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Tonbridge School 13+ Maths

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TONBRIDGE SCHOOL

Scholarship Examination Sample Paper

MATHEMATICS I

Time allowed: 1 hour 30 minutes

*Answer as many questions as you can.
Questions 1 to 5 are worth 8 marks each;
Questions 6 to 9 are worth 15 marks each.
You may attempt the questions in any order.*

*All answers must be supported by adequate explanation.
Calculators may be used in any question.*

1. A machine produces two sizes of square tiles.

Big ones have area x cm²; small ones have area y cm².

You are given that:

- 3 big tiles and 5 small tiles have a total area of 8 cm²;
- A big tile has an area which is 2 cm² greater than that of a small tile.

Use this information to write down two simultaneous equations involving x and y .

Hence find the perimeter of a big tile.

[8 marks]

2. On the Réaumur temperature scale, the freezing point of water is 0 degrees Réaumur and the boiling point of water is 80 degrees Réaumur. On the Fahrenheit temperature scale, the freezing point of water is 32 degrees Fahrenheit and the boiling point of water is 212 degrees Fahrenheit.

- (a) What is 50 degrees Réaumur in degrees Fahrenheit?
- (b) What is 68 degrees Fahrenheit in degrees Réaumur?
- (c) What (negative) number corresponds to the same temperature in degrees Réaumur and degrees Fahrenheit?

[8]

3. This question is about the interior and exterior angles of regular polygons. In each part, find the number of sides of the regular polygon from the information given:

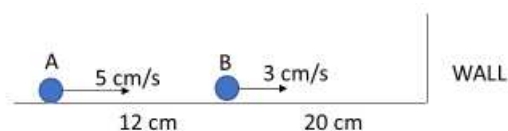
- (a) The interior angle is smaller than the exterior angle.
- (b) The interior angle is 100° more than the exterior angle.
- (c) The interior angle is 100 times the exterior angle.

[8]

4. Two very small balls are moving towards a wall, as shown in the diagram.

Ball A travels at 5 cm/s and Ball B travels at 3 cm/s.

Initially, they are 12 cm apart when Ball B is 20 cm from the wall.



- (a) Show that the balls collide when Ball B is 2 cm from the wall.
- (b) Suppose the balls start in the same positions as in the diagram, but the speeds of the balls are swapped, so that Ball A travels at 3 cm/s and Ball B at 5 cm/s. If Ball B rebounds from the wall at the same speed (5 cm/s), how far from the wall do the balls collide?

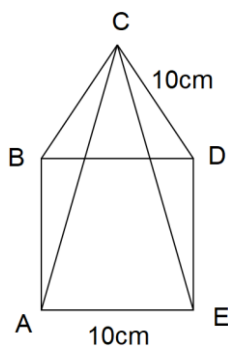
[8]

5. The kinetic energy, E , due to the rotation of a solid sphere may be estimated from the formula $E = \frac{8Mr^2}{T^2}$ where M is the mass of the sphere in kilogrammes, r its radius in metres and T the time in seconds for one complete revolution of the sphere.

- (a) Find M when $E = 550, T = 3.6, r = 1.7$.
- (b) Find T when $E = 1345, M = 9.3, r = 0.85$.
- (c) Calculate E for the earth where $M = 5.98 \times 10^{24}$ kg, $r = 6.38 \times 10^6$ m and it takes one day to complete one revolution.

[8]

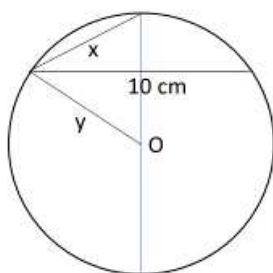
6. The diagram shows an equilateral triangle BCD with sides of length 10 cm next to a square $ABDE$ whose sides are also of length 10 cm.



- (a) Find the size of angle $\angle ACE$.
- (b) By first finding the perpendicular distance from C to AE , find the area of triangle ACE .
- (c) Use your answers to (a) and (b) to find the area of a regular dodecagon (12-sided polygon) with sides of length 10 cm.
- (d) Find the radius of the circle which passes through all the vertices (corners) of the dodecagon in (c).

[15]

7. The three lengths shown in the diagram of a circle, centre O , are connected by the formula $y = \frac{x^2}{\sqrt{4x^2 - 100}}$.

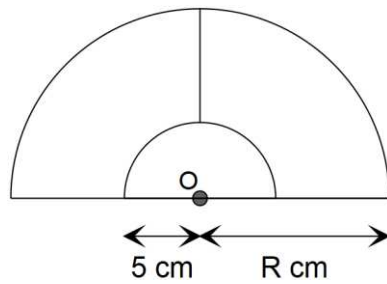


- (a) When $x = 5.5$, show that $y = 6.60$ (to 2 decimal places).
- (b) Find the values of y for $x = 6.0, 6.5, 7.0, 7.5, 8.0, 8.5$.
- (c) Choosing sensible scales, use your values in (a) and (b) to plot a graph of y against x .
- (d) Find the coordinates of the minimum point on the graph.
- (e) Draw as carefully as you can the diagram above with the values of x and y you found in (d).

[15]

TURN OVER

8. The figure shows a small semicircle, radius 5 cm, a large semicircle, radius R cm, and a line which is part of a radius of the large semicircle. Both semicircles have the same centre O .



- (a) Find the value of R if all three regions in the figure have the same area.
- (b) Find the value of R if all three regions in the figure have the same perimeter.

[15]

9. Study carefully the pattern of numbers in the table below. The numbers in Column C come from multiplying those in Columns A and B.

	Column A	Column B	Column C
Row 1	3	2	6
Row 2	5	5	25
Row 3	7	10	70
Row 4	9	17	153
Row 5			
Row 6			
Row 7			
Row n			

- (a) Write down the entries in Columns A, B and C for Rows 5, 6, 7.
- (b) For Row n , find formulae in terms of n for the entries in Columns A, B and C.
- (c) If the entry in Column A is 197, what is the entry in Column C?
- (d) If the entry in Column B is 3482, what is the entry in Column C?
- (e) If the entry in Column C is 10150, find the entries in Columns A and B.
[Hint: Factorise 10150.]
- (f) What can you say about the Row numbers for which the entries in Column C are a multiple of 3?

[15]

END OF PAPER

Paper Notes: 13+ Maths Sample Paper (13+ Maths Sample Paper)

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

Overview

This is a **scholarship examination sample paper** in **Mathematics I** published by **Tonbridge School** for candidates preparing for **13+ entrance**. The paper is designed to identify pupils who demonstrate exceptional mathematical ability beyond the standard entrance level, and is aimed at those seeking academic scholarships. The paper allows **1 hour 30 minutes** and consists of nine questions with varying mark allocations, explicitly stating that calculators may be used throughout.

The first five questions carry **8 marks each**, whilst questions 6 to 9 are worth **15 marks each**. This weighting structure encourages candidates to demonstrate depth and sophistication in their longer responses. The paper tests problem-solving, algebraic manipulation, geometric reasoning, and pattern recognition at a level substantially above the core curriculum.

Candidates are instructed to answer as many questions as they can in any order, and all answers must be supported by adequate explanation. This emphasis on clear mathematical communication is typical of scholarship papers, where examiners assess not only correctness but also reasoning and presentation. The paper suits strong Year 8 pupils preparing for competitive entry to independent senior schools.

How this paper is organised

The paper comprises **nine questions** divided into two distinct bands by difficulty and mark value. Questions 1 to 5 are shorter problems worth **8 marks each**, totalling 40 marks for this section. These questions test core topics such as simultaneous equations, linear conversion between temperature scales, properties of regular polygons, kinematics with collision problems, and formula manipulation with scientific notation.

Questions 6 to 9 are extended problems carrying **15 marks each**, totalling 60 marks. These longer questions demand multi-step reasoning and integration of several mathematical techniques. Question 6 combines geometry of regular shapes with trigonometry and circle properties; question 7 involves plotting a function from a geometric formula and identifying a minimum; question 8 explores concentric semicircles and equating areas or perimeters; question 9 investigates number patterns using algebra and factorisation.

The paper awards a total of **100 marks** and allows **90 minutes**, giving roughly 10 to 11 minutes per question on average if time were divided equally. However, the longer questions naturally require more time. Candidates may attempt questions in any order, allowing them to play to their strengths and manage time strategically.

Topics covered

- Simultaneous linear equations in two variables, solved by substitution or elimination, applied to word problems involving area
- Linear conversion between non-standard temperature scales (Réaumur and Fahrenheit), including finding intersection points of linear functions
- Interior and exterior angles of regular polygons, including solving equations to determine the number of sides from angle relationships
- Kinematics in one dimension: relative motion, collision problems, and reflection/rebound scenarios involving constant velocities
- Formula rearrangement and substitution with scientific notation, including rotational kinetic energy of spheres with real-world data
- Geometry of composite figures combining equilateral triangles and squares; calculation of angles and areas using Pythagoras and trigonometry
- Properties of regular polygons (dodecagons) and circumradius of cyclic polygons derived from geometric construction
- Plotting functions derived from circle geometry; identifying minimum points graphically and interpreting geometric meaning
- Area and perimeter of concentric semicircles with algebraic reasoning to equate regions
- Pattern recognition in sequences; derivation of general formulae for quadratic patterns; factorisation and divisibility properties
- Systematic problem-solving requiring multi-step reasoning and clear written explanation of method

How to use this paper for revision

- Revise formula manipulation thoroughly: questions 5 and 7 require confident rearrangement of equations to make different variables the subject, and this skill underpins many scholarship problems.
- Practise multi-step geometry problems that combine several shapes or require auxiliary constructions, such as dropping perpendiculars or constructing radii, as seen in questions 6 and 8.
- Strengthen pattern-spotting and general formula derivation: question 9 is typical of scholarship papers, where quadratic sequences and difference methods are essential techniques.
- Work on explaining your reasoning clearly in writing. The rubric stresses that all answers must be supported by adequate explanation, so practise annotating diagrams and writing short justifications for each step.
- Time yourself on past scholarship papers to develop stamina and pacing. With 90 minutes for 100 marks, you need to balance speed with accuracy and detail.
- Review properties of regular polygons, including the formulae for interior and exterior angles, and how these relate to the number of sides. Question 3 requires algebraic manipulation of these relationships.

Common mistakes to avoid

- In simultaneous equations (question 1), confusing the area of a square tile with its side length. Remember that if the area is $x \text{ cm}^2$, the side is $\sqrt{x} \text{ cm}$, so the perimeter is $4\sqrt{x} \text{ cm}$.
- In temperature conversion (question 2), setting up the linear relationship incorrectly. Sketch a conversion graph or use the two-point form of a line to avoid sign errors.
- In polygon angle problems (question 3), forgetting that interior and exterior angles are supplementary (they sum to 180°). This relationship is the key to forming equations.
- In kinematics (question 4), failing to account for relative motion or the direction of travel after a rebound. Draw a timeline or position diagram to track each ball clearly.
- In formula substitution (question 5c), dropping powers of ten or confusing units. Write out substitutions explicitly and check that your final answer has sensible magnitude.

Exam technique

Begin by skimming all nine questions and identifying those that suit your strengths. Questions 1 to 5 are shorter and may build confidence early, but if you are particularly strong in geometry or pattern work, tackling a longer question (6 to 9) first can secure substantial marks. Aim to spend roughly **7 to 9 minutes** on each 8-mark question and **13 to 17 minutes** on each 15-mark question, leaving a few minutes at the end for checking.

Show all working clearly and annotate diagrams wherever possible. Scholarship examiners award credit for method even if a final answer is incorrect, so partial solutions are valuable. If you become stuck on a multi-part question, move to the next part if it is independent, or leave space and return later. Do not spend more than 20 minutes on any single question without progress.

Use a calculator efficiently but do not rely on it for algebraic manipulation. Questions such as 7 and 9 require symbolic reasoning that a calculator cannot assist with. Check units carefully in questions involving physical formulae (question 5), and verify that geometric answers are plausible by estimating or sketching. Finally, read each question twice to ensure you answer what is asked: for example, question 1 asks for the perimeter, not the side length.

What to revise alongside this paper

To prepare thoroughly for this paper, ensure fluency in solving quadratic equations by factorisation, completing the square, and using the formula, as these skills underpin many scholarship problems. Revise circle theorems (angles in the same segment, tangent-radius perpendicularity) and properties of cyclic quadrilaterals, which extend the geometry tested in questions 6 and 7.

Study arithmetic and geometric sequences in depth, including summation formulae and the method of differences for finding n th terms of quadratic sequences. This will strengthen your approach to question 9 and similar pattern questions. Practise algebraic proof, particularly divisibility and parity arguments, which are common in scholarship work.

Explore kinematics beyond constant velocity: acceleration, distance-time and velocity-time graphs, and equations of motion (SUVAT) will prepare you for scholarship physics and mechanics modules. Finally, work on constructing and interpreting graphs from formulae, including transformations and identification of stationary points without calculus, as required in question 7.

Key terms

Simultaneous equations, Linear conversion, Interior angle, Exterior angle, Regular polygon, Kinematics, Collision, Formula rearrangement, Scientific notation, Equilateral triangle, Dodecagon, Circumradius, Concentric semicircles, Quadratic sequence, Factorisation, Pattern recognition

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TONBRIDGE SCHOOL

Scholarship Examination Sample Paper

MATHEMATICS II

Time allowed: 1 hour 30 minutes

*There are seven questions in this paper.
Answer as many questions as you can.
All the questions carry equal marks.
You may attempt the questions in any order.*

*All answers must be supported by adequate explanation.
Calculators may be used in any question.*

1. The following equation is used in the manufacture of the lenses of glasses: $\frac{P}{n-1} = \frac{1}{Q} - \frac{1}{R}$, where P is the power of the lens, n depends on what the lens is made of, and Q, R are related to the curvature of the two surfaces of the lens.

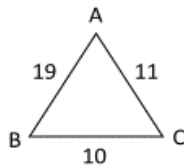
Note that any of P, Q, R may be negative numbers, but n is always positive.

In the questions below, give your answers as decimals correct to 2 decimal places.

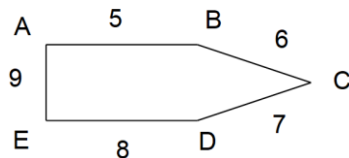
- (a) If $n = 1.5, Q = 0.4, R = -0.7$, find P .
- (b) If $P = 2.6, n = 1.7, Q = 0.3$, find R .
- (c) If $P = 0.2, Q = 2.4, R = 3.7$, find n .
- (d) If $P = 1.8, n = 1.4$ and $R = 2Q$, find Q .

2. In the following two diagrams, the number on each edge is the sum of the two numbers at the ends of the edge. For example, in (a), we have $A + B = 19$.

- (a) By forming and solving appropriate equations, find the numbers A, B, C .



- (b) In a similar way, find the numbers A, B, C, D, E .

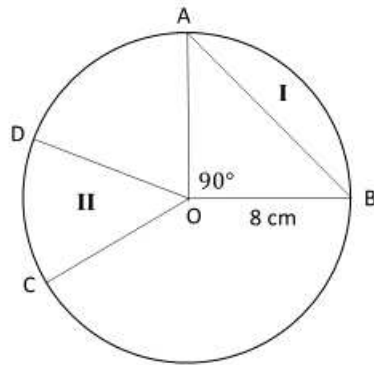


3. [In this question you will need to use the facts that a sphere of radius r has curved surface area $S = 4\pi r^2$ and volume $V = \frac{4}{3}\pi r^3$.]

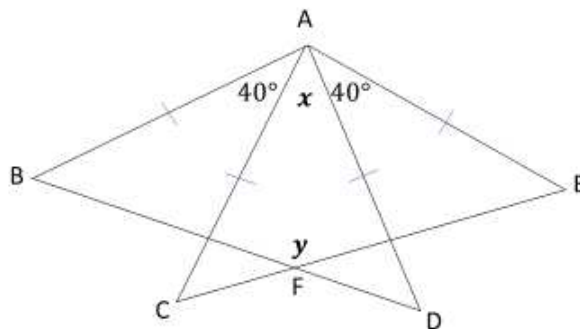
This question concerns hollow spheres which are the solid shapes formed by removing a small inner sphere of radius r cm from a large solid sphere of radius R cm.

- (a) If $R = 9$ and $r = 6$, find the volume of the hollow sphere and its total (inner and outer) surface area.
- (b) If $R = 12$ and the volume of the hollow sphere is 5000 cm^3 , find r .
- (c) Find positive integer values of R and r for which the hollow sphere has the same total (inner and outer) surface area as that of a solid sphere of radius 10 cm.

4. The figure below shows a circle centre O with radius 8 cm and angle $\angle AOB = 90^\circ$.
 Region I is the segment bounded by the straight line AB and the arc AB .
 Region II is the sector bounded by the radii OC, OD and the arc CD .
 Region I and Region II have equal areas.



- (a) Find the area of Region I.
- (b) By considering what fraction of the whole circle sector COD occupies, find angle $\angle COD$.
- (c) Which of Region I or Region II has the larger perimeter?
 [You need to give calculations to justify your answer.]
5. In the diagram, the triangles ABC, ACD and ADE are isosceles with $\angle BAC = \angle DAE = 40^\circ$.
 Also, angle $\angle CAD = x$ and angle $\angle BFE = y$.



- (a) If $x = 30^\circ$, find y .
- (b) Use algebra to show that, whatever the value of x , you always get the same answer for y that you got in (a).

TURN OVER

6. This question concerns the graph whose equation is $y = \frac{1}{x} + \frac{5x^2}{x^2+4}$.
- Make a table of y values (correct to 2 decimal places) first for x values starting at $x = 0.2$ and going to $x = 1$ in steps of 0.2 and also for $x = 2, 4, 6, 8, 10$.
 - Why is $x = 0$ not included in the table of values?
 - Using all of your values in (a) and choosing sensible scales, plot a graph of y against x .
 - Write down the coordinates of two points on the graph whose x and y coordinates are both positive integers with $1 \leq x \leq 10$. Explain carefully why there are no other such points on the graph.
7. Study the pattern of numbers in the table below carefully. Column B gives the answer to the sum in Column A; Column C gives the number in Column B in a factorised form.

	A	B	C
Row 1	1×4	4	1×4
Row 2	$1 \times 4 + 2 \times 7$	18	2×9
Row 3	$1 \times 4 + 2 \times 7 + 3 \times 10$	48	3×16
Row 4			
Row 5			
Row n			

- Write down the entries in Columns A, B and C for Row 4 and Row 5.
- For Row n , find a formula in terms of n for the two numbers at the right-hand end of Column A and for the entry in Column C.
- If the entry in Column B is 7600, what is the entry in Column C?
 - If the two numbers at the right-hand end of Column A multiply to give 444, what is the entry in Column B?
- Explain carefully why the entries for Column B in Row n have values that are between n^3 and $(n + 1)^3$.
- Use (d) to help you find the value of n for which the entry in Column B is 5237748.

END OF PAPER

Paper Notes: 13+ Maths Sample Paper (13+ Maths Sample Paper)

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

Overview

This is **Tonbridge School's 13+ scholarship examination** sample paper for **Mathematics II**, designed for Year 8 pupils seeking entrance to Year 9 at this independent school in Kent. The paper assesses mathematical ability well beyond the standard curriculum, testing algebraic manipulation, problem-solving with simultaneous equations, three-dimensional geometry, circle theorems, isosceles triangle properties, graphing rational functions, and pattern recognition with algebraic generalisation.

The paper comprises **seven questions of equal weighting**, each demanding extended reasoning and clear written explanations. Calculators are permitted throughout, yet success depends on algebraic insight rather than computation alone. The format emphasises depth over breadth, with each question containing multiple linked parts that build in difficulty.

This paper suits strong mathematicians preparing for **academic or scholarship entry** to independent senior schools. The applied context in question 1 (lens manufacture), the spatial reasoning required in question 3 (hollow spheres), and the proof-style work in question 5 (algebraic generalisation of angle relationships) distinguish this from standard 13+ entrance papers. Candidates should expect to tackle unfamiliar problem types and demonstrate resilience when initial approaches prove insufficient.

How this paper is organised

The paper allows **1 hour 30 minutes** for **seven equally weighted questions**, suggesting roughly 12 to 13 minutes per question. Candidates may attempt questions in any order, a flexibility that rewards strategic time management. All answers must be supported by adequate explanation, meaning bare numerical answers score poorly even if correct.

Questions typically contain three to five subparts, with later parts often depending on earlier results or extending the same theme. Question 1 explores rearranging and solving a single formula across four scenarios. Question 2 presents two network puzzles requiring simultaneous equations. Question 3 on hollow spheres progresses from direct calculation to equation-solving to a search for integer solutions. Question 4 combines circle geometry with sector and segment area, culminating in a perimeter comparison that traps the unwary.

Questions 5 through 7 demand higher-order thinking. Question 5 asks for a specific numerical answer before proving the result holds for any value of the variable. Question 6 combines table-building, graphing, and analytical reasoning about integer coordinates. Question 7, the pattern investigation, requires candidates to generalise expressions, factorise quadratics in n , and use inequalities to locate an unknown row number. The paper's structure rewards those who read all questions before committing to an order of attack.

Topics covered

- Rearranging formulae with multiple variables, including handling negative values and isolating terms within fractions
- Forming and solving simultaneous equations from network diagrams where edges represent sums of vertex labels
- Volume and surface area of composite three-dimensional shapes, specifically hollow spheres formed by subtracting one sphere from another
- Circle geometry including sectors, segments, and calculating areas and perimeters using πr^2 and arc-length formulae
- Properties of isosceles triangles, angle-chasing in complex figures, and using algebra to prove angle relationships independent of a variable
- Graphing rational functions with asymptotic behaviour, interpreting division by zero, and identifying integer coordinate points
- Recognising and extending arithmetic patterns, expressing sums in sigma notation, and factorising quadratic expressions in n
- Using inequalities involving cubes to bound unknown values and solve inverse problems
- Proof by algebra, demonstrating results hold for all values of a parameter rather than a single case
- Strategic problem-solving across applied contexts such as optical lens design and geometric constructions

How to use this paper for revision

- Practise rearranging formulae where the subject appears in multiple places or within a fraction; question 1 part (c) requires isolating n from both numerator and a subtraction.
- Revise forming simultaneous equations from word problems and diagrams; label unknowns systematically and write down all constraints before attempting elimination or substitution.
- Strengthen your command of sphere formulae and be comfortable working with π symbolically until a numerical answer is required; question 3 part (c) needs trial of integer pairs.
- Review sector and segment area formulae, and remember that a segment's perimeter includes both the chord and the arc; question 4 part (c) is easily misread.
- For angle-chasing in composite figures, mark all known angles on your diagram and use isosceles properties to deduce base angles before applying angle sum rules.
- When graphing rational functions, calculate several points near any asymptote or turning point; question 6 rewards a smooth curve through the tabulated values.
- In pattern problems, calculate several explicit cases before attempting generalisation; writing out rows 4 and 5 in question 7 reveals the structure needed for row n .

Common mistakes to avoid

- Forgetting that n must be positive in question 1 but P , Q , and R may be negative; sign errors when substituting $R = -0.7$ are common.
- Setting up too few equations in question 2 part (b); five vertices require at least four independent equations, and students often overlook one edge constraint.
- Calculating only outer surface area or only volume in question 3; the hollow sphere has both an outer surface and an inner surface that must be summed.
- Confusing sector and segment in question 4; a segment is bounded by a chord and an arc, not by two radii, so its perimeter calculation differs from a sector's.
- Stopping after finding y for the specific case $x = 30^\circ$ in question 5 part (a); part (b) requires algebraic proof that y is constant for all x .
- Plotting graph points carelessly in question 6; decimal values to two places must be read accurately, and scale choices should allow clear identification of integer coordinates.
- In question 7, trying to find a closed-form sum for column B without recognising the factorised pattern in column C; the factorisation $n \times (\text{something})$ guides the algebra.
- Misapplying cube inequalities in question 7 part (e); ensure you cube-root bounds correctly and check boundary cases rather than assuming the middle integer is always the answer.

Exam technique

Scan all seven questions before starting and identify two or three that feel most accessible; beginning with a confidence-building question maximises early marks and settles nerves. Allocate roughly 12 minutes per question, but remain flexible. If a part proves stubborn after three minutes, move to the next part or question and return later. Each question carries equal weight, so completeness across questions trumps perfection on one.

Write explanations as you calculate. The rubric states all answers must be supported by adequate explanation, meaning examiners want to see reasoning even for straightforward parts. Show substitutions into formulae, label simultaneous equations (e.g. equation ① and equation ②), and state geometric properties by name ('base angles of isosceles triangle ABC are equal'). This builds partial credit and demonstrates mathematical maturity.

For multi-part questions, check whether later parts depend on earlier answers. If part (b) uses your answer from part (a), double-check part (a) before proceeding; one error can cascade. Conversely, if parts are independent, skip a blocked part and return after

completing others. Use calculator efficiently but show formulae before numerical work; examiners distinguish between 'used calculator to find $4\pi(9^2 - 6^2) = 1017.88$ ' and a bare decimal. Finally, in the last five minutes, skim your work for missing units (cm, cm², cm³, degrees), unclosed brackets, and questions where you wrote no explanation at all.

What to revise alongside this paper

Strengthen your algebra by practising rearrangement of literal equations and solving for a variable that appears in multiple terms; this underpins question 1 and parts of question 7. Revisit three-dimensional geometry beyond basic prisms and cylinders, focusing on spheres, cones, and compound solids where volumes and surface areas must be subtracted or combined. Study circle theorems in depth, including the relationship between central angles, arc lengths, and sector areas, and the distinction between major and minor segments.

For proof and generalisation, work through problems requiring algebra to show a result holds for all cases, not just one numerical example; question 5 is typical of this genre. Extend your graphing skills to rational and reciprocal functions, understanding asymptotic behaviour and identifying turning points or stationary points. Familiarise yourself with sequences and series, particularly recognising arithmetic and quadratic patterns, and expressing sums using sigma notation or closed-form expressions.

Beyond this paper's scope, explore polynomial division, trigonometric identities, and harder geometry such as cyclic quadrilaterals and tangent-chord theorems. These topics often appear in scholarship papers at 13+ and will deepen your problem-solving toolkit.

Key terms

Rearranging formulae, Simultaneous equations, Sphere volume and surface area, Hollow sphere, Circle sector, Circle segment, Arc length, Isosceles triangle, Angle-chasing, Asymptote, Rational function, Pattern generalisation, Algebraic proof, Factorisation, Inequalities with cubes

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TONBRIDGE SCHOOL

Guidance for candidates preparing for the Year 9 November Entrance Papers

Boys taking this examination, for entry into Year 9, are required to sit papers in Mathematics and English only. Exams take place in October/November of the year preceding entry and can be written either at Tonbridge, BE Education in China, Academic Asia in Hong Kong or at British Councils around the world. It is the responsibility of the applicant to let the Admissions Officer know in plenty of time where he is intending to sit the exam and to confirm arrangements with the chosen centre.

More information about the exam syllabuses is outlined below.

Mathematics 13+ entrance exam

The Mathematics exam will be a 60 minute paper which is set using the ISEB (Independent Schools Examination Board) 13+ Common Entrance syllabuses for Maths Level 3. This syllabus can be found on the ISEB webpage at <http://www.iseb.co.uk/> (with all topics on the Maths syllabus page included). In addition to the past papers available on this website, past ISEB papers, which will give some indication as to the level of the Tonbridge exam, can be obtained from the ISEB.

English 13+ entrance exam

The 90 minute English exam will consist of two sections.

Section A: Poetry Comprehension (45 minutes)

Candidates will be provided with a short poem followed by four or five questions which test their language and comprehension skills. Rather than looking for hidden meanings, candidates will be rewarded for writing clearly about what they see in the poem. As well as basic literary criticism skills candidates might find it helpful to have studied in advance:

- the use of key words and emotive language
- why poets and other writers employ metaphors, similes and personification

Section B will be a 45 minute 'Writing' paper, consisting of a single section.

Candidates will be given a number of titles and asked to write on them in the form of a short-story, description or argumentative piece. Marks are awarded in this section for clarity and lucidity of written expression, originality (pre-prepared work will be penalised) and imaginative range

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

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

Overview

This document provides official guidance for candidates preparing for **Tonbridge School's Year 9 November Entrance Papers**, designed for boys seeking entry into **Year 9**. The examination takes place in October or November of the year before entry and can be sat at multiple locations including Tonbridge itself, BE Education in China, Academic Asia in Hong Kong, or British Councils worldwide.

The entrance assessment comprises two papers: **Mathematics** and **English**. The Maths paper is a **60-minute examination** set using the **ISEB 13+ Common Entrance syllabuses for Maths Level 3**, covering all topics on the ISEB Maths syllabus page. The English paper runs for **90 minutes** and is divided into two distinct sections: a 45-minute poetry comprehension and a 45-minute writing task.

This guidance document is particularly valuable for families considering Tonbridge School, as it outlines exactly what the school expects candidates to know and how the entrance papers are structured. The document emphasises that candidates should familiarise themselves with ISEB Level 3 content and gives specific advice on literary techniques to revise for the poetry section, alongside the writing skills required for the creative and argumentative tasks.

How this paper is organised

The **Mathematics paper** lasts **60 minutes** and follows the **ISEB 13+ Common Entrance syllabuses for Maths Level 3**. All topics listed on the ISEB Maths syllabus page are included, and past ISEB papers provide a reliable indicator of the difficulty level candidates will encounter.

The **English paper** runs for **90 minutes** and is split equally into two sections. **Section A: Poetry Comprehension** lasts 45 minutes and presents candidates with a short poem followed by four or five questions testing language and comprehension skills. Candidates are assessed on their ability to write clearly about what they observe in the poem rather than seeking hidden meanings.

Section B: Writing also lasts 45 minutes and requires candidates to choose from a number of titles and produce a short story, description, or argumentative piece. Marks are awarded for clarity and lucidity of expression, originality (with pre-prepared work

penalised), and imaginative range. Candidates should be prepared to write in multiple genres under timed conditions.

Topics covered

- ISEB 13+ Maths Level 3 syllabus content including number, algebra, geometry, statistics and problem-solving
- Poetry comprehension techniques: identifying and analysing the use of key words and emotive language
- Literary devices: metaphors, similes, and personification in poetry and their effects
- Close reading and textual analysis of short poems, focusing on observable features rather than abstract interpretation
- Creative writing: short-story composition with attention to narrative structure, character, and setting
- Descriptive writing: use of sensory detail, figurative language, and varied sentence structure
- Argumentative and persuasive writing: constructing a coherent case with evidence and logical progression
- Written expression: clarity, lucidity, originality, and imaginative range under timed conditions

How to use this paper for revision

- Work through past **ISEB 13+ Level 3 Maths papers** available from the ISEB website to familiarise yourself with the question style and difficulty level expected.
- Practise close reading of poetry by selecting short poems and writing brief answers explaining what you observe about language, structure, and imagery without over-interpreting.
- Revise the key literary devices: **metaphors, similes, and personification**. Be able to identify them in poems and explain their effect clearly and simply.
- Set yourself **45-minute timed writing tasks** in all three genres (story, description, argument) to build stamina and pacing for the English Section B.
- Avoid memorising essays or stories to reproduce in the exam. **Originality is explicitly rewarded** and pre-prepared work will be penalised.
- Plan your writing briefly before you start. Even two or three minutes spent outlining your structure will improve clarity and coherence under exam pressure.
- Read widely across fiction, non-fiction, and poetry to build your vocabulary and exposure to different writing styles and techniques.

Common mistakes to avoid

- Over-interpreting poetry by searching for hidden meanings instead of writing clearly about observable features such as word choice, imagery, and structure.
- Neglecting to explain why a poet uses a particular literary device. Identifying a metaphor is not enough; you must explain its effect or purpose in the poem.
- Writing a memorised essay or story in Section B. The examiners penalise pre-prepared work and reward responses that engage genuinely with the given titles.
- Poor time management in the English paper: spending too long on the poetry questions and rushing the writing task, or vice versa. Both sections carry equal weight.
- In Maths, failing to show working clearly. ISEB-style papers reward method marks, so even if your final answer is incorrect, clear working can earn partial credit.
- Writing without planning in Section B, leading to rambling, incoherent stories or arguments that lack structure and fail to sustain imaginative engagement.

Exam technique

For the **Maths paper**, begin by reading through all questions and tackling those you find most straightforward first. This builds confidence and secures marks early. Always

show your working clearly, as ISEB-style papers award method marks even when final answers are incorrect. If you get stuck on a question, move on and return to it later rather than losing valuable time.

In the **English paper**, allocate your 90 minutes strictly: **45 minutes per section**. For the poetry comprehension, read the poem at least twice before attempting the questions. Answer in clear, concise sentences and avoid over-elaboration or speculation. Focus on what the poem actually says and does, not what you imagine it might mean.

For the **Writing section**, spend the first few minutes choosing your title carefully and planning your structure. A brief outline (beginning, middle, end for a story; topic sentences for an argument) will help you write with clarity and purpose. Aim to leave two or three minutes at the end to proofread for basic errors in spelling, punctuation, and grammar, which can undermine even imaginative work.

What to revise alongside this paper

Alongside this paper, candidates should ensure they have covered the full **ISEB 13+ Maths Level 3 syllabus**, including topics such as algebraic manipulation, properties of shapes, ratio and proportion, and statistical interpretation. Past papers from the ISEB provide the best practice material and help candidates understand the level of challenge expected.

For English, widen your reading of poetry from different periods and styles. Practise identifying and explaining the effects of figurative language, and develop your ability to write clearly about what you observe. Revise the three writing modes tested: narrative fiction, descriptive writing, and argumentative or persuasive writing.

Consider working on exam technique under timed conditions. Sit practice papers in full to build stamina, pacing, and confidence. After completing each paper, review your answers carefully, particularly any questions you found difficult, and seek feedback from a teacher or tutor to identify areas for further improvement.

Key terms

ISEB 13+ Level 3, Common Entrance, Poetry comprehension, Emotive language, Metaphor, Simile, Personification, Literary criticism, Short story, Descriptive writing, Argumentative writing, Clarity and lucidity, Originality, Imaginative range, Close reading

For more free 11+ practice papers, past papers and online practice tests, visit [SATs-Papers.co.uk](https://www.SATs-Papers.co.uk).

Name: School:



TONBRIDGE SCHOOL

Year 9 Entrance Examinations: Specimen A

MATHEMATICS

Time allowed: 1 hour

Total Marks: 100

THIS IS A NON-CALCULATOR PAPER

Instructions:

1. Complete Name and School at the top of the cover page.
2. All questions should be attempted and answers given in the space provided.
3. A completely correct answer may receive no marks unless all workings are shown.

1. (a) Write 62% as a fraction **in lowest terms**.

Answer: (2)

(b) Write $\frac{2}{5}$ as a decimal.

Answer: (2)

(c) Calculate 20% of \$18.70.

Answer: \$..... (2)

(d) Calculate $\frac{5}{12}$ of 720 metres.

Answer: (2)

2. (a) By **first writing each number correct to 1 significant figure**, estimate the answer to

$$\frac{17.8 \times 227}{98.1}$$

Answer: (2)

- (b) Calculate $3^3 \times \sqrt[3]{64}$.

Answer: (2)

- (c) Write 108 as a product of prime factors, **using indices**.

Answer: (3)

- (d) Find the Lowest Common Multiple of 14 and 10.

Answer: (2)

3. (a) It takes 5 hour 37 minutes to travel from Edinburgh to London by train. John catches the 11.35 a.m. train from Edinburgh.

At what time should John arrive in London?

Answer:p.m. (2)

- (c) How far does a car travel in 40 minutes at 72km/h?

Answer: km (2)

- (d) A runner runs a 100m race in exactly 10 seconds. What is his average speed in kilometres per hour?

Answer: km/h (2)

4. Calculate

(a) the sum of 72.6 and 4.53.

Answer: (2)

(b) the difference between 92 and 5.25.

Answer: (2)

(c) the product of 7.6 and 9.

Answer: (2)

5. (a) **Fully** simplify the following:

(i) $7d + 14d$

Answer: (1)

(ii) $4y^3 \times 3y^4$

Answer: (2)

(iii) $\frac{24y^8}{9y^2}$

Answer: (2)

(b) Multiply out the brackets **and fully simplify**:

$$12(3p + 4q) - (p - 2q)$$

Answer: (3)

(c) Factorise **completely**:

$$6a^3 + 33a$$

Answer: (2)

6. Solve the following equations:

(a) $9a - 3 = 21 - a$

Answer: $a = \dots\dots\dots$ (2)

(b) $\frac{1}{6}(b + 1) = 10$

Answer: $b = \dots\dots\dots$ (2)

(c) $2c^2 = 50$

Answer: $c = \dots\dots\dots$ (2)

(d) $\frac{1}{2}(6f + 2) - 6 = 10$

Answer: $f = \dots\dots\dots$ (2)

(e) $\frac{35}{x} = 10$

Answer: $x = \dots\dots\dots$ (2)

7. Solve these inequalities:

(a) $2n + 1 > 15$

Answer: (2)

(b) $2(n - 4) \leq 16$

Answer: (2)

8. (a) 156 sweets are to be divided between two people in the ratio of 5:7.
How many sweets do each of the two people receive?

Answers: and (2)

- (b) An amount of money is divided into the ratio 2:4:5. The person with the smallest share receives £86. What does the person with the largest share receive?

Answer: (2)

9. Given that $a = \frac{2}{3}$ and $b = \frac{3}{5}$ and $c = \frac{1}{6}$, find the value of

(a) $a + b$

Answer: (2)

(b) $\frac{12}{c}$

Answer: (2)

(c) $\frac{b}{c}$

Answer: (2)

(d) abc

Answer: (2)

10. A vehicle uses $\frac{2}{5}$ of a litre of petrol for every mile it covers.

It uses 16 litres in a day.

How many miles has it travelled?

Answer: (2)

11. A fair, six-sided dice has faces numbered 1, 2, 3, 4, 5 and 6. When the dice is thrown, the number facing up is the score.

The dice is thrown once.

(a) What is the probability that the score is less than 3?

Answer: (1)

(b) If the dice was thrown 300 times, how many times would a score greater than 4 be expected?

Answer: (2)

12. **By first drawing a set of axes**, draw the line defined by the equation

$$y = -\frac{1}{2}x + 5$$

showing the coordinates where the line intercepts the axes.

(3)

13. The following graph is to be drawn

$$y = 2x^2 - 4x$$

- (a) Complete the table

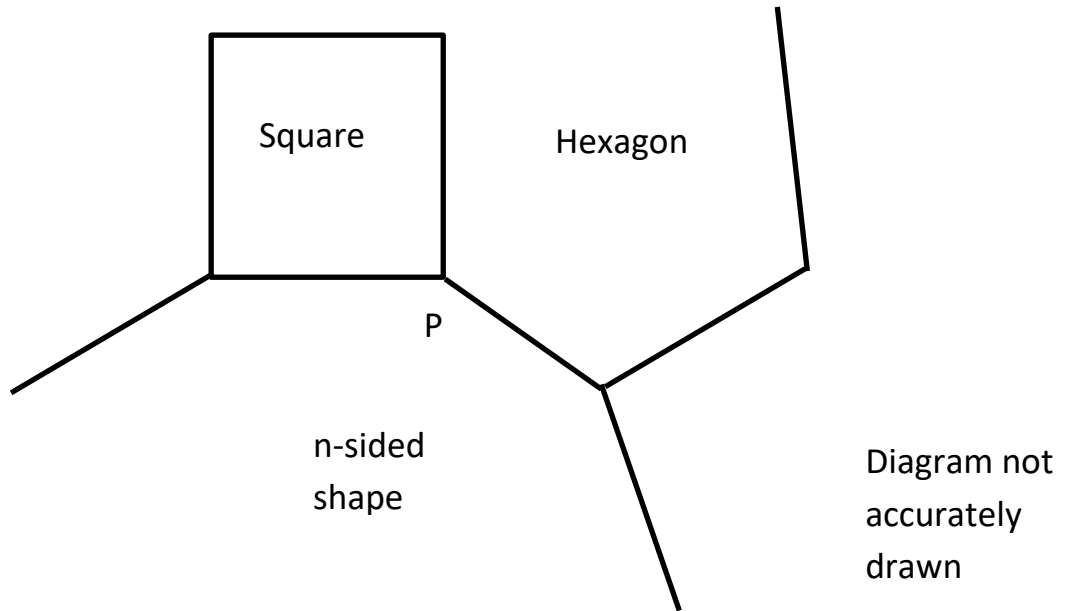
x	-2	-1	0	1	2	3
x^2						
$2x^2$						
$4x$						
y		6				6

(2)

- (b) **By first drawing a set of axes**, then plotting appropriate points based on the information in the above table, draw the graph for the values $-2 \leq x \leq 3$.

(2)

14. Two sides of a regular hexagon, a square and a regular n -sided polygon meet at the point P.



Find the value of n , showing your working clearly.

$$n = \dots\dots\dots (3)$$

15. A man is 32 years older than his son. Ten years ago he was three times as old as his son was then. By forming an appropriate equation, or equations, find and list the age of each.

Answer: (3)

16. A sequence begins:

10 8 6 4

(a) Calculate the 25th term.

Answer: (2)

(b) Write down a formula for the n th term.

Answer: (2)

(c) Find the value of n when the n th term equals -36.

Answer: (2)

(d) Determine the term number following which the sum of all terms turns negative.

Answer: (2)

17. A man runs to a post and back in 900 seconds. His speed on the way to the post is 5m/s and his speed on the way back is 4m/s. Find the distance to the post.

Answer: (3)

18. A bus is travelling with 52 passengers. When it arrives at a stop, x get off and 4 get on. At the next stop one third of the passengers get off and 3 get on. There are now 25 passengers. Find x .

Answer: (3)

19. A slot machine takes only 10p and 50p coins and it contains a total of twenty one coins altogether. The total value of these twenty one coins is £4.90. By forming suitable equations, find the number of coins of each value.

Answer: (3)

TOTAL MARKS = 100

Paper Notes: 13+ Maths Sample Paper (13+ Maths Sample Paper)

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

Overview

This is a **specimen mathematics entrance paper** published by **Tonbridge School** for candidates applying for **Year 9 entry** (13+ level). The paper is designed to assess the mathematical proficiency of prospective students across a broad range of topics typically covered in the upper years of primary and early secondary education. It is a **non-calculator paper** carrying a total of **100 marks** and must be completed within **one hour**.

The examination tests core skills in arithmetic, algebra, geometry, probability, and problem-solving, with questions ranging from straightforward calculations to multi-step word problems requiring the formation and solution of equations. The format includes short-answer questions, each allocated a specified number of marks (typically two or three), and candidates are reminded that correct answers without working may receive no credit.

This paper is particularly valuable for students preparing for competitive independent school entrance examinations at 13+. It provides a clear benchmark of the standard expected by a leading UK independent school and offers excellent practice in exam technique under timed conditions.

How this paper is organised

The paper comprises **19 numbered questions**, subdivided into parts labelled (a), (b), (c), and so on, yielding a total of **approximately 50 individual items**. Mark allocations are shown in parentheses after each part, ranging from one mark for simple tasks (such as collecting like terms) to three marks for more complex multi-step problems (such as forming and solving simultaneous equations or working with sequences).

Questions 1 to 4 focus on fundamental arithmetic and numerical fluency: percentages, fractions, decimals, time calculations, and speed-distance problems. Questions 5 to 9 move into algebra, covering simplification, factorisation, and solving linear and quadratic equations, as well as manipulating algebraic fractions and working with numerical fractions. Questions 10 to 13 include applied word problems, probability, and coordinate geometry (plotting a linear graph and completing a table for a quadratic curve).

The final section (Questions 14 to 19) features more demanding problem-solving: interior angles of polygons, age-related word problems, arithmetic sequences (including finding the n th term and determining when a cumulative sum turns negative), distance-time problems with variable speeds, passenger-flow algebra, and a coins problem requiring simultaneous equations. Each question is followed by a dotted answer line and the mark value, making the scoring transparent.

Topics covered

- Percentages, fractions, and decimals: converting 62% to simplest form, expressing fractions as decimals, calculating percentages of monetary amounts, and finding fractional parts of quantities
- Estimation and rounding: approximating the result of a complex calculation by rounding each number to one significant figure
- Powers, roots, and prime factorisation: evaluating cube numbers and cube roots, expressing 108 as a product of primes using index notation
- Lowest common multiples and highest common factors: finding the LCM of 14 and 10
- Time calculations and 12-hour clock arithmetic: adding hours and minutes across the noon boundary
- Speed, distance, and time problems: calculating distance travelled at constant speed, converting units (metres per second to kilometres per hour), and solving journey problems with different outbound and return speeds
- Decimal arithmetic: addition, subtraction, and multiplication of decimal numbers without a calculator
- Algebraic simplification: collecting like terms, multiplying powers with the same base, dividing algebraic fractions, expanding brackets, and factorising expressions completely
- Solving linear equations, including those with fractions and brackets, and solving simple quadratic equations of the form $2c^2 = 50$
- Linear inequalities: solving and expressing solutions in inequality notation
- Ratio and proportion: dividing quantities in given ratios (including three-part ratios) and working backwards from one share to find another
- Operations with fractions: adding, dividing, and multiplying fractions, including mixed operations
- Probability: calculating theoretical probabilities from fair dice and using probability to predict frequencies over many trials
- Coordinate geometry and graph plotting: sketching the line $y = -\frac{1}{2}x + 5$ with intercepts labelled, and completing a table of values for the quadratic $y = 2x^2 - 4x$ before plotting the curve
- Interior angles of regular polygons: calculating angles and determining the number of sides when polygons meet at a point
- Forming and solving equations from word problems: age problems, sequences (finding the n th term, solving for n , and summing arithmetic series), simultaneous linear equations (coins and passengers), and distance-time problems with varying speeds

How to use this paper for revision

- Practise converting between fractions, decimals, and percentages fluently; these appear throughout the paper and errors here cascade into later steps.
- Work through prime factorisation methodically using a factor tree, and always express your final answer using index notation when the question specifies it.
- When estimating calculations, round each number independently to one significant figure before performing the arithmetic; do not round intermediate results.
- For speed-distance-time problems, write down the formula you are using (e.g. distance = speed \times time) and convert units carefully before substituting values.
- In algebra questions, always show every step: expand brackets fully, collect like terms explicitly, and factorise by taking out the highest common factor first.
- When solving equations, perform the same operation to both sides and write each new line underneath the previous one; this makes errors easier to spot and earns method marks.
- For ratio problems, find the value of one part first, then multiply to find the required shares; label your working clearly to avoid confusion.

Common mistakes to avoid

- Writing 62% as 62/100 and forgetting to simplify to lowest terms; always cancel common factors (here, divide numerator and denominator by 2).
- Rounding prematurely in estimation questions; you must round each number to one significant figure before multiplying or dividing, not after.
- Forgetting to write cube root and cube symbols correctly; $\sqrt[3]{64}$ is 4, and 3^3 is 27, but mixing these up or misreading the notation is common.
- Misapplying index laws when multiplying powers: $4y^3 \times 3y^4$ requires you to multiply coefficients ($4 \times 3 = 12$) and add exponents ($y^{3+4} = y^7$), not multiply the exponents.
- Incorrectly expanding double brackets or dropping minus signs; in $12(3p + 4q) - (p - 2q)$, the subtraction changes the signs inside the second bracket to $-p + 2q$.
- Dividing both sides of an inequality by a negative number without reversing the inequality sign, although this paper's inequalities do not require that step.
- Setting up ratio problems without finding the total number of parts first; in a 2:4:5 ratio, the total is 11 parts, so divide the total amount by 11 to find one part.

Exam technique

Attempt every question, as the paper explicitly states that all questions should be tried. Marks are awarded for method as well as correct answers, so even if you cannot complete a problem fully, writing down a relevant formula or the first step of working will earn partial credit. Pace yourself carefully: with 50 items in 60 minutes, you have just over one minute per mark on average, so do not linger on any single part for more than its mark allocation suggests.

Read each question twice before starting. Word problems (particularly Questions 15 to 19) require you to extract information, define variables, and form equations; underlining key facts (ages, speeds, coin values) helps prevent careless errors. For graph-plotting questions, draw axes neatly with a ruler, label intercepts clearly, and plot at least three points to check your curve or line is accurate.

Show all working in the space provided. The rubric warns that a correct answer without working may receive no marks, so even simple arithmetic (like 20% of 18.70) should be demonstrated as a calculation ($0.2 \times 18.70 = 3.74$). If time permits, return to questions you skipped and attempt at least the first step to secure method marks.

What to revise alongside this paper

Students should revise **fractional and percentage calculations** in context, including reverse percentages and comparing fractions with different denominators.

Strengthening fluency with **negative numbers** and **order of operations** (BIDMAS/BODMAS) will support the arithmetic and algebra questions. Reviewing **index laws** in full (including division and zero/negative indices) will prepare you for harder algebraic manipulation.

For geometry, practise calculating **interior and exterior angles of regular polygons** using the formula $(n-2) \times 180^\circ / n$, and work through problems where angles meet at a point or on a straight line. In coordinate geometry, ensure you can plot both **linear and quadratic graphs** from tables of values, and identify key features such as turning points and intercepts. For sequences, revise how to find the **sum of an arithmetic series** (using $S_n = n/2 \times (2a + (n-1)d)$) and how to solve for n when the n th term or sum reaches a given value.

Finally, tackle more multi-step word problems involving **forming and solving simultaneous equations**, particularly those with monetary or measurement contexts (coins, tickets, mixtures). Practising these problem types under timed conditions will build confidence and accuracy for the full range of 13+ entrance papers.

Key terms

Lowest terms, Significant figure, Prime factorisation, Index notation, Lowest common multiple, Speed, distance, time, Like terms, Expand brackets, Factorise completely, Linear equation, Quadratic equation, Inequality, Ratio, Probability, Intercept, nth term, Arithmetic sequence, Simultaneous equations

For more free 11+ practice papers, past papers and online practice tests, visit [SATs-Papers.co.uk](https://www.SATs-Papers.co.uk).

Name: School:



TONBRIDGE SCHOOL

Test for Entrance into Year 9: Specimen B

MATHEMATICS

Time allowed: 1 hour

Total Marks: 100

THIS IS A NON-CALCULATOR PAPER

Instructions:

1. Complete Name and School at the top of the cover page.
2. All questions should be attempted and answers given in the space provided.
3. A completely correct answer may receive no marks unless all workings are shown.

1. (a) Write 45% as a fraction **in lowest terms**.

Answer: (2)

(b) Write $\frac{5}{8}$ as a decimal.

Answer: (2)

(c) Calculate 30% of \$12.50.

Answer: \$..... (2)

(d) Calculate $\frac{7}{15}$ of 4.5 metres.

Answer: (2)

2. (a) By **first writing each number correct to 1 significant figure**, estimate the answer to

$$\frac{11.4 \times 194}{93.1}$$

Answer: (3)

- (b) Calculate $2^3 \times \sqrt[3]{27}$.

Answer: (2)

- (c) Write 300 as a product of prime factors, **using indices**.

Answer: (3)

- (d) What is the smallest integer by which 300 has to be multiplied by to produce a perfect square ?

Answer: (2)

3. (a) It takes 2 hour 27 minutes to travel from York to London by train. Christopher catches the 11.35 a.m. train from York.

At what time should Christopher arrive in London ?

Answer:p.m. (2)

- (b) A race horse averages 2 miles every 5 minutes. How long will it take the horse to run 26 miles at this rate ?

Answer: h min (2)

- (c) How far does a car travel in 35 minutes at 30km/h ?

Answer: km (2)

- (d) Write 40km/h as a speed in metres per second.

Answer: m/s (2)

4. Calculate

(a) the sum of 73.5 and 9.74

Answer: (1)

(b) the difference between 84 and 7.7

Answer: (1)

(c) the product of 4.3 and 7

Answer: (1)

(d) $24 \div 0.4$

Answer: (2)

5. (a) **Fully** simplify the following:

(i) $2m + 3m$

Answer: (1)

(ii) $3y^3 \times 3y^3$

Answer: (2)

(iii) $\frac{9y^6}{3y^2}$

Answer: (2)

(b) Multiply out the brackets **and fully simplify**

$$2(3p + 4q) - 6(p - 2q)$$

Answer: (3)

(c) Factorise **completely**

$$9a^2 + 27a$$

Answer: (2)

6. (a) Solve the following:

(i) $5a - 3 = 21 - a$

Answer: $a = \dots\dots\dots$ (1)

(ii) $\frac{1}{3}(b + 1) = 10$

Answer: $b = \dots\dots\dots$ (1)

(iii) $5c^2 = 45$

Answer: $c = \dots\dots\dots$ (2)

(iv) $\frac{1}{2}(6d + 2) - 4 = 10$

Answer: $d = \dots\dots\dots$ (3)

(v) $\frac{10}{e} = 20$

Answer: $e = \dots\dots\dots$ (1)

(b) Solve these inequalities:

(i) $n + 2n > 9$

Answer: (2)

(ii) $2(n - 3) \leq 6$

Answer: (2)

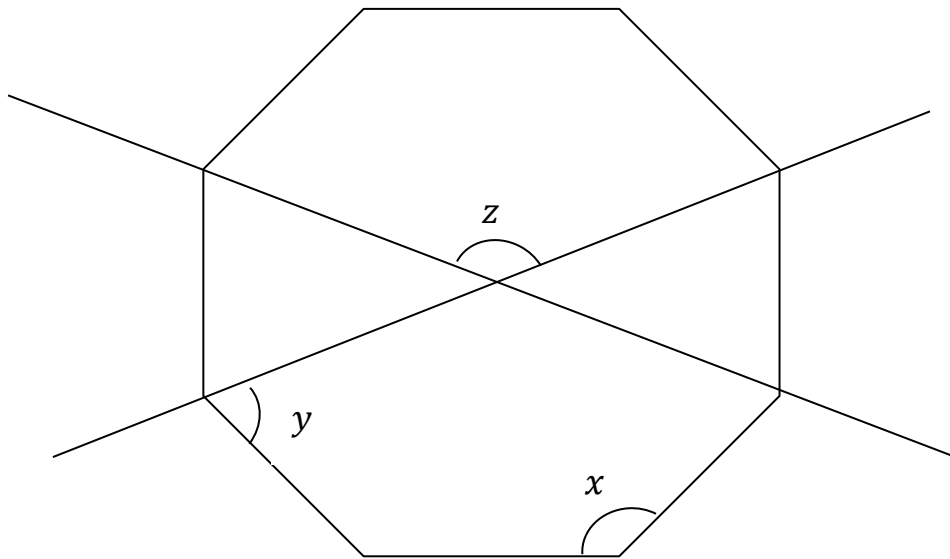
7 (a) 60 sweets are to be divided between two people in the ratio of 5:7.
How many sweets do each of the two people receive ?

Answers: and (2)

(b) When £143 is divided in the ratio 2:4:5, what is the difference between the largest share and the smallest share ?

Answer: (3)

8. Below is a picture of a regular octagon.



Calculate the size of the angles x , y and z

Answers: $x = \dots\dots\dots$ (2)

$y = \dots\dots\dots$ (2)

$z = \dots\dots\dots$ (2)

9. Given that $a = \frac{2}{5}$ and $b = \frac{3}{4}$ and $c = \frac{1}{3}$, find the value of

(a) $a + b$

Answer: (2)

(b) $\frac{12}{c}$

Answer: (1)

(c) $\frac{b}{c}$

Answer: (2)

(d) abc

Answer: (2)

10. In the desert, every soldier drinks $\frac{3}{5}$ of a litre of water each day.

An army patrol drinks 18 litres in a day

How many soldiers are there in the patrol ?

Answer: (2)

11. A fair, six-sided dice has faces numbered 1, 2, 3, 4, 5 and 6. When the dice is thrown, the number facing up is the score.

The dice is thrown once.

(a) What is the probability that the score is 1 or 2

Answer: (1)

(b) If the dice was thrown 300 times, how many times would a score of 5 be expected?

Answer: (1)

12. **By first drawing a set of axes**, draw the line defined by the equation

$$y = 2x + 5$$

showing the coordinates where the line intercepts the axes.

(3)

13. The following graph is to be drawn

$$y = 2x^2 - 3x$$

- a) Complete the table

x	-2	-1	0	1	2	3
x^2						
$2x^2$						
$3x$						
y		5				9

(2)

- b) **By first drawing a set of axes**, then plotting appropriate points based on the information in the above table, draw the graph for the values $-2 \leq x \leq 3$

(2)

14. The wage bill for five builders and six carpenters is £1,340, while the bill for eight builders and three carpenters is £1,220. What wage is paid to each builder?

Answer: (4)

15. A sequence begins:

5 8 11 14

(a) Write down a formula for the n th term

Answer: (2)

(b) Calculate the 25th term

Answer: (1)

(c) Find the value of n when the n th term equals 146

Answer: (2)

(d) Determine the value of the first term which is greater than 1000

Answer: (2)

16. A *unit fraction* is one like $\frac{1}{4}$ with numerator 1.

(a) Write 1 as the sum of three different unit fractions

Answer: (2)

(b) By multiplying your answer to (a) by a suitable unit fraction, write $\frac{1}{6}$ as the sum of three different unit fractions

Answer: (2)

(c) Use your answers to (a) and (b) to write 1 as the sum of five different unit fractions

Answer: (3)

END OF PAPER

Paper Notes: 13+ Maths Sample Paper (13+ Maths Sample Paper)

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

Overview

This is a **Specimen Paper B** for the **13+ entrance examination** published by **Tonbridge School** in Tonbridge, Kent. Tonbridge School is a leading independent boys' school, and this paper forms part of the admissions process for boys hoping to enter **Year 9**. The paper tests a comprehensive range of mathematical skills at the end of Year 8, and is designed to assess readiness for the school's academic curriculum.

The paper is a **non-calculator** examination lasting **one hour** and carrying a total of **100 marks**. Questions span arithmetic, algebra, geometry, ratio, sequences, probability, and graph work, all requiring clear working to be shown. The format combines short calculations, longer multi-step problems, and a few questions demanding graphical or algebraic reasoning.

This paper suits students preparing for selective independent school entrance at 13+, particularly those targeting schools with rigorous mathematical standards. It offers realistic practice under timed conditions and highlights the breadth of topics students must master, from fraction manipulation to simultaneous equations and quadratic graphs.

How this paper is organised

The paper contains **16 numbered questions**, many with multiple parts, distributed across 16 pages. Questions are worth between 1 and 4 marks each, totalling 100 marks. Early questions focus on percentages, fractions, and decimals (Question 1), estimation and indices (Question 2), and time, speed, and distance (Question 3). The middle section covers decimal arithmetic (Question 4), algebraic manipulation and factorisation (Question 5), solving equations and inequalities (Question 6), and ratio problems (Question 7).

Later questions increase in difficulty. Question 8 tackles angle properties of regular polygons, Question 9 explores fraction operations, and Question 10 applies fractions to a word problem. Probability appears in Question 11, linear graphs in Question 12, and quadratic graphs requiring table completion and plotting in Question 13. Question 14 introduces simultaneous equations in a wage context, Question 15 examines arithmetic sequences, and Question 16 challenges students to express 1 as a sum of unit fractions.

The layout provides generous white space for working. Each part is clearly labelled with its mark value in parentheses, and answer lines are clearly indicated. Instructions on the cover page emphasise that **all working must be shown**, even for correct answers, reflecting the school's focus on mathematical reasoning and method.

Topics covered

- Percentages, including conversion to fractions in lowest terms and calculating percentage values of amounts in dollars
- Fraction and decimal conversions, including expressing fractions as terminating decimals and finding fractions of metric quantities
- Estimation by rounding to one significant figure, applied to multi-step calculations involving multiplication and division
- Indices and surds, including evaluating expressions with fractional and cube roots, and writing numbers as products of prime factors using index notation
- Speed, distance, and time problems, including converting between units (km/h to m/s) and calculating journey times and distances
- Algebra: simplifying expressions, multiplying and dividing powers, expanding brackets, collecting like terms, and factorising completely using highest common factors
- Solving linear equations (including those with fractions), quadratic equations, and linear inequalities
- Ratio and proportion, including dividing quantities in given ratios and finding differences between shares
- Angle properties of regular polygons and vertically opposite angles formed by intersecting lines
- Fraction arithmetic, including addition, division, and multiplication of fractions
- Probability, including calculating theoretical probabilities and expected frequencies over multiple trials
- Coordinate geometry: plotting linear graphs from equations, identifying intercepts, and completing tables of values for quadratic functions
- Arithmetic sequences: deriving nth term formulae, calculating specific terms, and solving equations to find term positions
- Simultaneous equations in a real-world context (wages for builders and carpenters)
- Unit fractions: expressing 1 and other unit fractions as sums of distinct unit fractions

How to use this paper for revision

- Revise fraction operations thoroughly, including division by a fraction (multiply by the reciprocal), and practice converting between fractions, decimals, and percentages without a calculator.
- Memorise the formula for the interior angle of a regular polygon: $(n - 2) \times 180^\circ \div n$, and practise identifying vertically opposite and supplementary angles in diagrams.
- Work through simultaneous equations using both elimination and substitution methods, ensuring you can set up equations from worded problems about costs, wages, or ratios.
- For sequences, practise writing nth term formulae for arithmetic progressions (form $a + (n - 1)d$) and solving equations of the form $a + (n - 1)d = k$ to find n .
- When plotting quadratic graphs, complete the table carefully, checking each calculation twice, and use a ruler to draw smooth curves through the plotted points.
- Practice estimation by rounding each number to one significant figure before calculating, and compare your estimate to the exact answer to check plausibility.
- Review prime factorisation using factor trees, and understand how to use the result to identify the smallest multiplier needed to create a perfect square.

Common mistakes to avoid

- Failing to show working even when the answer is correct. Tonbridge explicitly states that a correct answer may score zero marks without clear method, so write every step.
- Confusing the order of operations when expanding brackets and simplifying. Always multiply out brackets fully before collecting like terms, and take care with negative signs.
- Misapplying ratio division. Remember to find the total number of parts first, divide the total amount by that number, then multiply by each part to find each share.
- Mixing up angle types in polygon questions. An interior angle of a regular octagon is 135° , but students often calculate the exterior angle (45°) or forget to subtract from 180° .
- Rounding too early in multi-step calculations. For estimation questions, round each number to one significant figure at the start, but in exact calculations, keep full precision until the final answer.
- Plotting quadratic graphs with straight lines between points instead of smooth curves, or missing the turning point because the table does not include enough x-values near the vertex.

Exam technique

Allocate your time carefully across the hour. Aim to spend roughly one minute per mark, so a 4-mark question deserves around four minutes. If you are stuck, move on and return later rather than losing time on a single problem. Start with questions you find straightforward to build confidence and secure quick marks, but do not rush. Careless errors in arithmetic or algebra can be costly.

Read every question twice, especially worded problems involving ratios, speeds, or simultaneous equations. Underline or highlight key numbers and what you are asked to find. Write your working in a logical sequence down the page, not scattered around the margins. If a question asks you to draw axes or complete a table, do so neatly and accurately. Use a ruler for graphs and label intercepts clearly.

Check your answers if time permits. For equations, substitute your solution back into the original equation to verify. For ratio problems, check that your shares add up to the total given. For graphs, ensure your line or curve passes through all plotted points. If you finish early, revisit any questions you skipped and attempt them, showing as much method as possible even if you cannot reach a final answer.

What to revise alongside this paper

Students should consolidate work on **negative numbers** and **order of operations**, as these underpin many algebraic manipulations in the paper. Review the **laws of indices** (including zero and negative powers) and practice simplifying expressions with fractional indices and surds. Strengthen understanding of **algebraic fractions**, which extend the factorisation and simplification skills tested here.

For geometry, revise **circle theorems** and properties of **quadrilaterals** and **triangles**, as these often appear alongside polygon angle questions. Explore **coordinate geometry** further by finding gradients, midpoints, and equations of lines from two points. Practice solving **quadratic equations** by factorisation, completing the square, and using the quadratic formula, as this extends the quadratic graph work in Question 13.

To progress beyond this paper, tackle **algebraic proof**, **trigonometry** in right-angled triangles, and more complex problem-solving involving **percentages** (such as compound interest or reverse percentage problems). Work through past papers from other independent schools at 13+ to familiarise yourself with different question styles and contexts.

Key terms

Lowest terms, Prime factors, Indices, Cube root, Speed, distance, time, Simplify, Expand brackets, Factorise completely, Highest common factor, Inequality, Ratio, Interior angle, Vertically opposite angles, Probability, Linear equation, Simultaneous equations, Quadratic graph, nth term, Arithmetic sequence, Unit fraction

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Specification for Maths Entrance Paper

The paper is 60 marks and is roughly the harder 60% of a GCSE/iGCSE paper. The questions will mostly be drawn from the list below but will include some problem solving.

- Quadratics: Factorising and Formula
- Linear Inequalities and Linear Simultaneous Equations
- Quadratic inequalities
- Averages and Probability
- Area and Volumes including scale factors
- Sine, cosine rule and area of the triangle
- Straight Line Coordinate Geometry
- Bounds in Calculations
- Algebraic Fractions
- Rational Numbers and Surds
- Recognising Graphs of $y = Ax^n$ with $n = -2, -1, 0, 1, 2, 3$
- Simultaneous Equations with one linear and one quadratic
- Arithmetic Sequences
- Differentiation of functions of the form $y = ax^n$, where n is a rational number.
Note – this is covered in IGCSE but not GCSE!

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

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

Overview

This is the **specification document** for the **Tonbridge School 13+ Maths entrance examination**, published by Tonbridge School in Kent. It outlines the syllabus coverage and expected mathematical knowledge for candidates seeking entry at Year 9 level. The paper is worth **60 marks** and is described as being **roughly equivalent to the harder 60% of a GCSE or iGCSE paper**, positioning it as a challenging assessment for Year 8 pupils.

The specification lists fourteen distinct topic areas, ranging from core algebraic techniques such as quadratic factorisation and simultaneous equations through to coordinate geometry, trigonometry, and basic calculus. Candidates are expected to handle problem-solving questions in addition to standard topic-based exercises. Notably, the paper includes **differentiation of power functions**, a topic covered in iGCSE but not in standard GCSE, meaning students from GCSE-only curricula will need additional preparation.

This document is designed for pupils preparing for Tonbridge School's entrance exam and their teachers or tutors. It provides clear guidance on what mathematical content will be assessed, allowing focused revision and identification of any gaps in a candidate's knowledge. Familiarity with all listed topics is essential for confident performance on the actual examination paper.

How this paper is organised

The specification is presented as a single-page document rather than a full exam paper. It opens with a brief contextual statement explaining that the examination totals **60 marks** and equates to the more demanding 60% of a GCSE or iGCSE paper. The document then clarifies that questions will be drawn mostly from the listed topics, with the inclusion of **problem-solving elements** that may combine multiple areas.

Fourteen bullet-pointed topic areas follow, each naming a specific area of mathematics that candidates must master. The topics are not grouped by theme but listed sequentially, covering algebra, number, geometry, trigonometry, statistics, and introductory calculus. There is no indication of how marks are distributed across topics, so students should assume all areas carry significant weight.

A parenthetical note at the end highlights that differentiation is part of the iGCSE syllabus but not the standard GCSE, serving as an important reminder for candidates to check their own curriculum coverage. This document is intended to be studied alongside past papers and practice questions, not used in isolation.

Topics covered

- Quadratic equations: factorising quadratics into binomial products and solving using the quadratic formula when factorisation is not straightforward
- Linear inequalities and linear simultaneous equations: solving two-variable systems by elimination or substitution, and representing inequality solutions on number lines
- Quadratic inequalities: solving inequalities of the form $ax^2 + bx + c > 0$ and sketching solution sets
- Averages and probability: calculating mean, median, mode, and range from data sets, and working with theoretical and experimental probability
- Area and volumes including scale factors: finding surface areas and volumes of 3D solids, and applying linear and volume scale factor relationships
- Sine rule, cosine rule, and area of a triangle: solving non-right-angled triangles using these formulae and calculating areas using $\frac{1}{2}ab \sin C$
- Straight line coordinate geometry: finding gradients, equations of lines, midpoints, and distances between points in the Cartesian plane
- Bounds in calculations: understanding upper and lower bounds of rounded or truncated measurements and their impact on computed values
- Algebraic fractions: simplifying, adding, subtracting, multiplying, and dividing algebraic fractions, including those requiring factorisation
- Rational numbers and surds: manipulating expressions involving surds, rationalising denominators, and distinguishing rational from irrational numbers
- Recognising graphs of $y = Ax^n$ for $n = -2, -1, 0, 1, 2, 3$: identifying and sketching reciprocal, linear, quadratic, and cubic functions
- Simultaneous equations with one linear and one quadratic: solving systems algebraically by substitution and interpreting graphical intersections
- Arithmetic sequences: finding n th terms, common differences, and sums of arithmetic progressions
- Differentiation of power functions $y = ax^n$ where n is rational: applying the power rule to differentiate polynomials and fractional or negative powers

How to use this paper for revision

- Work through GCSE Higher-tier past papers first to consolidate foundational skills, then progress to iGCSE extended papers to encounter differentiation and more demanding problem-solving.
- Practise factorising quadratics daily until the process becomes automatic, as this skill underpins algebraic fractions, simultaneous equations, and quadratic inequalities.
- Create a formula sheet for trigonometry (sine rule, cosine rule, area formula) and coordinate geometry, then test yourself weekly by covering it and reproducing from memory.
- For differentiation, ensure you can apply the power rule confidently to negative and fractional indices, not just positive integers, as this is a common stumbling block.
- Tackle multi-step problem-solving questions that combine topics (for example, forming and solving a quadratic from a geometric context) to build exam resilience.
- Revise bounds and rounding carefully, as these questions require precision in setting up inequalities and are often worth high marks relative to their difficulty.
- Use graphing software or a graphical calculator to visualise the families of curves $y = Ax^n$, particularly reciprocal and cubic functions, to develop rapid recognition skills.

Common mistakes to avoid

- Forgetting to check both roots when solving quadratic inequalities, or failing to sketch a graph to determine which intervals satisfy the inequality.
- Misapplying the quadratic formula by incorrectly substituting negative coefficients or making sign errors when simplifying under the square root.
- Confusing sine rule and cosine rule contexts: using sine rule when an angle is enclosed by two known sides, which requires cosine rule instead.
- Rationalising denominators incompletely, for example leaving $\sqrt{2}$ in the denominator of a final answer or multiplying by the wrong conjugate for binomial surds.
- Differentiating $y = ax^n$ but forgetting to multiply by the coefficient a , or incorrectly handling negative powers by adding instead of subtracting from the exponent.
- Mixing up linear and volume scale factors, particularly when calculating how volumes change: if length scale factor is k , volume scale factor is k^3 , not k .

Exam technique

Read the specification carefully and audit your own knowledge against each bullet point, highlighting any topics where you feel uncertain. Tonbridge School's paper is designed to test fluency across a broad range of topics, so gaps in understanding will be exposed. Allocate your revision time proportionally, spending extra hours on weaker areas such as differentiation or trigonometric rules if these are less familiar.

When sitting the actual exam, budget roughly **one mark per minute**, allowing a few minutes at the end for checking. Attempt all questions, as Tonbridge School papers typically include a mix of straightforward recall and multi-step problem-solving. If a problem-solving question seems intractable, move on and return to it later rather than losing time.

Show all working clearly, even for algebraic manipulations you find routine. Partial credit is often available for correct method even if the final answer is wrong, and showing intermediate steps helps you spot errors when checking. For topics like bounds or quadratic inequalities, annotate your reasoning (for example, labelling upper and lower bounds or sketching a quick graph) to keep your logic transparent.

What to revise alongside this paper

After mastering the content in this specification, consider extending your study to **sequences and series** beyond arithmetic progressions, including geometric sequences and their sums, which often appear in 13+ papers at selective independent schools. Integration (the reverse of differentiation) is a natural next step if you are confident with differentiation, though it is not listed here and may not be assessed.

For geometry, revise **circle theorems** (angles in the same segment, tangent-radius properties) and constructions, as these occasionally feature in problem-solving contexts even when not explicitly listed. Strengthen your algebraic manipulation by working on **proof questions**, such as proving algebraic identities or showing that expressions simplify to given forms, as these build the rigour expected at this level.

Finally, explore past papers from other independent schools such as Winchester, Eton, or King's Canterbury to see how similar topics are tested in different formats. This breadth of practice will prepare you for the specific style and difficulty of Tonbridge's examination.

Key terms

Quadratic formula, Factorisation, Simultaneous equations, Sine rule, Cosine rule, Coordinate geometry, Gradient, Surds, Rationalising the denominator, Bounds, Algebraic fractions, Differentiation, Power rule, Arithmetic sequence, nth term

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