AQA

LEVEL 3 CERTIFICATE
Mathematical Studies

1350/1 Paper 1
Mark scheme

1350
June 2016

Version 1.0: Final Mark Scheme

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk.

Glossary for Mark Schemes

Examinations are marked in such a way as to award positive achievement wherever possible. Thus, for mathematics papers, marks are awarded under various categories.
If a student uses a method which is not explicitly covered by the mark scheme the same principles of marking should be applied. Credit should be given to any valid methods. Examiners should seek advice from their senior examiner if in any doubt.

M	mark is for method
dM	mark is dependent on one or more M marks and is for method
A	mark is dependent on M or m marks and is for accuracy
B	mark is independent of M or m marks and is for method and accuracy
E	mark is for explanation
ft	follow through from previous incorrect result
CAO	correct answer only
CSO	correct solution only
AWFW	anything which falls within
AWRT	anything which rounds to
ACF	any correct form
AG	answer given
SC	special case
OE	or equivalent
A2,1	2 or 1 (or 0) accuracy marks
PI	possibly implied
SCA	substantially correct approach
c	candidate
sf	significant figure(s)
dp	decimal place(s)

Q	Answer	Mark	Comments
1a	discrete **and** quantitative	B2	B1 for 1 correct word if only one word circled or B1 for both correct words and one other circled or B1 for one correct word and at most one incorrect word circled
1b	Lowest 50 and highest 99	B1	
	Lower quartile 65	B1	
	Median 75	B1	
	Upper quartile 82	B1	
1c	Both fully completed box plots drawn accurately with at least one labelled	B3 ft	±½sq ft their values for Paper 2 B2 One fully completed box plot drawn accurately and labelled or both box plots correct but no labels B1 one box plot fully correct with no label or both boxes (median and quartiles box) correctly drawn (no label needed)
	Additional Guidance		
	Ignore whiskers extended into box Whiskers do not need end lines Any height of box is allowed If boxes overlap mark to scheme if clear which is which		

Q	Answer	Mark	Comments
1d	Comparing equivalent values median, IQR/width of box, range, both quartiles, lowest value, highest value, particular parts of distribution Eg On Paper 2 there were more students who got 90+ On Paper 2 nobody got under 50 marks but on Paper 1 one person did On Paper 1 there were fewer students who got under 70 marks The average was higher on Paper 2	M1	ft correct conclusion for their Paper 2 median If they do not draw both boxes then they must show values for IQR and/or range
	compares median in context eg the median was higher on Paper 2 so on average they did better on Paper 2 eg the average mark was higher on Paper 2 so they did better on this paper	A1ft	ft correct conclusion for their medians
	Compares spread in context Eg the IQR was smaller so the marks were more consistent on Paper1	A1ft	ft correct conclusion for their quartiles/width of box They can use the IQR or the range

1d	**Additional Guidance**
	Only award A marks for comparison of median and IQR in context. For the comparison of spread they must mention the word consistent or variation in results/more varied etc Eg 1 Paper 2 had a higher median M1 A0A0 Eg 2 The box was wider on paper 2 so the marks on Paper 1 were more consistent M1A1 Eg 3 The median was higher on Paper 2 so on average they did better on Paper 2. They were more consistent on Paper 1. M1A1A0 (no evidence to back up consistent) Eg 4 The median was higher on Paper 2 so on average they did better on Paper 2. The smaller IQR on Paper 1 shows they were more consistent on Paper 1. M1A1A1 Eg 5 They had a better success rate on paper 2 as the median was higher M1A1 Eg 6 There was a wider range of marks on Paper 2 M1A0A0

Q	Answer	Mark	Comments
2	**Alternative method 1**		
	22.5(0) × 1.2 or $\frac{20}{100}$ × 22.5(0) + 22.5 or 10% of 22.5(0) = 2.25 **and** 2.25 × 2 + 22.5 or 27 seen	M1	oe
	their 27 ÷ 0.9	M1	oe
	30	A1	Not 30% SC1 29.70
	Alternative method 2		
	0.9 ÷ 1.2 or 0.75	M1	or 1.2 ÷ 0.9 or 1.33….
	22.5(0) ÷ their 0.75	M1	22.5(0) × their 1.33…
	30	A1	Not 30%
	Additional Guidance		
	If 1.3 is seen do not assume it is from 1.2 ÷ 0.9. It is more likely to be from adding 10% and 20%. In this case 22.5(0) × 1.3 = 29.25 is M0		

Q	Answer	Mark	Comments
3a	Assumes an amount per day/week/month	B1	Allow any realistic value eg 0.5 (kg) per day 3 (portions) per day 2 (pieces of) fruit and veg per day 3 (kg) per week Allow splitting into fruit and veg separately if combined later or summer/ winter etc
	their value per day × 365 or their value per week × 52 or their value per month × 12	M1	Allow 4 weeks in a month Allow rounding of 365 and 52 if explained Allow splitting into different parts of a year but must total a whole year
	Calculates accurate answer based on their assumed amount of fruit **and** veg per day/week/month with units used stated	A2	A1 Calculates accurate answer based on their assumed amount of fruit **and** veg per day/week/month with incorrect or no units used stated Condone units missed off the answer line if they are seen with the **total** amount of fruit and veg in the body of the script or A1 Calculate accurate answer based on their assumed amount of just fruit or just veg with units stated Eg 1 apple a day × 365 = 365 B0M1A0A0 Eg 1 apple a day × 365 = 365 apples B0M1A0A1
	Additional Guidance		
	If they only mention fruit or only mention veg then max 2 marks are available Time periods must be correct eg 6 portions per **week** × 365 =2190 portions per year gains M1M0A0A0 If they extend to longer than a year eg a lifespan, they can achieve M1M1A1A0 for an accurate answer with units		

Q	Answer	Mark	Comments
3b	States one refinement eg Count the portions of fruit and veg one day Weigh the amount of fruit/veg for a week Carry out a survey to find out how much fruit and veg people eat Consider times when you might eat more fruit eg on holiday	B1	B0 for split into fruit and veg separately Do a survey Work out the exact amount an average person eats Record all the fruit and veg people eat for a year

Q	Answer	Mark	Comments
4a	Full explanation eg Yes as it takes the sample in proportion to the number of girls and boys or Yes as there are more girls than boys in year 12 so the sample will have more girls than boys or Yes as it is (more) representative of the number of girls and boys or Yes as it is representative of the population or Yes as the ratio of girls to boys in the sample is the same as in the year group	B2	B1 partial explanation eg Yes as there are more girls than boys Yes as it is more representative
	Additional Guidance		
	Yes may be implied , eg It is, because….. Answer of No is B0 Reference to not using other year groups is B0		

Q	Answer	Mark	Comments
4b	Number the girls	B1	Not 'Number the girls from 1 to 34'
	Use a random number generator/button/ tables	B1	
	Use the first 34 different numbers (within the range) or Use the first 34 numbers ignoring repeats	B1	SC2 Number each girl, put all the numbers in a hat/box etc and pick out 34 oe
	Additional Guidance		
	Put all the girls names in a hat and pick out 34 is B0		
4c	Cluster	B1	Accept convenience

Q	Answer	Mark	Comments
5	**Alternative method 1**		
	838 × 0.88 or 737.44 or 838 × 0.12 or 100.56 **and** 838 – their 100.56	M1	oe Full attempt to get to 88%
	(their 737.44 – 250) × $\frac{2}{3}$ or 487.44 × $\frac{2}{3}$ or 324.96	M1	
	2173 ÷ their 324.96 or 6.6(…) or 7 × their 324.96 or 2274.(72)	M1	dep on 1st or 2nd M1 awarded
	6.6(…) **and** Yes or 7 **and** Yes or 2274.(72) **and** Yes	A1	Yes can be implied eg 2274.(72)> 2173 Allow 2275
	Alternative method 2		
	838 × 0.88 or 737.44 or 838 × 0.12 or 100.56 **and** 838 – their 100.56	M1	oe Full attempt to get to 88%
	(their 737.44 – 250) × $\frac{2}{3}$ or 487.44 × $\frac{2}{3}$ or 324.96	M1	
	2173 ÷ 7 or 310.(43)	M1	
	324.96 **and** 310.(43) **and** Yes	A1	

Q	Answer	Mark	Comments
6	**Alternative method 1**		
	31 785 + 10 600 or 42 385	M1	Calculating threshold for 40% tax Condone 31 876 + 10 600 or 42 386
	their 42 385 – 39 500 or 2885	M1	Calculating extra salary for 20% tax and 12% N.I
	43 500 – 42 385 or 1115	M1	Calculating amount charged at 40% tax and 2% N.I
	their 2885 × 0.2 + their 1115 × 0.4 or 577 + 446 or 1023	M1	Tax Allow 577.20 from 31876 used
	their 2885 × 0.12 + their 1115 × 0.02 or 346.2(0) + 22.3(0) or 368.5(0)	M1	N.I Allow 346.32 from 31876 used
	(£)1023 **and** (£)368.5(0) or (£) 1023.20 **and** (£)368.62 or (£)1391.5(0) or (£)1391.82	A1	extra tax and extra N.I.
	(43500 – 39500) – their 1023 – their 368.5(0) or (£)2608.50 or (£)2608.18	M1	or their 1023 + their 368.5(0) + 12 × 150 or 3191.5(0) or 3191.82
	their (£)2608.5(0) ÷ 12 or their (£)2608.18 ÷ 12	M1	43500 – 39500 or 4000
	217.(..) per month **and** Yes or 67 extra or 150 × 12 =1800 and 2608.5(0) **and** Yes or 4000 **and** 3191.(50) **and** Yes or 4000 **and** 3191.(82) **and** Yes	A1ft	ft their increase in net pay per month/year compared with travel costs per month/year

	Additional Guidance
	Allow use of 31785 or 31786 for upper tax limit
	Ignoring higher tax limit and taxing all at 20% can gain max 7 marks (loses 4th M1 and 1st A1)
	Ignoring higher NI or only needing to use 12% can gain max 7 marks (loses 5th M1 and 1st A1)
	Ignoring both higher limits can gain max 6 marks
	For premature rounding allow all method marks
	1023 or 577 + 446 implies the first 4 method marks
	368.5(0) or 346.2(0) + 22.3(0) implies first 3 and 5th method marks

Q	Answer	Mark	Comments
6	**Alternative method 2**		
	43 500 – 10 600 or 32 900	M1	taxable income
	(32 900 – 31786) × 0.4 + 31786 × 0.2 or 445.6(0) + 6357.2(0) or 6802.8	M1	calculating annual tax Allow 31785 used giving 446 + 6357 or 6803
	their 6802.8 ÷ 12 or 566.9(.)	M1	monthly tax
	43500 ÷ 12 or 3625	M1	monthly gross pay
	(their 3625 – 3532) × 0.02 or 1.86 or (3532 – 672) × 0.12 or 343.2(0) or 345.(..)	M1	N.I at 2% or 12%
	3625 – (their 566.9(0) + their 1.86 + their 343.2(0))	M1	Total tax and NI
	2713.(...)	A1	calculating new net monthly salary
	their 2713.(..) – 2495.64 or their 2713.(...) – 150	M1	Increase in net pay or subtracting 150 from their new net pay
	217.(..) per month **and** Yes or 67 extra or 2563.(..) **and** Yes	A1ft	ft their increase in net pay per month/year compared with travel costs per month/year Comparison with recalculated wrong old net pay loses this mark
	Additional Guidance		
	Allow use of 31785 or 31786 for upper tax limit		
	Ignoring higher tax limit and taxing all at 20% can gain max 7 marks (loses 2nd M1 and 1st A1)		
	Ignoring higher NI or only needing to use 12% can gain max 7 marks (loses 5th M1as neither bracket will be correct, and 1st A1)		
	Ignoring both higher limits can gain max 6 marks		
	6802.8 or 6803 implies M2 566.9() implies M3 2713.(..) is the first 7 marks		

Q	Answer	Mark	Comments
6	**Alternative method 3**		
	43 500 – 10 600 or 32 900	M1	taxable income
	(32 900 – 31786) × 0.4 + 31786 × 0.2 or 445.6(0) + 6357.2(0) or 6802.8 or (32 900 – 31786) × 0.6 + 31786 × 0.8 or 668.4 + 25428.8 or 26097.(..)	M1	Allow 31785 used giving 446 + 6357 or 6803
	(43500 – 42385) × 0.02 or 22.3 or (42385 – 8064) × 0.12 or 4118.52 or 4140.(..)	M1	2% or 12% NI
	their 6802.8 +their 22.3 + their 4118.52 or 10943.82 or their 26097.(..) – their 22.3 – their 4118.52 or 21956.38	M1	or their 6802.8 + their 4140.82 their total tax + NI Must be consistent time periods
	43500 – their 10943.82 or their 21956.38 + 10600	M1	Gross salary – (tax +NI) Must be consistent time periods or 43500 – 10943.82 - 1800
	32556.(18)	A1	or 30756.(18) (only if 12 × 150) deducted
	their 32556.(18) ÷ 12 or 2713.(..) or 2495.64 × 12 or 29947.(68) **and** 12 × 150 (if not included at some other point	M1	their 30756.18 ÷ 12 or 2563.(..) or 2495.64 × 12 or 29947.(68)
	their 2713.(..) – 2495.64 or their 32556.(..) – their 29947.68	M1	For 1800 subtracted earlier, answer of 30756.(..) **and** 29947.(..) **and** Yes or 2563.(..) **and** Yes implies final M1and A1as no subtraction is required

	217.(..) per month **and** Yes or 67 extra or 2563.(…) **and** Yes or 30756.(..) **and** 29947.(..) **and** Yes	A1ft	2563.(..) **and** Yes ft their increase in net pay per month/year compared with travel costs per month/year Comparison with recalculated wrong old net pay loses this mark
	Additional Guidance		
	Allow use of 31785 or 31786 for upper tax limit		
	Ignoring higher tax limit and taxing all at 20% can gain max 7 marks (loses 2nd M1 and 1st A1)		
	Ignoring higher NI or only needing to use 12% can gain max 7 marks (loses 3rd M1as neither bracket will be correct, and 1st A1)		
	Ignoring both higher limits can gain max 6 marks		
	For premature rounding allow all method marks		
	6802.8 or 6803 implies M2 566.9() implies M3 2173.(..) is first 7 marks		

Q	Answer	Mark	Comments
7	Scale 1 cm^2 = 25 people or 24 cm^2 = 600 or 1 small square = 1 person or frequency density scale labelled in 5's every cm or one other bar shown with correct frequency	M1	
	[(5 × 12) + (1 × 15)] × 9 or 75 × 9 or 675 **and** 5 × 3 × 9 or 15 × 9 or 135 or (75 + 15) × 9 or 810	M1	Correct method for either end implies correct scale so 1st M1
	[600 – their (75 +15)] ×12 or [(9 ×15) + (5 × 22) + (5 × 24) + (10 × 10) + (15 × 3)] × 12 or 510 × 12 or 6120	M1	their 75 + 15 must be from use of correct scale Condone 1 error when adding **all** the other bars/ages (must include all of bar up to 65)
	(£)6930	A1	
	Additional Guidance		
	6975 or 6921 may imply M2 from combining 20-21 within the £12 or 64 -65 within the £9		

Q	Method	Mark	Comments
8	9300 – 6200 or 3100	M1	calculates loan amount
	their 3100 × 1.055 or 3270.5	M1	oe
	(56 700 – 21 000) ÷ 12 or 2975	M1	or (56700 – 21000) × 0.09 or 3213
	their 2975 × 0.09 or 267.75	M1	their 3213 ÷ 12 or 267.75
	10 × their 267.75 or 2677.50	M1	
	their 3270.5 – their 2677.5	M1dep	dep on previous M1 their 3270.5 can be 3100
	593	A1	SC5 318.(..) for use of repayment plan 1 if no working seen
	Additional guidance		
	The 3rd and 4th method marks can be in either order or combined So (56700 – 21000) × 0.09 ÷ 12 gains 3rd and 4th method marks If students use repayment plan 1 and show working then they can achieve B1,M1,M0,M1,M1,M1,A0 eg gets 3270.5 M2 (56700 – 17335) × 0.09 =3542.85 M0 3542.85 ÷ 12 = 295.(..) M1 10 × 295. (..) = 2952.(..) M1 3270.5 – 2952.(..) M1 318.(..) A0 If no working is seen award SC5 for the correct answer of £318.(..) Failing to subtract 21000 loses 3rd M1 and A1 so can gain 5 marks		

Q	Answer	Mark	Comments
9	**Alternative method 1**		
	Makes an assumption for average number of people in 3 or 4 bedroom homes eg 3 or 4 bedroom family homes average 4 people per home or Makes an assumption for average number of people in 1 or 2 bedroom homes eg 1 or 2 bedroom homes average 2 people per home	B1	
	Uses [134,191] (cubic metres) for the family homes	B1	
	Uses [54,134] (cubic metres) for the 1 or 2 bedroom homes	B1	
	240 × their usage for 3 or 4 bed homes eg 240 × 164 or 39 360 or approx. 39 000	M1	Allow any rounded or unrounded answer eg 240 × 164 is approx. 40 000 or 39 500
	80 × their usage for 1 or 2 bed homes eg 80 × 101 or 8080 or approx.8000	M1	Allow any rounded or unrounded answer
	30 × 54 or 1620 or approx. 1600	M1	water usage for retirement flats must use 54 for annual use or per day [145, 150] litres or [0.14, 0.15] cubic metres Allow rounding to 1 or 2 sf
	their 40 000 + their 1600 + their 9000	M1	sum of their 3 rounded or unrounded answers
	Correct answer for their values	A1	All method marks must be scored
	their answer ÷ 365 (×1000) or their answer ÷ 52 ÷ 7 (×1000)	M1	Condone ÷ 12 ÷ 31
	Correct division of their total per year to give value per day and conversion to litres	A1	Must convert to litres Penalise decimal answers

9	**Alternative method 2-working on daily values**		
	Makes an assumption for average number of people in 3 or 4 bedroom homes eg 3 or 4 bedroom family homes average 4 people per home or Makes an assumption for average number of people in 1 or 2 bedroom homes eg 1 or 2 bedroom homes average 2 people per home	B1	
	Any water usage ÷ 365 (×1000)	B1	Implied by figures within the ranges of the values used for each size of home
	For the 3-4 bed homes, uses [360, 530] litres or [0.36, 0.53] cubic metres	B1	
	For the 1 or 2 bedroom homes, uses [145, 360] litres or [0.145, 0.36]	B1	
	240 × their usage for 3 or 4 bed homes eg 240 × 450 or 108 000 or approx. 110 000	M1	Allow any rounded or unrounded answer Allow rounding to 1 or 2 sf
	80 × their usage for 1 or 2 bed homes eg 80 × 367 or 29 360 or approx. 29 000	M1	Allow any rounded or unrounded answer eg 80 × 0.367 = 29.36 or 29.4 or 29 or 30 Allow rounding to 1 or 2 sf
	30 × 148 or 4440 or approx. 4500 or 30 × 0.148 or 4.44 or approx. 4.5	M1	Water usage for retirement flats per day [145,150] litres or [0.14,0.15] cubic metres Allow rounding to 1 or 2 sf
	their 110 000 + their 29000 + their 4500	M1	Sum of their 3 rounded or unrounded answers
	Correct answer for their values (in litres or cubic metres)	A1	All method marks must be scored
	Answer given with correct evaluations of division by 365 (changing to per day) seen earlier	A1	Penalise decimal answers

	Additional Guidance
	All values can be rounded at any point.
	Example for final mark 138000 given as their answer (first A mark)is incorrect A0 In their working they divided their water usages correctly by 365 Their answer is in litres and no decimals so final A1 is awarded (Note the M1 for dividing water usage by 365 is for one seen-whereas the A1ft is for dividing all water usages accurately)