GCSE

Mathematics A

General Certificate of Secondary Education

Component **J512/04:** Paper 4

Mark Scheme for January 2012

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Annotations used in the detailed Mark Scheme.

Annotation	Meaning
✓	Correct
✗	Incorrect
BOD	Benefit of doubt
FT	Follow through
ISW	Ignore subsequent working (after correct answer obtained), provided method has been completed
M0	Method mark awarded 0
M1	Method mark awarded 1
M2	Method mark awarded 2
A1	Accuracy mark awarded 1
B1	Independent mark awarded 1
B2	Independent mark awarded 2
MR	Misread
SC	Special case
∧	Omission sign

These should be used whenever appropriate during your marking.

The **M**, **A, B** etc annotations must be used on your standardisation scripts for responses that are not awarded either 0 or full marks.
It is vital that you annotate these scripts to show how the marks have been awarded.
It is not mandatory to use annotations for any other marking, though you may wish to use them in some circumstances.

Subject-Specific Marking Instructions

1   **M** marks are for <u>using a correct method</u> and are not lost for purely numerical errors.
    A marks are for an <u>accurate</u> answer and depend on preceding **M** (method) marks. Therefore **M0 A1** cannot be awarded.
    B marks are <u>independent</u> of **M** (method) marks and are awarded for a correct final answer or a correct intermediate stage.
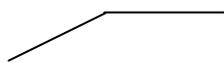   **SC** marks are for <u>special cases</u> that are worthy of some credit.

2   Unless the answer and marks columns of the mark scheme specify **M** and **A** marks etc, or the mark scheme is 'banded', then if the correct answer is clearly given and is <u>not from wrong working</u> **full marks** should be awarded.
Do <u>not</u> award the marks if the answer was obtained from an incorrect method, ie incorrect working is seen <u>and</u> the correct answer clearly follows from it.

3   Where follow through (**FT**) is indicated in the mark scheme, marks can be awarded where the candidate's work follows correctly from a previous answer whether or not it was correct.

      Figures or expressions that are being followed through are sometimes encompassed by single quotation marks after the word *their* for clarity, eg FT 180 × (*their* '37' + 16), or FT 300 – √(*their* '5^2 + 7^{2}'). Answers to part questions which are being followed through are indicated by eg FT 3 × *their* (a).

      For questions with FT available you must ensure that you refer back to the relevant previous answer. You may find it easier to mark these questions candidate by candidate rather than question by question.

4   Where dependent (**dep**) marks are indicated in the mark scheme, you must check that the candidate has met all the criteria specified for the mark to be awarded.

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

-    **figs 237**, for example, means any answer with only these digits. You should ignore leading or trailing zeros and any decimal point eg 237000, 2.37, 2.370, 0.00237 would be acceptable but 23070 or 2374 would not.
-    **isw** means **ignore subsequent working** (after correct answer obtained).
-    **nfww** means **not from wrong working**.
-    **oe** means **or equivalent**.
-    **rot** means **rounded or truncated**.
-    **seen** 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.
-    **soi** means **seen or implied**.

6   Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise, indicated for example by the instruction 'mark final answer'.

7   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).

8   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.

9   Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures even if this is rounded or truncated on the answer line. For example, an answer in the 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.

10   If the correct answer is seen in the body of working

   i.   and the answer given in the answer space is a clear transcription error allow full marks unless the mark scheme says 'mark final answer'. Place the annotation ✓ next to the correct answer.

   ii.   but the answer space is blank, allow full marks. Place the annotation ✓ next to the correct answer.

   iii.   but a completely different answer is seen in the answer space, then accuracy marks for the answer are lost. Method marks could still be awarded. Use the M0, M1, M2 annotations as appropriate and place the annotation ✗ next to the wrong answer.

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

12   For methods not provided for in the mark scheme give as far as possible equivalent marks for equivalent work. If in doubt, consult your Team Leader.

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.

Question			Answer	Marks	Part Marks and Guidance	
1			Perimeter 32 Area 33	2 2	**M1** for 1 + 7 + 6 + 7 + 2 + 3 + 3 + 3 oe **M1** for (7 × 1) + (2 × 7) + (3 × 4) oe If answers 32 and 33 transposed allow also **SC1**	Allow shape split in different ways eg (7 × 6) – (3 × 3) It is possible to score **M2 SC1** or **M1 SC1** or **M0 SC1** For all marks ignore the words perimeter, area or units if written
2	(a)		1.8	2	**M1** for 1.7[7…]	
	(b)		7.6	2	**M1** for 57.76 seen	Condone ±
3	(a)		Bearing for B, 320 ± 2° Distance for B, 9cm ± 2mm Bearing for D, 75 ± 2° Distance for D, 5cm ± 2mm	B1 B1 B1 B1	If lines for B and D drawn and not labelled assume longest is for B If no lines shown or points plotted explicitly for B and D, ie **B0** scored, then **SC1** for both letters B and D written in approximately the correct positions If **all** distances and bearings not from the dot L, but all from a single different place then treat as misread	Take care as lines may not be drawn; look for labelled points Condone B and D not labelled if points in correct place Approximately means part of each letter needs to be in the correct position
	(b)		12km ± 0.2km 118° ± 4°	B1 B1	FT *their* (a) ± 0.2km FT *their* (a) ± 4° FT provided both lines drawn and/or both points clearly marked	If no diagram allow both 12km & 118° On FT condone bearing not given as 3 figure

Question			Answer	Marks	Part Marks and Guidance	
4			$46.2(…) & $45.9(…) or €32.2(…) or £27.8(…)	4	**M3** for $46.2(…) & 32 ÷ 0.697 or $45.9(…) & 28 ÷ 0.606 or (28 ÷ 0.606) × 0.697 or (32 ÷ 0.697) × 0.606 **M2** for $46.2(…) or $45.9(…) or 28 ÷ 0.606 and 32 ÷ 0.697 **M1** for 28 ÷ 0.606 or 32 ÷ 0.697	Condone final amounts rounded or truncated to whole numbers provided not T&I method Condone missing $, £ or € signs Take care to follow through their rounding and award all method marks as appropriate May find $ equivalent of £1 & €1 £1 = $1.65… €1 = $1.43 …
			Euros	B1	Provided at least **M2** awarded If T&I or exchange rates rounded then **SC3** for prices indicated as above $46 (for £) & below $46 (for €) & answer Euros Or **SC2** for prices indicated as above $46 (for £) & below $46 (for €) Or **SC1** for prices indicated as above $46 (for £) or below $46 (for €) Euros with no working scores 0 marks	Method converting £ to € or € to £ may have steps in different order ie 0.697 ÷ 0.606 or 0.606 ÷ 0.697 first then × £28 or × €32 respectively
5			2.34 nfww	4	**M3** for (90 × 7800 ÷ 100 000) ÷ 3 Or **M2** for **any two steps** of cm to km; total cm; distance/time calculation (the two steps must be part of a single method, not a choice of attempts) Or **M1** for cm to km or total cm or distance/time calculation	Mark final answer Figs 234 scores at least **M2** May be done in stages km: 7.02 or (90 × 7800 ÷ 100 000) & cm: 90 × 7800 or 702000 seen For d/t calculation allow time in hours, minutes or seconds & allow for distance 7800, figs 90 or figs 702
6	(a)		H H H H H C C C C H H H H H	1		Ignore further working in this space as possibly for part (b)
	(b)		C 7 and H 16	2	**B1** for either correct If **B0** then **SC1** for 7 and 16 transposed	

Question			Answer	Marks	Part Marks and Guidance	
	(c)		C n oe eg $1 \times n$	1		Condone upper case N and C = n, Do not allow $+n$ or nC
			H $2n + 2$ oe eg $2(n + 1)$	2	**B1** for $2n$ oe eg $n2$ or $2 \times n$ or $n + n$ or $+ 2n$ Allow for $2n + $ a number	Allow unsimplified expression Condone H = $2n + 2$ for both marks Condone $2(n + 1$ for both marks Allow unsimplified equality for **SC1**
					If **B0** then **SC1** for $[n =] 2C + 2$ or $[h =] 2C + 2$	Do NOT allow $n + C + 2$
7	(a)		Rotation or rotate	1	If more than one transformation award no marks throughout	
			90° [anticlockwise or to the left] or 270 clockwise or –270	1		90° to the right or clockwise scores 0
			(1, 0)	1		Condone brackets missing
	(b)		Correct reflection	2	**M1** for reflection of P with one point incorrect or reflection of Q in $y = -1$ or reflection P in $y = 1$ or in $x = -1$	
8			–40	3	**B2** for $-\dfrac{4}{5}x = 32$ or $5x = 9x + 160$ Or **B1** for $x = \dfrac{9}{5}x + 32$ If **B0** & T&I method with trial values that are negative then **SC2** for at least two complete correct trials where the second trial is a better trial Or **SC1** for one complete correct trial	x is F or C; allow any letter Ignore any early trials of positive values or of 0

Question			Answer	Marks	Part Marks and Guidance	
9			15 for dress nfww	4	**B3** for 48.51 and 48.36 Or **M2** for 48.51 or 48.36 or 49.5 × 0.98 and 52 × 0.93 Or **M1** for 49.5 × 0.98 or 52 × 0.93 or 49.5 × 0.02 and 52 × 0.07 If **M2, but not B3** then also **SC1** for *their* correct difference & dress If **M0** or **B0** then **SC1** for £4.92 and shoes or £4.93 and shoes	Condone £0.15[p] if £ sign given or 15p or 15pence This may be done in stages This may be done in stages
10	(a)		C	1		
	(b)		Straight line with positive gradient through origin	1		Accept good freehand Allow within ± 2mm of (0, 0) Accept /‾
11	(a)		$13.4(2\ldots)$ nfww or $13\frac{19}{45}$	4	**B1** for at least 3 correct midpoints **seen** or implied by correct products **AND** **M2** for Σ('midpoints' × frequencies)/90 Or **M1** for 'midpoints' × frequencies If 13.4(2…) seen and 12 < m ≤ 16 on answer line award 3 marks only If 13.4(2 …) not seen and only answer given as 13 allow 4 marks provided $\dfrac{1208}{90}$ seen	Midpoints 2, 6, 10, 14 18, 22 Corrects products 4, 42, 290, 364, 288, 220 Total 1208 Allow Σ in range 1028 – 1388 or if total outside range allow one error in products if seen At least 3 seen, allow 'midpoints' any value in correct class including both end-points

Question			Answer	Marks	Part Marks and Guidance	
(b)			$8 < m \leq 12$	1		Accept any indication of correct class eg 8 – 12, but not 29
(c)			Fully correct	2	**M1** for 5 or more heights in correct class (may be implied by bar chart) or 5 or more midpoints correct or 4 or more points correct	Points ± ½ small square Allow both marks where frequency <u>polygon</u> drawn **over** bar chart Ignore points (2, 4) & (22, 10) joined to each other or to the axis
(d)			(2) 9 38 64 80 90	1		
(e)			Fully correct graph (curve or polygon)	3	**M2** for all plots correct or at least 4 correct plots with correct graph or correct shape graph translated left ≤ 1cm Or **M1** for at least 5 plots at upper class boundary or at least 5 correct heights in correct class (heights may be implied by bar chart)	For all marks: FT *their* increasing (d) provided non-linear For graph accept curve or polygon with points ± ½ small square Condone (0, 0) missing
(f)	(i)		13	B1	Strict FT *their* increasing non linear graph reading at 45 ± ½ small square	If no graph 0 marks Working may or may not be seen
	(ii)		32	B2	Strict FT *their* increasing non linear graph reading from 15 ± ½ small square **M1** for *their* reading at 15 minutes or 90 – *their* reading at 15 minutes where *their* reading ± 1 small square	If no graph 0 marks Working may or may not be seen
(g)			Median and not affected by low and/or high times or Mean and **takes account of all** the values/data	2	**B1** for mean or median and a reason given, but reason not fully correct or incorrect	For 2 marks must have correct reason not just description or part description of how to calculate

Question			Answer	Marks	Part Marks and Guidance	
	(h)		What **effect** did the energy drink have on your **recovery time**? Less [time] More [time] No difference	2	**M1** for a reasonable question asking for comparison and response section, but either the question is not quite clear and/or the response section does not cover all possibilities of increase/ decrease/no effect	Suitable question re **effect** of drink on **recovery time** and responses that allow for at least 3 non-overlapping choices without gaps greater than a minute covering increase/decrease/no effect
12	(a)		$(x-4)(x+4)$	1		Mark final answer Condone final bracket missing
	(b)		$u = \sqrt{v^2 - 2as}$	2	**M1** for $u^2 = v^2 - 2as$	Mark final answer Condone sq root sign incomplete, at least as far as 2nd term
	(c)	(i)	$s^5 t^{10}$ or $(st^2)^5$	2	**M1** for $s^{2+3} t^{8+2}$ or $s^5 t^n$ or $s^n t^{10}$	Mark final answer Condone clear × signs
		(ii)	$x^{12} y^4$	2	**M1** for $x^{4\times3} y^4$ or $x^7 y^4$ or $x^{12} y^n$ or $x^{81} y^4$	Mark final answer Condone clear × signs
13	(a)		(2, 7)	3	**B1** for $x = 2$ or A (2, 0) **M1** for $y = 3 \times$ *their* $x + 1$ If **B0** then **SC1** for $y = 7$	Allow for 2 next to A on graph or in working or (2, __) in answer space
	(b)		(−1.5, −3.5) oe	3	**B2** for either $x = -1.5$ oe or $y = -3.5$ oe Or **M1** for $x - 2 = 3x + 1$ oe eg $0 = 2x + 3$ or $2y = -7$ oe or $y + 2 = \frac{1}{3}(y - 1)$ oe	Accept answers for x and/or y as proper or improper fractions, need not be simplified

Question			Answer	Marks	Part Marks and Guidance	
14	(a)		2.4[4…] nfww	3	**M2** for $(x =)$ 2.6 × sin70 or 2.6 × $\dfrac{\sin70}{\sin90}$ Or **M1** for sin70 = $\dfrac{x}{2.6}$ or $\dfrac{x}{\sin70}$ = $\dfrac{2.6}{\sin90}$	Full complete alternative method scores **M2** Award method marks for answers 2.3 – 2.32 or 2.34 – 2.35 or 2.01 – 2.01212 or 2.25 – 2.3
	(b)		21.7 – 21.8 nfww	4	**M3** for [cos$y$] = 0.928 – 0.93 Or **M2** for [cos$y$] = $\dfrac{8^2 + 7^2 - 3^2}{2 \times 8 \times 7}$ or 112 cos$y$ = 104 Or **M1** for $3^2 = 8^2 + 7^2 - 2 \times 8 \times 7$ cos$y$	Award method marks for answers 0.38 – 0.3803 or 24.2 – 24.21
15	(a)		Fully correct circle drawn	2	**M1** for ¼ circle or better or at least 4 correct points plotted explicitly with no incorrect plots or for graph attempted with at least 4 correct plots, then any plots clearly excluded from *their* graph may be ignored If **M0** then **SC1** for circle centre (0, 0) drawn with compasses	Accept correct circle using compasses radius 4.8mm – 5.2mm without plotted points Allow good freehand circle within 2mm of overlay Ignore line $y = 3x - 1$ if drawn
	(b)	(i)	$x^2 + (3x – 1)^2 = 25$ or $9x^2 – 3x – 3x + 1$ or better $x^2 + 9x^2 – 3x – 3x + 1 = 25$ or better $5x^2 – 3x – 12 = 0$ (answer given)	M1 M1 A1		**A** mark awarded for correct algebra to reach answer given

Question			Answer	Marks	Part Marks and Guidance	
		(ii)	1.88 and −1.28	3	**M2** for $\dfrac{3 \pm \sqrt{249}}{10}$ or better or $x - 0.3 = \pm\sqrt{2.49}$ or better Or **M1** for $(x =)\dfrac{\pm 3 \pm \sqrt{(-)3^2 - 4 \times 5 \times -12}}{2 \times 5}$ or better Or $(x - 0.3)^2 - 0.3^2 - 2.4 = 0$ or better If **M0** then **SC1** for −1.88 and 1.28	**M2** can be implied by one correct solution, 1.87 to 1.88, and/or −1.27 to −1.28, provided **M1** already scored ie an algebraic method used
		(iii)	(1.8 to 1.9, 4.4 to 4.7) and (−1.2 to −1.3, −4.6 to −4.9)	2	**B1** for one correct point If **B0** then **SC1** for both y values correct	Allow even if (b)(ii) incorrect or no response & condone one bracket missing For **SC1** y values may or may not be as coordinates

Question	Answer	Marks	Part Marks and Guidance	
16	2.5 nfww	5	**M4** for $r^2 = \dfrac{\frac{4}{3} \times \pi \times 30^3}{160 \times \pi \times 36}$ or $r^2 = 6.25$ oe fraction Or **M3** for $\dfrac{4}{3}\pi \times 30^3 = 160 \times \pi \times r^2 \times 36$ oe Or **M2** for $\dfrac{4}{3}\pi \times 30^3$ and $160 \times \pi \times r^2 \times 36$ or $(\dfrac{4}{3}\pi \times 30^3) \div 160$ and $\pi \times r^2 \times 36$ Or **M1** for $\dfrac{4}{3}\pi \times 30^3$ seen or $160 \times \pi \times r^2 \times 36$ seen or implied If **M1** scored, for Vol sphere, then also **SC2** for final answer 31.6… Or **SC1** for $r^2 = 1000$	Fraction may be proper or improper This may have been simplified & may be done in stages eg ÷ 160 then ÷ 36 then ÷ π Note for **M3** and **M4** π may be cancelled Volume cylinders $10895r^2 - 18098r^2$ or $5760\pi r^2$ Volume sphere $113097 - 113112$ or 36000π
17	1.21 or 1.216 nfww or 1.2 if full correct method shown or $\dfrac{3503}{2800}$ or $1\dfrac{623}{2880}$	4	**B3** for $1 \div 0.82$ to 0.823 or 1.215 to 1.22 or unsimplified equivalent fraction (proper or improper) Or **B2** for $\dfrac{1}{1.55} + \dfrac{1}{5.65}$ selected or 0.82 to 0.823 selected Or **B1** for $\dfrac{1}{a} + \dfrac{1}{b}$ where $1.5 < a \le 1.55$ and $5.6 < b \le 5.65$ seen If **B0** then **SC1** for final answer 1.18(3…) or 1.14 to 1.15	Allow 1.549 or better or 5.649 or better for all marks Allow **B3** for embedded value for T ie $\dfrac{1}{1.21[6...]} = \dfrac{1}{1.55} + \dfrac{1}{5.65}$

APPENDIX 1

Exemplar responses for question 11 (g)

Response	Mark awarded
Mean, Average of all the data	1 for mean, 0 for reason
Mean, adds up all the data	1 for mean, 0 for reason
Mean, uses all the values	2
Median	0 no reason given
Mode uses all the values	0; must have mean or median to score anything

Exemplar responses for question 11 (h)

Response	Mark awarded
Has energy drink affected recovery time	0, no responses given
How has an energy drink made a difference to recovery time? Better Worse	1
With the energy drink did your time; Improve Get worse Stay same Other	2
Did an energy drink make your time … Better Worse Don't know	1
Did you improve with an energy drink? yes better, no worse, stay same, unsure	0, no mention of time in question or responses
Did the energy drink make you faster? yes no	0, no mention of what is faster
Did the energy drink make your recovery faster? yes no	1, insufficient responses for 2 marks
How long was your recovery time? under 2 minutes 2 – 4 minutes over 4 minutes	0, no considering change in time in either question or response choices
How long was your change in recovery time? 0 minutes up to ±3 minutes over ± 3 minutes	1 as could not tell whether increase or decrease from an answer choice ticked
How much faster was your recovery? A little A lot Not at all	1 for time implied by faster, responses insufficient
Did your recovery time? Increase Decrease Stay same	BOD 2, this is the very least needed for both marks