GCSE

Mathematics A (Two Tier)

General Certificate of Secondary Education

Component **J512/04:** Paper 4

Mark Scheme for January 2011

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MARKING INSTRUCTIONS FOR ASSISTANT EXAMINERS

1   Mark strictly to the mark scheme.

2   Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise.

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 marks are independent of **M** (method) marks and are awarded for a correct final answer or a correct intermediate stage.

5   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).

6   When the data of a question is consistently misread in such a way as not to alter the nature or difficulty of the question, please follow the candidate's work and allow follow through for **A** and **B** marks. Deduct 1 mark from any **A** or **B** marks earned and record this by using the **MR** annotation. **M** marks are not deducted for misreads.

7   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 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.

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

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

Award NR (no response) 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.

10   Where a follow through 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.

J512/04 MARK SCHEME AND RATIONALE JANUARY 2011

General comments

- Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures seen. E.g. answer on mark scheme is 15.75 which is seen in the working. The candidate then rounds or truncates this to 15.8, 15 or 16 on the answer line. Allow full marks for the 15.75.

- Anything in the mark scheme which is in brackets (…) is not required for the mark to be earned, but if present it must be correct.

- Ranges of answers given in the mark scheme are always inclusive.

- 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** (after correct answer obtained), provided the method has been completed**.**

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

- 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 the answer line, even if it is not in the method leading to the final answer.

- Figs: for example **figs 237** means any answer with just these digits with leading or trailing zeros disregarding any decimal point. E.g. 237000, 2.37, 2.370, 0.00237 but not 23070 or 2374.

1	(a)	11.28 or 11 $\frac{7}{25}$	2	**M1** for 16.9(2) ÷ 1.5 or $\frac{282}{25}$ If M0 then **SC1** for 11.3	
	(b)	0.38	2	**B1** for 0.37(7...) seen	
2	(a)	2x + 15 = 43 or 2x + 5 × 3 = 43 oe or x = ½ (43 - 15) Any further work must be correct <u>equations</u>	2	**M1** for 2x + 5 × 3 Or if correct answer seen, but further working is incorrect Or if using letter for large balloon eg L and answer of 2x + 5L = 43 or 2x+3L = 43	Allow 2x to be written as 2 x x and 15 as 5 x 3 Condone £ signs
	(b)	14	2	**M1** for 2x = 43 – 15 If M0 then **SC1** for correct embedded Answer ie 2 x 14 + 5 x 3 = 43	May be seen in stages eg 43 – 15 = 28, 28 / 2
3		(Probability yellow =) ¼ or 0.25 or 25% (Probability) ¼ <u>doubled </u>is ½ or equivalent statement or P(Y) needs to be ½ or 2/4 or 0.5 or 50% or evens or fifty-fifty or need <u>same</u> number of yellow as blue 2 (yellow)	**M1** **M1** **A1**	**DEP** on 1st M1 If M0 or M1 only, award also **SC1** for 2 (yellow) Or need 3 yellow and 3 blue Or **add** 2 + n yellow and n blue where n>0 and n is an integer	May be seen in tree diagram etc Do not allow method marks for odds or ratio **M2** for $\frac{1+n}{4+n} = \frac{1}{2}$

4	(a)	3 | 4 4 4 | 6 5 | 4 7 9 6 | 1 3 8 7 | 0 3 7 9 8 | 1 4 cao	2	**M1** for complete unordered stem & leaf or ordered stem & leaf with up to & including 3 errors/omissions	Take care the 4, as in 34, may be crossed out and replaced by 7, as in 57 in their working for part (b) Or may see 7 as in 57 added as their working for part (b) **Must** clearly see this to award both marks
		Any correct numerical key eg 6 | 3 = 63 (°F)	1	If **M0** then **SC1** for stem written 30, 40, 50 … with <u>all</u> leaves correct and matching key eg 60 | 3 = 63 (°F)	
	(b)	(Mode) increase (by 23) (to 57) (from 34)	1	If numbers quoted they need to be correct	Allow <u>change from 34 to 57</u>, not just the mode becomes or is 57 Just 34, 57 seen without words indicating increase or change scores <u>no</u> marks
		(Median) unchanged / stays the same	1	If number quoted it needs to be correct	Stays as 63
5	(a)	157488 Allow 157500 or 157000 www	3	**M2** for 81600 × 1.93 or 81600 + (81600 × 0.93) Or **M1** for 81600 × 0.93 or 75888 or 81600 + *their* 75888	May be done in stages If full correct method followed by subtracting 81600 award M2 If full correct method followed by other working, method spoilt award M0
	(b)	60.3(....) www Accept 60 if obtained from non T&I method If T&I method allow 60 only if 60.3(…) or 160.3(…) seen in working	3	**M2** for (81600 − 50900) ÷ 50900 × 100 or (81600 ÷ 50900) − 1 or (81600 ÷ 50900) (x100) − 100 or 160.3(…) seen Or **M1** for (81600 − 50900) ÷ 50900 or 81600 ÷ 50900 or (81600 ÷ 50900) x 100 or 160 For T&I method leading to an answer 60.(…) award **SC1**	May be done in stages

6	(a)	$x < 5.25$ or $x < 5\frac{1}{4}$ or $x < \dfrac{21}{4}$	2	**M1** for $4x < 20 + 1$ If M0 then **SC1** for 5.25 or $5\frac{1}{4}$ or $\dfrac{21}{4}$ or $x < 4.75$ or $x < 4\frac{3}{4}$	Mark final answer only Condone x missing ie allow <5.25, $<5 1/4$, $< \dfrac{21}{4}$ For M or SC mark condone $= > \geq \leq$
	(b)	1, 2, 3, 4, 5	1	All values & no extras If 0 then **SC1** for 1, 2, 3, 4 provided their (a) $(x <)$ 4.75 or $4\frac{3}{4}$	Allow $1 - 5$
7	(a)	$3 \times 180 = 540$ or $(5\times180) - 360 = 540$ AND $540 \div 5 = 108$ oe rearrangement Or $360/5 = 72$ oe rearrangement AND $180 - 72 = 108$ oe rearrangement Or $108 \times 5 = 3 \times 180$ Or $360/5 = 180 - 108$ Or $180 - (360/5) = 108$ Or $(5\times180) - 360 = 5 \times 108$	2	**M1** for 3×180 or $(5\times 180) -360$ or $360/5$ Award **M0** if <u>just</u> see $540 \div 5 (= 108)$ Or $108 \times 5 (=540)$ Or $540 \div 108 (= 5)$	For 3×180 allow $360 + 180$
	(b)	36 www	3	**B2** for $180 - 2(180 - 108)$ Or **B1** for $2(180 - 108)$ or 144 seen	
	(c)	Correct construction with ruled line through angle C $\pm 2°$ with arcs visible	2	**M1** for complete method using construction of pairs of arcs that intersect and will lead to the correct angle bisection If M0 then **SC1** for correct ruled line $\pm 2°$	Look for pairs of arcs which have symmetry Allow M marks for perpendicular bisector of AE or BD **It is suggested that you set up an angle of 54° on your screen and do not delete it**

8		Correct trial from 2 to 3 inclusive Improved correct trial to 1dp or better	M1 M1	Improved trial means a further trial which does give an answer closer to 7 For both M and A marks: Trials <u>must</u> be evaluated Allow rounding or truncating to 1dp or better Condone missing .0	Condone 2.2 if 2.3 is first trial Allow correct trials 2.2 and 2.3 with numerical explanation that 2.3 gives a closer answer than 2.2
		Two correct trials between 2.25 and 2.3(5) inclusive that give answers below 7 & above 7	A1		Trial Result: 2 4 2.1 5.061 2.2 6.248 2.25 6.89.... 2.26 7.02... 2.27 7.157… 2.28 7.29… 2.29 7.4… 2.3 7.567 2.4 9.024 2.5 10.625 2.6 12.376 2.7 14.283 2.8 16.352 2.9 18.589 3 21
		2.3 cao	A1	Dependent on both **M** marks only	It is possible to award M1 M1 A0 A1 It is not possible to award M1 M0 A0 A1 or M1 M0 A1A1 or M1 M0 A1 A0

9	(a)	-3.5 (-3 ½) and -5	1	Both	
	(b)	Both points plotted Curve 'correct' shape, through at least all given points and one plotted point	1 1	FT their (a) ± ½ small square ± ½ small square	MUST see at least one point plotted
	(c)	Correct ruled line drawn extending from (0, -5) to (2.5, 0)	3	**M2** for $y = 2x + c$ for $c < 0$ or for y = $\underline{4}$x − 5 or finding two points on $y = 2x - 5$ Or **M1** for $y = mx - 5$ for $m > 0$ or finding any point on $y = 2x - 5$	M marks for lines can only be awarded if lines extend to both axes Two points can be implied from a short correct line Finding means written down in a sum or a table or as coordinate or <u>clearly plotted</u>
	(d)	0.6 3.4	2	Strict FT *their* graphs provided both graphs, curve & line are drawn ± ½ small square **B1** for one correct ± ½ small square If B0 and both given as coordinates with both x values correct ± ½ small square then **SC1** only	Condone for both marks where both x and y values given independently ie x=… & y=… not coordinates
	(e)	$2x^2 - 6x - 1 - 2x + 5 = 0$ or better or $2x^2 = 8x - 4$ or better or $x^2 - 3x - ½ = x - 2½$ or better or $x^2 - 3x - ½ - x + 2½ = 0$ or better **AND** correct result seen	1	For ANY incomplete or incorrect algebraic steps do not award this mark	Condone '= 0' missing on given equation ONLY
	(f)	0.586 & 3.414 www	3	**B2** for $2 ± √2$ or $\dfrac{4 ± \sqrt{8}}{2}$ Or **M1** for $(x - 2)^2 - 4 + 2 = 0$ or better or $\dfrac{(±)4 ± \sqrt{(-)4^2 - 4 \times 2 \times 1}}{2 \times 1}$ or better If B0 or M0 then **SC2** for 0.586 and 3.414 If M1 then also **SC1** for 0.586 **or** 3.414 or two 'correct' answers where one or both rounded to 2dp or given to 4+dp	

10	(a)	4.1 www	3	**B2** for 4.105 - 4.11 Or **B1** for 25.8 ÷ 2π	
	(b)	58.4 – 58.5 www Allow 58 supported by full correct method	2	**B1** for ½ × π × 6.1²	May be done in stages
11	(a)	t^{10}	1		
	(b)	$s^8 t^6$	2	**M1** for $s^{5+3} t^{4+2}$ or $s^8 t^n$ or $s^n t^6$ where n an integer & n > 0	
	(c)	$8t^{12}$	2	**B1** for $2^3 × t^{4×3}$ If B0 then **SC1** for $6t^{12}$ or $8t^7$ or $2t^{12}$	
12		3625000 or 3.625×10^6 or 3.625 million www	3	**M2** for any complete correct method to find 58% Or **M1** for 16% = 1000000 or 100% = 6250000 or 1% = 62500 For incorrect values of zero's for 1 million allow method marks If M0 then **SC2** for final answer figs 3625	May be done in stages E.g. 1000000/16 × 58
13	(a)	(i) $(x - 6)(x + 6)$ or $(- x - 6)(- x + 6)$	1		Mark final answer only
		(ii) $4x(2x + 3y)$	2	**B1** for $4(2x^2 + 3xy)$ or $x(8x + 12y)$ or $2x(4x + 6y)$ or $2(4x^2 + 6xy)$ If B0 then **SC1** for $4x(2x - 3y)$	Condone missing final bracket
	(b)	$c = \sqrt{\dfrac{E}{m}}$ or $c = \pm\sqrt{\dfrac{E}{m}}$	2	**B1** for $c^2 = E/m$	

14	(a)	(i) 3.2×10^5	1		
		(ii) 2.5×10^{-2}	1		
	(b)	2.7×10^{20}	2	**M1** for $27 \times 10^{7+12}$ or 27×10^{19}	
15	(a)	(i) Relative frequency (1 game) = 1 & relative frequency (2 games) = ½	1		Condone probability
		(ii) Win Lose	1	Both	Do NOT condone Yes No
	(b)	0.3 – 0.4 inclusive	1		Allow fractions or % in range Ratios or odds are UNacceptable
	(c)	Correct plots, 0.38-0.39 at 13 & 0.42 – 0.43 at 14 & lines joined	3	**M2** for 5/13 (0.38-0.39, 38-39%) & 6/14 (0.42-0.43, 42-43%) seen or plotted Or **M1** for 5/13 (0.38-0.39, 3-39%) or 6/14 (0.42-0.43, 42-43%) seen or plotted	Check graph FIRST If graph incorrect for one or both, check working lines and ISW any correct fraction with incorrect conversion to decimal or %
16	(a)	400	1		
	(b)	116 or $115.\dot{9}$ www	2	**M1** for 258.5 – 142.5 or $258.4\dot{9}$ – 142.5	Allow both marks for 258 – 143 (=115) followed by answer of 116 If recurring decimal must be correct notation for both marks ($115.9\dot{9}$ or 115.9^r are NOT correct notation)

17	(a)	5.4 – 5.42 www	3	**M2** for (AB =) 8.1 × sin42 Or **M1** for sin 42 (=) AB/8.1	Condone use of sine rule for M1 & M2 Award M2 for other complete alternative methods
	(b)	17 – 17.2 www	3	**M2** for (QR² =) 295.699... Or **M1** for (QR² =) 5.2² + 12.6² – 2 × 5.2 × 12.6cos147	Allow for all 3 marks correct answer in range <u>provided M1 awarded</u> If answer not correct, for M2 allow QR² = 295, or 295.6 – 295.8 or 296 Take care correct working seen, **answer in range from method using angle bisection score 0**
	(c)	48.93 – 49 www	3	**M2** for (sin*x* =) 6.9 × sin72/8.7 Or **M1** for sin*x*/6.9 (=) sin72/8.7 or 6.9 / sin*x* (=) 8.7 / sin 72	For answer 49 correct working must be shown
18	(a)	32 www	3	**M2** for (2 × 5) + (1.3 × 10) + (0.6 × 15) Or **M1** for any two correct products seen	10 + 13 + 9 For 1.3 allow range 1.2 – 1.4 for M marks only
	(b)	(i) End value or oldest age	1		Condone width <u>for final class</u> or range <u>for final class</u>
		(ii) Suitable reason & value 55 – 95	1		E.g. 65 because that is age when most people retire

19	(a)	(i)	$225/360 \, \pi \, 4^2 = \pi \, r \times 4$	M1		Condone both area sector & curved SA calculated correctly & equal
			or $225/360 \times 2 \, \pi \times 4 = 2 \, \pi \, r$ oe			or both arc length & circumference of cone base calculated & equal
			$r = 2.5$	A1	Note 2.5 **is** given in question	Just $(225/360) \times 4$ or $4 \div (360/225)$ scores 0 marks
		(ii)	20.4 – 20.44 www	4	**M3** for $\frac{1}{3} \pi \, 2.5^2 \times \sqrt{(4^2 - 2.5^2)}$ **M2** for $\sqrt{(4^2 - 2.5^2)}$ **M1** for correct use of Pythagoras to find height eg $4^2 = ht^2 + 2.5^2$ or $4^2 - 2.5^2$ If M0 or M1 then also **SC1** for $\frac{1}{3} \pi \, 2.5^2 \times$ *their* 3.12 where *their* 3.12 ≠ 4	Condone no bracket under square root sign Height cone $\sqrt{4^2 - 2.5^2} = 3.122\ldots$ For M3 allow: Height = 3.12 or better without method seen Any degree of accuracy for height provided method to find height seen in (a) or (b) or on diagram
	(b)		3^3 or 27	1		

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