compiled by [SATs-Papers.co.uk](https://www.SATs-Papers.co.uk) to help you get the most from this paper.

## Overview

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This is the **Eton College King's Scholarship Examination 2019 Mathematics A** paper, a **13+ entrance** assessment designed for candidates seeking academic scholarships at one of the UK's most selective independent schools. The paper is divided into two sections totalling **100 marks** and must be completed in **one and a half hours** without the use of calculators or protractors.

The examination tests a broad range of mathematical skills appropriate for strong Year 8 pupils preparing for Year 9 entry. **Section I** comprises short-answer questions covering arithmetic with fractions and decimals, bearings, statistics, algebra, coordinate geometry, standard form, number theory and simultaneous equations. **Section II** presents extended problem-solving tasks on polygon geometry, divisibility rules, magic squares, rate problems and Pythagorean triples.

The paper is particularly suited to students working at or above the top of the Key Stage 3 curriculum who wish to demonstrate mathematical maturity, logical reasoning and the ability to tackle unfamiliar problems under timed conditions. Candidates are instructed to show all working and to answer all of Section I plus as many questions as possible from Section II.

## How this paper is organised

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The paper is organised into **two distinct sections**. **Section I** carries **50 marks** and consists of short-answer questions numbered 1 to 10; these cover fundamental skills in arithmetic, algebra, geometry and number. Each part is worth between **2 and 4 marks**, with most questions split into sub-parts (a), (b) and (c). Candidates are expected to complete all of Section I.

**Section II** also carries **50 marks** and contains four extended questions numbered 11 to 15. These multi-part problems (each worth between **7 and 10 marks**) require deeper reasoning, geometric proof, algebraic manipulation and systematic problem-solving. Question 11 explores angles in regular polygons, question 12 examines divisibility rules, question 13 introduces algebraic magic squares, question 14 presents a rates problem with inaccurate watches, and question 15 combines Pythagorean triples with kite geometry.

Candidates are instructed to answer on the paper itself in the spaces provided, ensuring their candidate number appears on every sheet. The rubric emphasises that all working must be shown and that diagrams are not to scale.

## Topics covered

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- Arithmetic with mixed fractions: multiplication, division and subtraction requiring reduction to lowest terms
- Decimal arithmetic: multiplication, division and powers of decimals to four significant figures
- Bearings: reverse bearings and compass conventions
- Mean and weighted averages: calculating the mean of a subset when the overall mean is known
- Linear equations and inequalities: solving multi-step equations with brackets and expressing inequalities in standard form
- Coordinate geometry: calculating the distance between two points using Pythagoras
- Quadratic modelling: interpreting and evaluating a quadratic formula for projectile motion
- Standard form: addition and subtraction of numbers in scientific notation
- Number theory: least common multiples, divisibility rules for 4, 9, 18 and 36, and Chinese remainder theorem-style problems
- Simultaneous equations: forming and solving two-variable systems from word problems
- Angle properties in regular polygons: calculating interior angles and using isosceles triangles to establish angle ratios
- Algebraic magic squares: finding the magic number and completing entries using algebra
- Rate and time problems: calculating cumulative gain or loss over multiple days and finding when two rates coincide
- Pythagorean triples: identifying integer solutions to  $a^2 + b^2 = c^2$  and applying Pythagoras to kite geometry
- Area and perimeter of composite shapes: using right-angled triangles within a kite to find unknown lengths and total area

## How to use this paper for revision

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- Revise fraction arithmetic thoroughly, including converting mixed numbers to improper fractions and simplifying answers to lowest terms.
- Practise standard form addition and subtraction by aligning powers of ten; remember to express final answers with one non-zero digit before the decimal point.
- Familiarise yourself with divisibility tests: a number is divisible by 4 if its last two digits form a multiple of 4, and by 9 if its digit sum is a multiple of 9.
- When solving simultaneous equations from word problems, define your variables clearly and write two distinct equations before eliminating one variable.
- For geometry problems, draw clear diagrams and label all known lengths and angles; use properties of regular polygons (interior angle formula) and isosceles triangles.
- In multi-part extended questions, attempt earlier sub-parts even if you cannot complete the whole question; marks are awarded incrementally.
- Work systematically through rate problems by calculating the total gain or loss step by step, checking your arithmetic at each stage.

## Common mistakes to avoid

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- Leaving fractions unreduced or as improper fractions when the question asks for a reduced mixed number.
- Misaligning powers of ten in standard form calculations, leading to incorrect final exponents.
- Confusing divisibility rules: testing only the final digit for divisibility by 4 rather than the last two digits.
- Failing to show all working in algebra questions, which loses method marks even when the final answer is correct.
- Estimating or measuring angles with a protractor in Question 11, despite the explicit instruction that no credit will be given for this approach.
- Attempting too many Section II questions superficially rather than completing fewer questions thoroughly; partial marks are easier to secure with clear, complete working.

## Exam technique

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Begin by reading the entire paper to identify which Section II questions look most accessible; plan to spend roughly **45 minutes on Section I** and **45 minutes on Section II**. Tackle Section I methodically, showing all steps for arithmetic and algebraic

manipulation. If a calculation becomes messy, pause and check your working rather than pressing on with an error.

In Section II, read each question carefully and underline key information. Start with the question you find most straightforward (many candidates find Question 11 or Question 15 a good entry point). Write clearly, define variables and label diagrams; even if you cannot reach the final answer, method marks are awarded for correct intermediate steps. If stuck, move to another question and return later.

Leave time at the end to review your answers: check that fractions are fully reduced, that inequalities are written with the variable on the left, and that you have not accidentally omitted units (cm, cm<sup>2</sup>, degrees). Remember that calculators are not permitted, so mental arithmetic and estimation are valuable for spotting errors.

## What to revise alongside this paper

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Students should consolidate their understanding of **ratio and proportion**, particularly forming and solving equations from word problems, as this underpins Questions 4 and 10. Revise **properties of quadrilaterals** (kites, trapezia, parallelograms) and methods for calculating area using perpendicular height. Strengthen skills in **algebraic proof** and manipulation, especially factorising, expanding brackets and rearranging formulae.

For students aiming at scholarship level, explore **Diophantine equations** and the theory of Pythagorean triples in greater depth; investigate Euclid's formula for generating triples and the distinction between primitive and non-primitive solutions. Practise **geometric reasoning** with regular polygons, cyclic quadrilaterals and circle theorems, as these topics often appear in scholarship papers.

Finally, work on **problem-solving under time pressure** by attempting similar past papers from selective independent schools or UKMT Junior Mathematical Challenge problems. This builds confidence in tackling unfamiliar questions and develops the resilience needed for scholarship examinations.

## Key terms

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**Mixed fraction, Standard form, Bearing, Mean, Weighted average, Inequality, Coordinate geometry, Distance formula, Quadratic function, Divisibility rule, Least common multiple, Simultaneous equations, Regular polygon, Interior angle, Isosceles triangle, Magic square, Pythagorean triple, Kite (quadrilateral), Area of a triangle**

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# Eton College King's Scholarship Examination 2019

## MATHEMATICS B

(One and a half hours)

*Candidate Number:.....*

*Please answer on the paper in the spaces provided.*

*Please write your candidate number on every sheet.*

*Each question is worth 10 marks.*

*Show all your working.*

*Answers without sufficient working may receive little or no credit.*

*The use of calculators is permitted.*

**Do not turn over until told to do so.**

1. Throughout this question, assume that:

716 gallons = 3255 litres

535 miles = 861 kilometres.

a) How many gallons are there in 82 litres? Leave your answer to 1 decimal place.

b) How many miles are there in 1117 kilometres? Leave your answer to 1 decimal place.

A car engine runs on unleaded petrol, consuming  $\frac{37}{500}$  litres per mile.  $\frac{3}{4}$  of a tank of fuel allows the car to travel 956 kilometres.

c) If unleaded petrol costs £5.81 per gallon, how much does it cost to completely fill the fuel tank from empty, to the nearest penny?

[10 marks]

2. a) On Monday Albert runs 3 km. One week later he runs the same distance, but his average speed is 20% faster. If his total running time is reduced by 2 minutes 24 seconds, what was his original running time (in minutes and seconds)?
- b) Cath runs the same distance on Thursday, Friday and Saturday. On Saturday she runs 15% faster than on Friday and her total running time is  $y$  minutes less. On Thursday she runs 15% slower than on Friday and her total running time is  $z$  minutes more. Show, with clear justification, that  $23y = nz$  for an integer  $n$  which you should calculate.

[10 marks]

3. a) Expand the following, simplifying fully:

(i)  $(a - b)^2$

(ii)  $a(a - b) - b(a - b)$

(iii)  $(a - b)^3$

Consider the following pair of simultaneous equations:

$$\begin{aligned}x^2 - xy &= 238 \\xy - y^2 &= 189\end{aligned}$$

b) By factorising the left-hand side of both equations, show that

$$(x - y)^2 = 49$$

c) Given additionally that  $x$  and  $y$  are positive and  $x > y$ , find  $x$  and  $y$ .

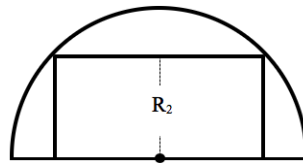
d) Consider the following system of simultaneous equations. By how much do  $u$  and  $v$  differ?

$$\begin{aligned}u^3 - 3u^2v &= 16 \\v^3 - 3uv^2 &= -11\end{aligned}$$

[10 marks]

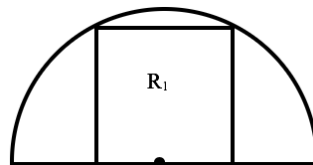
4. a) Figure A shows a semicircle of radius 1 with an inscribed rectangle,  $R_2$ , formed from two adjacent congruent squares. Show the area of  $R_2$  is 1.

**Figure A**



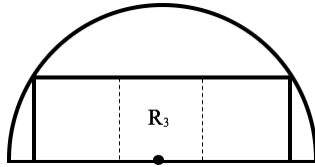
- b) Figure B shows a semicircle of radius 1 with an inscribed square,  $R_1$ . Find the area of  $R_1$ .

**Figure B**

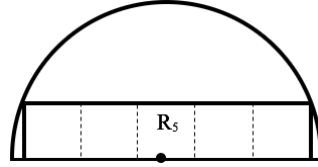


- c) Figures C and D also show semicircles of radius 1 with inscribed rectangles  $R_3$  and  $R_5$ , formed from 3 and 5 adjacent congruent squares, respectively. Find the ratio of the areas of  $R_3:R_5$ , leaving your answer in the form  $m:n$  in lowest form for integers  $m$  and  $n$ .

**Figure C**



**Figure D**



[10 marks]

5. When Margaret reached her 17<sup>th</sup> birthday, Meredith was four times older than Marion.

When Margaret reaches her 25<sup>th</sup> birthday, eleven times the difference of Meredith and Marion's ages will equal five times the sum of their ages.

- a) Find the ages of Meredith and Marion on Margaret's 17<sup>th</sup> birthday.
- b) Margaret's current age divides Meredith's age exactly. Given Margaret is younger than 25, determine her current age.

- c) Claire is the daughter of Anne. The product of their ages is 1885. How old was Anne when Claire was born?

[10 marks]

6. Suppose that  $p$  and  $p + 2$  are both prime numbers.
- a) Is the integer between  $p$  and  $p + 2$  odd or even? Explain your answer.

b) Expand the following, simplifying fully:

i)  $(2n)^2$

ii)  $(2n + 1)^2$

For the remainder of this question, assume additionally that the integer between the primes  $p$  and  $p + 2$  is a perfect square.

- c) Explain why there exists an integer  $n$  such that  $4n^2 - 1 = p$ .

- d) By considering  $(2n - 1)(2n + 1)$ , find the only possible value of  $p$ .

[10 marks]

7. Marcus is making cupcakes for a charity sale. The ingredients cost 15p per cake. Suppose that each cake is sold for  $\pounds C$  and that Marcus sells  $n$  cakes.
- a) Write down a formula for the total profit  $\pounds P$  Marcus makes, in terms of  $C$  and  $n$ .

90 people will attend the charity sale. If Marcus charges nothing at all for his cakes, 75 people will take a cake (and Marcus will make no money). For each pound above zero Marcus charges per cake, 20 fewer people will buy a cake.

- b) Explain why  $n = -20C + 75$
- c) Show that  $P = -20C^2 + 78C - 11.25$

- d) By expanding  $(C - 1.95)^2$ , find a number  $k$  such that

$$P = -20(C - 1.95)^2 + k$$

- e) What price should Marcus charge for each cupcake if he wishes to raise the most money possible for charity? Explain your answer.

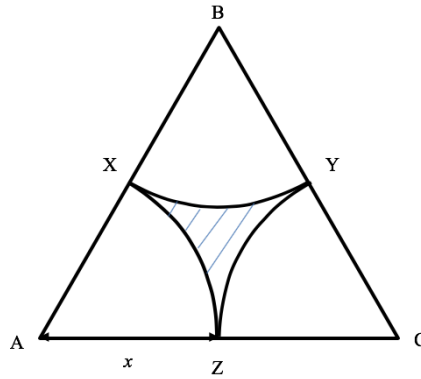
[10 marks]

8. Figure E shows an *Astrum* floor tile. ABC is an equilateral triangle. XZ, XY and YZ are all circular arcs (portions of complete circles) centred at A, B and C respectively.

Lengths  $AX = XB = BY = YC = CZ = ZA = x$ .

- a) Show the area of triangle ABC equals  $\sqrt{3}x^2$ .

Figure E

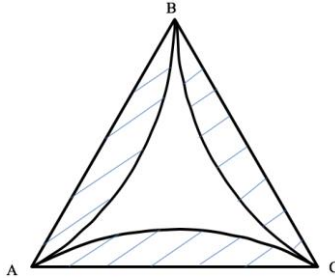


A tessellation of a flat surface (such as a floor) is a tiling that covers the surface using geometric shapes (the tiles) with no overlaps and leaving no gaps.

- b) A large floor is tessellated using *Astrum* tiles. What percentage of the floor will be shaded? Give your answer to 2 decimal places.

- c) Figure F shows a *Folium* floor tile. ABC is an equilateral triangle. Circular arcs AB, BC and CA all have radii equal to the triangle side length AB. If a large floor is tessellated using *Folium* tiles, what percentage of the floor will be unshaded? Give your answer to 2 decimal places.

**Figure F**



[10 marks]

**END OF PAPER**

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# Paper Notes: 13+ Maths Question Paper (13+ Maths Past Paper (2019))

Compiled by [SATs-Papers.co.uk](https://www.SATs-Papers.co.uk) to help you get the most from this paper.

## Overview

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This is **Mathematics B**, a past paper from the **King's Scholarship Examination 2019** set by **Eton College**. It forms part of the **13+ entrance exam** for Year 9 entry and is designed to identify the most mathematically able candidates competing for the prestigious King's Scholarship.

The paper comprises **eight multi-part questions**, each worth **10 marks**, and candidates are given **one and a half hours** to complete it. The questions span a wide range of topics, including unit conversions, speed and percentages, algebraic manipulation, simultaneous equations, geometry (semicircles, equilateral triangles, tessellations), number theory (prime numbers, perfect squares), and optimisation problems. Calculators are permitted, and full working must be shown to earn credit.

This paper is aimed at the top tier of 13+ candidates who are comfortable working at or above the level expected at the end of Key Stage 3. It assumes fluency in algebraic techniques, geometric reasoning, and problem-solving strategies, and it rewards candidates who can justify their methods clearly and work through multi-step problems with confidence.

## How this paper is organised

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The paper is divided into **eight questions**, each carrying equal weight at **10 marks**. Questions are multi-part, with parts labelled (a), (b), (c), and occasionally (d) or (e), requiring candidates to build on earlier results or demonstrate progressive reasoning.

The opening question tests practical unit conversions and multi-step problem-solving involving fuel consumption and cost. Questions 2 through 7 explore algebraic topics: percentages and time (Question 2), expansion and factorisation leading to simultaneous equations (Question 3), and a cupcake pricing optimisation requiring quadratic completion (Question 7). Question 5 examines age-related word problems, while Question 6 delves into prime number theory and proof.

The final two questions focus on geometry: Question 4 asks candidates to find areas of rectangles inscribed in semicircles, and Question 8 investigates tessellations and percentage areas of decorative tiles. The paper tests both computational accuracy and conceptual depth, with a strong emphasis on explanation and justification.

## Topics covered

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- Unit conversions between imperial and metric systems (gallons to litres, miles to kilometres) with multi-step word problems
- Speed, distance, and time calculations involving percentage changes in average speed
- Algebraic expansion and simplification: squaring and cubing binomials, factorising differences of squares
- Simultaneous equations with quadratic terms, including factorisation to derive intermediate results
- Geometric problem-solving: inscribed shapes in semicircles, applying Pythagoras' theorem and coordinate reasoning
- Number theory: twin primes, perfect squares, and proof by considering factorisations
- Age-related word problems requiring algebraic translation and solution of linear and quadratic equations
- Optimisation and quadratic functions: completing the square to identify maximum values in real-world contexts
- Area calculations for equilateral triangles, circular sectors, and composite shapes in tessellated designs
- Percentage calculations for shaded and unshaded regions in geometric tessellations

## How to use this paper for revision

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- Practise converting between imperial and metric units under timed conditions, and work through multi-step problems that link conversions with other operations such as multiplication and division.
- Review the binomial expansion formulae for squares and cubes, and ensure you can factorise expressions confidently, particularly differences of squares.
- Strengthen your simultaneous equation techniques, especially when one or both equations are quadratic; look for opportunities to subtract or add equations to simplify.
- Revisit coordinate geometry and the equation of a circle; many inscribed-shape problems are best solved by setting up a coordinate system and using Pythagoras' theorem.
- Familiarise yourself with completing the square, not just for solving quadratics but also for identifying maximum or minimum values in optimisation problems.
- Work on translating word problems into algebraic equations methodically, defining variables clearly and writing down what you know step by step.
- Practise geometric problems involving sectors, arcs, and equilateral triangles, and remember standard results such as the area of an equilateral triangle with side length  $s$  being  $(\sqrt{3}/4)s^2$ .

## Common mistakes to avoid

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- Forgetting to convert all units consistently in multi-step problems, for example mixing miles with kilometres or litres with gallons within the same calculation.
- Expanding binomial cubes incorrectly; remember that  $(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$ , not  $a^3 - b^3$ .
- Failing to factorise fully before attempting to solve simultaneous equations, which can obscure useful relationships such as  $(x - y)^2$  emerging from a sum or difference.
- Omitting intermediate working when asked to 'show' or 'explain' results; examiners award marks for method, not just final answers.
- Misinterpreting geometric setups, such as assuming that the centre of a semicircle is at the midpoint of the rectangle's base without checking coordinate constraints.
- In optimisation problems, stopping after finding the vertex of a quadratic without interpreting what that coordinate means in the context (e.g. price or number sold).

## Exam technique

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Allocate roughly **11 minutes per question** on average, but recognise that some multi-part questions will take longer than others. Begin by reading through the entire paper to identify which questions feel most accessible, and tackle those first to build confidence and secure marks early.

Pay close attention to command words: 'show' and 'explain' require full written justification, while 'find' or 'calculate' still demand clear working. Write out intermediate steps even when using a calculator, as method marks are awarded throughout. If a question builds on an earlier part, check your previous answer before proceeding; an error in part (a) can propagate through to parts (b) and (c).

For geometric and optimisation problems, sketch diagrams or coordinate axes neatly in the margin to clarify your reasoning. In the final five minutes, review your answers for arithmetic slips and ensure that you have answered the question asked (for example, stating a ratio in lowest terms or rounding to the specified number of decimal places).

## What to revise alongside this paper

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Candidates should revise **quadratic functions** in depth, including sketching parabolas, finding roots, and interpreting the vertex in context. Practice with **circle geometry** and **coordinate methods** will support the inscribed-shape questions, while fluency in **trigonometry** (particularly sine, cosine, and the area formula for triangles) can offer alternative solution paths.

Number theory problems benefit from a solid understanding of **factors, multiples, and prime factorisation**, as well as proof techniques such as **proof by contradiction** and reasoning about parity. Review **algebraic proof** structures, especially when asked to show a result holds for all integers.

To extend beyond this paper, explore **GCSE Higher tier topics** such as circle theorems, transformations of graphs, and iterative methods, as well as **UKMT Intermediate and Senior Challenge** problems that emphasise creative problem-solving under time pressure.

## Key terms

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**Binomial expansion, Factorisation, Simultaneous equations, Pythagoras' theorem, Completing the square, Equilateral triangle, Semicircle, Inscribed rectangle, Tessellation, Prime number, Perfect square, Difference of squares, Optimisation, Percentage increase and decrease, Unit conversion**

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