MATHEMATICS B   J567/04

Paper 4 (Higher Tier)

Additional Specimen Mark Scheme

The maximum mark for this paper is **100**.

This document consists of **10** printed pages.

ADDITIONAL SPECIMEN

Marking Instructions

1. Mark strictly to the mark scheme.

2. Make no deduction for omission of units except as indicated on the mark scheme.

3. Work crossed out but not replaced should be marked.

4. M (method) marks are not lost for purely numerical errors.
   A (accuracy) marks depend on preceding M (method) marks. Therefore M0 A1 cannot be awarded.
   B (independent) marks are independent of M (method) marks and are awarded for a correct final answer or a correct intermediate stage.

5. Subject to 4, two situations may be indicated on the mark scheme conditioning the award of A marks or independent marks:
   - Correct answer obtained without wrong working
   - Follows correctly from a previous answer whether correct or not ("ft").

6. As a general principle, if two or more methods are offered, mark only the method that leads to the answer on the answer line. If two (or more) answers are offered, mark the poorer (poorest).

7. Always mark the greatest number of significant figures seen, even if this is then rounded or truncated on the answer line, unless the question asks for a specific degree of accuracy.

8. If the correct answer is seen in the body and the answer given in the answer space is a clear transcription error allow full marks unless the mark scheme says 'mark final answer' or 'cao'. If the answer is missing but the correct answer is seen in the body allow full marks. If the correct answer is seen in the working but a completely different answer is seen in the answer space then accuracy marks for the answer are lost. Method marks would normally be given.

9. Where there is clear evidence of a misread, and this does not affect the nature or difficulty of the question, a penalty of 1 mark is generally appropriate. This may be achieved by awarding M marks but not an A mark, or awarding one mark less than the maximum.

10. For methods not provided for in the mark scheme give as far as possible equivalent marks for equivalent work.

11. For answers scoring no marks, you must either award NR (no response) or 0, as follows:

   Award NR if:

   - Nothing is written at all in the answer space
   - There is any comment which does not in any way relate to the question being asked ("can't do", "don't know", etc.)
   - There is any sort of mark that is not an attempt at the question (a dash, a question mark, etc.)

Award 0 if:

- There is any attempt that earns no credit. This could, for example, include the candidate copying all or some of the question, or any working that does not earn any marks, whether crossed out or not.

12.   Where a follow through (ft) mark is indicated on the mark scheme for a particular part question, you must ensure that you refer back to the answer of the previous part question.

13.   Anything in the mark scheme which is in square brackets […] is not required for the mark to be earned, but if present it must be correct.

Abbreviations

The following abbreviations are commonly found in GCSE Mathematics mark schemes.

- Where you see **oe** in the mark scheme it means **or equivalent.**

- Where you see **isw** in the mark scheme it means **ignore subsequent working.**

- Where you see **www** in the mark scheme it means **without wrong working.**

- Where you see **cao** in the mark scheme it means **correct answer only.**

- Where you see **soi** in the mark scheme it means **seen or implied.**

- Where you see **rot** in the mark scheme it means **rounded or truncated.**

- Where you see **seen** in the mark scheme it means that you should award the mark if that number/expression is seen anywhere in the answer space, including on the answer line, even if it is not in the method leading to the final answer.

- Where you see **figs 237**, for example, this means any answer with only these digits. You should ignore leading or trailing zeros and any decimal point e.g. 37000, 2·37, 2·370, 0·00237 would be acceptable but 23070 or 2374 would not

4

1	**(a)**	Δ with vertices at (1, 0), (⁻3, 0) and (1, 2)	3	**M2** for rotation about (2, 0) through 90° clockwise or **M1** for rotation through 90° anticlockwise about wrong centre
	(b)	Yes, same shape and size	1	Or "exactly the same, just rotated"
2	**(a)**	(i) 2 | 3 5 7 8 3 | 0 1 2 5 6 7 4 | 0 1 2 4 8 5 | 1 2 2 3 6	3	**M2** if correct except for one error or omission Or **M1** for unordered leaves with at most one error or omission
		(ii) 33	1	
		(iii) 38·5	2	**M1** for at least one of 37 and 40 identified
	(b)	3·85 or 3·9	4	**M1** for at least 3 of correct midpoints 2·75, 3·25 etc soi by second mark **M1** for *their* midpoints × frequencies seen or implied (eg at least 3 of 5·5, 16·25, 11·25, 29·75, 14·25 or total 77) To qualify for this mark *their* midpoints must be consistent values within each group and multiplied by correct frequencies **M1** for *their* Σ*fx* ÷ *their* Σ*f* Allow **A1** for answer of 4 only if correct method seen
3	**(a)**	64	1	
	(b)	50	3	**M1** for other interior angles as 140° and 132° **M1** for sum of interior angles = 540° soi OR **M1** for other exterior angles as 80° and 62° and **M1** for sum of exterior angles = 360° soi
	(c)	3·1496... rounded to 2 sf or more	3	**M2** for $\sqrt{3\cdot9^2 - 2\cdot3^2}$ or $\sqrt{9\cdot92}$ Or **M1** for 3·9² = h^2 + 2·3² or h^2 = 3·9² − 2·3² or 9·92 Or **SC1** for $\sqrt{3\cdot9^2 + 2\cdot3^2}$ or $\sqrt{20\cdot5}$ or 4·52…

ADDITIONAL SPECIMEN

4	(a)	11·5 to 11·6	3	**M2** for 1150 to 1160 Or **M1** for 3 cm × (180 to 183) **M1** for correct conversion of their growth to metres and adding 6·1
	(b)	13·5	1	
	(c)	5457 or 5460	3	**M2** for 5100 × 1·07 Or **M1** for 5100 × 0·07 **M1** for 5100 + their 7% of 5100 Allow **A1** for 5500 only if correct method seen
		(ii) $1·07^{10}$ = 1·967 so hasn't quite doubled in 10 years or 'about doubled / about right' oe	1 1 1	or $5100 × 1·07^{10}$ or equivalent or 10 032 or comparison with 10 200 (nb. may use a different starting population from 5100)
5	(a)	6·5 or equivalent	3	**M1** for correct collection of numbers **M1** for correct collection of x terms **M1** for answer follow through from their $ax = b$
	(b)	$x < {}^-3$	2	**M1** for $5x < {}^-15$ or $15 < {}^-5x$ Or **SC1** for ${}^-3$ with equation or wrong inequality or embedded $(5 × {}^-3 + 17 < 2)$

6	(a)	2 : 15	2	**M1** for 6 : 45 or 10 : 75 or 2/15 : 1 or 1 : 7·5 or for 2 ml : 15 ml
	(b)	360	2	**M1** for 120 seen or for $240 \times \dfrac{3}{2}$ oe
	(c)	Yes with correct and clearly expressed supporting method showing volume of tea in pot and volume required for 4 mugs	5	Including clearly stated units
		Volume of tea in pot found and volume required for 4 mugs but decision not clear **SC**: allow **4** marks for complete solution of problem with 8·4 used instead of 7·4 [volume of 1 mug = 323 to 324 ml, and of 4 mugs = 1292 to 1296 ml]	4-3	For lower mark - Volume of pot = 11 × 11 × 12 = 1452 ml <u>and</u> volume of one mug = π × 3·5² × 7·4 = 284 to 285 ml or for volume of 4 mugs = 1132 to 1140 [ml] but not volume of pot
		Volume of 1 mug or volume of pot Incorrect answer with no relevant content	2-1 0	For lower mark – correct method for volume of pot or correct method for volume of mug
	(d)	(i) 455 000 or 4·55 × 10⁵, given to 2 or 3 sf	2	**M1** for digits 45(5) or 46 seen with wrong number of zeros or poor standard form notation
		(ii) 28·8 to 28·9 or 29	2	**M1** for 1·26 / 4·36 [× 100] oe ignore powers of 10 for this mark
	(e)	843 to 844	3	**M2** for $250 \times \left(\dfrac{12 \cdot 6}{8 \cdot 4}\right)^3$ Or **M1** for [linear] scale factor = 12·6 ÷ 8·4 [=1·5] soi Allow **A1** for 840 if method seen
7		⊥ bisector of AB drawn with correct arcs Circle drawn, centre C radius 5 cm Correct region shaded	2 1 1	**B1** if drawn with no / wrong arcs At least relevant part of circle must be drawn ft *their* intersecting line and circle

8	(a)	4, ‾4	1	
		All 7 points correctly plotted	2	ft *their* points **M1** for 4 points correct
		Smooth curve within 2 mm of their points	1	No ft from wrong table for curve mark
	(b)	Correct trial of value of 2·5 ≤ x < 3	1	Outcomes of their trials must agree with table to at least 1 dp
		Correct trial of 2·6 ≤ x ≤ 2·7	1	Allow equivalent trials of $x^3 - 5x - 6 = 0$
		Correct trials of 2·68 and 2·69 or better, giving one result < 6 and one > 6	1	
		Answer 2·69	1	

2.5	3.125	2.61	4.729581
2.6	4.576	2.62	4.884728
2.7	6.183	2.63	5.041447
2.8	7.952	2.64	5.199744
2.9	9.889	2.65	5.359625
		2.66	5.521096
		2.67	5.684163
		2.68	5.848832
2.685	5.931769	2.69	6.015109

9		Disagree <u>and</u> compares medians	1	See below
		Agree <u>and</u> UQ = 6·25 [h] or 6 h 15 min	1	Or statement *Letsmove* UQ > 6
		Agree <u>and</u> *Springers* range smaller Or disagree <u>and</u> *Springers* IQR smaller	1	Or equivalent comparisons; need to use relevant numbers or refer to length of box etc

	Letsmove	Springers
Lowest	2.00	3.25
LQ	3.75	4.00
Median	4.50	5.00
UQ	6.25	6.75
Highest	8.50	7.00

| 10 | (a) | 1·5 or equivalent | 2 | **M1** for evidence of rise ÷ run |
| | (b) | y = 1·5x + 4
Or ft y = [*their* (a)]x + 4 | 2ft | **M1** for y = other m + 4
or y = 1·5x + other c   or   y = [*their* (a)]x + other c
or 1·5x + 4   or   [*their* (a)]x + 4 without "y =" |

11	(a)	$(x - 5)(x + 4)$	2	**M1** for other $(x \pm 5)(x \pm 4)$ or for other two term factors giving two terms of expansion correct
	(b)	$[r =] \sqrt[3]{\dfrac{3V}{2\pi}}$	3	**M1** for each of three correct constructive steps leading to answer Allow follow through from a previous error A correct 'triple-decker' fraction earns **M2** only
12	(a)	$57{\cdot}6^2 = 87{\cdot}4^2 + 62{\cdot}1^2 - 2 \times 87{\cdot}4 \times 62{\cdot}1 \times \cos x$ Correct completion to given answer, showing at least two intermediate steps	M1 A1	For a correct cos rule statement; condone working with 41° to show opposite side approx. 57·6
	(b)	2193 to 2196 or 2200	3	**M1** for ½ × 87·4 × 62·1 × cos 41·1(...) [= 1783 to 1785] **M1** for *their* area × 1·23
13	(a)*	Correct steps to rearrange the equation as given; these are algebraically correct and clear. Generally, candidates will multiply through by x + 2 and x − 3, then correctly combine the terms, eg $(x - 3) + 7(x + 2)$ or $8x + 11$ on LHS, or $x^2 - x - 6$ as common denominator, or show $4(x^2 - x - 6)$ or expanded equivalent. Candidates then complete to the given answer with at least one interim step shown, eg by showing $4x^2 - 4x - 24 - 8x - 11 = 0$	3	
		There is one minor slip in the algebra or the algebraic communication is unclear or not technically accurate but otherwise the method is completely correct or candidates may proceed correctly to multiply by x + 2 and x − 3, then correctly combine the terms, eg $(x - 3)$ + 7(x + 2) or 8x + 11 on LHS, or $x^2 - x$ − 6 as common denominator, or show $4(x^2 - x - 6)$ or expanded equivalent but then fail to 'complete'.	2-1	For the lower mark, candidates attempt to multiply through by x + 2 and x − 3 or candidates carry out the first two steps shown for 2 marks but there is either one minor slip in the algebra or the algebraic communication is unclear or not technically accurate or a fully correct method is shown but there are two minor slips in the algebra
		No relevant algebraic manipulation	0	
	(b)	$\dfrac{12 \pm \sqrt{12^2 - 4 \times 4 \times -35}}{2 \times 4}$ 4·82 and ⁻1·82	M1 A2	or $(2x - 3)^2 = 35 + 9$; for use of formula or completing the square, condoning one error **A1** for one of these or for both of 4·8166... and ⁻1·8166... to 1 or 3 or more decimal places

14	(a)	$y = 25x^2$ or equivalent www	3	**M1** for $y = kx^2$ **M1** for $100 = k \times 2^2$ allow **A1** for $k = 25$
	(b)	900 cao	1	
15		A correct formula involving density 16·5 used 3·25, 2·65, 1·85 used 262·897	M1 M1 M1 A1	Soi Eg volume = 15·933... seen
16		10 obtained from 6 + 3 + 1 (6 ways) 6 + 2 + 2 (3 ways) 5 + 1 + 4 (6 ways) 5 + 2 + 3 (6 ways) 4 + 4 + 2 (3 ways) 4 + 3 + 3 (3 ways) total 27 ways 9 obtained from 6 + 2 + 1 (6 ways) or 5 + 2 + 2 (3 ways) or 5 + 1 + 3 (6 ways) or 4 + 4 + 1 (3 ways) or 4 + 2 + 3 (6 ways) or 3 + 3 + 3 (1 way) total 25 ways At least one of 25 and 27 correct Total no of ways = 6^3 or 216 So 10 is more common with difference in probability of 2/216 oe	M1 M1 A1 M1 A1	For each of 9 and 10, allow **M1** if at least 20 different ways correctly identified If **M0**, allow **SC1** for all the different combinations found for at least one of 9 or 10 Dependent on the relevant method mark May be seen as denominator in probability Allow final **A1** only if all ways found for each number

Paper Total: 100

Assessment Objectives and Functional Elements Grid

GCSE MATHEMATICS B

J567/04 - Paper 4 (Higher Tier)

	Topic	**Context**	**Ref**	**AO1**	**AO2**	**AO3**	**Functional**
1	Rotation; congruence		HIG6	4			
2	Stem and leaf	Car speeds	HIS3 HBS2	3	7		
3	Angles on parallel lines and in polygons; Pythagoras' theorem		HIG1 HBG3 HBG4	7			
4	Length/time problem; lower bounds; percentage change; compound change	Whales	HBG1 HBN4 HSN2 HGN5	1	3	6	6
5	Linear equation and inequality		HIA2 HBA2	5			
6	Ratio; volume of cuboids and cylinders; standard form; enlargement and volume	Cups, teapots, mugs, tea and jugs	HIN5 HBG5 HSN3 HSG7	2	9	5	10
7	Loci	Buoys	HBG6		4		4
8	Graph of a cubic; trial and improvement		HSA5 HIA5	8			
9	Comparing distributions using box and whisker plots	Dance clubs	HSS2 HSS3		3		
10	Equations of straight lines		HSA7	4			
11	Factorise quadratic; rearrange formula with power		HSA2 HSA3	5			
12	Cosine rule; area of Δ	Field for sale	HGG3		5		3
13	Algebraic fraction; solve quadratic using formula		HGA4 HGA2	6			
14	Direct proportion		HGA1	4			
15	Density and upper bounds	Metal cuboid	HBG2 HGN4		4		
16	Probability	Three dice	HGS1			5	
	TOTALS			**49**	**35**	**16**	**23**

Paper Total: 100 marks