Ma

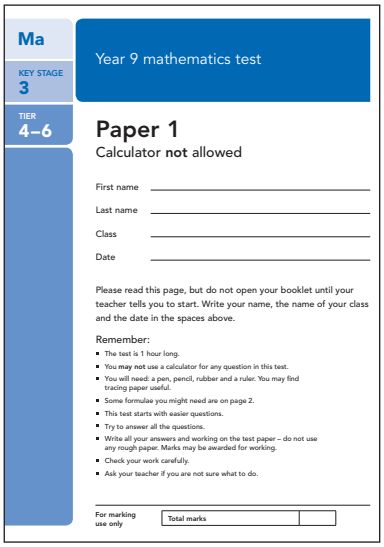
KEY STAGE 3

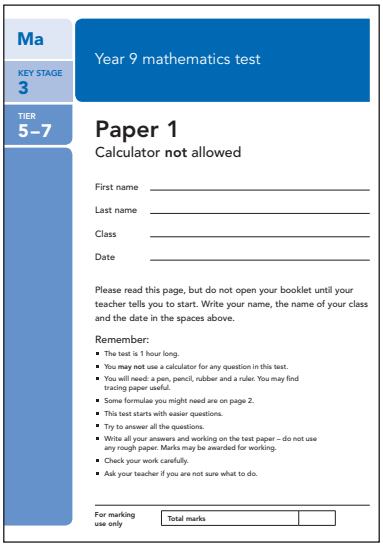
LEVELS 4–7

OPTIONAL

Year 9 optional mathematics tests

Teacher's guide


Ma
KEY STAGE 3
TIER 4–6
Year 9 mathematics test
Paper 1
Calculator **not** allowed
First name
Last name
Class
Date
Please read this page, but do not open your booklet until your teacher tells you to start. Write your name, the name of your class and the date in the spaces above.
Remember:
- The test is 1 hour long.
- You **may not** use a calculator for any question in this test.
- You will need: a pen, pencil, rubber and a ruler. You may find tracing paper useful.
- Some formulae you might need are on page 2.
- This test starts with easier questions.
- Try to answer all the questions.
- Write all your answers and working on the test paper – do not use any rough paper. Marks may be awarded for working.
- Check your work carefully.
- Ask your teacher if you are not sure what to do.
For marking use only
Total marks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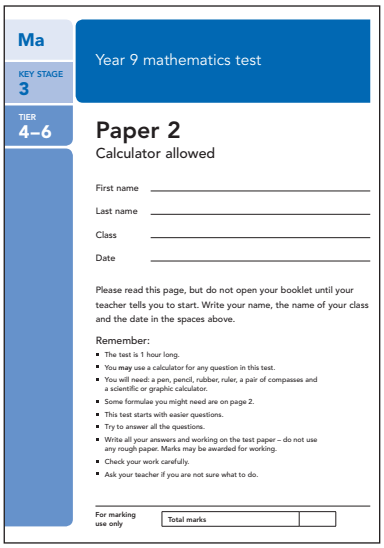
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Last name
Class
Date
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Remember:
- The test is 1 hour long.
- You **may** use a calculator for any question in this test.
- You will need: a pen, pencil, rubber, ruler, a pair of compasses and a scientific or graphic calculator.
- Some formulae you might need are on page 2.
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- Write all your answers and working on the test paper – do not use any rough paper. Marks may be awarded for working.
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For marking use only
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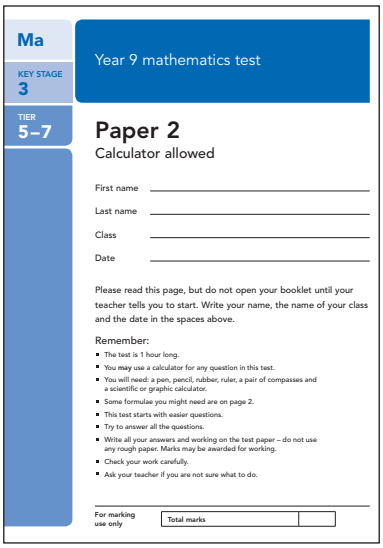
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For marking use only
Total marks

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Contents

Introduction

The year 9 optional mathematics tests provide schools with a tool to help monitor pupils' progress against national standards at the end of key stage 3 and an instrument for gathering assessment evidence in support of teacher judgements.

The test materials may be used in whole or in part at any point during key stage 3 to provide valuable qualitative information about pupils' strengths and weaknesses. Teachers may choose to use the materials alongside written work, class discussions and group activities in a variety of contexts. When used in this way the materials can yield evidence in support of teacher assessment, including national curriculum level judgements.

The tests follow a similar structure to the previously statutory end of key stage 3 mathematics tests taken by pupils in year 9. They can be administered and marked formally and the results may be used to determine a national curriculum level. Even when used in this way, there is still useful additional information that can be discerned from pupils' responses. This guide explains the options in more detail.

The mathematics tests are available in two tiers, covering levels 4–6 and 5–7.

Supporting teacher assessment

The optional key stage 3 mathematics tests aim to be supportive of school assessment arrangements and can be used as part of an integrated approach to teacher assessment. Assessing Pupils' Progress (APP) materials are also available and may be used alongside these tests. APP is a structured approach to periodic assessment, enabling teachers to:

- use information about pupils' strengths and weaknesses to improve teaching, learning and rates of pupils' progress;
- track pupils' progress over a key stage or longer.

The optional test materials may be used in a variety of contexts in order to give pupils the broadest opportunities to show what they can do. Individual questions and pupil responses can be used to stimulate class discussions and group activities, contributing to a rich evidence base for teacher assessment. The notes on individual questions make some specific suggestions for teaching and learning (see Section B).

Section A: Formal administration

The guidance in this section must be followed in order to produce a national curriculum level for each pupil using the level threshold supplied (page 67).

Administering the tests

This information is provided for anyone who is involved in administering the tests, including teachers, other members of school staff, and other adults who may be assisting in test administration.

The tests should be carried out under test conditions; they may be held in a school hall, classroom or any other suitable accommodation.

Equipment needed for the papers

In addition to pens, pencils, rubbers and rulers, the following equipment will need to be available to pupils when they take the papers:

Paper 1: Tracing paper (optional) – tiers 4–6 and 5–7.

Paper 2: Scientific or graphic calculator (essential) – tiers 4–6 and 5–7.
A pair of compasses – tiers 4–6 and 5–7.

Pupils **must not** have access to a calculator during Paper 1.

Timing

Pupils should be given 60 minutes to complete each test. You may indicate to the pupils when they are halfway through the time allowed for the test, and again a few minutes before they have to stop.

Introducing the tests

Test administrators are advised to draw pupils' attention to the 'Remember' section on the front cover of the test booklet, and to the instructions on page 2. Care should be taken when distributing the papers to ensure each pupil is given the correct tier for the test.

Examples of what might be said at the beginning of the tests are given below. Test administrators might find these useful when preparing opening comments for the mathematics tests.

- *This is the year 9 mathematics test Paper 1 [or Paper 2].*
- *The test is one hour long.*
- *For Paper 2, make sure you have the same tier as you had for Paper 1.*
- *Check the list of equipment on the front cover of your paper, to make sure you have what you may need.*
- *Write your name, class and the date on the front of the test paper.*
- *The test starts with easier questions. Try to answer all the questions in the booklet.*
- *Write all your answers and working on the test paper – do not use rough paper. Marks may be awarded for your working even if your answer is wrong.*
- *The number of marks allocated to each part of a question is indicated beside each question. Where two or three marks are available, two or three distinct points are required for a full answer.*
- *Remember to check your work carefully.*
- *I will tell you when you are halfway through the test and also tell you when you are into the last five minutes. I will tell you when the test is over and when to stop writing.*
- *If you have any urgent questions during the test, you should put your hand up and wait for someone to come to you. You must not talk to each other.*
- *You should now open your test booklet. The test has started.*

For Paper 2:

- *You may use a calculator in this test. Make sure you have your calculator and that it is working properly.*

Helping pupils during the tests

Teachers should ensure that pupils are clear about what they have to do but should not provide help with the mathematics being tested. Teachers should not help by explaining specific mathematical terms, nor by interpreting graphs or mathematical tables or diagrams.

If a pupil asks for clarification of a mathematical symbol or notation then the teacher may read it to the pupil but should not indicate the operation or process to be used.

Access arrangements

These tests have been designed to be accessible to the majority of pupils working at the levels that the tests assess. A small number of pupils may require additional arrangements to be made in order for them to access the tests.

For some pupils, for example those who suffer from attention-related difficulties, breaking the tests into shorter sessions may be beneficial. For others, working separately away from the main group with an assistant might aid concentration and more closely resemble their normal working conditions.

If you have chosen to use the year 9 optional test in mathematics with the full cohort, you are free to make adaptations to the tests that will improve their accessibility for pupils with special educational needs and for pupils for whom English is an additional language. In making any changes to the way the tests are used, the focus should be on the assessment needs of the individual pupil. Any adaptations should be similar to those made to the materials which pupils work with in the classroom.

Examples of appropriate adaptations

School-based adaptations to the tests may include:

- allowance of up to 25% additional time
- use of readers, prompters, signers and amanuenses
- provision of tactile shapes and number cards
- use of transcripts and word processors
- separating the tests into sections, taping, photocopying onto coloured paper, use of coloured overlays, use of apparatus
- enhancing the shading on diagrams, including charts and graphs, to increase visual clarity
- enlarging diagrams, cutting them out, embossing or mounting them on card or other material according to normal classroom practice
- translation of words or phrases in the test papers that are likely to prove difficult for pupils for whom English is an additional language, and also if required for pupils who use British sign language (BSL) or other sign-supported communication
- use of bilingual dictionaries.

Access arrangements should not provide an unfair advantage. It is important to ensure that any assistance given does not alter the nature of the test questions, and that any answer given is the pupil's own.

Questions that must not be enlarged:

If your school needs to enlarge questions or parts of questions to meet the specific requirements of individual pupils, and has not ordered the enlarged papers from the modified test agency, the following questions must **not** be enlarged. This is because enlargement may affect the pupils' responses.

Paper 1	4–6	5–7
Paper and cube	9	

Paper 2	4–6	5–7
Rectangle area	20	10
Diagonal	23	13

Modified versions of the tests

Modified large print, enlarged print and braille test papers for visually impaired pupils are available from the QCDA modified test agency. Additional guidance notes for teachers administering the modified versions of the tests are supplied with the test papers.

If you have any questions about ordering the modified tests, contact the QCDA modified optional test agency on: 0300 303 3019.

For further guidance on access arrangements please refer to *Access arrangements for key stage 3 non-statutory tests*, available on the QCDA website at: http://www.qcda.gov.uk/accessarrangements

Marking the tests

The structure of the mark scheme

Pages 11–17 of this booklet contain guidelines on how to mark the tests. This general guidance should be observed unless specific instructions to the contrary are given, and should be read before marking begins. It could form the basis of departmental INSET to ensure standardisation of marking within, and between, schools.

The marking information for questions within the written tests is set out in the form of tables which start on page 18 (Paper 1) and page 42 (Paper 2). The columns on the left-hand side of each table provide a quick reference to the question number, question part and the total number of marks available for that question part. There is also an indication of where it may be necessary to refer to the general guidance.

The **Correct response** column usually includes two types of information:

- a statement of the requirements for the award of each mark, with an indication of whether credit can be given for correct working, and whether the marks are independent or cumulative
- examples of some different types of correct response, including the most common.

The **Additional guidance** column indicates alternative acceptable responses, and provides details of specific types of response that are minimally acceptable or unacceptable. Other guidance, such as when 'follow-through' is allowed, is provided as necessary.

For some graphical and diagrammatical responses, including those in which judgements on accuracy are required, **marking overlays** have been provided as the centre pages of this booklet.

Recording marks on the test paper

All questions, even those not attempted by the pupil, should be marked, with a 1 or a 0 entered in each marking space. Where two marks can be split into one mark gained and one mark lost, with no explicit order, then this should be recorded by the marker as 1
0

The total marks awarded for a double page can be written in the box at the bottom of the right-hand page, enabling the correct total to be more easily transferred to the front of the test paper.

Finding levels

A total of 120 marks is available at each tier (60 from Paper 1 and 60 from Paper 2). The sum of the marks allocated from these two components indicates the level at which the pupil is working.

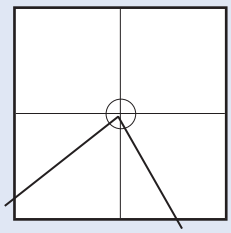
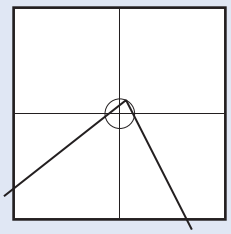
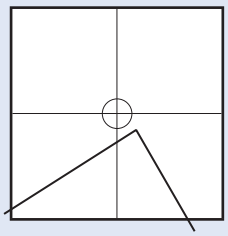
The level thresholds can be found on page 67.

General guidance for marking

Answers that are numerically or algebraically equivalent are acceptable unless the mark scheme states otherwise.

In order to ensure consistency of marking, the most frequent procedural queries are listed on the following two pages with the prescribed correct action. This is followed by further guidance relating specifically to the marking of questions that involve money, negative numbers, time, measures, coordinates, probability or algebra. Unless otherwise specified in the mark schemes, markers should apply the following guidelines in all cases.

What if…	Marking procedure	
The pupil's response is numerically or algebraically equivalent to the answer in the mark scheme.	Markers should award the mark unless the mark scheme states otherwise.	
The pupil's response does not match closely any of the examples given.	Markers should use their judgement in deciding whether the response corresponds with the statement of the requirements given in the 'Correct response' column. Refer also to the 'Additional guidance'.	
The pupil has responded in a non-standard way.	Calculations, formulae and written responses do not have to be set out in any particular format. Pupils may provide evidence in any form as long as its meaning can be understood. Diagrams, symbols or words are acceptable for explanations or for indicating a response. Any correct method of setting out working, however idiosyncratic, should be accepted. Provided there is no ambiguity, condone the continental practice of using a comma for a decimal point.	
There appears to be a misreading affecting the working.	This is when the pupil misreads the information given in the question and uses different information without altering the original intention or difficulty level of the question. For each misread that occurs, deduct one mark only.	
No answer is given in the expected place, but the correct answer is given elsewhere.	Where a pupil has shown understanding of the question, the mark(s) should be given. In particular, where a word or number response is expected, a pupil may meet the requirement by annotating a graph or labelling a diagram elsewhere in the question.	
The final answer is wrong, but the correct answer is shown in the working.	Where appropriate, detailed guidance will be given in the mark scheme and must be adhered to. If no guidance is given, markers will need to examine each case to decide whether:	
	• the incorrect answer is due to a transcription error	If so, award the mark.
	• in questions not testing accuracy, the correct answer has been given but then rounded or truncated	If so, award the mark.
	• the pupil has continued to give redundant extra working which does not contradict work already done	If so, award the mark.
	• the pupil has continued, in the same part of the question, to give redundant extra working which does contradict work already done.	If so, do not award the mark. Where a question part carries more than one mark, only the final mark should be withheld.
The pupil's answer is correct but the wrong working is shown.	A correct response should always be marked as correct unless the mark scheme states otherwise.	

What if…	Marking procedure
The pupil has made a conceptual error.	In some questions, a method mark is available provided the pupil has made a computational, rather than conceptual, error. A computational error is a 'slip' such as writing 4 × 6 = 18 in an otherwise correct long multiplication. A conceptual error is a more serious misunderstanding of the relevant mathematics; when such an error is seen, no method marks may be awarded. Examples of conceptual errors are: • misunderstanding of place value, such as multiplying by 2 rather than 20 when calculating 35 × 27 • subtracting the smaller value from the larger in calculations such as 45 – 26 to give the answer 21 • incorrect signs when working with negative numbers.
The correct response has been crossed or rubbed out and not replaced.	Any legible crossed or rubbed out work that has not been replaced should be marked according to the mark scheme. If the work is replaced, then crossed or rubbed out work should not be considered.
More than one answer is given.	If all answers given are correct, or a correct range is given, the mark should be awarded unless prohibited by the mark scheme. If both correct and incorrect responses are given, no mark should be awarded.
The pupil's answer correctly follows through from earlier incorrect work.	Follow-through marks may be awarded only when specifically stated in the mark scheme, but should not be allowed if the difficulty level of the question has been lowered. Either the correct response or an acceptable follow-through response should be marked as correct.
The answer is correct but, in a later part of the question, the pupil has contradicted this response.	A mark given for one part should not be disallowed for working or answers given in a different part, unless the mark scheme specifically states otherwise.
The pupil's accuracy is marginal according to the overlay provided.	Overlays can never be 100% accurate. However, provided the answer is within or touches the boundaries given, the mark(s) should be awarded.
The pupil has drawn lines which do not meet at the correct point.	Markers should interpret the phrase 'slight inaccuracies in drawing' to mean meeting within or on a circle of radius 2mm with centre at the correct point.  within the circle accepted  on the circle accepted  outside the circle not accepted

Responses involving money

	✓ Accept	✗ Do not accept
Where the £ sign is given *for example:* *£3.20, £7*	✓ £3.20 £7 £7.00 Any unambiguous indication of the correct amount, eg £3.20p £3 20 pence £3 20 £3,20 £3-20 £3:20 320p with £ sign crossed out	✗ Incorrect placement of pounds or pence, eg £320 £320p Incorrect placement of decimal point, or incorrect use or omission of 0, eg £3.2 £3 200 £32 0 £3-2-0
Where the p sign is given *for example:* *40p*	✓ 40p Any unambiguous indication of the correct amount, eg £0.40p £.40p £0.40 with p sign crossed out	✗ Incorrect or ambiguous use of pounds or pence, eg 0.40p £40p
Where no sign is given *for example:* *£3.20, 40p*	✓ £3.20 320p 40p £0.40 Any unambiguous indication of the correct amount in £ or p as shown above At **levels 3 and 4 only** also accept omission of units, eg 3.20 320 40 0.40	✗ Omission of final zero, eg 3.2 0.4

Responses involving negative numbers

	✓ Accept	✗ Do not accept
For example: *–2*		To avoid penalising the error below more than once within each question, do not award the mark for the *first* occurence of the error within each question. Where a question part carries more than one mark, only the final mark should be withheld. ✗ Incorrect notation, eg 2–

Responses involving time

	✓ Accept	✗ Do not accept
A time interval *for example:* *2 hours 30 minutes*	✓ 2 hours 30 minutes Any unambiguous, correct indication, eg $2\frac{1}{2}$ hours 2.5 hours 2h 30 2h 30 min 2 30 Digital electronic time, ie 2:30	✗ Incorrect or ambiguous time interval, eg 2.3 hours 2.3h 2h 3 2.30 min 2.30 2-30 2,30 2.3
A specific time *for example:* *8:40am, 17:20*	✓ 8:40am 8:40 twenty to nine Any unambiguous, correct indication, eg 08.40 8.40 0840 8 40 8-40 8,40 Unambiguous change to 12 or 24 hour clock, eg 17:20 as 5:20pm or 17:20pm	✗ Incorrect time, eg 8.4am 8.40pm Incorrect placement of separators, spaces, etc or incorrect use or omission of 0, eg 840 8:4:0 8.4 084 84

Responses involving measures

	✓ Accept	✗ Do not accept
Where units are given *(eg kg, m, l)* *for example:* *8.6kg*	✓ 8.6kg Any unambiguous indication of the correct measurement, eg 8.60kg 8.6000kg 8kg 600g	✗ Incorrect or ambiguous use of units, eg 8600kg

Note

If a pupil leaves the answer box empty but writes the answer elsewhere on the page, then that answer must be consistent with the units given in the answer box and the conditions listed above.

If a pupil changes the unit given in the answer box, then their answer must be equivalent to the correct answer, using the unit they have chosen, unless otherwise indicated in the mark scheme.

Responses involving coordinates

	✓ Accept	× Do not accept
For example: *(5, 7)*	✓ Unconventional notation, eg (05, 07) (five, seven) $\begin{matrix} x & y \\ (5, & 7) \end{matrix}$ $(x = 5, y = 7)$	× Incorrect or ambiguous notation, eg (7 , 5) $\begin{matrix} y & x \\ (7, & 5) \end{matrix}$ $(5x , 7y)$ $(5^x , 7^y)$ $(x - 5, y - 7)$

Responses involving probability

	✓ Accept	! Take care × Do not accept
A numerical probability should be expressed as a decimal, fraction or percentage only. *for example:* *0.7* $\frac{7}{10}$ *70%*	✓ Equivalent decimals, fractions and percentages, eg 0.700 $\frac{70}{100}$ $\frac{35}{50}$ 70.0%	The first **four** categories of error below should be ignored if accompanied by an acceptable response, but should not be accepted on their own. However, to avoid penalising the first **three** types of error below more than once within each question, do not award the mark for the *first* occurrence of each type of error unaccompanied by an acceptable response. Where a question part carries more than one mark, only the final mark should be withheld.
	✓ A probability correctly expressed in one acceptable form which is then incorrectly converted, but is still less than 1 and greater than 0, eg $\frac{70}{100} = \frac{18}{25}$	! A probability that is incorrectly expressed, eg 7 in 10 7 over 10 7 out of 10 7 from 10 ! A probability expressed as a percentage without a percentage sign. ! A fraction with other than integers in the numerator and/or denominator. ! A probability expressed as a ratio, eg 7:10 7:3 7 to 10 × A probability greater than 1 or less than 0

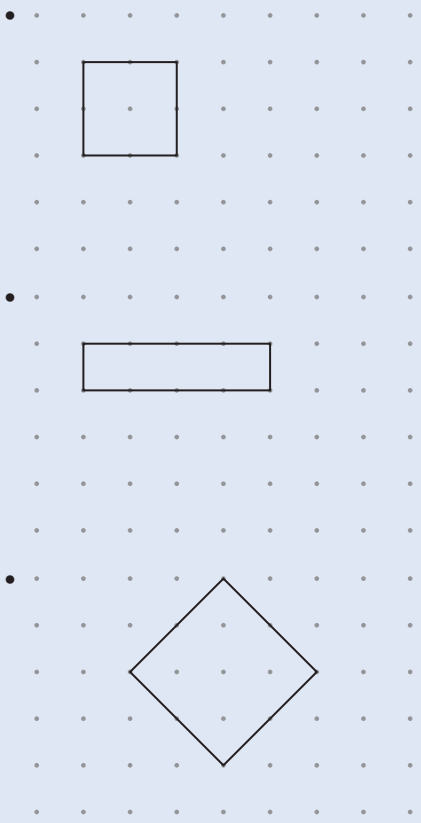
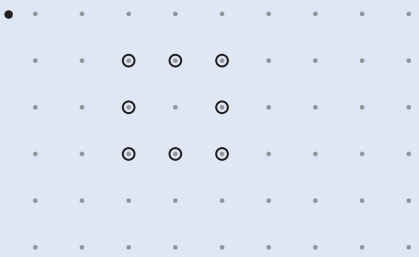
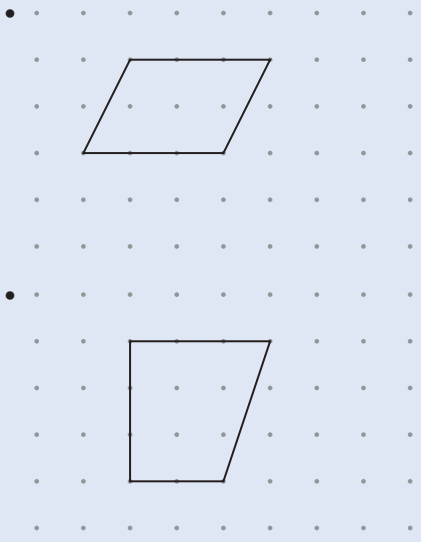
Responses involving the use of algebra

	✓ Accept	! Take care ✖ Do not accept
For example: $2 + n$ $n + 2$ $2n$ $\frac{n}{2}$ n^2	✓ Unambiguous use of a different case or variable, eg N used for n x used for n	! Unconventional notation, eg $n \times 2$, or $2 \times n$, or $n2$ or $n + n$ for $2n$ $n \times n$ for n^2 $n \div 2$ for $\frac{n}{2}$ or $\frac{1}{2}n$ $2 + 1n$ for $2 + n$ $2 + 0n$ for 2 Within a question that demands simplification, do not accept as part of a final answer involving algebra. Accept within a method when awarding partial credit, or within an explanation or general working. ✖ Embedded values given when solving equations, eg in solving $3x + 2 = 32$, $3 \times 10 + 2 = 32$ for $x = 10$ To avoid penalising the two types of error below more than once within each question, do not award the mark for the *first* occurrence of each type within each question. Where a question part carries more than one mark, only the final mark should be withheld.
	✓ Words used to precede or follow equations or expressions, eg $t = n + 2$ tiles or tiles = $t = n + 2$ for $t = n + 2$	! Words or units used within equations or expressions, eg n tiles + 2 n cm + 2 Do not accept on their own. Ignore if accompanying an acceptable response.
	✓ Unambiguous letters used to indicate expressions, eg $t = n + 2$ for $n + 2$	✖ Ambiguous letters used to indicate expressions, eg $n = n + 2$ for $n + 2$

Mark scheme for Paper 1

Tier & Question				Interpreting
4–6	5–7			
1		Mark	Correct response	Additional guidance
		1m	Gives a correct interpretation eg • Girls with blue eyes • Girls that do not have brown eyes	
		1m	Gives a correct interpretation eg • Girls in total • Girls with brown eyes and blue eyes • Girls • That are not boys • 15 girls, 7 with brown eyes and 8 with blue	× ***Reference to girls omitted*** eg • Brown eyes and blue eyes ! ***Reference only to component parts*** Condone eg • 7 girls with brown eyes and 8 with blue (no linking to 15)
		1m	Gives a correct interpretation eg • Pupils altogether • Girls and boys • Boys and girls with brown eyes and boys and girls with blue eyes • Children	✓ ***Reference to boys and/or girls omitted*** eg • Altogether • All of them • Brown eyes and blue eyes

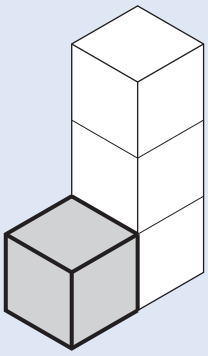
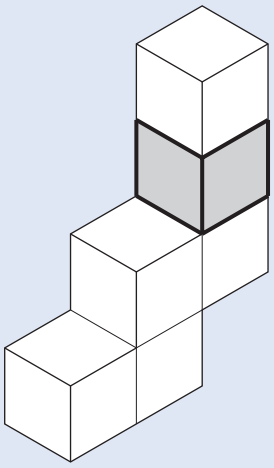
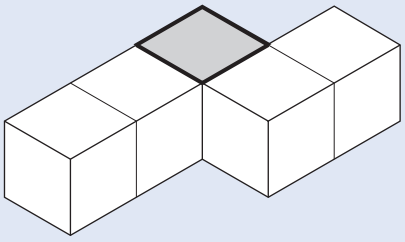
Properties of shapes

Tier & Question		Mark	Correct response	Additional guidance
4–6	5–7			
2				
a		1m	Draws a square or a rectangle, using the dots on the grid eg 	! ***Lines not ruled*** Accept provided the pupil's intention is clear ! ***Lines not accurate*** Accept vertices within 2mm of the dots of the grid ! ***Internal lines drawn*** Ignore × ***Sides not drawn*** eg  × ***Vertices not using dots***
b		1m	Draws any four-sided shape that is not a square or a rectangle, using the dots on the grid eg 	

Section A: Mark scheme for Paper 1

Tier & Question 4–6	5–7	Mark	Correct response	Which one? Additional guidance
3		1m	Indicates 30g, ie • ☐ ☐ ☑ ☐	✓ *Unambiguous indication*
		1m	Indicates 1 litre, ie • ☑ ☐ ☐ ☐	
		1m	Indicates 200 cm, ie • ☐ ☑ ☐ ☐	

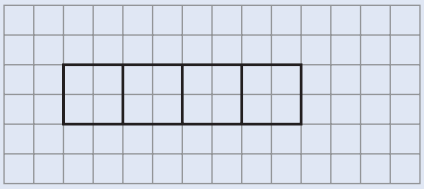
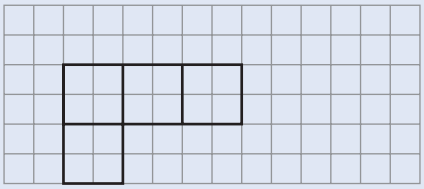
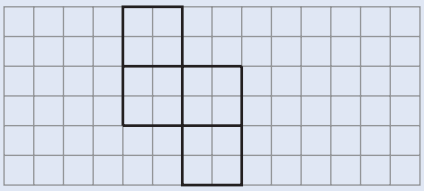
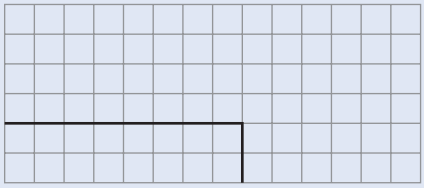
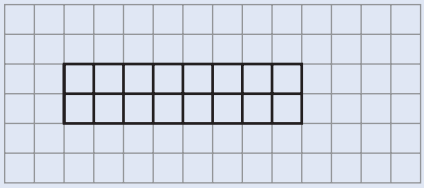
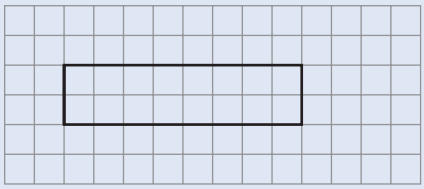
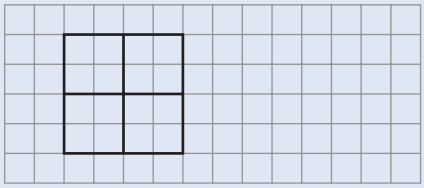
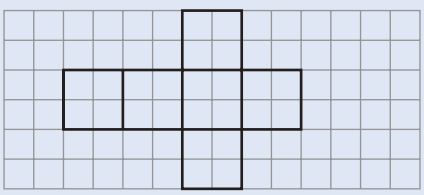
Tier & Question 4–6	5–7	Mark	Correct response	Find the ways Additional guidance
4		1m	30	! *Operation repeated* Condone eg, for the first mark accept • + 30
		1m	4	
		1m	2	
		1m	20	

Tier & Question				Pairs of cubes
4–6	5–7	Mark	Correct response	Additional guidance
5		1m	Shades the three visible faces of the correct cube, ie 	✓ *Unambiguous indication of correct faces* × *For the first and second marks, all of the visible faces of the correct cube not indicated*
		1m	Shades the two visible faces of the correct cube, ie 	
		1m	Shades the one visible face of the correct cube, ie 	

Tier & Question 4–6	Tier & Question 5–7	Tennis court		
6		Mark	Correct response	Additional guidance
		2m	Gives a whole number in the range 650 to 750 inclusive eg • 700 • About 750 • Approximately 650	! ***Range given*** Accept provided all values are between 650 and 750 inclusive eg • 650 to 750 • About 720–730 • 680 or 690
		or		
		1m	Gives a value of 350 to 450 associated with the larger bank of seats or a value of 75 to 125 associated with the smaller eg • 200 + 400 + 100 • 120 (written on smaller bank)	

Tier & Question 4–6	Tier & Question 5–7	Write numbers		
7		Mark	Correct response	Additional guidance
		1m	Writes three correct numbers eg • 10 × 10 – 20 • 9 × 11 – 19 • 8 × 10 – 0 • 8 × 5 – –40	× ***One or more boxes left empty***
		1m	Writes three correct numbers eg • 100 × 10 – 200 • 20 × 45 – 100 • 11 × 80 – 80	

Tier & Question 4–6	Tier & Question 5–7	Number lines		
8		Mark	Correct response	Additional guidance
		1m	Indicates the correct number eg • 2 • 2.0	
		1m	Indicates the correct number eg • 0.65 • 0.650 • $\frac{65}{100}$	

Tier & Question		Paper and cube		
4–6	5–7			
9		Mark	Correct response	Additional guidance
		2m	Completes the drawing to show four squares that cover four faces of the cube eg •  •  • 	! *Lines not ruled or accurate* Accept provided the pupil's intention is clear ! *Edge(s) of grid used as edge(s) of shape* eg •  Condone ✓ *Extra internal lines drawn* eg •  ✓ *Internal lines omitted* eg •  × *Incorrect strip* eg • 
		or 1m	Draws the complete net of the cube eg • 	

Section A: Mark scheme for Paper 1

Time differences

Tier & Question 4–6 10	Tier & Question 5–7 1	Mark	Correct response	Additional guidance
a	a	1m	6	! *–6* Condone
b	b	1m	Indicates, in either order Hong Kong and San Juan or Dhaka and Chicago or Dubai and Los Angeles	✓ ***Unambiguous indication*** eg • HK and SJ • Dh and C • Du and LA • Du and Los • Pairs of cities shown on the table ! ***Ambiguous indication*** eg • D (could be Dhaka or Dubai) • H (could be Hong Kong or Harare) • L (could be Los Angeles or London) Penalise only the first occurrence ! ***Numbers used*** eg • –8 and 4 (for LA and Dubai) Penalise only the first occurrence
c	c	1m	Indicates one of the pairs of cities above that has not already been credited	

Dice

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
11	2	**2m**	States or implies that the probabilities for A and C are $\frac{1}{6}$ and that the probability for B is different or unknown eg • Dice A: The probability is $\frac{1}{6}$ Dice B: You would need to do an experiment Dice C: It's the same as A • Dice A: It looks like probability is $\frac{1}{6}$ assuming they are fair dice Dice B: I would guess that the probability is more Dice C: It's $\frac{1}{6}$ if it is fair	✓ ***Explanations do not refer to 'probability'*** eg, accept • Dice A: $\frac{1}{6}$ Dice B: Don't know Dice C: $\frac{1}{6}$ ✓ ***Probability for B quantified*** Condone eg, accept • Dice A: $\frac{1}{6}$ Dice B: $\frac{1}{12}$ Dice C: $\frac{1}{6}$
		or		
		1m	States or implies that the probabilities for A and C are $\frac{1}{6}$ and does not comment on Dice B eg • Dice A: The probability is $\frac{1}{6}$ Dice B: Dice C: It's the same as A or States or implies that the probabilities for A and C are the same and the probability for B is different or unknown eg • Dice A: The probability is the same as C Dice B: You can't be sure Dice C: It's the same as A	✗ ***Probability incorrectly expressed*** Do not accept for 2m ! ***Probability incorrectly expressed*** For 1m condone provided equality is implied eg, accept • Dice A: The probability is 1 in 6 Dice B: You can't be sure Dice C: It's the same as A ! ***Likelihood expressed in words*** For 1m, accept as implying equality eg, accept • Dice A: It's unlikely Dice B: Likely Dice C: It's unlikely

Thinking a b

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
12	3	**1m**	Gives both correct values, ie $a = 6$ $b = 4$	

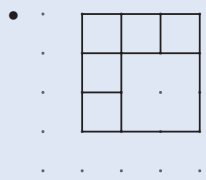
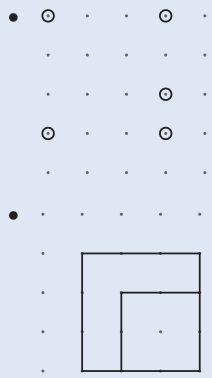
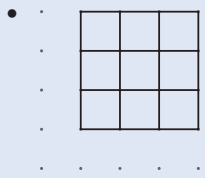
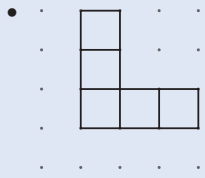
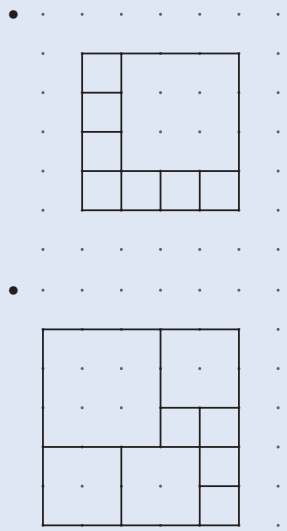
Regular polygons

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
13	4	**1m**	48	
		1m	7	
		1m	Pentagon	

Barcelona

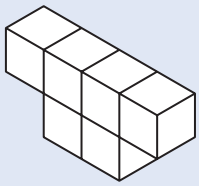
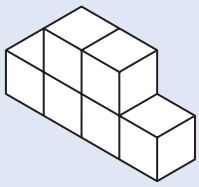
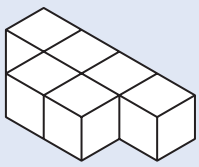
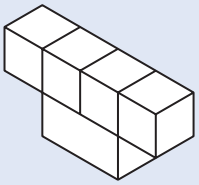
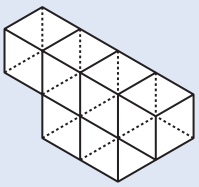
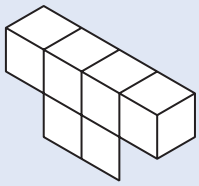
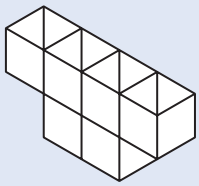
Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
14	**5**			
a	a	**1m**	June and July (in either order)	✓ ***Unambiguous indication***
b	b	**1m**	Makes a correct statement about temperature and rainfall eg • They have similar temperatures but different amounts of rain • It is drier in May but just as warm • May rain 55 and temperature 21 October rain 85 and temperature 21	! ***Inaccurate reading of graph*** Condone within a correct explanation eg, accept • In both months the temperature is 20 but the rainfall is 50 in May and 90 in October
	c	**1m**	States or implies that different things are being measured eg • They are both 21 but one is rainfall and the other is temperature • The numbers are the same but they are different things • Rainfall is in mm and temperature is in °C	✓ ***Minimally acceptable explanation*** eg • Different things

Dividing square

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
	a	**2m**	Draws a 3 × 3 square split into 6 smaller squares using the dots of the grid eg 	✓ ***Diagram in any orientation*** ! ***Lines not ruled or accurate*** Accept slight inaccuracies in drawing provided there is an intention to draw straight sides
		or **1m**	Indicates dots which would be all the vertices of the 3 × 3 square and two vertices of the 2 × 2 square even if no lines are drawn eg 	× ***Additional incorrect vertices shown*** eg  × ***One vertex of 3 × 3 square missing*** eg 
	b	**2m**	Draws a 4 × 4 or 5 × 5 square split into 8 smaller squares using the dots of the grid eg 	✓ ***Diagram in any orientation*** ! ***Lines not ruled or accurate*** Accept slight inaccuracies in drawing provided there is an intention to draw straight sides
		or **1m**	Draws a sketch diagram showing how to split a large square into 8 smaller squares but does not use the dots of the grid, or uses them inaccurately, or uses them accurately but omits one vertex	

Cards for fractions

Tier & Question 4–6 16	Tier & Question 5–7 7	Mark	Correct response	Additional guidance
a	a	1m	$\frac{2}{15}$	
b	b	2m	Gives a pair of equivalent fractions which use 5, 15 and one of 2, 7 or 11 eg • $\frac{2}{5}$ and $\frac{6}{15}$ • $\frac{5}{15}$ and $\frac{2}{6}$ • $\frac{11}{5}$ and $\frac{33}{15}$	
		or 1m	Gives a pair of equivalent fractions which use two of 2, 5, 7, 11 and 15 eg • $\frac{5}{15}$ and $\frac{1}{3}$ • $\frac{2}{10}$ and $\frac{11}{55}$ • $\frac{1}{7}$ and $\frac{15}{105}$	

Tier & Question			Solid fit	
4–6	5–7			
17	**8**	**Mark**	**Correct response**	**Additional guidance**
		2m	Uses the isometric grid to draw the correct shape in any orientation eg •  •  • 	✓ ***For 2m or 1m, internal lines omitted*** eg, for 2m accept •  ! ***Lines not ruled*** Accept provided the pupil's intention is clear ! ***Lines not accurate*** Accept vertices within 2 mm of the dots of the grid ! ***Hidden lines shown*** For 2m, accept provided they are clearly indicated as hidden lines eg, for 2m accept • 
		or **1m**	In an otherwise correct shape the only error is to omit some external lines or to show some hidden lines eg •  • 	

Win or lose

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
18	9	1m	Indicates Win and gives a correct explanation eg • $\frac{7}{12} > \frac{1}{2}$ • The numerator is more than half of the denominator • Six out of 12 is half, and this is more • 6 is half of 12 and 7 > 6 • The probability of losing is $\frac{5}{12}$ therefore he is more likely to win • $\frac{7}{12} > \frac{5}{12}$	✓ ***Minimally acceptable explanation*** eg • Half of 12 is 6 • 7 is over half way • It's over half • 7 is more than half • More than a half chance • Because 7 is only 5 away from 12 • 7 > 6 • 7 > 5 • Losing is $\frac{5}{12}$ • An even chance is $\frac{6}{12}$ ✗ ***Incomplete or incorrect explanation*** eg • He's more likely to win • The number at the top is lower than at the bottom • 7 is 5 away from 12 • 7 is close to 12 • It is over 6 • He has more than half % probability to win

Tier & Question				
4–6	5–7			**Ticket price**
19	**10**	**Mark**	**Correct response**	**Additional guidance**
		2m	Gives both correct prices eg One adult: £5 One child: £3.50	✓ ***Unambiguous indication***
				✗ ***For 2m, incorrect or ambiguous indication of the cost of the tickets*** eg • C = 3.5, A = 5
				! ***Money*** See general guidance on page 14
		or **1m**	Gives one correct price eg • Child (£) 3.5(0) • Adult (£) 5	
			or	
			Shows a complete correct method with not more than one computational error eg • 20.5 − 17 = *2.5 (error)* 2.5 × 2 = 5 17 − 5 = 12 12 ÷ 2 = 6	✗ ***Method does not show the calculation of the child ticket***
			or	
			Forms two correct equations eg • $2a + 3c = 20.5$ $2a + 2c = 17$	

Tests

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
20	11			
a	a	1m	(Student) G	✓ *Unambiguous indication*
b	b	2m	32, 33, 34, 35 or 36 or A range that uses two of these values eg • 33 – 34 • 32 to 36	✗ *Decimal number* For 2m, the answer must be a whole number
		or 1m	31 or 37 or A decimal number between 32 and 36	✓ *For 1m range given* eg • 31 – 35 • 36 – 37

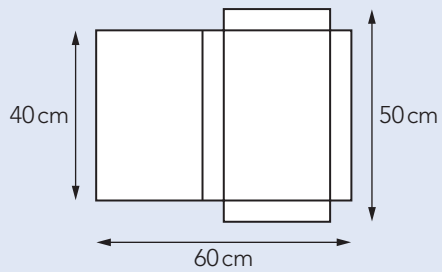
Triangle two

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
21	12			
		1m	Indicates Yes and gives a correct explanation eg • $6 \times 3 \div 2 = 3 \times 6 \div 2$ • If you turn the second one round they have the same base and the same height • They are both 9 • Both are half a 6 by 3 rectangle • Completes 6 by 3 rectangles and indicates that $\frac{1}{2}$ is shaded in both	✓ *Minimally acceptable explanation* eg • 9 • They both have the same number of squares ✗ *Incomplete or incorrect explanation* eg • I counted • They both have 12 squares • They are both 6 by 3

Glass bottles

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
22	13	**2m**	24	
		or		
		1m	Shows both × 60 and ÷ 25, or equivalent operations eg • 10 ÷ 5 × 12 or Method uses repeated addition with only one computational error eg • 1 = 25, 2 = 50, 3 = 1 hr 15, 4 = 1 hr 40, 5 = *2 hr 15 (error)*, 10 = 4 hr 30, 20 = 9 hrs, 22 = 9 hrs 50 Answer = 22 bottles	✗ ***Use of 1hr = 100 min*** eg • 1 = 25, 2 = 50, 3= 75, 4 = 1hr 10 × 4 = 40 bottles

Wrapping

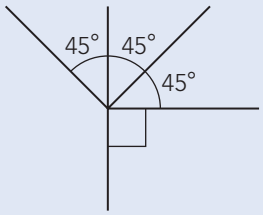
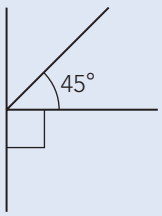
Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
23	14	**3m**	Gives an answer which is 45 cm or more and less than 60 cm eg • 50 (cm) • 45 or 46 (cm)	✓ ***Throughout the question units omitted***
		or		
		2m	Gives an answer which is 60 (cm) or more and less than 70 (cm) (wrapping the wrong way round)	
		or		
		1m	Draws or sketches a correct net of the box labelled with some measurements eg • 	

Tier & Question				Adults studying
4–6	5–7			
24	**15**	**Mark**	**Correct response**	**Additional guidance**
		1m	Gives a correct explanation eg • If you add the different values you will get more than 100% so some people must have said that they used more than one way • The percentages sum to more than 100 • The first two are nearly 50% each, but there is only 100% altogether so some adults do two or more	✓ ***Minimally acceptable explanation*** eg • More than 100 • 48 + 46 + 30 > 100 ! ***Explanation uses the total percentage*** Do not accept a total of more than 200% eg • The percentages add up to 229 which is more than 100 ✗ ***Incomplete or incorrect explanation*** eg • The percentages do not add up to 100 • 48 + 46 + 30 = *114 (error)* which is more than 100

Coins and probability

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
25	16	**2m**	Indicates Both equally likely and gives a correct explanation eg • Anna has 20p, 10p Her probability is $\frac{1}{2}$ Tom has 10p, 10p, 5p, 5p His probability is $\frac{2}{4} = \frac{1}{2}$ • Tom has two 10p coins and two other coins Anna has one 10p coin and one other Both have a half chance of choosing a 10p coin • For Tom the ratio of 10p coins to other coins is 2 : 2 = 1 : 1 For Anna the ratio is also 1 : 1 • For Tom, the ratio of total coins to 10p coins is 4 : 2 For Anna, the ratio of total coins to 10p coins is 2 : 1 4 : 2 = 2 : 1	✓ ***Minimally acceptable explanation*** eg • 20, 10 and 10, 10, 5, 5 1 in 2, 2 out of 4 (condone notation given context) • Tom 2 × 10p Anna 1 × 10p $\frac{1}{2}$ • Tom = 2 : 2 Anna = 1 : 1 • He 4 : 2 She 2 : 1 × ***For 2m, incomplete or incorrect explanation*** eg • Both half • She has 20 and 10 He has 10, 10, *20 (error)*, 5 Both half
		or		
		1m	Incorrect or no box ticked but gives a correct explanation or For both Tom and Anna, gives the correct coins eg • Anna has 20p, 10p Tom has 10p, 10p, 5p, 5p or For Anna or for Tom, gives the correct probability and the correct number of 10p coins eg • Tom 10, 10, 5, 5 $\frac{1}{2}$ • Tom has 2 × 10p coins and 2 other coins Half chance • Anna has one 10p coin and 1 other coin Probability = 0.5 or Gives the correct probability or the correct ratio of 10p coins to other coins and indicates that this applies to both Tom and Anna eg • Both have a half chance of choosing a 10p coin • The ratio of 10p coins to other coins is 1 : 1 (with 'both equally likely' ticked)	✓ ***Minimally acceptable explanation*** eg • Anna = 20, 10 Tom = 10, 10, 5, 5 ✓ ***Minimally acceptable explanation*** eg • Tom has 2 × 10p Half • Anna has one 10p 0.5 ✓ ***Minimally acceptable explanation*** eg • Half (with 'both equally likely' ticked) • Both 1 : 1

Tile design

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
a	a	1m	Gives a correct response eg • 360 − 90 = 270, 270 ÷ 2 = 135 • 135 + 135 + 90 = 360 • 	✓ ***Minimally acceptable explanation*** eg • Half of 270 • 90 + 45 • 180 − 45 • 135 + 45 = 180 • $\frac{3}{4}$ of 180 •  × ***Incomplete explanation*** eg • It is halfway between 90° and 180°
b	b	1m	Gives a correct ratio eg • 1 : 3 • 2 : 6	

Passing through

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
a	a	1m	E and writes the correct ordinate for their chosen line eg • A goes through (0, −1) • B goes through (0, 1) • C goes through (0, −2) • D goes through (0, 2)	✓ ***Unambiguous indication*** eg • E circled • $y = x$! ***Incorrect algebra used within unambiguous indication*** Penalise only the first occurrence eg, for part (a) • Straight line $x - 1$ goes through $(0, -1)$ eg, for part (b) • Straight line $x + 1$ goes through $(-1, 0)$
b	b	1m	Writes the correct ordinate for their chosen line eg • A goes through (1, 0) • B goes through (−1, 0) • C goes through (2, 0) • D goes through (−2, 0)	! ***The same straight line chosen for part (b) as in part (a)*** Condone × ***Line E chosen for part (b)***

Tier & Question 4–6	5–7	Mark	Correct response	Additional guidance
	19			***n*th term**
		1m	Completes the *n*th term for sequence B, ie $22 - 2n$	! ***Algebra*** See general guidance on page 17 ✓ $22 - 2 \times n$
		1m	Gives all three correct terms, ie 14, 8, 2	

Tier & Question 4–6	5–7	Mark	Correct response	Additional guidance
	20			**Losing phones**
		1m	Completes the first sentence correctly using 20,000 or 18,000 or 19,000 or 18,500 or 18,400 or 18,490 or 18,495 or 18,494 eg • 18,500 taxis	
		1m	Completes the second sentence correctly eg • 1 device was left per 3 taxis • $\frac{1}{3}$ of them had another device	! ***Explanation not precise*** Condone use of laptop etc instead of other device and use of 30% instead of $\frac{1}{3}$ eg, accept • 1 laptop was left per 3 taxis • $\frac{1}{3}$ of them had an mp3 • 30% had another device × ***Explanation uses fractions of a device*** eg • 0.33 laptops per taxi

Tier & Question 4–6	5–7	Mark	Correct response	Additional guidance
	21			**Enlarging round**
		1m	For B to C, centre (7, 0)	
		1m	For C to A, centre (3, 10)	✓ ***Gives an answer of (7, 12.(...))***
		1m	For C to A, scale factor $\pm\frac{1}{4}$ or equivalent	× ***$-\frac{1}{4}$ with (3, 10) as centre of enlargement***

Journey

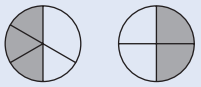
Tier & Question 4–6	5–7	Mark	Correct response	Additional guidance
	22		Indicates graph B (Please note that this answer is not credited)	! ***Incorrect or no letter ticked*** Ignore responses, since the requirement to tick is there only to support thinking
		1m	Chooses graph A as not representing a journey and gives a correct reason eg • The vertical line represents travelling a distance in no time which is not possible • You can't go about half the distance in 0 seconds	✓ ***Minimally acceptable reason*** eg for graph A • It travels distance without time changing • You can't go 10 miles in 0 seconds • Time has stopped
			or	✗ ***Incomplete or incorrect reason*** eg for graph A • It travels up without time changing • You can't have vertical lines on distance-time graphs • Hills are not that steep • The vertical line means he wasn't going at a constant speed
			Chooses graph C as not representing a journey and gives a correct reason eg • It would mean you are going backwards in time which is not possible • You cannot be in two places at once	✓ ***Minimally acceptable reason*** eg for graph C • It goes backwards in time ✗ ***Incomplete or incorrect reason*** eg for graph C • You can't double back like that
		1m	Chooses a different graph from the one previously chosen, and gives a correct reason	

Percentage up and down

Tier & Question 4–6	5–7	Mark	Correct response	Additional guidance
	23	**1m**	250	! ***Percentage sign included in their answer(s)*** Condone
		1m	60	

Sunflowers

Tier & Question 4–6	5–7	Mark	Correct response	Additional guidance
	a	**1m**	181 cm	
	b	**1m**	24 %	! ***Percentage sign repeated*** Ignore

Tier & Question				**Which is greater?**
4–6	5–7 **25**	**Mark**	**Correct response**	**Additional guidance**
	a	**1m**	Indicates Both the same and gives a correct explanation eg • $\frac{2}{3} \times \frac{3}{4} = \frac{1}{2} = \frac{3}{4} \times \frac{2}{3}$ • 'Of' means multiply and multiplication is commutative, ie $\frac{2}{3} \times \frac{3}{4} = \frac{3}{4} \times \frac{2}{3}$	✓ ***Minimally acceptable explanation*** eg • Both half • It's multiplication so order doesn't matter • $\frac{2}{3}$ of $\frac{3}{4}$ of 12 = 6; $\frac{3}{4}$ of $\frac{2}{3}$ of 12 = 6 ✓ ***Diagrammatical solution***  $\frac{3}{4}$ of $\frac{2}{3}$ $\frac{2}{3}$ of $\frac{3}{4}$ × ***Incomplete explanation*** eg • Same numbers
	b	**2m**	Indicates $\frac{3}{4} \div \frac{2}{3}$ and gives a correct explanation The most common correct explanations: Use formal fraction manipulation eg • $\frac{2}{3} \div \frac{3}{4} = \frac{2}{3} \times \frac{4}{3} = \frac{8}{9}$ $\frac{3}{4} \div \frac{2}{3} = \frac{3}{4} \times \frac{3}{2} = \frac{9}{8}$ $\frac{9}{8} > \frac{8}{9}$ Use informal reasoning eg • $\frac{2}{3} \div \frac{3}{4} < 1$ since $\frac{3}{4} > \frac{2}{3}$ but $\frac{3}{4} \div \frac{2}{3} > 1$ since $\frac{2}{3} < \frac{3}{4}$ • $\frac{2}{3} \div \frac{3}{4} = \frac{8}{12} \div \frac{9}{12}$ $\frac{3}{4} \div \frac{2}{3} = \frac{9}{12} \div \frac{8}{12}$ $8 \div 9 < 9 \div 8$ • 0.6666… ÷ 0.75 0.75 ÷ 0.6666… the first is dividing by more than itself, which produces a lower number than the second	✓ ***Minimally acceptable explanation*** eg • $\frac{9}{8}$ and $\frac{8}{9}$ seen • $\frac{3}{4}$ is bigger than $\frac{2}{3}$ so the first is < 1 and the second is > 1 • $\frac{9}{8}$ and reasoning why $\frac{2}{3} \div \frac{3}{4} < 1$ • $\frac{8}{9}$ and reasoning why $\frac{3}{4} \div \frac{2}{3} > 1$! ***Decimal truncated*** eg • 0.6 ÷ 0.75 • 0.75 ÷ 0.6 Condone provided general reasoning is given
		or **1m**	Shows $\frac{9}{8}$ or $\frac{8}{9}$ with no evidence of an incorrect division or Shows a correct method with not more than one computational error	× ***Incorrect division seen or implied*** eg • $\frac{3}{2} \times \frac{3}{4} = \frac{9}{8}$ • $\frac{4}{3} \times \frac{2}{3} = \frac{8}{9}$

Area triangle

Tier & Question 4–6	5–7	Mark	Correct response	Additional guidance
	26	**2m** *or* **1m**	Gives the correct area, ie 16 Shows a correct method eg • $\frac{8 \times 4}{2}$ • 8×2 • $\frac{8 \times 10}{2} - \frac{8 \times 6}{2}$ • $80 - 48$, then half	

Odd or even?

Tier & Question 4–6	5–7	Mark	Correct response	Additional guidance
	27	**2m**	Gives all four correct decisions, ie ☑ ☐ ☐ ☑ ☐ ☑ ☑ ☐	
		or **1m**	Gives any three correct decisions	

Index to mark scheme for Paper 1

Mark scheme for Paper 2

Tier & Question				Order matters
4–6	5–7			
1		Mark	Correct response	Additional guidance
		2m	Gives only the three correct values, in any order eg • 794 947 974	! ***Correct values repeated*** Condone eg, for 2m accept • 794 947 974 947 eg, for 1m accept • 947 974 947
		or		
		1m	Gives any two correct values with no incorrect or Gives all three correct values with not more than one incorrect	× ***Three correct values with more than one incorrect*** eg • 947 *749 (error)* 974 794 *749 (error)*

Tier & Question		Pentagons or not		
4–6	5–7			
2		Mark	Correct response	Additional guidance
a		1m	Indicates Yes and gives a correct explanation eg • Both shapes have 5 sides	✓ ***Minimally acceptable explanation*** eg • 5 • 5 angles • 5 points ✓ ***Explanation refers generally to the number of sides without specifically giving the number 5*** eg • I counted the number of sides • Same number of sides ✗ ***Incomplete explanation*** eg • Same sides
b		1m	Indicates No and gives a correct explanation eg • The first is regular as it has equal length sides and equal sized angles but the second doesn't • The second shape has different length sides • The angles in the second shape are not all the same • The first shape has lines of symmetry but the second one does not • They might both not be regular, the first looks as if it is but you don't know for sure that it has equal sides	✓ ***Correct explanation given in part (a)*** eg • Both are pentagons because they have 5 sides but the second is irregular ✓ ***Minimally acceptable explanation*** eg • Not all sides the same • Different angles • The first one is • Second isn't shaped like one • One shape has equal sides • One shape has no symmetry • They do not have the same amount of symmetry ✗ ***Incomplete or incorrect explanation*** eg • Not the same • The shapes are different • One of them isn't shaped like one • No angles are the same • Equal sides • The first one is but the second one is not the correct shape for a pentagon ✗ ***Explanation implies 'regular' means 'ordinary' or 'usual' or 'normal'*** eg • You don't see the second shape very often

Tier & Question					Multiple coins
4–6	5–7	Mark	Correct response	Additional guidance	
3					
		2m	Gives all five correct ways, in any order eg	✓ ***Unambiguous indication***	

-

8	0
6	1
4	2
2	3
0	4

-

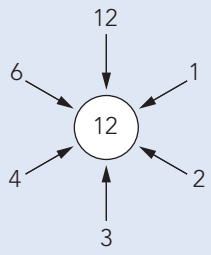
6	1
2	3
4	2
8	
	4

		or			
		1m	Indicates at least three correct ways, even if there is duplication or omission or Indicates all five ways using the total values of the coins rather than the number of coins eg		

-

80	0
60	20
40	40
20	60
0	80

Factor

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
4		**2m**	Shows all six factors of 12, in any order eg •  	✓ ***Answer not given in diagrammatic form*** eg • 1 × 12, 2 × 6, 3 × 4 Condone ! ***Factors repeated*** Ignore
		or **1m**	Shows at least four correct factors one of which must be either 3 or 4, with no incorrect factors or Shows all the correct factors, with not more than two incorrect factors	

UK rivers

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
5				
a		**1m**	3	✓ ***Unambiguous indication***
b		**1m**	1000	✓ ***Answer in words***

Family flights

Tier & Question 4–6	5–7	Mark	Correct response	Additional guidance
6		**2m** ***or*** **1m**	Shows the total cost of flights through QP Airlines, ie £744 Shows or implies the cost of flights through QP Airlines for children aged 1 to 12, or children under 1 eg • 120 seen • 240 + 240 + 240 + (a value that clearly represents 10% of 240) • 24 seen as part of a calculation for QP Airlines	
		1m	Shows the total cost of flights through Budget Air, ie £784	

High tide

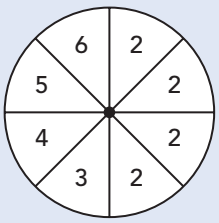
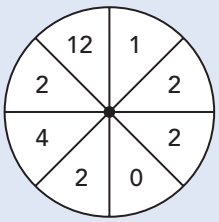
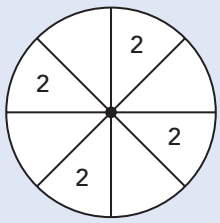
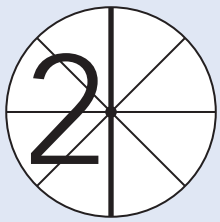
Tier & Question 4–6	5–7	Mark	Correct response	Additional guidance
7 a		**1m**	11:30	✓ ***Indication of am repeated*** eg • 11:30am ✗ ***Incorrect time*** eg • 11:30pm • 23:30
b		**1m**	5th (September)	✓ ***Unambiguous indication*** eg, for part (b) • 5 ! ***Incorrect month given*** Ignore
c		**1m**	3rd (September)	

Tier & Question				More perimeters
4–6	5–7	Mark	Correct response	Additional guidance
8				
		1m	50	
		1m	34	

Tier & Question				Fifty percent
4–6	5–7	Mark	Correct response	Additional guidance
9				
		1m	Gives a correct explanation eg • It means a half • 50% = $\frac{1}{2}$ • It's the same as 0.5	✓ ***Minimally acceptable explanation*** eg • $\frac{1}{2}$ • It's 50:50 • Half • 50 per 100 • 50% means 50 out of 100 ! ***Context given*** Condone eg, accept • $\frac{1}{2}$ price • Half agree • If there are 100 people then 50 want a new hospital • 50% of 20 is 10 ! ***More than one statement given*** Accept provided at least one of the statements is correct and none are incorrect ✗ ***Incorrect or incomplete statement*** eg • 50% means it is half of 100 • 50% is half of 100% • 50% means 50 per cent

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Fruit Additional guidance
10		**1m**	Gives the correct change for 1 orange and 1 apple, ie 24p	
		3m	Gives four more distinct pairs of fruits, together with the correct change for each	✓ ***Cost of 1 banana = 15p and/or Cost of 1 satsuma = 24p*** *A complete list of the remaining pairs is as follows (figures in brackets use 15p for a banana and/or 24p for a satsuma)* 1 peach and 1 apple: 1p 1 peach and 1 banana: 17p (16p) 1 orange and 1 banana: 40p (39p) 1 apple and 1 banana: 36p (35p) 1 peach and 1 satsuma: 6p (7p) 1 orange and 1 satsuma: 29p (30p) 1 apple and 1 satsuma: 25p (26p) 1 banana and 1 satsuma: 41p (40p, 42p)
		or		
		2m	Gives three more distinct pairs of fruits, together with the correct change for each or Gives the correct change for one pair including a satsuma and one pair including a banana eg • 1 orange and 1 banana: 40p (39p) and 1 peach and 1 satsuma: 6p (7p) • 1 banana and 1 satsuma: 41p (40p or 42p)	! ***Incorrect value (including decimals) used for the price of 1 banana or 1 satsuma*** *Penalise only the first occurrence of each* *eg accept for 2 marks* • 1 peach and 1 apple: 1p 1 peach and 1 banana: *15p (error)* 1 orange and 1 banana: 38p 1 apple and 1 banana: 34p
		or		
		1m	Shows or implies the correct cost (a whole number of pence) of 1 apple (30p), 1 banana (14p or 15p) and 1 satsuma (25p or 24p) or Gives the correct change for 1 peach and 1 apple, and one other pair eg • 1 peach and 1 apple: 1p and 1 apple and 1 banana: 36p (35p)	

Spinning

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
a	a	1m	C	! *Spinners identified using probabilities* ie $\frac{1}{3}$ for part (a) and $\frac{1}{4}$ for part (b) Mark as 0, 1
b	b	1m	B	
c	c	1m	Shows or implies that 4 of the 8 numbers are 2 eg •  • 	✓ *The only sectors labelled are 2* eg •  • 

Time

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
		2m	Shows the correct time and date, ie 1:00 16 November or 01:00 16 November	
		or 1m	Shows the correct date or a correct time eg • 1:00 date incorrect or omitted • 3:00 16 November	

Remainders

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
13	3	1m	34	
		1m	Gives two integers, x then y, such that $x = 4y + 3$, provided $\lvert y \rvert > 3$ eg • 19 ÷ 4 • 23 ÷ 5 • 43 ÷ 10	

Sitting comfortably

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
a	a	1m	Gives both correct answers, ie Chair height: 14 inches Table height: 22 inches	! *Incorrect units inserted* Ignore
b	b	1m	Indicates Yes and gives a correct explanation eg • Three-quarters is 75% and 80% > 75% • 80% is $\frac{4}{5}$ which is greater than $\frac{3}{4}$ • 80% is 5% more than three-quarters	✓ *Minimally acceptable explanation* eg • 75 • 80% • 20% don't • 80 is bigger than 75 • 5% more/less • Just over three-quarters • $\frac{4}{5}$ is bigger ✗ *Incomplete or incorrect explanation* eg • It says so on the graph • 80% is about $\frac{3}{4}$ • 80% = $\frac{3}{4}$

PIN

Tier & Question 4–6	5–7	Mark	Correct response	Additional guidance
15	5	2m	Identifies the four correct numbers only, in any order eg • 9063, 9173, 9283, 9393 • 9393 ~~9933~~ 9283 ~~9823~~ 9173 ~~9713~~ 9063 ~~9603~~	! ***9 and 3 not repeated*** Condone eg, accept • 9063 1 7 2 8 3 9
		or		
		1m	Identifies two or three of the correct numbers with no additional incorrect numbers or Identifies the four correct numbers along with one additional, incorrect, number	

Finding values

Tier & Question 4–6	5–7	Mark	Correct response	Additional guidance
16	6	2m	Gives all five values correct and in the correct positions, ie y | $2y$ | y^2 3 | 6 | 9 2 | 4 | 4 6 | 12 | 36	✓ ***Values of −6 and −12***
		or		
		1m	Gives at least three values correct and in the correct positions	✓ ***For 1m, follow-through from their $y = 6$, providing their $y \neq 0$ or their $y \neq 1$***

Wallpaper

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
17	7	**2m**	Indicates No and gives a correct explanation that shows or implies the amount that 11 rolls will decorate and the perimeter of Kate's room eg • 11 rolls papers 20 m, but Kate's room is 21m altogether • A perimeter of 20 m needs 11 rolls, but Kate's is 1m bigger than that • 6 + 4.5 = 10.5 10.5 + 10.5 = 21 with the table continued to show 20, 11 • To paper 21m she needs 12 rolls	✓ ***Minimally acceptable explanation*** Provided there is no indication of an incorrect method, accept eg • 21, 11 • 21, 20 • 21, 12 • 12 rolls • 1 more roll is needed ✓ ***Half rolls used*** Condone, eg for 2m accept • She has 11 but she needs 11.5 ! ***Incorrect units given*** Ignore × ***For 2m, method used is direct proportion*** eg • 20 m is twice 10 m and the table shows that would need 12 rolls • 14 m is 8 rolls so 21m is 12 rolls
		or		
		1m	Shows or implies that 11 rolls will paper 20 m eg • A room of 20 m needs 11 rolls, but Kate's room is bigger than that or Shows or implies the perimeter of the room is 21m eg • 4.5 + 6 + 4.5 + 6 = 21 • 2(4.5 + 6) = 21 or States clearly the relationship between perimeter and number of rolls needed eg • For every 2 m round the room it goes up by 1 roll • To find the number of rolls divide the length by 2 then add 1	✓ ***Minimally acceptable explanation*** eg • 20, 11 • There is only just enough for 20 ✓ ***Minimally acceptable explanation*** eg • 21m • 2 × 10.5 = 21

When is it true?

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
18	8	2m	Completes the table correctly, ie	✓ ***Unambiguous indication*** eg • ✓ for true, ✗ for false

	$n = 4$	$n = 5$	$n = 6$	$n = 7$
n is greater than 5			✓	✓
$2n$ is equal to 10		✓		
$2 + n$ is less than 8	✓	✓		
n^2 is less than 30	✓	✓		

		or 1m	Completes two rows of the table correctly	

Triangle

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
	a	2m	Gives three correct angles eg • 50°, 60°, 70° • 47°, 66°, 67° • 53°, 54°, 73°	
		or 1m	Gives three angles that sum to 180° with two differing by 20° eg • 10°, 30°, 140° • 40°, 60°, 80°	
	b	2m	Gives three correct angles eg • 10°, 75°, 95° • 18°, 71°, 91° • 2°, 79°, 99°	
		or 1m	Gives three angles, including an obtuse angle, that sum to 180° with the acute angles having a difference of 20° eg • 10°, 30°, 140° • 1°, 21°, 158° • 34°, 54°, 92°	

Rectangle area

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
20	10	**2m** *or* **1m**	60 60 seen or Shows a complete correct method eg • $5 \times 4 \times 3$ or Shows or implies the dimensions of the rectangle are 6 (cm) and 10 (cm) or Shows or implies the area of one white square is 4 (cm^2)	✗ ***4 seen but not linked to the area of a white square***

Sixes

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
21	11	**1m**	Gives a correct value eg • 0.94 • .94 • $\frac{94}{100}$ • $\frac{47}{50}$	! ***Answers of 94, 34*** Mark as 0, 1
		1m	Gives a correct value eg • 0.34 • .34 • $\frac{17}{50}$	

Tier & Question				
4–6	5–7			**Swimming pool**
22	**12**	**Mark**	**Correct response**	**Additional guidance**
		3m	Identifies the correct minimum monthly cost (£40.50) and shows either another correct monthly cost or a correct method for another monthly cost eg • £40.50 in answer box with £49.17 shown elsewhere • £40.50 in answer box with 26.50 + 2 × 15 shown elsewhere or Identifies the correct minimum monthly cost (£40.50) and shows £486 and another correct annual cost	! ***Cost not identified as minimum (answer box left blank)*** Condone provided there is a correct comparison and no ambiguity eg, accept • £40.50 is less than £49.17 eg, do not accept • £56.50, £40.50, £54.50 • 26.5 + 2 × 15 = £40.00 (error) 26.5 + 2 × 7 = £40.50 7.25 × 8 = £58 which is more Some different cost options (with the annual equivalents in brackets) are – Annual memberships: £49.17 (£590) 230 + 2 × 180 = 590 590 ÷ 12 = 49.1666 (condone 49.16) – Monthly memberships: £56.50 (£678) 26.5 + 2 × 15 – Casual swims: £54.40 (£652.80) 3.5 + 2 × 1.65 = 6.8 6.8 × 2 × 4 (condone 1 month = 4 weeks) – Add-on memberships: £40.50 (£486) 26.5 + 2 × 7 (cheapest) – Family swims: £58.00 (£696) 7.25 × 2 × 4 (condone 1 month = 4 weeks)
		or **2m**	Gives any correct monthly cost (see additional guidance) eg • £40.50 • £49.17 or Shows correct methods for the minimum cost and one other but without a correct result, and gives an answer consistent with their results eg • 26.5 + 2 × 7 = *44.5 (error)* 26.5 + 2 × 15 is more Answer of £44.50 • 590 ÷ 12 = *39.33 (error)* 26.5 + 2 × 7 = *£199.50 (error)* Answer of £39.33	
		or **1m**	Shows a correct method for a monthly cost but with an incorrect or no answer	

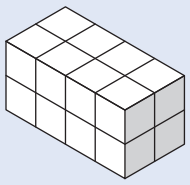
Diagonal

Marking overlay available

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
23	13	**2m** **or** **1m**	Completes the rectangle within the tolerance as shown by the overlay Shows correct use of compasses to create a shape with two sides of 6 cm and/or two sides of 8 cm eg • A kite with side lengths 6 cm and 8 cm, and correct compass arcs shown • A rhombus drawn with side length 6 cm, and correct compass arcs shown • A quadrilateral drawn with two side lengths of 8 cm, and correct compass arcs shown or Completes the top or the bottom half of the rectangle within the tolerance as shown by the overlay or Correctly draws the construction arcs either with an incorrect rectangle drawn or no rectangle drawn	× ***For 2m or 1m, given diagonal not used*** × ***Spurious compass arcs that have an incorrect radius*** ! ***Overlay may need turning over***

Word game

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
a	a	**1m**	Gives a correct probability eg • $\frac{29}{100}$ • 0.29 • 29%	! ***Probability*** See general guidance on page 16
b	b	**2m** ***or*** **1m**	Gives the values 8, 8 and 10 in the correct order 26 seen or Shows or implies ÷ 13 eg • 104 ÷ 13 • ÷ 13 seen • Answer 32, 32, 40	! ***8 seen*** Do not accept for 1m unless ÷ 13 is implied × ***13 seen without the operation***

Tier & Question				
4–6	5–7			**Volume**
25	**15**	**Mark**	**Correct response**	**Additional guidance**
		2m ***or*** **1m**	10 Shows or implies that the cuboid is 2 cubes high, 2 cubes wide and 4 cubes long eg • 4 × 2 × 2 seen • Lines drawn on the diagram showing the shaded end is made from 4 cubes and the longest side is made from 8 cubes, ie  or Shows a complete correct method with not more than one computational error eg • 40 × 20 × 20 ÷ 16 = 1000 $\sqrt[3]{1000}$ = *100 (error)*	

Chinese growth

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
a	a	1m	Gives a correct value eg • 0.2 cm per year • $\frac{1}{5}$ cm per year	✗ ***Units changed*** eg • 0.002 metres • 2 mm
b	b	2m ***or*** 1m	1.56 m or equivalent Shows the digits 156 or Shows the digits 36 eg • 0.36 or Shows a complete correct method with not more than one computational error eg • 1.2 × 1.3 • 1.2 × 0.3 + 1.2 • 1.2 ÷ 10, × 3, + 1.2 • 10% of 1.2 = 0.12 30% = 0.12 × 3 = *0.26 (error)* 0.26 + 1.2 = 1.46 or The only error is to use the height from 1957, ie gives an answer of 1.43m or 143cm	✓ ***Units changed*** eg • 156 cm ! ***Answer 1.6m*** Accept 1.6m provided a correct method or more accurate value is seen eg, accept • 1.3 × 1.2 seen Answer = 1.6m • 0.3 × 1.2 = 0.36 0.4 + 1.2 = 1.6m eg, do not accept • 30% of 1.2 = 0.4 Answer = 1.6m

Squarea

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
		1m	38.4(…) or 38.5 or 12.25π	✓ ***12.25 written as a fraction or mixed number*** ! ***Answer of 38*** Accept with a correct method or more accurate value seen

Tier & Question				Lemons
4–6	5–7 18	Mark	Correct response	Additional guidance
	a	1m	August (20)06 or September (20)06 or October (20)06	
	b	1m	Gives one, two or all of the months June, July, August, or gives a description of these months eg • Summer • Middle of the year • June–August	× ***Non-general response*** eg • Summer 2006 • July 2002

Tier & Question				Bank of England
4–6	5–7 **19**	**Mark**	**Correct response**	**Additional guidance**
	a	**2m**	£ 10 970 million	✕ ***For 2m, in parts a and b, answer given in millions in the answer box*** eg • £10 970 000 000 million Penalise only the first occurrence
		or		
		1m	Shows or implies that the number of each banknote must be multiplied by the value of each note eg • At least two of 106 × 5, 323 × 10, 328 × 20, 13 × 50 seen • At least two of 530, 3230, 6560 and 650 seen • Digits 1097 seen	! ***For 1m, error in the interpretation of 'million'*** Condone eg • 5 × 10 600 000, 10 × 3 230 000
	b	**2m**	Gives a value between 4900 and 5100 inclusive	
		or		
		1m	Gives a value in the range 4400 to 4500 inclusive ($\frac{1}{8}$ × 35525 rounded) or Gives a value in the range 5900 to 6000 inclusive ($\frac{1}{6}$ × 35525 rounded) or Gives a value in the range 5300 to 5400 inclusive (15% × 35525 rounded) or Shows a correct method, that would lead to an answer between 4900 and 5100 inclusive, with not more than one error, whether rounding or computational eg • $\frac{50}{360}$ × 35525 • 35525 ÷ 7 • 50 ÷ 360 = 0.1388 = *0.13 (error)* 35525 × 0.13 = 4618	

Motorway

Tier & Question 4–6	Tier & Question 5–7	Mark	Correct response	Additional guidance
	20	**4m**	Indicates Type B and gives the correct costs for both types, with no evidence of inconsistent numbers of lights eg • Type A 12 × 2.5 = 30 5000 ÷ 30 = 166.6 167 × 4200 = 701400 Type B 15 × 2.5 = 37.5m 5000 ÷ 37.5 = 133.3 134 × 5025 = 673350 Type B is cheaper at £673350 • Type A £700000 Type B £670000	! ***Numbers of lights*** Accept the following • Type A – 166, 167 or 168 • Type B – 133, 134 or 135 Total costs The following table may be useful
		or		
		3m	Shows a correct method and total costs for both types but with errors or inconsistent numbers of lights eg • Type A 12 × *2.2 (error)* = 26.4 5000 ÷ 26.4 = 189.39 189 × 4200 = *604800 (error)* Type B 15 × 2.5 = 37.5m 5000 ÷ *38 (error)* = 131.6 *132 (inconsistent)* × 5025 = 663300	✓ ***Unrounded number of lights*** For 3m or 2m accept methods that use one or more unrounded values for the number of lights
		or		
		2m	Shows a correct method and total costs for one type of light even if there are errors	
		or		
		1m	Gives a correct whole number of lights for at least one type	! ***Range given*** Condone eg, accept • Type A 166-168 • Type B 133, 134 or 135

	Lights		
	166/133	167/134	168/135
Type A	£697200	£701400	£705600
Type B	£668325	£673350	£678375

Tier & Question				
4–6	5–7			**Body Mass Index**
	21	**Mark**	**Correct response**	**Additional guidance**
		3m	Gives a correct rounded or unrounded value eg • 9.7797 (kg) • 10 (kg)	✓ ***Throughout the question units omitted***
		or		
		2m	Gives the correct weight for a BMI of 24.9 or 25 eg • Value of 85.2203 rounded or unrounded seen • Value of 85.5625 rounded or unrounded seen	✗ ***90 seen without a more accurate value***
		or		
		1m	Gives the man's current BMI eg • Value of 28, 27.8 or 27.7(…) seen or Attempts to find the weight for a BMI of 24.9 or 25 eg • $\frac{W}{1.85^2}$ = 24.9 seen •	! ***Trial and improvement for 1m*** Accept provided a BMI between 24 and 26 (exclusive) is found The following may be useful

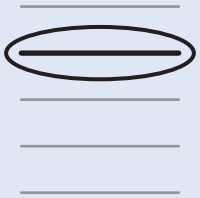
Weight	BMI
90	26.3
83	24.3
84	24.5

Weight	BMI
88	25.7
87	25.4
86	25.1
85	24.8
84	24.5
83	24.3

Tier & Question				
4–6	5–7			**Keeling curve**
	22	**Mark**	**Correct response**	**Additional guidance**
		2m	Indicates 'Michael' and gives a correct explanation that compares a calculation or a calculated value with one read from the graph eg • 7 × 320 is not 380 • 20% of 320 = 2 × 32 = 64, 320 + 64 = 384, which is about correct • 380 – 320 = 60, 60/320 = 0.1875, which is about 20%	
		or		
		1m	Gives a relevant calculated value eg • 7 × 320 = 2240 • 20% of 320 = 2 × 32 = 64 • 380 – 320 = 60, 60/320 = 0.1875 or Indicates 'Michael' and gives a correct explanation that compares a calculation or a calculated value with one read from the graph but makes one error in calculation or reading from the graph	

Tier & Question				
4–6	5–7			**L-shape reasoning**
	23	**Mark**	**Correct response**	**Additional guidance**
		2m	$\frac{3}{2}$ or equivalent fraction or decimal	
		or		
		1m	Shows the perimeter of the L-shape is 24 or Shows a correct expression for the perimeter of the L-shape eg • $17 + y + 7 - y$ or Shows or implies a correct expression for the area of the L-shape eg • $2y + 21$ • $5y + 3(7 - y)$ • $35 - 2(7 - y)$	✓ ***Minimally acceptable*** eg • $2y$ and 21 seen • $5y$ and $3(7 - y)$ seen • 35 and $2(7 - y)$ seen

Power time

Tier & Question 4–6	5–7	Mark	Correct response	Additional guidance
	a	1m	Gives a correct justification eg • 24 × 60 = 1440 and 1000 < 1440 < 10 000 • 1000 minutes would be 16.6(…) hours and 10 000 minutes would be 166.6(…) hours but 24 hours is between the two	✓ ***Minimally acceptable justification*** eg • 1000, 1440 and 10 000 seen • 24 × 60 is between 1000 and 10 000 • 16.6(…) (or 16.7 or 17), 24 and 166.6(…) (or 167 or 170) seen • 1.44×10^3 ! ***Sight of 86400*** As this may be working for the second part of the question, ignore ✗ ***Incomplete or incorrect justification*** eg • 1440 is between 10^3 and 10^4
	b	1m	Indicates the correct answer, ie 	✓ ***Unambiguous indication*** eg • Correct answer ticked

Circle around

Tier & Question 4–6	5–7	Mark	Correct response	Additional guidance
		2m ***or*** **1m**	5.8 Shows or implies correct evaluation of at least the denominator eg • 173.(…) seen • 5.7 • digits 577 or digits 578 seen or 152.0 (finds the fourth root rather than multiplying by 4 and then rounds to 1 dp)	✗ ***Equivalent fractions or decimals***

Index to mark scheme for Paper 2

Section B: Using the test outcomes

The following subsections provide information about interpreting the outcomes of the year 9 optional mathematics tests. The first subsection explains how teachers can use the test scores to help make judgements on the national curriculum levels attained by pupils in mathematics. The second subsection presents useful information obtained during the development of the tests that may be used to support making qualitative teacher judgements.

Level thresholds

In order to make use of the information in this section, you must administer the tests according to the guidance in Section A: Formal administration. It is particularly important that you observe the time limits given, follow the test instructions, and mark the questions according to the mark scheme. If you have used the tests in a different context to provide qualitative information about pupils' strengths and weaknesses then the information derived from this section will not be applicable and you should refer to the Useful information subsection.

In a formal administration pupils need to take both test booklets in order for the total marks to be translated reliably into a national curriculum level for mathematics overall.

The following tables give an indication of the national curriculum levels for pupils attaining each of the mark ranges in the tests.

Tier 4–6

Level	Mark range
Below level 4	0–30
4	31–49
5	50–71
6	72–120

Tier 5–7

Level	Mark range
Below level 5	0–20
5	21–38
6	39–64
7	65–120

Variability of results

Any scores derived from a test are subject to some variation according to the precise circumstances under which the test has been sat and marked. This does not mean that pupils get 'incorrect' test results, but it does mean that some caution should be exercised in translating scores which are very close to a threshold mark into an overall mathematics level for the pupil. The level thresholds provided are indicative, and teachers should be aware that differences in the status, administration and marking procedures open the tests to a potentially broader range of variation than the former statutory national curriculum tests.

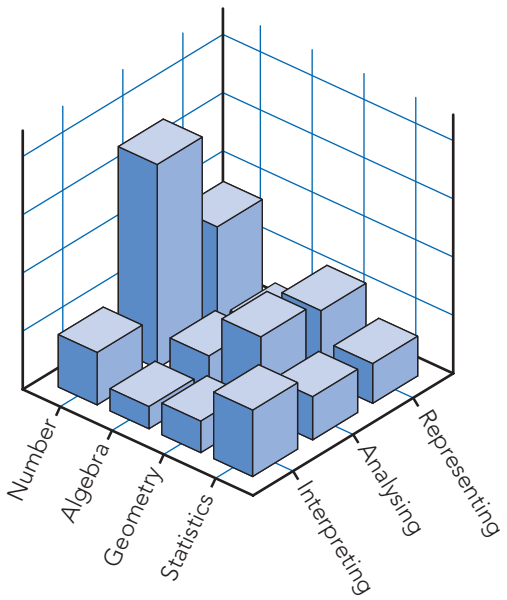
Useful information

What are we assessing?

The 2008 key stage 3 curriculum specifies mathematics in terms of Key Processes (*Representing, Analysing, Interpreting & Communicating*) and Range and Content (*Number, Algebra, Geometry, Statistics*). It can be thought of as an array.

		Key processes		
		Representing	Analysing	Interpreting & Communicating
Range and Content	Number			
	Algebra			
	Geometry			
	Statistics			

Any mathematical task requires the deployment of various different combinations of Key Processes and Range and Content, in other words as occupying particular cells in the table above. Each question in this test can therefore also be attributed to one or more cells. Doing this for all the questions in the test (from both tiers) gives the following picture of how the year 9 optional test samples from the 2008 curriculum.



New questions

To underline the emphases in the new curriculum, many questions demand skills of representing and/or interpreting as well as analysing. Broadly speaking, representing is about *choosing the technique(s) and/or information to use*, analysing is about *using the chosen technique(s)* and interpreting is about *making sense of the answer*. Therefore many questions are not explicit about the approach to be taken and pupils need to make decisions from the outset about what to do. This can apply equally to a question set in a 'realistic' context and one that is purely mathematical.

	Tier & Question			
Paper	4–6	5–7	**Question name**	**Notes**
2	**6**		Family flights	It is deliberate that the question does not tell pupils to calculate the total cost for each airline – this is a decision for them to make (there is really no sensible alternative).
2	**19**	**9**	Triangle	There are several possible approaches. An algebraic method can be fruitful in both parts; if trial and improvement is used the decision needs to be made where to start – the equilateral triangle is an insightful choice.

It is often the case that, once the initial decisions have been make, the problem may demand relatively straightforward techniques.

	Tier & Question			
Paper	4–6	5–7	**Question name**	**Notes**
1	**24**	**15**	Adults studying	Once a decision has been made what to do, all that is required is some very approximate reading of the bar chart and addition of whole numbers.

Interpreting and communicating may involve working with results or information that is already given, or may be based on the results of the pupil's own analysis. It may be a substantial part of the activity or it may be just a small detail, such as rounding the answer correctly because of the context.

	Tier & Question			
Paper	4–6	5–7	**Question name**	**Notes**
1	**23**	**14**	Wrapping	In this question, the main problem is to interpret the measurements that are given and to visualise how they relate to the problem. The final answer is simply a number so communication skills are not much in evidence.
2	**17**	**7**	Wallpaper	Once a value for the perimeter of the floor has been obtained and the table has been extended, a decision needs to be made about whether the answer is 'Yes' or 'No', and then the reasoning has to be explained.

Qualitative assessment information

Looking at pupil's responses to the questions in the tests can give a wide variety of qualitative assessment information. The following list is not exhaustive but aims to identify some significant themes and questions that may provide insights into them.

Units

Some of the questions in these tests do not provide units in the answer space and the mark schemes do not penalise omission or incorrect choice of units. To see whether your pupils give appropriate units with their answers look at their responses to the following questions.

	Tier & Question			
Paper	4–6	5–7	**Question name**	**Notes**
1	**21**	**12**	Triangle two	Are units used in the explanation? If so, are they units of area? Are 'squares' used in recognition that the units are necessary but unknown?
2	**10**		Fruit	Money. Is 'p' indicated?
2	**17**	**7**	Wallpaper	Are units used for perimeter in the explanation? Is there confusion about which numbers need units?
2		**20**	Motorway	Distance (m and km), money (£). Is conversion of units used in calculation? Are units (£) given with answers?
2		**21**	Body Mass Index	Units of mass and length. Is the correct one used with the answer? If a BMI is calculated, is a unit (incorrectly) given with it?
2		**23**	L-shape reasoning	Is a unit (eg cm) incorrectly given with a value for y?

Quality of written communication

There are broadly two aspects to the quality of written responses. The first is making appropriate choices about what to communicate and how. The second is about the technical and linguistic accuracy of the response. Even among responses that get the same marks there can be wide variations in quality, and examination of the following questions can provide insights into this.

	Tier & Question			
Paper	4–6	5–7	**Question name**	**Notes**
1	**24**	**15**	Adults studying	Does a correct explanation justify an assertion that the percentages add up to more than 100? If so, are the figures used over-precise?
1	**25**	**15**	Coins and probability	As with many mathematical explanations, the best ones will be a mixture of words and symbols/calculations.
1	**26**	**17**	Tile design	In part (a), does the explanation use correct technical terms – for example, 'angles on a straight line'?
1		**25**	Which is greater?	An efficient explanation does not involve evaluating the expressions, particularly in part (a).
2	**6**		Family flights	Despite the nature of the question, the marks for this item are all to do with correct calculations. Nevertheless pupils' responses will exhibit differing degrees of engagement with the demand to communicate a recommendation.
2	**22**	**12**	Swimming pool	Full marks are not available unless there is a comparison of at least two prices. However, even within correct responses there is scope for wide variation in the extent to which pupils produce a thorough and systematic response.
2		**22**	Keeling curve	The best explanations will engage with the error in John's statement and not try to be over-precise in the values read from the graph.

Choice of method

In many questions pupils need to choose the method to use and there may be a number of options. A good choice is efficient but uses techniques that the individual is comfortable with. Looking at the responses to these questions will tell something about the sorts of choices pupils make.

	Tier & Question			
Paper	4–6	5–7	**Question name**	**Notes**
1	19	10	Ticket price	Using simultaneous equations is a 'clever' choice but a poor one, even if the pupil's algebra is good, as there are more efficient methods.
1	20	11	Tests	A scatter graph would be an excellent choice of method in part (b), although the lack of a grid makes it an unlikely one.
2	10		Fruit	To produce a correct solution efficiently it is important to be systematic. It is only necessary to use four of the five fruits to generate enough combinations and a good choice is to minimise the number of different fruits used.
2	17	7	Wallpaper	Does the pupil try to work out how big a room can be decorated with 11 rolls, or how many rolls are needed for the room shown? With the figures given the first way is easier.
2	22	12	Swimming pool	Flexibility works well in this question. Some price options are clearly expensive so the best responses will deliberately limit which possibilities they consider.
2		23	L-shape reasoning	Trial and improvement is a viable method, and may be a good choice for a pupil who is insecure with algebraic manipulation. It should not take many iterations to realise that the perimeter is independent of y.

Interpreting the problem

Many of the questions are based on real data or realistic contexts. Where a question is based on a real-life problem it is generally necessary to make simplifying assumptions in order to represent it as a mathematical problem. Pupils often do this almost unconsciously, but an aspect of their mathematical development should be an increased awareness of the assumptions made. It may also be necessary to interpret the answer to the mathematical result to provide a full answer to the original problem. To see whether your pupils have awareness of these issues you could look at their responses to the following questions.

	Tier & Question			
Paper	4–6	5–7	**Question name**	**Notes**
1	6		Tennis court	Is there any indication of engagement with the *uncertainty* of the answer? For example, is the answer qualified with 'about' or similar?
1	11	2	Dice	Do answers for A and C show awareness that the dice may not be fair?
1	14	5	Barcelona	In part b) does the answer *read* the graph or *interpret* it? Is the rainfall reading given for October, or is it described as 'wetter'?
1	23	14	Wrapping	Does the answer make an allowance for an 'overlap'? Answers of 45cm or 60cm are probably based on no overlap.
2	22	12	Swimming pool	Engagement with the real situation on which the question is based can point the way to which price plans are likely to prove most economical. Working down the price list from top to bottom is a sign that the context is being ignored.
2		18	Lemons	In part (b) it is necessary to interpret 'most expensive' (as 'higher on the graph'). It is also desirable to engage with the real situation in deciding the kind of answer to give – 'summer' shows a level of awareness that 'August' does not.

Calculator use

Additional information about some aspects of calculator use can be gleaned from the responses to some questions from paper 2. In particular, whether or not their answer is creditworthy, do they round their answer appropriately and do they round prematurely in working? In questions involving money is the calculator display interpreted correctly? Relevant questions are as follows.

	Tier & Question			
Paper	4–6	5–7	**Question name**	**Notes**
2	**10**		Fruit	What choice is made about rounding the price of a banana or a satsuma? Is there evidence of confusion between pounds and pence?
2	**13**	**3**	Remainders	Is there confusion between remainders and decimals? Is a calculator used inappropriately in this question?
2	**22**	**12**	Swimming pool	Are sensible decisions made about how to deal with weeks, months and years? Is the calculator display interpreted correctly in terms of money?
2	**27**	**17**	Squarea	Is there premature rounding in working? And, on the other hand, is the final answer rounded to an appropriate degree of accuracy?
2		**20**	Motorway	Are the numbers of each type of light rounded appropriately to a whole number, based on the context?
2		**25**	Circle around	Is there evidence of efficient calculator use, for example use of the power function and perhaps the reciprocal button? Is the answer rounded correctly?

Level 8 and above

Although these tests do not have overall level thresholds corresponding to level 8 performance, there are some questions where the highest attainers have the opportunity to show the combination of technical competence and mathematical insight which is most characteristic of those working at this level. Here are some examples.

	Tier & Question			
Paper	4–6	5–7	**Question name**	**Notes**
1		**26**	Area triangle	The correct answer will most often be obtained as the difference in area of the two right-angled triangles. Only pupils with insight and a very firm concept of area of a triangle will calculate the area directly using 4cm as the base and 8cm as the height.
2		**9**	Triangle	The suggestions under 'Taking it further' below have scope to stretch bright pupils. Only the very best will think of using algebra without being prompted.
2		**20**	Motorway	It is possible to identify the cheaper type of light by comparing the ratio of heights to the ratio of costs per light. Asking high attaining pupils 'How can you tell which type of light gives the cheaper total without working out the total cost' may elicit some interesting responses.
2		**21**	Body Mass Index	It is extremely tempting (but entirely unnecessary) to work out the man's current BMI. Pupils who set up and solve an equation to find the solution without either going down this dead end or using trial and improvement are likely to be working above level 7.
2		**23**	L-shape reasoning	It takes insight to recognise that the perimeter of the L-shape is 24cm without setting up an equation in which every y cancels out. Depending how the L-shape is divided, different equations may be obtained. The highest attainers are more likely to go straight to $2y + 21 = 24$ with no working.

Taking it further

Some questions can form the starting points for more extensive pieces of mathematical work in the classroom. Some suggestions are outlined below.

Dice (Paper 1, tier 4–6 question 11; tier 5–7 question 2)

- Is the probability of a score of 5 on dice B more or less than $\frac{1}{6}$?
  Discuss.
- How would you estimate the actual probability?
  An obvious way is to do an experiment, and one way of managing this is to stick two centicubes together, roll the 'dice' so formed and use 'point up' to represent one way of getting a score of 5. There is a discussion to be had about why 'point down' might not be a good representation.
- If you do an experiment, how many times do you need to roll the 'dice' to estimate the probability to a certain degree of accuracy?
  One way of arriving at a figure is to see how many trials it takes with a normal fair dice to get the degree of accuracy required and then do the same number of trials with your dice B.

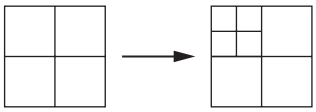
Dividing squares (Paper 1, tier 4–6 question 15; tier 5–7 question 6)

- Is it possible to split a 5 × 5 square into 8 squares? Yes (an answer is in the mark scheme) but it's not obvious. Is it possible with a 6 × 6 square? How can you tell?
  It is tempting (and to some extent fruitful) to translate this into a number problem. You can make 36 from 8 squares:

  $6^2 = 3^2 + 3^2 + 2^2 + 2^2 + 2^2 + 2^2 + 1^2 + 1^2$

  $36 = 9 + 9 + 4 + 4 + 4 + 4 + 1 + 1$

  But this doesn't give you a way of splitting a 6 × 6 square into 8 squares – try it!
- Never mind the size of the squares (use plain paper), what are the possible numbers of smaller squares into which you can split a square? Obviously 2 and 3 are impossible and 4 is easy. 5 is impossible but 6, 7 and 8 can be done. How do you do 7?



4 squares 7 squares

This shows how you can always do 3 more squares. So, if you can do 6, 7 and 8 you must be able to do *every greater whole number*.

Triangle (Paper 2, tier 4–6 question 19; tier 5–7 question 9)

- With the constraints in part (a), what are the smallest and largest whole-number values for the size of the smallest angle?
  As a challenge, what precisely are these values (there is scope for algebra here)?
- Similarly, with the constraints in part (b), what values are possible for the obtuse angle?

Diagonal (Paper 2, tier 4–6 question 23; tier 5–7 question 13)

- What other rectangles could have the dotted line as a diagonal?
  If you marked the corners of them all, what would the diagram look like?

Multiple coins (Paper 2, tier 4–6 question 3)

- How many ways are there of making 10p, 20p, 30p, 40p, 50p etc using 10p and 20p coins? What is the pattern here? Why is the pattern like this?

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