Mark Scheme (Results)

November 2011

Applications of Mathematics (GCSE)
Unit 1: 5AM1H_01 (Higher)

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NOTES ON MARKING PRINCIPLES

1   All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.

2   Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.

3   All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.

4   Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.

5   Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

6   Mark schemes will indicate within the table where, and which strands of QWC, are being assessed. The strands are as follows:

   i) *ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear*
       Comprehension and meaning is clear by using correct notation and labeling conventions.

   ii*) select and use a form and style of writing appropriate to purpose and to complex subject matter*
       Reasoning, explanation or argument is correct and appropriately structured to convey mathematical reasoning.

   iii) *organise information clearly and coherently, using specialist vocabulary when appropriate*.
       The mathematical methods and processes used are coherently and clearly organised and the appropriate mathematical vocabulary used.

7 **With working**

If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.

If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.

If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks. Send the response to review, and discuss each of these situations with your Team Leader.

If there is no answer on the answer line then check the working for an obvious answer.

Any case of suspected misread loses A (and B) marks on that part, but can gain the M marks. Discuss each of these situations with your Team Leader.

If there is a choice of methods shown, then no marks should be awarded, unless the answer on the answer line makes clear the method that has been used.

8 **Follow through marks**

Follow through marks which involve a single stage calculation can be awarded without working since you can check the answer yourself, but if ambiguous do not award.

Follow through marks which involve more than one stage of calculation can only be awarded on sight of the relevant working, even if it appears obvious that there is only one way you could get the answer given.

9 **Ignoring subsequent work**

It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: e.g. incorrect canceling of a fraction that would otherwise be correct

It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect e.g. algebra.

Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.

10 **Probability**

Probability answers must be given a fractions, percentages or decimals. If a candidate gives a decimal equivalent to a probability, this should be written to at least 2 decimal places (unless tenths).

Incorrect notation should lose the accuracy marks, but be awarded any implied method marks.

If a probability answer is given on the answer line using both incorrect and correct notation, award the marks.

If a probability fraction is given then cancelled incorrectly, ignore the incorrectly cancelled answer.

11   Linear equations
Full marks can be gained if the solution alone is given on the answer line, or otherwise unambiguously indicated in working (without contradiction elsewhere). Where the correct solution only is shown substituted, but not identified as the solution, the accuracy mark is lost but any method marks can be awarded.

12   Parts of questions
Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another.

13   Range of answers
Unless otherwise stated, when an answer is given as a range (e.g 3.5 – 4.2) then this is inclusive of the end points (e.g 3.5, 4.2) and includes all numbers within the range (e.g 4, 4.1)

Guidance on the use of codes within this mark scheme
M1 – method mark A1 – accuracy mark B1 – Working mark C1 – communication mark QWC – quality of written communication oe – or equivalent cao – correct answer only ft – follow through sc – special case dep – dependent (on a previous mark or conclusion) indep – independent isw – ignore subsequent working

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5AM1H_01				
Question		Working	Answer	Mark	Notes
1		$\dfrac{5}{100} \times 208$ 208 + 10.40 1.05 × 208	218.40	3	M1 for 0.05 × 280 or 10.4(0) M1(dep) for 208 + "10.40" A1 for 218.40 OR M2 for 1.05 × 208 oe A1 for 218.40
2	(a)		28g butter 14g flour 142m*l* milk 84g cheese	2	M1 for use of 1 ounce = 28g or 1 pint= 568m*l* (may be implied by at least 2 correct quantities) A1 cao
	(b)	12 × 142	1.704	2	M1 for 12 × "142" or sight of figures 1704 A1 ft (accept 1.7, 1.70)
3	(a)		Point plotted	1	B1 for plotting (10, 19) tol ±1 sq
	(b)		Line of best fit	1	B1 for a straight line passing between (1, 4) and (1, 8) and between (17, 24) and (17, 28) – see diagram.
	(c)		Relationship described	1	B1 for 'as the number of years they have done their job increases, so does their (hourly) pay' oe OR B1 'positive correlation' oe
4	(i)	3*y* + 20 + 2*y* + *y* + 10	6*y* + 30	4	M1 for 3*y* + 20 + 2*y* + *y* + 10 A1 for 6*y* + 30 (=180)
	(ii)	6*y* + 30 = 180 *y* = (180 – 30)÷6	25		M1 for "6*y* + 30" = 180 or correct sequence of operations using "6*y* + 30" and 180 A1 ft on an equation of the form *ay* + *b* = 180 T&I B2 for 25, B0 otherwise

5AM1H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
5		(1 × 33) + (2 × 140) + (3 × 109) + (4 × 165) + (5 × 41) + (6 × 12) = 33 + 280 + 327 + 660 + 205 + 72 1577 ÷ 500	3.154	3	M1 for at least 5 of 1 × 33 (=33), 2 × 140 (=280), 3 × 109 (=327), 4 × 165 (=660), 5 × 41(=205), 6 × 12 (=72) or for 1577 M1 (dep) for $\Sigma fx \div \Sigma f$ A1 for 3.154 or 3.15 or 3.2
6	(a)(i)	eg 80 ÷ 20	4	4	M1 for attempt to find the gradient eg 80 ÷ 20 or drawing a right-angled triangle with the line as hypotenuse. A1 for 3.5 to 4.5
	(ii)	20 × 4	80		M1 for 20 × "4" or clear attempt to find the costs for a difference of 20 or method shown on graph A1 ft on "4"
	(b)	4n + 160 = 8n + 20 8n − 4n = 160 − 20 4n = 140 n = 140 ÷ 4	35	3	M1 for plotting at least 2 points on grid M1 draw line to intersect with given graph A1 cao OR M1 for working out the cost at the Grange hotel for one value of n not already in the table eg 15× 8 = 120, 120 + 20 M1 for working out the cost at the Grange hotel for n = 35 eg 35 × 8= 280. 280 + 20 A1 cao OR M1 for 4"n" + 160 = 8"n" + 20 M1 for clear correct method to isolate terms in n and number terms on opposite sides of a four term equation eg. 8n − 4n = 160 − 20 A1 cao (SC B2 for 33 – 34 if no marks scored)

Question		Working	Answer	Mark	Notes
7		$\dfrac{48.45}{425} \times 100$ OR $\dfrac{11}{100} \times 425 = 46.75$	Katie spends more	3	M1 for $\dfrac{48.45}{425} \times 100$ A1 for 11.4 C1 (dep on M1) for conclusion ft from comparison of two percentages OR M1 for $\dfrac{11}{100} \times 425$ or for 10% = 42.5(0), 1% = 4.25, 42.5(0) + 4.25 A1 for 46.75 C1 (dep on M1) for correct ft from comparison of "46.75" and 48.45
8	(i) (ii)		187.50 37.50	2	B1 for W = 187.5(0) B1 for S = 37.5(0)
9		6 × 4.5 27 ÷ 1.44 19 × £12.87	£244.53	4	M1 for 6 × 4.5 M1 for "6 × 4.5" ÷ 1.44 M1 for "19" × £12.87 A1 cao

5AM1H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
10	(a)	$\dfrac{1000}{8} \times 50$	£62.50	2	M1 for $\dfrac{1000}{8} \times 50$ or $\dfrac{1000}{8} \times 0.5$ oe or digits 625(0) A1 for £62.50 or 6250p or £62.50p
	(b)	$5 \times 356g = 1780g, \ 1780 \div 7.12 = 250$ $250 \times 2p = 500p$ $5 \times 356g = 1780g, \ 1780 \div 3.56 = 500$ $500 \times 1p = 500p$ OR $356 \div 7.12 = 50, 50 \times 2p = 100p$ $5 \times 100p = 500p$ $356 \div 3.56 = 100, 100 \times 1p = 100p$ $5 \times 100p = 500p$ OR 1p coins are half the weight of 2p coins A bag of 2 p coins must have half the number of coins as a bag of 1p coins	both have the same value + evidence	2	M1 for correct attempt at finding the value of the coins in a pack or 5 packs Eg $5 \times 356g \div 7.12 = 250, 250 \times 2p = 500p$ or $5 \times 356g \div 3.56 = 500, 500 \times 1p = 500p$ OR $356 \div 7.12 \times 2p = 100p \ (5 \times 100p = 500p)$ or $356 \div 3.56 \times 1p = 100p \ (5 \times 100p = 500p)$ C1 (dep) for valid conclusion based on correct working OR M1 For reasoning from the comparative weights and values of the 1p and 2p coins e.g. Weight of 1p coin is half of the weight of a 2p coin so there are twice as many 1p coins in a bag as there are 2ps C1 (dep) for valid conclusion based on correct reasoning

Question	Working	Answer	Mark	Notes
11 (a)		Appropriate question including distance units + response boxes	2	B1 for appropriate question stem and inclusion of distance units (units may be given with response boxes) B1 for at least 3 correctly labelled, non-overlapping response boxes or for at least 3 correctly labelled exhaustive response boxes
(b)		Valid reason	1	B1 for a valid reason. eg "her friends may all live near each other", "sample size is too small" oe
12	$\dfrac{1}{2} \times 70 \times 150$ $\dfrac{1}{2}(90+150) \times 40$ $5250 + 4800$	10050	4	M1 for correct method to work out the area of the triangle eg $\dfrac{70 \times 150}{2}$ oe or 5250 M1 for correct method to work out the area of the trapezium eg $\dfrac{90+150}{2} \times (110-70)$ oe or 4800 M1 (dep on at least one of the previous Ms) for '5250' + '4800' A1 cao
13	$\dfrac{84}{100} \times 61$ 383×130281 $51\,240\,000 - 49\,897\,623 =$ 1342377	1 300 000	5	M1 for correct method to work out 84% of 61 million eg $\dfrac{84}{100} \times 61$ or digits 5124 seen A1 for 51.2(4) million oe M1 for 383×130281 or digits 4989....seen M1 (dep on at least 1 previous M1) for "51.24" − "49.89…" A1 1 300 000 – 1 350 000 oe

5AM1H_01				
Question	Working	Answer	Mark	Notes
14	$4(x + 4) = 4x + 16$ $4(3x + 4) = 12x + 16$ $4x + 16 = \frac{2}{3}(12x + 16)$ $12x + 48 = 24x + 32$ $12x = 16$	5⅓	5	M1 for a correct expression for at least one perimeter. M1 for "$4x + 16$" $= \frac{2}{3}$"$(12x + 16)$" oe M1 for $12x + 48 = 24x + 32$ or $4x + 16 = 8x + \dfrac{32}{3}$ oe A1 for $\dfrac{4}{3}$ B1 ft for "$\dfrac{4}{3}$" $+ 4$ OR M2 for $x + 4 = \frac{2}{3}(3x + 4)$ M1 for $3x + 12 = 6x + 8$ or $x + 4 = x + \dfrac{8}{3}$ oe A1 for $\dfrac{4}{3}$ B1 ft for "$\dfrac{4}{3}$" $+ 4$ T&I B4 for 5.33 or better

Question		Working	Answer	Mark	Notes
15	(a)		Mercury	1	B1 cao
	(b)		2.28×10^8	2	B2 cao (B1 for $a \times 10^8$, $a \neq 2.28$ or 2.28×10^n, $n \neq 8$)
	(c)	$M_J \div M_E = 987.9....$ OR $1000 \times 5.97 \times 10^{24} = 5.97 \times 10^{27}$ OR $5.898 \times 10^{27} \div 1000 = 5.898 \times 10^{24}$	No + reason	2	M1 for mass of Jupiter ÷ mass of Earth or mass of Earth × 1000 or mass of Jupiter ÷ 1000 A1 No with supporting reason(s) eg 5.97×10^{27} OR M1 both masses written as ordinary numbers A1 No + 1000 × correctly written mass of Earth
16		25 50 75 100 125 150 **175** 35 70 105 140 **175**	10·96	5	M1 for attempt to find the LCM of 25 and 35 eg at least 3 correct multiples of 25 and at least 3 correct multiples of 35 or 2 factor trees with at least one correct A1 for 175 M1 for at least one of $\dfrac{"175"}{25}$ or "5" or $\dfrac{"175"}{35}$ or "7" or 5.50 or 5.46 either unassociated or associated with the correct pack. M1 for "5" × £1.10 + "7" × 78p A1 cao. OR M2 for attempt to find the number of packs of cups and plates eg sight of 5 (× 35) or 7 (× 25) A1 for 5 (× 35) and 7 (× 25) M1 for 5 × £1.10 + 7 × 78p A1 cao

| 5AM1H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
17	(a)	100 − 67	33	2	M1 for use of graph at 50 years or sight of 66, 67, 68 A1 for 32,33,34
	(b)	Median = 44 – 44.5 LQ = 32 – 33, UQ = 51.5 – 52	Box plot drawn	4	B4 for fully correct box plot (B3 for 4 correct values plotted including box and tails) (B2 for 3 correct values plotted including box and tails or 5 correct values plotted and no box and tails) (B1 for 2 correct values plotted including box and tails or for a correct median or quartile)
	(c)		comparison	2	B2(ft) for at least two of : Comparison of a measure of location e.g. median age of male teachers is less than median age of female teachers Comparison of spread e.g. IQR for male teachers is greater than IQR for female teachers or the ranges are the same Comparison of skewness e.g. the age distribution of female teachers is more negatively skewed than the age distribution of male teachers (B1 ft for one of them)

5AM1H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
18	(a)	$500 \times 1.035 \times 1.02^3$ $= 549.17514$ Or $500 \times 1.035 = 517.50$ $517.50 \times 1.02 = 527.85$ $527.85 \times 1.02 = 538.407$ $538.407 \times 1.02 = 549.17514$	549.18 or 549.17	3	M1 for use of 1.035 or 1.02 oe (may be implied by sight of 517.50 or 510 or 547.50) M1 for $500 \times 1.035 \times 1.02^3$ oe A1 for 549.17 - 549.18
	(b)	$1.035 \times 1.02^3 = 1.09835028$ $\sqrt[4]{1.09835028} = 1.023729495$	2.4	3	M1 for 1.035×1.02^3 M1 for $\sqrt[4]{1.0983(...)}$ or 1.0237(....) A1 for 2.4 (accept 2.37......) OR M1 for $\dfrac{"a"}{500}$ M1 for $\sqrt[4]{\left(\dfrac{"a"}{500}\right)}$ A1ft (Note: Do not accept answer without working)

5AM1H_01				
Question	**Working**	**Answer**	**Mark**	**Notes**
19	$\left(\dfrac{7}{1.25}\right)^2 \times 0.5 = 31.36 \times 0.5$ $15.68 - 0.5$ Or angle AOD = $\dfrac{0.5}{1.25^2} \times \dfrac{360}{\pi} = 36.6(6....)$ $36.6(6...) \times 7^2 \times \dfrac{\pi}{360} = 15.68$ $15.68 - 0.5$ Or Area of small circle = $\pi \times 1.25^2 = 4.908(7...)$ Area of sector AOD: area of small circle = 1: 9.817… Area of sector OBC = $\pi \times 7^2 \div 9.817... = 15.68$ $15.68 - 0.5$	15.2	5	M1 for $\dfrac{7}{1.25}$ or sight of 5.6 M1 $\left(\dfrac{7}{1.25}\right)^2 \times 0.5$ A1 for 15.68 M1(dep on 1st M) for "15.68" – 0.5 A1 for 15.18- 15.2 OR M1 angle AOD = $\dfrac{0.5}{1.25^2} \times \dfrac{360}{2\pi}$ M1 area of large sector = $36.6(6...) \times 7^2 \times \dfrac{\pi}{360}$ A1 for 15.68 M1(dep on 1st M) for "15.68" – 0.5 A1 for 15.18- 15.2 OR M1 for finding ratio of area of small sector to area of small circle or sight of 0.101(…) M1 for attempt to find the corresponding fraction of area of large circle A1 for 15.68 m² M1(dep on 1st M) for "15.68" – 0.5 A1 for 15.18- 15.2

5AM1H_01				
Question		**Working**	**Answer**	**Mark**	**Notes**

5AM1H_01

Question		Working	Answer	Mark	Notes
20	(a)		reason	1	B1 for reason e.g. Nhabi needs a sample in the same proportions as the population.
	(b)	$1650 + 5346 + 2085 + 5968$ $\dfrac{5346}{15049} \times 200$	71	2	M1 for $\dfrac{5346}{15049} \times 200$ or $\dfrac{15049}{200} = 75.245$ and $\dfrac{5346}{'75.245'}$ A1 for 71 (accept 72)
	(c)	$\dfrac{60}{150} \times (1650 + 5346 + 2085 + 5968)$	6019 or 6020	2	M1 for $\dfrac{60}{150} \times (1650 + 5346 + 2085 + 5968)$ oe A1 6019 or 6020
21	(a)		$x + y \geq 60$	1	B1 cao
	(b)	$40x + 80y \leq 4000$ Or $0.4x + 0.8y \leq 40$		2	M1 for $40x + 80y$ or $0.4x + 0.8y$ A1 cao
	(c)			3	M2 for all three lines drawn correctly (solid or dotted) ft (a) (M1 for 1 or 2 lines drawn correctly (solid or dotty)) ft (a) A1 for correct region cao
	(d)		£16.00	2	M1 for identification of (60, 20) on diagram or in working space A1 cao

Question	Working	Answer	Mark	Notes
22	Area $(1 < 1 < 6) = (0.12 \times 1) + (0.32 \times 1) + (0.38 \times 1) + (0.52 \times 1) + (0.16 \times 1)$ $= 1.50$ Total Area $= (0.12 \times 2) + (0.32 \times 1) + (0.38 \times 1) + (0.52 \times 1) + (0.16 \times 2)$ $= 1.78$ Proportion $= \dfrac{1.50}{1.78}$	0.84 or $\dfrac{75}{89}$	4	M1 for attempt to use frequency density × width e.g. 0.12×2 or 0.24 M1 for $(0.12 \times 2) + (0.32 \times 1) + (0.38 \times 1) + (0.52 \times 1) + (0.16 \times 2)$ or 1.78 seen M1 for $((0.12 \times 1) + (0.32 \times 1) + (0.38 \times 1) + (0.52 \times 1) + (0.16 \times 1))/$"$1.78$" A1 for answer which rounds to 0.84 or 84% or $\dfrac{75}{89}$ or equivalent vulgar fraction OR M1 for attempt to use area e.g. sight of any one of 4.8, 6.4, 7.6, 10.4 or 6.4 (cm²) oe M1 for $4.8 + 6.4 + 7.6 + 10.4 + 6.4$ or 35.6 (cm^2) oe seen M1 for $(2.4 + 6.4 + 7.6 + 10.4 + 3.2)$ "35.6" oe A1 for answer which rounds to 0.843 or 84.3%% or $\dfrac{75}{89}$ or equivalent vulgar fraction

17(b)

Age
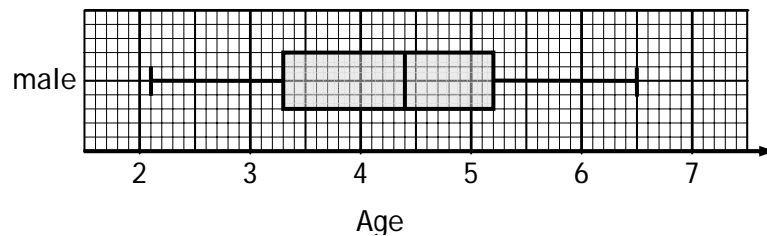
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