Ma

KEY STAGE
3
ALL TIERS

2004

Mathematics tests

Mark scheme for Paper 1

Tiers 3–5, 4–6, 5–7 and 6–8

2004

department for
education and skills
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QCA

Introduction

The test papers will be marked by external markers. The markers will follow the mark scheme in this booklet, which is provided here to inform teachers.

This booklet contains the mark scheme for paper 1 at all tiers. The paper 2 mark scheme is printed in a separate booklet. Questions have been given names so that each one has a unique identifier irrespective of tier.

The structure of the mark schemes

The marking information for questions is set out in the form of tables, which start on page 10 of this booklet. The columns on the left-hand side of each table provide a quick reference to the tier, question number, question part, and the total number of marks available for that question part.

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 unacceptable. Other guidance, such as when 'follow through' is allowed, is provided as necessary.

Questions with a *UAM* element are identified in the mark scheme by an encircled *U* with a number that indicates the significance of using and applying mathematics in answering the question. The *U* number can be any whole number from 1 to the number of marks in the question.

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

The 2004 key stage 3 mathematics tests and mark schemes were developed by the Mathematics Test Development Team at QCA.

General guidance

Using the mark schemes

Answers that are numerically equivalent 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 to marking of questions that involve money, time, coordinates, algebra or probability. Unless otherwise specified in the mark scheme, markers should apply the following guidelines in all cases.

What if ...

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 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, is acceptable. Provided there is no ambiguity, condone the continental practice of using a comma for a decimal point.
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 $4 \times 6 = 18$ 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 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'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.
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. If the original intention or difficulty level of the question is not reduced, deduct one mark only. If the original intention or difficulty level is reduced, do not award any marks for the question part.
The correct answer is in the wrong place.	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.

What if …

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 seen.	A correct response should always be marked as correct unless the mark scheme states otherwise.	
The correct response has been crossed or rubbed out and not replaced.	Mark, according to the mark scheme, any legible crossed or rubbed out work that has not been replaced.	
More than one answer is given.	If all answers given are correct or a range of answers is given, all of which are correct, 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 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.	

Marking specific types of question

Responses involving money
For example: £3.20 £7

Accept ✓	Do not accept ×
✓ Any unambiguous indication of the correct amount eg £3.20(p), £3 20, £3,20, 3 pounds 20, £3-20, £3 20 pence, £3:20, £7.00 ✓ The £ sign is usually already printed in the answer space. Where the pupil writes an answer other than in the answer space, or crosses out the £ sign, accept an answer with correct units in pounds and/or pence eg 320p, 700p	× Incorrect or ambiguous use of pounds or pence eg £320, £320p or £700p, or 3.20 or 3.20p not in the answer space. × Incorrect placement of decimal points, spaces, etc or incorrect use or omission of 0 eg £3.2, £3 200, £32 0, £3-2-0, £7.0

Responses involving time
A time interval *For example: 2 hours 30 mins*

Accept ✓	Take care ! Do not accept ×
✓ Any unambiguous indication eg 2.5 (hours), 2h 30 ✓ Digital electronic time ie 2:30	× Incorrect or ambiguous time interval eg 2.3(h), 2.30, 2-30, 2h 3, 2.30min ! The time unit, hours or minutes, is usually printed in the answer space. Where the pupil writes an answer other than in the answer space, or crosses out the given unit, accept an answer with correct units in hours or minutes, unless the question has asked for a specific unit to be used.

A specific time *For example: 8.40am, 17:20*

Accept ✓	Do not accept ×
✓ Any unambiguous, correct indication eg 08.40, 8.40, 8:40, 0840, 8 40, 8-40, twenty to nine, 8,40 ✓ Unambiguous change to 12 or 24 hour clock eg 17:20 as 5:20pm, 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, 084, 84

Responses involving coordinates
For example: (5, 7)

Accept ✓	Do not accept ×
✓ Unambiguous but unconventional notation eg (05, 07) (five, seven) $(\overset{x}{5}, \overset{y}{7})$ (x=5, y=7)	× Incorrect or ambiguous notation eg (7, 5) (5x, 7y) (x5, y7) (5^x, 7^y)

Responses involving the use of algebra
For example: 2 + n n + 2 2n

Accept ✓	Take care ! Do not accept ×
✓ The unambiguous use of a different case eg N used for n ✓ Unconventional notation for multiplication eg $n \times 2$ or $2 \times n$ or $n2$ or $n + n$ for $2n$ $n \times n$ for n^2 ✓ Multiplication by 1 or 0 eg $2 + 1n$ for $2 + n$ $2 + 0n$ for 2 ✓ Words used to precede or follow equations or expressions eg $t = n + 2$ tiles or tiles = $t = n + 2$ for $t = n + 2$ ✓ Unambiguous letters used to indicate expressions eg $t = n + 2$ for $n + 2$ ✓ Embedded values given when solving equations eg $3 \times 10 + 2 = 32$ for $3x + 2 = 32$	! Words or units used within equations or expressions should be ignored if accompanied by an acceptable response, but should not be accepted on their own eg do not accept n tiles + 2 n cm + 2 × Change of variable eg x used for n × Ambiguous letters used to indicate expressions eg $n = n + 2$ However, to avoid penalising any of the three types of error above 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. × Embedded values that are then contradicted eg for $3x + 2 = 32$, $3 \times 10 + 2 = 32$, $x = 5$

Responses involving probability

A numerical probability should be expressed as a decimal, fraction or percentage only.

For example: 0.7

Accept ✓	Take care ! Do not accept ×
✓ A correct probability that is correctly expressed as a decimal, fraction or percentage. ✓ Equivalent decimals, fractions or percentages eg 0.700, $\frac{70}{100}$, $\frac{35}{50}$, 70.0% ✓ A probability correctly expressed in one acceptable form which is then incorrectly converted, but is still less than 1 and greater than 0 eg $\frac{70}{100} = \frac{18}{25}$	The following four categories of error should be ignored if accompanied by an acceptable response, but should not be accepted on their own. ! A probability that is incorrectly expressed eg 7 in 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. However, each of the three types of error above should not be penalised 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 expressed as a ratio eg 7 : 10, 7 : 3, 7 to 10 × A probability greater than 1 or less than 0

Recording marks awarded on the test paper

All questions, even those not attempted by the pupil, will be marked, with a 1 or a 0 entered in each marking space. Where 2m can be split into 1m gained and 1m lost, with no explicit order, then this will be recorded by the marker as $\begin{matrix}1\\0\end{matrix}$

The total marks awarded for a double page will be written in the box at the bottom of the right-hand page, and the total number of marks obtained on the paper will be recorded on the front of the test paper.

A total of 120 marks is available in tiers 3–5 and 6–8.
A total of 121 marks is available in tiers 4–6 and 5–7.

Awarding levels

The sum of the marks gained on paper 1, paper 2 and the mental mathematics paper determines the level awarded. Level threshold tables, which show the mark ranges for the award of different levels, will be available on the QCA website *www.qca.org.uk* from Monday, 21 June 2004. QCA will also send a copy to each school in July.

Schools will be notified of pupils’ results by means of a marksheet, which will be returned to schools by the external marking agency with the pupils’ marked scripts. The marksheet will include pupils’ scores on the test papers and the levels awarded.

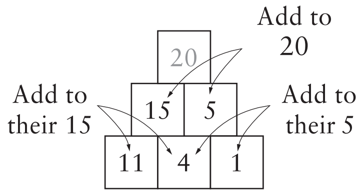
Answer of 100

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
1						
				1m	32	
				1m	5	
				1m	3	
				1m	30	

Pupils

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
2						
a				1m	3	✓ *Pupils identified* eg • A, M, S • Mike and two others
b				1m	Drama	
c				1m	Paul	✗ *Pupil not identified* eg • 6
d				1m	Sule	

Number pyramids

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
3						
a				**1m**	Completes the pyramid correctly, ie 10 7 3 6 1 2	
b				**1m**	Completes the first pyramid correctly eg ▪ 	✓ ***Numbers used are decimals, fractions, negatives or zero*** ✗ ***Zeros omitted***
				1m U1	Completes the second pyramid correctly, in a different way from one credited for the first pyramid	! ***Numbers credited for the first pyramid but shown in a different order*** Accept if the centre numbers of the bottom rows are different eg, accept ◆ 20 / 10 10 / 4 6 4 20 / 10 10 / 6 4 6 eg, do not accept ◆ 20 / 9 11 / 4 5 6 20 / 11 9 / 6 5 4

Stacking

3-5	4-6	5-7	6-8		Correct response	Additional guidance
4					**Correct response**	**Additional guidance**
a				**1m**	Gives all three correct and in the correct order ie 9, 18 and 27	! ***In both parts (a) and (b), bottom layer not included*** ie ◆ 0, 9 and 18 [for part (a)] 24 [for part (b)] Mark as 0; 1
b				**1m**	30	
c				**1m**	6	

Calculations

3-5	4-6	5-7	6-8		Correct response	Additional guidance
5					**Correct response**	**Additional guidance**
a				**1m**	523	
b				**1m**	182	
c				**1m**	147	
d				**1m**	40	

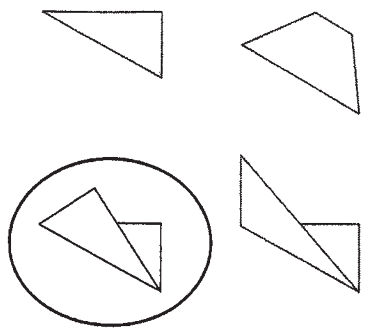
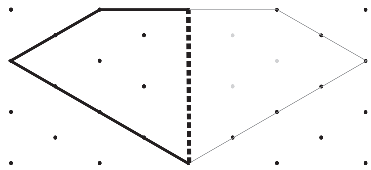
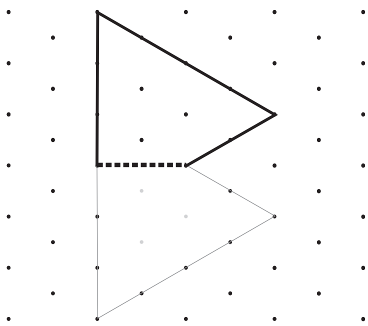
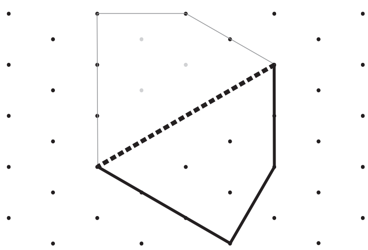
Coins

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
6	1					
				3m	Shows all five correct ways, with none incorrect or duplicated eg ▪ 0 2 4 0 3 2 0 4 0 1 0 3 1 1 1	✓ *Zeros omitted* ! *Values of coins given* eg ◆ 0 4 4 0 6 2 0 8 0 5 0 3 5 2 1 Provided this is the only error, mark as 1, 0, 0
				or 2m	Shows at least four correct ways, with not more than one incorrect or duplicated	
				or 1m	Shows at least three correct ways, with not more than two incorrect or duplicated	

Matchboxes

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
7	2					
a	a			1m	10.6	✓ *Equivalent fractions or decimals*
				1m	7.2	
				1m	3(.0)	
b	b			1m	8	! *Answer of 4* Accept only if it is clearly stated that another 4 boxes are needed eg, accept ◆ 4 more eg, do not accept ◆ 4

Folding shapes

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
8	3					
a	a			1m	Indicates the correct diagram, ie 	
b	b			1m	Completes the diagram correctly, ie 	! *Lines not ruled or accurate* Accept provided the pupil's intention is clear
				1m	Completes the diagram correctly, ie 	
				1m	Completes the diagram correctly, ie 	

Television

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
9	4					
				2m *or* 1m	£ 130 Shows or implies both – 900 and ÷ 3, and carries out at least one of these calculations correctly eg ■ 1290 – 900 = *330 (error)* 330 ÷ 3 = 110 ■ 390 ÷ 3 ■ Digits 13(0) seen	

Measuring

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
10	5					
				1m U1	Gives a correct explanation that shows the relationship between the volume of the jug and one litre eg ■ It's 2 jugs ■ Fill the jug once, pour it in the bucket and fill it again ■ He uses 500 + 500 ■ A jug is half a litre ■ Empty into the bucket twice	✓ ***Minimally acceptable explanation*** eg ◆ Fill it twice ◆ 500ml × 2 ✓ ***Jug assumed to be calibrated*** eg ◆ Put 200ml in the jug, then repeat to give a total of 5 times

Grid shapes

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
11	6					
a	a			1m	B and E in either order	✓ ***Shape A given alongside a correct response*** ! ***Responses for parts (a) and (b) transposed but otherwise correct*** Mark as 0; 1
b	b			1m	D and E in either order	
c	c			1m	30	✓ ***The given shape C excluded*** eg ◆ 29 more ◆ 29

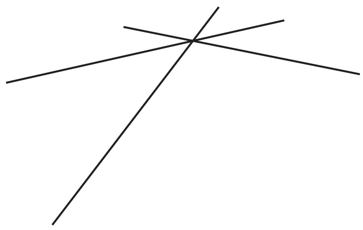
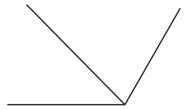
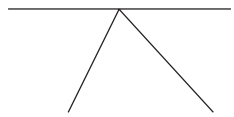
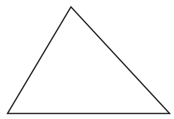
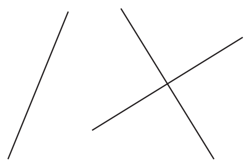
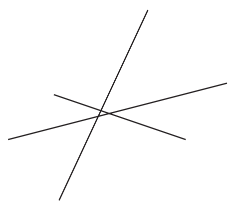
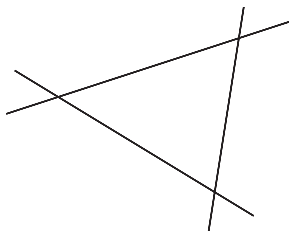
Club

Tier & Question 3-5	4-6	5-7	6-8	Mark	Correct response	Additional guidance
12	7					
a	a			1m U1	Indicates False and gives a correct explanation The most common correct explanations: Identify the statement is incorrect for week 2 eg ■ True for the first and last weeks only Identify the statement is incorrect for one of the Wednesdays eg ■ The most popular day was a Wednesday ■ The highest ever bar was Wednesday ■ One Wednesday there were 27	✓ *Minimally acceptable explanation* eg ◆ Not true for one of the weeks ◆ Wed was higher ! ***Explanation unclear as to whether it refers to one week or all three weeks*** Condone eg, accept ◆ Wed was the most popular day Do not accept incorrect explanations eg ◆ Each week Wed was most popular ! *Number of pupils identified* Where the value is a multiple of 5, do not accept incorrect values. Otherwise, within a correct response, accept integer values between the relevant multiples of 5, eg for Monday of week 3 accept 26, 27, 28 or 29 ✗ *Incomplete explanation* eg ◆ Not always true
b	b			1m U1	Indicates True and gives a correct explanation The most common correct explanations: Identify that for each week 20 pupils attended eg ■ 20 pupils went each Friday Identify the relevant feature of the charts eg ■ The bars are all the same height	✓ *Minimally acceptable explanation* eg ◆ 20 ◆ The bars are the same ✗ *Incorrect explanation, or incomplete explanation that simply restates the information given* eg ◆ They are all 25 *(error)* ◆ Same amount went ◆ It's the same number each week

Club (cont)

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
12	7					
c	c			1m U1	Indicates Not enough information and gives a correct explanation The most common correct explanations: State that names are not shown eg ■ It doesn't give their names so we don't know who went each week State that the people could be different eg ■ Same amount went each week but it could be different people ■ Different pupils might have gone on different Fridays State that only the total is shown eg ■ It doesn't say the same pupils went. It just says 20 pupils went on Friday ■ It doesn't tell you about each pupil, it tells you about the total	✓ *Minimally acceptable explanation* eg ◆ No names ✓ *Minimally acceptable explanation* eg ◆ It doesn't tell you which pupils ◆ Could be different each week ✓ *Minimally acceptable explanation* eg ◆ It only gives the total ◆ It just says 20 ◆ All it says is how many ✗ *Incomplete explanation* eg ◆ You don't know ◆ The charts don't show it ◆ It doesn't give that much detail

Points of intersection

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
13	8	1				
a	a	a		1m	Draws three straight lines intersecting at one point eg ▪ 	! *Ruler not used* Condone, provided the pupil's intention is clear ✓ *Lines meet rather than intersect* eg, for part (a) ◆  ◆  eg, for part (b) in tiers 3–5 and 4–6 ◆  ! *Diagrams for parts (a) and (b) in tiers 3–5 and 4–6 transposed but otherwise correct* Mark as 0; 1 ! *Other diagrams shown* Ignore, as these may be working for the last part of the question ✗ *Diagram is ambiguous* The drawing must clearly show the correct number of points of intersection eg, for part (b) in tiers 3–5 and 4–6 do not accept ◆  ◆ 
b	b			1m	Draws three straight lines intersecting at three different points eg ▪ 	

Points of intersection (cont)

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
13	**8**	**1**				
c	c	b		**1m** U1	Parallel	! ***Words used to describe parallel*** Accept if applicable to all sets of parallel lines eg ◆ Never meeting ◆ At the same angle ◆ In the same direction ◆ Not touching each other Do not accept if applicable to only some eg ◆ Vertical ◆ Horizontal ✗ ***Incomplete response describing parallel*** eg ◆ Like railway tracks ◆ Apart

Tier & Question					Daylight hours	
3-5	4-6	5-7	6-8			
14	9	2			**Correct response**	**Additional guidance**
				3m	Gives a complete correct response with both months identified correctly and correct values given within the ranges as shown below, ie June 18.5 to 19.5 inclusive December 5 to 6 inclusive	! ***Months not written in full*** Accept unambiguous indications eg, for December ◆ D Do not accept ambiguous indication that could refer to other months eg, for June ◆ J ! ***Dates given*** Ignore eg, for June accept ◆ June 15th
				or 2m	Makes not more than one error, but if the error is in identifying a month the pupil must follow through from that incorrect month eg ■ Jun *20 (error)* Dec 6 ■ June 19 *February (error)* 10	! ***Follow through*** Note that follow through must be applied from incorrect months. Ranges for correct values are shown below Jan 6.5 to 7.5 inclusive Feb 9.5 to 10 inclusive Mar 12 to 12.5 inclusive Apr 15 to 16 inclusive May 17.75 to 18.25 inclusive (Jun 18.5 to 19.5 inclusive) Jul 17.5 to 18 inclusive Aug 15 to 15.5 inclusive Sep 12 to 12.5 inclusive Oct 9 to 9.5 inclusive Nov 6.5 to 7.5 inclusive (Dec 5 to 6 inclusive)
				or 1m	Makes not more than two errors or omissions, but if the error is in identifying month(s) the pupil must follow through from that incorrect month(s) eg ■ June *12 (error)* Dec *7 (error)* ■ *July (error)* 18 *Oct (error)* 9 ■ June *12 (error)* *Jan (error)* 7	! ***Months omitted or months identified ambiguously*** Treat each omission or ambiguous response as one error eg, for 2m accept ◆ *J (ambiguous)* 19 Dec 5.8 eg, for 1m accept ◆ *(omits)* 19 *(omits)* 5.8

Plasters

3-5	4-6	5-7	6-8		Correct response	Additional guidance
15	10	3				
a	a	a		1m	$\frac{1}{35}$	! *Answer given as a decimal or a percentage without a correct fraction shown* Accept decimals within the following ranges, or their percentage equivalents: part (a) 0.028 to 0.03 inclusive part (b) 0.45 to 0.46 inclusive part (c) 0.54 to 0.55 inclusive ! *Words given alongside a correct probability* Ignore eg, for part (a) accept ◆ Unlikely, $\frac{1}{35}$
b	b	b		1m	$\frac{16}{35}$	
c	c	c		1m	$\frac{19}{35}$	

Calculators

Tier & Question 3-5	4-6	5-7	6-8	Mark	Correct response	Additional guidance
16	11	4				
				2m	£ 27.50	
				or 1m	Shows the digits 275 eg ■ 27.5 ■ 2750 ■ 2.75 or Shows a complete correct method for how to multiply 1.25 by 22, with not more than one computational error, but with the decimal point correctly positioned eg ■ 12.50 + 12.50 + 1.25 + 1.25 ■ 11 × 2.50 = 10 × 2.50 + 2.50 ■ 125 22 240 *(error)* 2500 2740 so 27.40	✗ ***Conceptual error*** eg ◆ 125 × 22 250 250 500 so 5.00 ! ***Method is repeated addition*** For 1m, at least some multiplication must be shown or implied eg, for 1m do not accept ◆ 1.25 + 1.25 + …..

Delivery charges

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
17	12	5				
a	a	a		1m	Completes the table correctly, ie 8 7.(00) 9 7.60	✓ *For 9 books, a value between 7.55 and 7.65 inclusive* ! *7.60 shown as 7.6* Condone
b	b	b		1m	60 p	! *Follow through from part (a)* Accept provided their 7.60 > their 7.00
c	c	c		1m	Draws the correct straight line $y = x$, at least of length 6cm, including the point of intersection with the given line, with no errors	! *Line not dashed* Condone ! *Line not ruled or accurate* Accept provided the pupil's intention is clear ✗ *Series of points that are not joined*
d	d	d		1m U1	6	! *Follow through from an incorrect line in part (c)* Provided there is only one point of intersection, follow through as the closest integer value above their x-value eg, from their intersection as (7.2, 6.5), accept ◆ 8 eg, from their intersection as (4, 4.6), accept ◆ 5 ! *Maximum of 10 books assumed* Condone eg, accept ◆ 6 to 10 books

Magic square

3-5	4-6	5-7	6-8		Correct response	Additional guidance
18	**13**	**6**				
a	a	a		2m	Gives all six correct values, ie <table><tr><td>13</td><td>12</td><td>5</td></tr><tr><td>2</td><td>10</td><td>18</td></tr><tr><td>15</td><td>8</td><td>7</td></tr></table>	✗ *Incomplete processing*
				or 1m	Gives at least three correct values	
b	b	b		2m	Gives all three correct values, ie $a = 16$, $b = 4$, $c = 9$	
				or 1m	Gives the correct value for b or the correct value for c	

Fractions

3-5	4-6	5-7	6-8		Correct response	Additional guidance
19	**14**	**7**				
				1m	$\frac{1}{3}$ or equivalent fraction	**!** *Decimals used* For $\frac{1}{3}$, accept 0.33 or better For $\frac{7}{12}$, accept 0.58, 0.583(...) For $\frac{1}{6}$, accept 0.17, 0.16, 0.166(...)
				1m	$\frac{7}{12}$ or equivalent fraction	
				1m	$\frac{1}{6}$ or equivalent fraction	

Functions

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
	15	8	1			
	a	a	a	1m	Gives both correct values, ie 4 → 6 18 → 20	✓ *Incomplete processing* eg, for part (a) ◆ 4 → 4 + 2 20 – 2 → 20 eg, for part (b) ◆ 4 → 4 × 2 20 ÷ 2 → 20
	b	b	b	1m	Gives both correct values, ie 4 → 8 10 → 20	✗ *Incorrect notation* eg, for part (a) ◆ 4 → 6n 18 → 20
	c	c	c	2m	Gives two different correct functions Examples of correct functions are shown below eg ▪ $\frac{n}{5}$ ▪ $\sqrt{n}$ ▪ $n - 20$ ▪ $\frac{n - 10}{3}$	! ***Unconventional notation for $\sqrt{n}$*** eg ◆ $n\surd$ Condone ! ***$n \rightarrow 5$*** Accept as a correct function, provided nothing that could be an incorrect operation is shown eg, do not accept ◆ $n \rightarrow +\ 5$
				or 1m	Gives one correct function	✗ *For 2m, same functions written with different symbols or same functions but unsimplified* eg ◆ $\frac{n}{5}$ and $n \div 5$ ◆ $\frac{n}{5}$ and $n \times 0.2$ ◆ $n - 20$ and $n - 10 + 30$
				U1		

Cuboids

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
	16	9	2			
	a	a	a	1m U1	Indicates Cuboid A and gives a correct explanation The most common correct explanations: Show the correct surface area for both A and D eg ▪ The surface area of A is 66, but D is 40 Consider the number of cube faces that are not visible eg ▪ Each cube in D has 3 or 4 faces that cannot be seen but each cube in A has only 1 or 2 ▪ Fewer faces of the cubes are touching each other in A Consider the number of cube faces that are visible eg ▪ In A the cubes show 4 or 5 faces, but in D it's 2 or 3 ▪ There are more cube faces facing out on A than on D	! *Units inserted* Ignore ✓ *Minimally acceptable explanation* eg, for the correct surface areas ◆ 66 and 40 seen ◆ 4 × 16 + 2 is bigger than 4 × 8 + 8 eg, for cube faces that are not visible ◆ There are fewer hidden faces in A ◆ D is more compact eg, for cube faces that are visible ◆ Cubes in A show 4 or more faces, D shows less than 4 ◆ A has more faces showing ◆ A is more spread out ! *Use of 'sides' for cube faces* Condone eg, accept ◆ More sides face out on A ! *Descriptors of cube faces* Note that pupils use a wide range of terms to describe the cube faces eg, for cube faces that are not visible ◆ Hidden faces ◆ Faces pointing inside ◆ Faces touching eg, for cube faces that are visible ◆ Faces facing out ◆ Faces showing ◆ Faces you can see Condone provided the pupil does not explicitly refer to the area of only one of the faces of each cuboid eg, do not accept ◆ You can see 8 faces on D and 16 faces on A ✗ *Use of 'square' for cube or cuboid* eg ◆ You can see more of each square's surface in A than in D ✗ *Explanation is simply a description of one or both of the cuboids* eg ◆ In A all 16 are in a line and not on top of each other ◆ D is two cubes high ✗ *Incorrect statement* eg ◆ Each cube in A shows 4 faces; D is 3

Cuboids (cont)

3-5	4-6	5-7	6-8		Correct response	Additional guidance
	16	9	2			
	b	b	b	**1m**	Indicates All the same	
	c	c	c	**1m**	4	
	d	d	d	**3m**	Shows, in any order, all four correct sets of dimensions eg ▪ 1 3 8 1 4 6 2 2 6 2 3 4	! *Repeated sets of dimensions* eg ◆ 1 3 8 1 8 3 *(repeated)* 2 2 6 6 2 2 *(repeated)* Ignore the repeats and mark as 1, 0, 0 ✘ *Negative or non-integer dimensions used*
				or **2m**	Shows three correct sets of dimensions	
				or **1m**	Shows two correct sets of dimensions	

Shading

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
	17	10	3			
	a	a	a	1m U1	Indicates **No** and gives a correct explanation The most common correct explanations: State or imply that the sides are not all the same length eg ■ The sides are not all the same length ■ Only 2 sides are the same State or imply that the angles are not all the same eg ■ The angles are not all equal ■ The angles aren't 60° State or imply that the order of rotation symmetry is not 3, or that the shape does not have 3 lines of symmetry	✓ *Minimally acceptable explanation* eg ◆ The lengths are different ◆ An equilateral triangle has equal sides ◆ It is isosceles ◆ One side is 4, the others are 4.5 ◆ The angles are different ◆ It has rotation symmetry of order 1 ◆ It doesn't have rotation symmetry ◆ There is only one line of symmetry ✗ *Incorrect explanation* eg ◆ No sides are equal ◆ No equal angles
	b	b	b	1m U1	Indicates **Yes** and gives a correct explanation, even if the fact that the shape is a quadrilateral is not stated explicitly The most common correct explanations: State or imply there are two pairs of adjacent equal length sides eg ■ The long sides are next to each other and they are the same length. So are the short ■ Two isosceles triangles on either side of the same base ■ Two pairs of equal length sides, but opposite sides are not parallel State or imply that the quadrilateral has exactly one line of symmetry through opposite vertices eg ■ The only line of symmetry is a diagonal State or imply that one diagonal bisects the other at right angles eg ■ One diagonal is the perpendicular bisector of the other	! *Minimally acceptable explanation (sides)* Note the explanation must make it explicit that the sides are both equal and adjacent eg, accept ◆ The top two sides are the same and the bottom two sides are the same ◆ Two joining sides equal, other two also equal ◆ It's two isosceles triangles eg, do not accept ◆ Two pairs of equal length sides ◆ It has a big triangle and a little triangle ◆ Opposite sides are equal in length ✗ *Incomplete explanation* eg ◆ There are two equal opposite angles ✓ *Minimally acceptable explanation (symmetry)* eg ◆ Relevant line of symmetry identified on diagram ✗ *Incomplete explanation (symmetry)* eg ◆ It has one line of symmetry [no line or incorrect line of symmetry shown on diagram]

Shading (cont)

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
	17	10	3			
	c	c	c	1m U1	Indicates **Yes** and gives a correct explanation The most common correct explanations: State or imply both that the sides are equal and the angles are equal eg ■ 4 equal sides and 4 right angles ■ It has 4 sides the same length and a right angle State or imply that the order of rotation symmetry is 4 State or imply that the shape has 4 lines of symmetry	✓ *Minimally acceptable explanation* eg ◆ Same sides, same angles ✗ *Incomplete explanation* eg ◆ 4 sides that are the same length ◆ 4 right angles ◆ Sides are the same length and if you rotate it it's a square ◆ Same sides and it has rotation symmetry

Sums and products

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
	18	11	4			
				1m	Both correct, ie 5 –3 **2** **–15**	
				1m	Both correct, ie –8 **3** –5 **–24**	! *Second and third columns completely correct, fourth column incorrect or omitted* Mark as 0, 1

Thinking fractions

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
	19	12	5			
		a	a	2m	$\frac{1}{2}$	✓ *For 2m, decimal fraction of 0.5*
				or 1m	Shows the fraction $\frac{15}{30}$ or other unsimplified but correct fraction eg ■ $\frac{450}{900}$ or Shows correct cancelling to $\frac{1}{2} \times \frac{1}{1}$, even if there are subsequent conceptual errors eg ■ $\frac{\cancel{5}^{1}}{\cancel{6}_{2}} \times \frac{\cancel{3}^{1}}{\cancel{5}_{1}} = \frac{2}{3}$ or Shows or implies a correct method using fractions with not more than one computational error, and with their fraction given in its simplest form eg ■ $\frac{5}{6} \times \frac{3}{5} = \frac{18}{30}$ *(error)* $= \frac{3}{5}$ or Shows or implies a correct method using decimals eg ■ $\frac{2.5}{5}$ ■ 0.83 recurring × 0.6	✗ *Conceptual error* eg • $\frac{5}{6} \times \frac{3}{5} = \frac{8}{30} = \frac{4}{15}$ (numerators added) • $\frac{5}{6} \times \frac{3}{5} = \frac{15}{11}$ (denominators added) ✗ *Decimal rounded* eg • 0.83 × 0.6

Thinking fractions (cont)

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
	19	12	5			
		b	b	2m	$\frac{3}{5}$ or equivalent fraction or decimal	
				or 1m	Shows or implies that the fractions should be multiplied, even if there are subsequent conceptual or computational errors eg ▪ $\frac{3}{4} \times \frac{4}{5}$ ▪ $\frac{1}{4}$ of $\frac{4}{5}$ is $\frac{1}{5}$, then times 3 ▪ $\frac{16}{20} \times \frac{15}{20}$ ▪ 0.8×0.75 ▪ 60% or Shows a complete correct method involving finding fractions of an arbitrary amount, with not more than one computational error eg ▪ $\frac{4}{5}$ of 100 = 80, $\frac{3}{4}$ of 80 = 60, so it is 60 out of 100 ▪ $\frac{3}{4} \times 20 = 15$, $\frac{4}{5} \times 15 = 3$ *(error)* so it's $\frac{3}{20}$	✗ ***The use of 'of' to imply multiplication*** eg ◆ $\frac{3}{4}$ of $\frac{4}{5}$ As the phrase is suggested by the question, do not accept as the only evidence ✗ ***Incomplete method*** To be complete, their final answer must show the connection between the arbitrary amount and the calculated value eg, do not accept ◆ $\frac{4}{5}$ of 100 = 80, $\frac{3}{4}$ of 80 = 60 without subsequent expression of 60 out of 100 or equivalent
				U1		

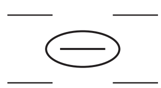
Rearrange

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
	20	13	6			
		a	a	1m	$a - 4$	
				1m	$\frac{c}{4}$	✓ $c \div 4$
				1m	$4k + 3$	
		b	b	2m	Rearranges correctly eg ■ $\frac{w}{5} - 2$ ■ $\frac{w - 10}{5}$	✓ *For 2m, negative denominator* eg ◆ $\frac{10 - w}{-5}$! *For 2m, use of division sign* Accept provided there is no ambiguity eg, accept ◆ $w \div 5 - 2$ ◆ $(w - 10) \div 5$ eg, do not accept ◆ $w - 10 \div 5$
				or 1m	Shows or implies a correct first step of algebraic manipulation eg ■ $2 + t = \frac{w}{5}$ ■ $10 + 5t = w$ ■ $5t = w - 10$ ■ $w - 10 \div 5$	

Journey

Tier & Question 3-5	4-6	5-7	6-8	Mark	Correct response	Additional guidance
		14	7			
				2m	24	
				or 1m	Shows the journey time is $2\frac{1}{2}$ (hours) or Shows a complete correct method eg ■ 60 ÷ 2.5 ■ 60 ÷ (100 ÷ 40) ■ 60 × 2 ÷ 5 ■ 40 × 0.6 ■ $60 = \frac{3}{5}$ of 100, so $\frac{3}{5}$ of 40 or The only error is to misread A for B, giving an answer of $66\frac{2}{3}$	! ***Answer given as a decimal*** Accept 66.7 or 66.6 or 66.6(...) Do not accept 67 unless a correct method or a more accurate value is seen

Factors again

Tier & Question 3-5	4-6	5-7	6-8	Mark	Correct response	Additional guidance
		15	8			
		a	a	1m	Indicates $(y + 2)(y + 6)$, ie 	
		b	b	2m	Gives a correct simplified expression eg ■ $y^2 + 11y + 18$ ■ $11y + 18 + y^2$	! ***Use of multiplication sign in simplified expression*** Accept either $y \times y$ or $11 \times y$, but not both
				or 1m	Multiplies out the brackets correctly, even if there is incorrect or no further simplification eg ■ $y^2 + 9y + 2y + 18$ or The only error is in the constant term but the pupil simplifies correctly to give an expression of the form $ay^2 + by + c$ eg ■ $y^2 + 9y + 2y + 11$ *(error)* $= y^2 + 11y + 11$	✘ ***a, b or c as zero***

Rodents

Marking overlay available

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
		16	9			
		a	a	1m	Indicates the correlation is positive	! ***Positive qualified*** Ignore eg, accept ◆ Strong positive ◆ Direct positive ✘ ***Sign of correlation not indicated*** eg ◆ High ◆ Strong ! ***Relationship quantified*** Ignore if alongside a correct response Otherwise, do not accept ✘ ***Relationship described without reference to correlation*** eg ◆ The longer the body, the longer the feet
		b	b	1m	Draws a line of best fit within the tolerance, and at least of the length, as shown on the overlay	! ***Line not ruled or accurate*** Accept provided the pupil's intention is clear ! ***Line of best fit is incorrect beyond the dashed lines on the overlay*** Condone eg, accept ◆ A correct line of best fit that is then joined to the origin
		c	c	1m	Indicates 7	

Rodents (cont)

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
		16	9			
		d	d	1m	Indicates No and gives a correct explanation The most common correct explanations:	
					Refer to the point being too far removed from the others eg ■ It would be an outlier ■ It would be a long way from the other points ■ It would be too far from the line of best fit	✓ *Minimally acceptable explanation* eg ◆ It's on its own on the graph ◆ It doesn't fit the correlation ◆ The body to foot ratio doesn't fit with the others ✗ *Incomplete explanation* eg ◆ It's on its own ◆ It doesn't fit with the others ✗ *Conceptual misunderstanding* eg ◆ The point isn't on the line of best fit
					Refer to the general relationship between foot length and body length for these species eg ■ A rodent as long as this would have much longer feet ■ For such a small foot, the body would be smaller	✓ *Minimally acceptable explanation* eg ◆ Foot too small ◆ Body too long ◆ This one is long but it has small feet ◆ Rodents with small feet are small in length too ✗ *Incomplete explanation* eg ◆ It doesn't fit the graph ! ***Their line of best fit used to estimate the foot length or the body length if the animal were one of these species of rodents*** Accept provided the value is correct according to their line (even if their line is incorrect) within the following ranges: Foot length ±2, or a range of 5 that includes their value Body length ±15
				U1	Use, implicitly or explicitly, the values 228 and 22 eg ■ Ratio of foot to body is too different from the others ■ 228 is over ten times 22, which is too much	! *Relationship quantified* Accept provided the approximate nature of the relationship is recognised, and body length is shown as between 4 and 6 (inclusive) times foot length, or foot length as between 16% and 25% (inclusive) of body length eg, accept ◆ 22 is not about a fifth of 228 ◆ 45.6 is a fifth of 228 and 22 is not close to this ◆ 228 is much more than about 6 times 22

Tier & Question				
3-5	4-6	5-7	6-8	
		17	10	

Two dice

Mark	Correct response	Additional guidance
2m	Gives the value $\frac{1}{2}$ or equivalent probability, and gives a correct justification The most common correct justifications:	
	Use a systematic approach to illustrate all outcomes, either numerically or as even or odd eg ■ $\begin{array}{c\|cccc} & 2 & 4 & 6 & 8 \\ \hline 2 & 4 & 6 & 8 & 10 \\ 3 & 5 & 7 & 9 & 11 \\ 4 & 6 & 8 & 10 & 12 \\ 5 & 7 & 9 & 11 & 13 \end{array}$ ■ $\begin{array}{c\|cccc} & 2 & 4 & 6 & 8 \\ \hline 2 & e & e & e & e \\ 3 & o & o & o & o \\ 4 & e & e & e & e \\ 5 & o & o & o & o \end{array}$	✓ *Minimally acceptable justification* eg ◆ $\frac{8}{16}$ ◆ 3 + 2, 3 + 4, 3 + 6, 3 + 8 5 + 2, 5 + 4, 5 + 6, 5 + 8 (odd outcomes only) ◆ 2, 2 2, 4 2, 6 2, 8 4, 2 4, 4 4, 6 4, 8 (even outcomes only implied) ! ***Reversals included to give 32 outcomes*** Accept as a correct method
	Use separate probabilities for each dice which are then multiplied eg ■ $\frac{4}{4} \times \frac{2}{4}$ ■ 1st dice all even so probability is 1, 2nd dice two even so probability is 0.5, 1 × 0.5	
	Reason generally eg ■ You are always adding an even from one dice. Half the time you add to another even which gives an even, half the time you add to an odd which gives an odd	✓ *Minimally acceptable justification* eg ◆ Using the 3 gives 4 odd numbers Using the 5 gives 4 odd numbers, and the other 8 must be even ◆ Even + even = even, even + odd = odd same amount of each
or 1m	Gives a correct probability without sufficient justification or with a non-systematic approach or Uses a systematic approach to show at least 12 correct outcomes with not more than one incorrect, even if an incorrect or no probability is given	✗ *Incorrect, spurious or no justification* eg ◆ 2 + 2 = 4, 4 + 3 = 7, 6 + 4 = 10, 8 + 5 = 13 so answer $\frac{1}{2}$ ◆ $\frac{2}{4} = \frac{1}{2}$ with no further working

Juice

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
		18	11			
				2m	Indicates all three correct values, ie Orange $\frac{3}{4}$ Cranberry $\frac{1}{2}$ Grape $\frac{1}{4}$	✓ *Equivalent fractions or decimals*
				or 1m	Gives a correct value for cranberry or grape, with no evidence, seen or implied, of an incorrect method for this value or Gives the correct value for orange and shows working indicating that one of the other amounts should be multiplied by 1.5 eg ▪ $\frac{1}{6} \times \frac{3}{2}$ ▪ $\frac{1}{3} \times 1.5$ ▪ $\frac{1}{3} \div 2 = \frac{2}{3}$ *(error)*, $\frac{2}{3} + \frac{1}{3}$ ▪ $\frac{2}{12} \times 1\frac{1}{2}$ or For each type of juice, shows the correct amount to be added eg ▪ $\frac{1}{4}, \frac{1}{6}, \frac{1}{12}$	✗ *Incorrect method shown or implied* eg ◆ Answer of $\frac{1}{2}, \frac{1}{2}, \frac{1}{2}$ ◆ Answer of $\frac{2}{3}, \frac{1}{2}, \frac{1}{3}$ ($\frac{1}{6}$ added to each) ◆ Answer of $\frac{4}{6}, \frac{3}{6}, \frac{2}{6}$ ($\frac{1}{6}$ added to each) ! *Unconventional notation* For 1m, condone eg, for $\frac{1}{4}$ accept ◆ $\frac{1.5}{6}$! *Decimals rounded within working* For 1m, accept $\frac{1}{3}$ rounded to 0.33 or better and $\frac{1}{6}$ rounded to 0.17 or 0.166 or better

Triangles

Tier & Question			
3-5	4-6	5-7	6-8
		19	12

Correct response

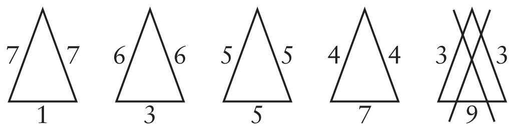
3m Gives a complete justification that identifies the four possible triangles as
4, 4, 7
5, 5, 5
6, 6, 3
7, 7, 1
and makes a correct deduction that allows them to reject other possibilities

The most common correct deductions:

State that the length of the two equal sides must sum to more than the length of the third
eg
- Call the sides a, a and b, then $2a > b$, so

1, 1, 13	× $1 + 1 < 13$
2, 2, 11	× $2 + 2 < 11$
3, 3, 9	× $3 + 3 < 9$
4, 4, 7	✓
5, 5, 5	✓
6, 6, 3	✓
7, 7, 1	✓

- It is not possible to make the base 9 or more as each side must be less than the sum of the other two



State that the length of the 'non-equal' side must be less than 8 (or 7.5)
eg
- $2x + y = 15$, $2x > y$ so $0 < y < 7.5$
  when $y = 7$, $x = 4$
  when $y = 5$, $x = 5$
  when $y = 3$, $x = 6$
  when $y = 1$, $x = 7$

Additional guidance

✓ ***Minimally acceptable deduction***
eg
- There are no more because the combined total of the equal sides must be more than the other side or it wouldn't meet [with four possible triangles identified]
- All sides must be < 8 or the other two sides would not reach, only possible solutions are
  5 + 5 + 5
  7 + 7 + 1
  6 + 6 + 3
  4 + 4 + 7

! ***Deduction is that 'the sides won't meet'***
For 3m, pupils must consider explicitly the 3, 3, 9 triangle
eg, for 3m accept
- 7, 7, 1
  6, 6, 3
  5, 5, 5
  4, 4, 7
  3, 3, 9 is not possible because the sides won't touch

Triangles (cont)

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
		19	12			
				or **2m**	Makes a correct deduction that $2a > b$ or that $b < 8$, even if the four possible triangles are not identified or Identifies the four possible triangles and states that the 3, 3, 9 triangle will not work, but gives an incomplete or no explanation as to why or Identifies the four possible triangles and gives an explanation that the sides on others won't meet, without explicitly considering the 3, 3, 9 triangle eg ■ There are no more as the sides wouldn't meet [with four possible triangles identified] ■ 2, 2, 11 and 1, 1, 13 won't work as the sides are too short to reach to make a triangle [with four possible triangles identified]	✗ *Triangles identified only through unlabelled scale drawings*
				or **1m**	Identifies the four possible triangles, with no impossible triangles identified as possible or Makes a correct statement about the sides of the triangles eg ■ The sum of the sides that are equal must be even ■ One side must be odd	
				U3		

Births

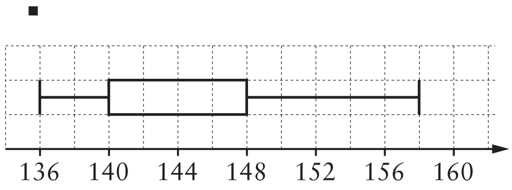
Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
			13			
			a	1m	1920	✓ *Unambiguous indication* eg • 1.13×10^6
			b	2m	4.5×10^4	
				or 1m	Shows or implies the value 45 000 eg ▪ 45 000 ▪ 45×10^3 ▪ 0.45×10^5	✗ *Incorrect value* eg • 45×10^4 • 4.5^4

Factors

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
			14			
			a	1m	$a = 4$ and $b = 3$	! *For parts (a) and (b), values embedded* Accept embedded values but do not accept incorrect statements eg, for part (a) accept • 2^4 and 2^3 seen eg, for part (a) do not accept • $a = 2^4$ or $b = 2^3$
			b	1m	7	✓ *For part (b), follow through from part (a) as the sum of their values for a and b*

Population

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
			15			
			a	1m U1	Indicates False and gives a correct explanation eg ■ Although the number of under 20s is constant, the population size has changed ■ It's a smaller proportion of the whole population ■ The overall number of people has increased so the percentage will drop ■ $\frac{2.3}{6} \neq \frac{2.3}{9}$ ■ It's out of more people	✓ *Minimally acceptable explanation* eg ◆ There are more people (in 2050) ! *Values evaluated or approximated* Accept within the following inclusive ranges: 1998 No. of people < 20: 2 or 2.2 to 2.4 (billion) Total no. of people: 5.9 to 6.1 (billion) Proportion of people < 20 33% to 45% 2050 No. of people < 20: 2 or 2.2 to 2.4 (billion) Total no. of people: 8.8 to 9.2 (billion) Proportion of people < 20 20% to 30% 1998 to 2050 Proportional increase needed 45% to 55% eg, accept ◆ To keep the number of under 20s about the same it would need to be about 50% more
			b	1m	Gives a value between 45 and 55 inclusive	
			c	1m	Gives a value between 250 and 350 inclusive	
			d	1m U1	Makes a correct statement that refers both to the increase in the population as a whole and to the increase in the proportion of the population who are aged 60 or over, or, minimally, 40 or over eg ■ By 2050 the world's population is expected to have risen by 50%. Much of this increase will be from people aged 60 or over ■ The whole population will be bigger but the proportion of young people will be less	! *Use of 'old' or 'young'* Accept old for people over 60, or, minimally, over 40 Accept young for people under 20, or, minimally, under 40 ✓ *Implicit reference to the increase in the population as a whole* eg ◆ Number of young people stays the same but old people increases ! *Follow through* Accept provided this does not invalidate the correct conclusion ✗ *Incomplete interpretation* eg ◆ More people in 2050, more over 60 ◆ The world population will be bigger and people are expected to live longer ◆ Proportion of young people will be less ✗ *No interpretation* eg ◆ The world population will increase by 50% and the number of people over 60 will increase by 300%

Tier & Question						**Box plots**	
3-5	4-6	5-7	6-8				
			16			**Correct response**	**Additional guidance**
			a	2m		Draws a correct box plot, in which shortest = 136 tallest > 156 IQR < 10 eg 	! ***Value for median shown, or other labels given*** Ignore, even if incorrect ! ***All four points of location shown correctly but box plot not drawn*** Mark as 1, 0
				or 1m		Their box plot has shortest = 136, and tallest > 156 or Their box plot has IQR < 10	
			b			Up to 3m are available from the categories shown on the opposite page, all of which compare year 9 with year 7 girls Note that a maximum of 2m can be awarded from the minimally acceptable interpretations for the categories, ie for all 3m at least some valid comparison must be made	! ***Year group(s) not specified*** Accept provided the statement is correct for year 9 eg, accept ◆ The range of heights is greater ! ***Incorrect statement or interpretation*** Within each category, do not accept contradictory statements or incorrect data eg, do not accept ◆ In year 9 the IQR was 8, that's *higher (error)* than for year 7 ◆ The year 9 range was bigger and it was *40 (error)*

Markers may find the following helpful:

	year 9		year 7
shortest	136	± 1	136
tallest	172	± 1	156
range	36	± 2	20
LQ	149.5	± 1	140
median	153	± 1	144
UQ	157	± 1	150
IQR	7.5	± 2	10

Box plots (cont)

Tier & Question 3-5	4-6	5-7	6-8	Mark	Correct response	Additional guidance
			16			
			b	1m	Uses the **range**, or both the shortest and tallest, to make a valid comparison with year 7 girls eg ▪ The range of heights for older girls is greater ▪ The shortest girl in year 9 is (about) the same as the shortest girl in year 7, but the tallest girl in year 9 is (much) taller than the tallest girl in year 7 ▪ The shortest girls are the same, but the tallest girl in year 9 is about 16cm taller ▪ Shortest girl in year 9 is 136, same as year 7 Tallest in year 9 is 172, in year 7 it is 156	✓ *Minimally acceptable interpretation* eg ◆ Identifies the year 9 range as 36 (± 2) ◆ Identifies for year 9 both the shortest as 136 (± 1) and the tallest as 172 (± 1) ✘ *Values not interpreted* eg ◆ 136, 172 (with no further indication of the meaning of these values) ✘ *Ambiguous interpretation* eg ◆ Year 9 girls are generally taller (with no further detail given)
				1m	Uses the **median** to make a valid comparison with year 7 girls eg ▪ The median is higher in year 9 ▪ The median for year 9 is nearly the same as the tallest girl in year 7 ▪ Year 9 median is 153 but year 7 is 144	✓ *Minimally acceptable interpretation* eg ◆ Identifies the median for year 9 as 153 (± 1) ! *'Average' used in place of 'median'* Condone
				1m	Uses the **IQR**, or both the LQ and the UQ, to make a valid comparison with year 7 girls eg ▪ The IQR for older girls is smaller ▪ Both quartiles are lower for year 7 pupils ▪ The IQR is 9 for year 9 but 10 for year 7 ▪ Year 7 has a lower quartile of 140 and an upper quartile of 150 but year 9 has a lower quartile of 150 and an upper quartile of 157	✓ *Minimally acceptable interpretation* eg ◆ Identifies for year 9 both the LQ as 149.5 (± 1) and the UQ as 157 (± 1) ◆ Identifies the year 9 IQR as 7.5 (± 2) ◆ Marks the median, the LQ and UQ on the *x*-axis of the cumulative frequency diagram, even if specific values or labels are not given
				1m U2	For year 9, **interprets the IQR** to make a valid comparison with year 7 girls eg ▪ There is less variability within the middle 50% of girls in year 9 ▪ In year 9 the middle 50% are more bunched up ▪ A lot of girls in year 9 are just a bit bigger or just a bit smaller than average	! *Incomplete interpretation* eg ◆ There is less variability in year 9 ◆ Results more consistent for year 9 As these could be incorrectly referring to the range rather than the IQR, do not accept

Graphs

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
			17			
				2m	Gives all five correct letters in the correct order, ie D C B A E	
				or 1m	Gives at least three correct letters	

Proving

Tier & Question 3-5	4-6	5-7	6-8		Correct response	Additional guidance
			18			
				3m	Gives a correct proof The most common correct proofs: Use algebra to manipulate expressions representing two consecutive numbers, interpreting the results eg ▪ n and $n + 1$ are consecutive numbers n^2, $(n + 1)^2 = n^2 + 2n + 1$ $n^2 + n^2 + 2n + 1 = 2n^2 + 2n + 1$ $= 2(n^2 + n) + 1$, which is odd ▪ $(2x)^2 = 4x^2$ $(2x - 1)^2 = 4x^2 - 2x - 2x + 1$, $4x^2 + 4x^2 - 2x - 2x + 1$ is even + even − even − even = even, then + 1 makes it odd Reason generally about odd and even numbers, showing explicitly the following four steps 1. Of the two numbers, one must be odd (or one must be even) 2. Odd^2 is odd 3. Even^2 is even 4. Odd + even is odd eg ▪ Out of the two you pick, one will be even and so have an even square. One will be odd and so have an odd square. An odd number added to an even number gives you an odd number	! *Numbers used* Ignore if used to illustrate but do not accept explanations that lack generality eg, do not accept ◆ $3^2 = 9$, $4^2 = 16$ $9 + 16 = 25$, which is odd ✓ *Minimally acceptable proof* eg, using algebra ◆ $n^2 + (n + 1)^2 = 2n^2 + 2n + 1$ $= 2(n^2 + n) + 1$ ◆ $n^2 + (n + 1)^2 = 2n^2 + 2n + 1$ = even + even + 1 ◆ $(2x)^2 + (2x - 1)^2 = 4(2x^2 - x) + 1$ eg, reasoning generally ◆ One is odd, odd × odd = odd even × even = even odd + even = odd ◆ Consecutive numbers are odd and even, and consecutive square numbers alternate between being odd and even. Odd + even = odd ✗ *For 3m, incomplete mathematical communication* eg ◆ One is odd, one is even Square them both and you have one odd number, and odd + even is odd

Proving (cont)

Tier & Question 3-5	4-6	5-7	6-8	Mark	Correct response	Additional guidance
			18			
				or 2m	Uses algebraic expressions to represent the squares of any two consecutive numbers, then expands the brackets correctly, even if expressions are not simplified eg ▪ n^2, $(n + 1)^2$ n^2, $n^2 + 2n + 1$ ▪ $(2x)^2 = 4x^2$ $(2x - 1)^2 = 4x^2 - 2x - 2x + 1$ or Reasons generally about odd and even numbers but omits one of the four steps shown above eg ▪ Odd^2 = odd, even^2 = even, Odd + even = odd [step 1 not explicit] ▪ Consecutive square numbers alternate between being odd and even, odd^2 = odd, an odd number added to an even number is always odd [step 3 not explicit] ▪ If the integers are consecutive, one of them will be even, the square of an odd number is always odd, and the square of an even number is always even [step 4 not explicit]	✓ ***For 2m, minimally acceptable response*** eg ◆ One is odd, one is even. Square them both and you have one odd number. Odd + even is odd
				or 1m U1	Uses algebraic expressions to represent any two consecutive numbers eg ▪ n, $n + 1$ ▪ $2x - 1$, $2x$ or Attempts to reason generally, showing at least one of the four steps eg ▪ Of two consecutive numbers, one is odd and one is even ▪ Odd^2 = odd ▪ Even × even = even ▪ One in every two consecutive squares is odd ▪ Odd + even = odd	✓ ***For 1m, minimally acceptable response*** eg ◆ One is odd

EARLY YEARS

NATIONAL CURRICULUM 5–16

GCSE

GNVQ

GCE A LEVEL

NVQ

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