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Level 3 Certificate  
**MATHEMATICAL STUDIES**  
**1350/1**

Paper 1

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Mark scheme

June 2024

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Version: 1.1 Final



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 Examiner.

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.

No student should be disadvantaged on the basis of their gender identity and/or how they refer to the gender identity of others in their exam responses.

A consistent use of 'they/them' as a singular and pronouns beyond 'she/her' or 'he/him' will be credited in exam responses in line with existing mark scheme criteria.

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## Glossary for Mark Schemes

Mathematical Studies examinations are marked in such a way as to award positive achievement wherever possible. Thus, for Mathematical Studies 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.

<b>M</b>	Method marks are awarded for a correct method which could lead to a correct answer.
<b>A</b>	Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied.
<b>B</b>	Marks awarded independent of method.
<b>ft</b>	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
<b>SC</b>	Special case. Marks awarded for a common misinterpretation which has some mathematical worth.
<b>M dep</b>	A method mark dependent on a previous method mark being awarded.
<b>B dep</b>	A mark that can only be awarded if a previous independent mark has been awarded.
<b>oe</b>	Or equivalent. Accept answers that are equivalent. eg accept 0.5 as well as $\frac{1}{2}$
<b>[a, b]</b>	Accept values between a and b inclusive.
<b>[a, b)</b>	Accept values $a \leq \text{value} < b$
<b>3.14 ...</b>	Accept answers which begin 3.14 eg 3.14, 3.142, 3.1416
<b>Use of brackets</b>	It is not necessary to see the bracketed work to award the marks.

Examiners should consistently apply the following principles

**Diagrams**

Diagrams that have working on them should be treated like normal responses. If a diagram has been written on but the correct response is within the answer space, the work within the answer space should be marked. Working on diagrams that contradicts work within the answer space is not to be considered as choice but as working, and is not, therefore, penalised.

**Responses which appear to come from incorrect methods**

Whenever there is doubt as to whether a student has used an incorrect method to obtain an answer, as a general principle, the benefit of doubt must be given to the student. In cases where there is no doubt that the answer has come from incorrect working then the student should be penalised.

**Questions which ask students to show working**

Instructions on marking will be given but usually marks are not awarded to students who show no working.

**Questions which do not ask students to show working**

As a general principle, a correct response is awarded full marks.

**Misread or miscopy**

Students often copy values from a question incorrectly. If the examiner thinks that the student has made a genuine misread, then only the accuracy marks (A or B marks), up to a maximum of 2 marks are penalised. The method marks can still be awarded.

**Further work**

Once the correct answer has been seen, further working may be ignored unless it goes on to contradict the correct answer.

**Choice**

When a choice of answers and/or methods is given, mark each attempt. If both methods are valid then M marks can be awarded but any incorrect answer or method would result in marks being lost.

**Work not replaced**

Erased or crossed out work that is still legible should be marked.

**Work replaced**

Erased or crossed out work that has been replaced is not awarded marks.

**Premature approximation**

Rounding off too early can lead to inaccuracy in the final answer. This should be penalised by 1 mark unless instructed otherwise.

**Continental notation**

Accept a comma used instead of a decimal point (for example, in measurements or currency), provided that it is clear to the examiner that the student intended it to be a decimal point.

Q	Answer	Mark	Comments
1	172.16	B1	04/05 balance
	104.99	B1ft	05/05 debit ft their 172.16 – 67.17 their 172.16 > 67.17
	523.17	B1	07/05 balance
	<b>Additional Guidance</b>		
	Pence are not required for the 2nd B1 if their value is an integer number of pounds For all other ft answers correct money notation is required		

Q	Answer	Mark	Comments
2(a)	Primary and qualitative	B1	
	<b>Additional Guidance</b>		
	More than one box ticked		B0
	Ignore crosses if there is only one tick		

Q	Answer	Mark	Comments
<b>2(b)</b>	Correct reason eg The number of students in the sample are not in proportion to the number of students in each year group	B1	statement must imply stratified sampling involves proportion
	<b>Additional Guidance</b>		
	She has taken equal numbers instead of numbers in proportion (to year size)	B1	
	It doesn't consider the ratio/percentages of people in each age group	B1	
	Its not an equal percentage from each year group (that represents the population)	B1	
	She has taken the same number from each year group	B0	
	Its not representative of the proportions in each group	B1	
	Its not representative of the numbers in each age group	B0	
	Its not representative	B0	
	She hasn't asked students from Years 10 and 11	B0	
	She should ask all the students	B0	
	Some groups are larger than others and this is not accounted for	B0	
	The sample is too small	B0	
	Should be different amounts	B0	
	This is quota sampling	B0	
	Just working out the stratified values for each year group	B0	
Ignore irrelevant statements unless they contradict			

	<p><b>Alternative method 1</b></p> <p>(Year 7) <math>\frac{304}{304 + 270 + 246}</math>  or 0.37(...) or 37.(..)(%)  or 22(.24...)</p> <p><b>or</b></p> <p>(Year 8) <math>\frac{270}{304 + 270 + 246}</math>  or 0.32(9..) or 32.(9..)(%)  or 0.33 or 33(%)  or [19.75, 19.8] or 20</p> <p><b>or</b></p> <p>(Year 9) <math>\frac{246}{304 + 270 + 246}</math>  or 0.3 or 30(%) or 18</p>	M1	oe eg $\frac{304}{820}$
2(c)	<p>At least <b>two</b> of</p> <p>(Year 7) <math>\frac{304}{304 + 270 + 246} \times 60</math>  or 0.37(..) <math>\times 60</math>  or 22(.24...)</p> <p><b>and</b></p> <p>(Year 8) <math>\frac{270}{304 + 270 + 246} \times 60</math>  or 0.32(9..) <math>\times 60</math> or 0.33 <math>\times 60</math>  or [19.75, 19.8] or 20</p> <p><b>and</b></p> <p>(Year 9) <math>\frac{246}{304 + 270 + 246} \times 60</math>  or 0.3 <math>\times 60</math> or 18</p>	M1dep	oe
	<p>Year 7 22  Year 8 20  Year 9 18  with no incorrect method seen</p>	A1	

Mark scheme and Additional guidance continue on the next pages

<b>2(c)</b> cont'd	<b>Alternative method 2</b>		
	$60 \div (304 + 270 + 246)$ or $60 \div 820$ or $0.073(\dots)$	M1	oe
	At least <b>two</b> of $304 \times 60 \div 820$ or $22.(24\dots)$ <b>and</b> $270 \times 60 \div 820$ or $[19.75, 19.8]$ <b>and</b> $246 \times 60 \div 820$ or 18	M1dep	oe
	Year 7 22 Year 8 20 Year 9 18 with no incorrect method seen	A1	
	<b>Alternative method 3</b>		
	$304 \div (820 \div 60)$ or $22.(24\dots)$ <b>or</b> $270 \div (820 \div 60)$ or $[19.75, 19.8]$ or 20 <b>or</b> $246 \div (820 \div 60)$ or 18	M1	oe eg $304 \div 13.6\dots$
	At least <b>two</b> of $304 \div (820 \div 60)$ or $22.(24\dots)$ <b>or</b> $270 \div (820 \div 60)$ or $[19.75, 19.8]$ or 20 <b>or</b> $246 \div (820 \div 60)$ or 18	M1dep	
	Year 7 22 Year 8 20 Year 9 18 with no incorrect method seen	A1	

**Additional Guidance is on the next page**

	<b>Additional Guidance</b>	
<b>2(c) cont'd</b>	One correct value seen scores M1 unless an incorrect method is seen for that value or it is for the wrong year group	
	22, 20 and 18 with errors seen in method or percentages cannot be awarded 3 marks. eg method not seen or incorrect method with values 21.67, 19.2 and 17.9 seen leading to answer 22, 20, 18	MOM0A0

Q	Answer	Mark	Comments
3(a)	1 268 400	B1	
	<b>Additional Guidance</b>		
	Ignore punctuation		

Q	Answer	Mark	Comments
3(b)	<b>Alternative method 1</b>		
	$359\,520 \div 1680$ or 214	M1	
	their 214 $\times$ 0.03 or 6.42	M1	oe
	their 214 – their 6.42	M1dep	oe dep on M1M1 their 214 $\times$ 0.97 implies 2nd and 3rd M1
	207.58	A1	SC2 230.94 or 230.95 SC2 220.42
	<b>Alternative method 2</b>		
	$359\,520 \times 0.03$ or 10 785.6(0)	M1	
	359 520 – their 10 785.6(0) or 348 734.4(0)	M1dep	oe 359 520 $\times$ 0.97 implies M2
	their 348 734.4(0) $\div$ 1680	M1	
	207.58	A1	SC2 230.94 or 230.95 SC2 220.42
	<b>Additional Guidance</b>		
	First SC is from using the first exchange rate of 1510 Second SC is for adding 6.42 to 214		
	Ignore subsequent rounding or truncation if 207.58 seen		
	$359\,520 \div 1.03 \div 1680 = 207.76$		Alt 2 MOMOM1A0

Q	Answer	Mark	Comments	
4(a)	8, 42, 74, 80	B1	implied by correct heights	
	Correct cumulative frequency graph joined with lines or smooth curve	B2ft	$\pm \frac{1}{2}$ square ft their cf values which must be increasing B1ft all their heights correct and joined with lines/smooth curve but plotted at incorrect horizontal position or B1ft plotted at upper class values and joined with lines/smooth  curve with at least 3 of their heights correct or B1ft all their points correct but no lines/curve or poor lines/curve	
	<b>Additional Guidance</b>			
	Accept an omission of the point with cf 0, but do not accept an incorrect starting point for the pattern of their points. eg using correct upper class boundaries the first point must be (10,0) using midpoints the first point can be (0,0) using lower class boundaries the first point should be (-10,0)			
	Accept a horizontal line drawn from their final point, but do not accept a continuation of the curve or polygon.			
	A poor curve is one that misses any points by more than $\frac{1}{2}$ square or is a double/feathered line or goes above 80			
	Ignore extra horizontal/vertical lines which may be their working for <b>(b)</b> or <b>(c)</b>			

Q	Answer	Mark	Comments
4(b)	Correct reading from cf of 40 or 40.5 for their graph	B1ft	must read at 40 or 40.5 but allow $\pm \frac{1}{2}$ sq on their read off value ft their increasing graph
	<b>Additional Guidance</b>		
	Do not ft from a histogram but if a cf graph is drawn on top of a histogram this can be used		
	Question asks them to use the graph so do not accept interpolation seen from the table		

Q	Answer	Mark	Comments
4(c)	<b>Alternative method 1</b>		
	Correct reading from age 55	B1ft	$\pm \frac{1}{2}$ square for their read off value ft their increasing graph
	$\frac{80 - \text{their cf}}{80} \times 100$	M1	oe
	Correct percentage calculated	A1ft	ft their increasing graph and reading
	<b>Alternative method 2</b>		
	$32 \times \frac{15}{20} + 6$ or 30	M1	oe eg finding number below 55 and subtracting from 80
	their $30 \div 80 \times 100$	M1	oe
	37.5	A1	accept 38 from correct method seen
	<b>Additional Guidance</b>		
	Do not ft from a histogram but if a cf graph is drawn on top of a histogram this can be used		
	Working out the percentage below 55 can gain maximum 1 mark on either scheme		

Q	Answer	Mark	Comments
5	Makes an assumption about heart beats per minute	B1	allow 40 to 120 bpm oe eg beats in ten seconds allow any equivalent which would be in the range 40 to 120 bpm
	Makes an assumption about average years a person lives	B1	allow 65 to 90 can be seen just in the calculation
	their beats per minute $\times 60 \times 24 \times 365$ ( $\times$ their years in a lifetime) or their beats per minute $\times 60 \times 24 \times 7 \times 52$ ( $\times$ their years in a lifetime)	M1	oe eg uses 1440 mins per day calculation to work out beats per year or lifetime allow 360, 364, 366 or 365.25 for 365 allow 48, 50 or 52 weeks allow 28, 30 or 31 days in a month ft their years in a lifetime
	Correct answer for their values	A1ft	ft their heart rate and years in a lifetime may be rounded
	<b>Additional Guidance</b>		
	The final 2 marks can be gained even with incorrect assumptions eg Assume heart beats 200 times per minute $200 \times 60 \times 24 \times 365 = 105\,120\,000$ Assume a person lives for 70 years $105\,120\,000 \times 70 = 7\,358\,400\,000$		B0 M1 B1 A1ft
	Rounding/truncation is acceptable for the final answer eg Assume heart beats 70 times per minute Assume person lives 80 years $70 \times 1440 \times 365 \times 80$ Answer 2.9 billion		B1 B1 M1A1ft
	Final answer may be in millions, billions, or in standard form		
Ignore conversion to millions, billions or standard form if correct full value seen			
Ignore any reference to illness/heart conditions			
Allow use of more than one heart rate eg for exercise. Both must fit range for first B1 and number of years must total their assumption of lifespan			

Q	Answer	Mark	Comments
6(a)	£36.89	B1	
	<b>Additional Guidance</b>		

Q	Answer	Mark	Comments
6(b)	their $36.89 \times 1.105$ or $40.76\dots$	M1	oe eg adds on 10.5% ft their <b>6(a)</b> or correct
	their $40.76\dots \times [1.05, 1.055]$ or $[42.79, 43.01]$	M1dep	oe uses half the 2022 rate of inflation their $36.89 \times 1.105 \times [1.05, 1.055]$ is M2 must not include any further years
	£43	A1ft	ft their <b>6(a)</b> , with their final value rounded to the nearest pound SC1 41
	<b>Additional Guidance</b>		
	SC is from using £35 as the starting point after Dec 21 instead of their answer to <b>6(a)</b>		
	Including an additional year(s) can score maximum M1		
	If <b>6(a)</b> is blank they must use one of the four options for part <b>(b)</b>		
	Common answer is £42.90 leading to 43 from use of 5.25%		
	Final values using the other options £33.21 → [38.52, 38.72] → £38 £40.40 → [46.87, 47.10] → £47 £53.90 → [62.52, 62.84] → £63		

Q	Answer	Mark	Comments
7(a)	<b>Alternative method 1: uses residual waste per year</b>		
	States an assumption for average number of people in the 4-bedroom <b>and</b> 3-bedroom <b>and</b> 2-bedroom houses	B1	4-bedroom allow 3 to 6 3-bedroom allow 2 to 5 2-bedroom allow 1 to 4 does not have to be an integer eg average 1.5 people per bedroom (in tolerance for all types)
	Makes an assumption about the total waste per person per year	B1	allow 390 to 425 implied by use of value in this range
	Makes an assumption about the percentage of waste that is recycled or makes an assumption about amount of residual waste after recycling	B1	allow (44,48] %  allow [52, 56] % may be implied by their calculations
	Calculates amount of residual waste per person per year	M1	eg $400 \times 0.54$ or 216 could be divided by 52 or 50 or 48 here oe eg divided by 12 then 30 or 31 <b>and</b> multiplied by 7
<p>150 × their residual waste per person × their number of people for 4-bed homes</p> <p><b>and</b></p> <p>200 × their residual waste per person × their number of people for 3- bed homes</p> <p><b>and</b></p> <p>90 × their residual waste per person × their number of people for 2-bed homes</p> <p><b>and</b></p> <p>60 × their residual waste for 1 person or calculates total number of people in the housing estate eg using 5 people, 4 people and 2 people per house (150 × 5 + 200 × 4 + 90 × 2 + 60)</p>	M2	<p>eg using 5 people, 4 people and 2 people per house</p> <p>150 × 216 × 5 or 162 000</p> <p><b>and</b></p> <p>200 × 216 × 4 or 172 800</p> <p><b>and</b></p> <p>90 × 216 × 2 or 38 880</p> <p><b>and</b></p> <p>60 × 216 or 12 960</p> <p>or</p> <p>M1 at least one size of household calculated correctly</p>	

<b>7(a) cont'd</b>	Calculates the amount of residual waste for the estate	M1	eg their 162 000 + their 172 800 + their 38 880 + their 12 960 or 386 640 eg $(150 \times 5 + 200 \times 4 + 90 \times 2 + 60) \times 216$ or 386 640 must include all types of households
	their answer $\div$ their weeks in a year	M1	residual waste per week allow 48 or 50 or 52 oe eg divided by 12 then 30 or 31 <b>and</b> multiplied by 7 eg $386\,640 \div 50$ or 7732.8
	Correct answer for their assumptions	A1ft	ft their assumptions with all method marks scored must round at least to nearest kg units not required on answer line

**Mark scheme and Additional guidance continue on the next pages**

<b>7(a) (cont)</b>	<b>Alternative method 2: uses total waste per year</b>		
	Makes an assumption for average number of people in the 4-bedroom <b>and</b> 3-bedroom <b>and</b> 2-bedroom houses	B1	4-bedroom allow 3 to 6 3-bedroom allow 2 to 5 2-bedroom allow 1 to 4 does not have to be an integer eg average 1.5 people per bedroom (in tolerance for all types)
	Makes an assumption about the total waste per person per year	B1	allow 390 to 425
	150 × their total waste per person × their number of people for 4-bed homes <b>and</b> 200 × their total waste per person × their number of people for 3-bed homes <b>and</b> 90 × their total waste per person × their number of people for 2-bed homes <b>and</b> 60 × their total waste for 1 person or calculates total number of people in the housing estate eg using 5 people, 4 people and 2 people per house (150 × 5 + 200 × 4 + 90 × 2 + 60)	M2	oe eg using 5 people, 4 people and 2 people per house 150 × 400 × 5 or 300 000 and 200 × 400 × 4 or 320 000 and 90 × 400 × 2 or 72 000 and 60 × 400 or 24 000  M1 at least one size of household calculated correctly
	Calculates the total amount of waste for the estate	M1	eg their 300 000 + their 320 000 + their 72 000 + their 24 000 or 716 000 eg (150 × 5 + 200 × 4 + 90 × 2 + 60) × 400 or 716 000

<b>7(a) cont'd</b>	Makes an assumption about the percentage of waste that is recycled or makes an assumption about amount of residual waste after recycling	B1	allow (44, 48]%  allow [52, 56)%  may be implied by their calculations
	their answer $\div$ weeks in a year or their answer $\times$ their % residual waste	M1	allow 48 or 50 or 52  oe eg divided by 12 then 30 or 31 <b>and</b> multiplied by 7  eg $716\,000 \div 50$ or 14 320  or  eg $716\,000 \times 0.54$ or 386 64
	their total waste per week $\times$ their % residual waste or their residual waste per year divided by their weeks in a year	M1	eg $14\,320 \times 0.54$    allow 48 or 50 or 52  eg $386\,640 \div 50$
	Correct answer for their assumptions	A1ft	ft their assumptions with all method marks scored  must round at least to nearest kg  units not required on answer line

<b>7(a) (cont)</b>	<b>Alternative method 3: uses residual waste per week</b>		
	Makes an assumption for average number of people in the 4-bedroom <b>and</b> 3-bedroom <b>and</b> 2-bedroom houses	B1	4-bedroom allow 3 to 6 3-bedroom allow 2 to 5 2-bedroom allow 1 to 4  does not have to be an integer  eg average 1.5 people per bedroom (in tolerance for all types)
	Makes an assumption about the total waste per person per year	B1	allow 390 to 425
	Makes an assumption about the percentage of waste that is recycled or makes an assumption about amount of residual waste after recycling	B1	allow (44,48]%    allow [52, 56)%  may be implied by their calculations

<b>7(a) cont'd</b>	their waste per year $\div$ weeks in year	M1	allow 48 or 50 or 52 oe eg divided by 12 then 30 or 31 <b>and</b> multiplied by 7 eg $400 \div 50 = 8$ total waste per person per week
	their waste per person per week $\times$ their % residual waste	M1	residual waste per person per week eg $8 \times 0.54$ or 4.32
	150 $\times$ their residual waste per person per week $\times$ their number of people for 4-bed homes eg <b>and</b> 200 $\times$ their residual waste per person per week $\times$ their number of people for 3-bed homes <b>and</b> 90 $\times$ their residual waste per person per week $\times$ their number of people for 2-bed homes <b>and</b> 60 $\times$ their residual waste for 1 person or calculates total number of people in the housing estate eg using 5 people, 4 people and 2 people per house ( $150 \times 5 + 200 \times 4 + 90 \times 2 + 60$ )	M2	oe eg using 5 people, 4 people and 2 people per house $150 \times 4.32 \times 5$ or 3240 <b>and</b> $200 \times 4.32 \times 4$ or 3456 <b>and</b> $90 \times 4.32 \times 2$ or 777.6 <b>and</b> $60 \times 4.32$ or 259.2 or M1 at least one size of household calculated correctly
	Calculates the amount of residual waste for the estate per week	M1	eg their 3240 + their 3456 + their 777.6 + their 259.2 or 7732.8 or ( $150 \times 5 + 200 \times 4 + 90 \times 2 + 60$ ) $\times$ 4.32
	Correct answer for their assumptions	A1ft	ft their assumptions with all method marks scored must round at least to nearest kg units not required on answer line

**Mark scheme and Additional guidance continue on the next pages**

<b>Alternative method 4: uses total waste per week</b>			
<b>7(a) (cont)</b>	Makes an assumption for average number of people in the 4-bedroom <b>and</b> 3-bedroom <b>and</b> 2-bedroom houses	B1	4-bedroom allow 3 to 6 3-bedroom allow 2 to 5 2-bedroom allow 1 to 4 does not have to be an integer eg average 1.5 people per bedroom (in tolerance for all types)
	Makes an assumption about the total waste per person per year	B1	allow 390 to 425
	their waste per year $\div$ weeks in year	M1	allow 48 or 50 or 52 oe eg divided by 12 then 30 or 31 <b>and</b> multiplied by 7 eg $400 \div 50$ or 8
	150 $\times$ their waste per person per week $\times$ their number of people for 4-bed homes <b>and</b> 200 $\times$ their waste per person per week $\times$ their number of people for 3-bed homes <b>and</b> 90 $\times$ their waste per person per week $\times$ their number of people for 2-bed homes <b>and</b> 60 $\times$ their waste for 1 person per week or calculates total number of people in the housing estate eg using 5 people, 4 people and 2 people per house $(150 \times 5 + 200 \times 4 + 90 \times 2 + 60)$	M2	oe eg using 5 people, 4 people and 2 people per house $150 \times 8 \times 5$ or 6000 <b>and</b> $200 \times 8 \times 4$ or 6400 <b>and</b> $90 \times 8 \times 2$ or 1440 <b>and</b> $60 \times 8$ or 480 or M1 at least one size of household calculated correctly
	Calculates the total amount of waste for the estate per week	M1	eg their 6000 + their 6400 + their 1440 + their 480 or 14 320 or $(150 \times 5 + 200 \times 4 + 90 \times 2 + 60) \times 8$

<b>7(a) cont'd</b>	Makes an assumption about the percentage of waste that is recycled or makes an assumption about amount of residual waste after recycling	B1	allow (44,48]%)  allow [52, 56)% may be implied by their calculations
	their total waste per week × their % residual waste	M1	eg $14\,320 \times 0.54$ or 7732.8
	Correct answer for their assumptions	A1ft	ft their assumptions with all method marks scored must round at least to nearest kg units not required on answer line

**Additional Guidance is on the next page**



Q	Answer	Mark	Comments	
7(b)	Acceptable explanation Examples If the estimate for the amount of waste per person was higher, then the weekly amount would be higher or If the estimate for the percentage of waste that is recycled was higher, then the amount of residual waste would be lower or If the number of people in a 4 bedroom house was lower, then the residual waste would be lower	B1	must relate to their assumptions	
	<b>Additional Guidance</b>			
	If the waste was more the answer would go up (doesn't specify whether residual waste, total waste or recycled waste)		B0	
	It may have been affected by how many people I chose in each house (doesn't say how it is affected)		B0	

Q	Answer	Mark	Comments	
8(a)	Bar drawn for $60 < t \leq 80$ with height of 1.2	B1		
	Bar drawn for $80 < t \leq 120$ with height of 0.4	B1		
	Table completed with $0 < t \leq 30$ frequency 24 <b>and</b> $40 < t \leq 60$ frequency 48	B1		
	<b>Additional Guidance</b>			
	Ignore extra vertical lines (they may be for part (b))			

Q	Answer	Mark	Comments
<b>8(b)</b>	<b>Alternative method 1: using frequency density</b>		
	$\frac{5}{20} \times 24$ or $5 \times 1.2$ or 6 or $\frac{15}{20} \times 24$ or $15 \times 1.2$ or 18	M1	oe frequency for 75 to 80 mins or 60 to 75 mins may be on histogram
	22 (above 75 mins) or 118 (below 75 mins)	A1	
	5 × 1.4 or 7 or 20 × 0.4 or 8 or 30 (× 1) or 10 × 3.8 or 38 or 20 × 1.8 or 36 or 15 × 1.4 or 21	M1	oe may be seen on histogram
	5 × 1.4 + 20 × 0.4 or 7 + 8 or 15 or 30 + 10 × 3.8 + 20 × 1.8 + 15 × 1.4 or 30 + 38 + 36 + 21 or 125	M1	may be seen on histogram
	15 (above 75 mins) or 125 (below 75mins) <b>and</b> number of patients whose waiting time exceeded the target has reduced/ is 7 less	A1ft	oe comment ft 15 and comparison with their 22 or 125 and comparison with their 118

**Mark scheme and Additional guidance continue on the next page**

<b>8(b) cont'd</b>	<b>Alternative method 2: scaling eg using <math>1 \text{ cm}^2 = 5 \text{ patients}</math></b>		
	$\frac{5}{20} \times 24$ or 6 $\frac{15}{20} \times 24$ or 18	M1	oe frequency for 75 to 80 mins or 60 to 75 mins may be on histogram
	22 (above 75 mins) or 118 (below 75 mins)	A1	
	1.4 + 1.6 or 3 or 6 + 7.6 + 7.2 + 4.2 or 25	M1	oe eg using 0.2 patients for one small square must only add the two relevant values
	their $3 \times 5$ or 15 or their $25 \times 5$ or 125	M1dep	dep on previous M1
	15 (above 75 mins) or 125 (below 75mins) <b>and</b> number of patients whose waiting time exceeded the target has reduced/ is 7 less	A1ft	oe comment ft 15 and comparison with their 22 or 125 and comparison with their 118
	<b>Additional Guidance</b>		
	Ignore any attempt at percentage decrease after stating their number of patients		
	Ignore extra comparisons eg nobody waited more than 100 mins		

Q	Answer	Mark	Comments
9	<b>Alternative method 1: calculating new annual net salary</b>		
	63 000 – 12 570 – 37 700 or 63 000 – 50 270 or 12 730	M1	calculating amount for higher rate tax and NI
	37 700 × 0.2 or 7540 <b>and</b> their 12 730 × 0.4 or 5092	M1dep	oe total tax of 12 632 is M2 implied by 50 368 after tax deducted
	37 700 × 0.12 or 4524 <b>and</b> (63 000 – 50 270) × 0.02 or 254.6(0)	M1	total NI of 4778.6(0) implies first M1 implied by 58 221.4 after NI deducted only
	their 7540 + their 5092 + their 4524 + their 254.6(0) or 17 410.6(0)	M1	oe eg 12 632 + 4778.6(0) must be higher and standard tax and NI and must be annually 17 410.6(0) implies M4
	63 000 – their 17 410.6(0)	M1	oe their 17 410.6(0) must include at least one lot of tax and one lot of NI
	45 589.(40)	A1	new net salary
	their 45 589.(40) ÷ 12 <b>and</b> 35 302.40 ÷ 12 or 3799 .1(...) <b>and</b> 2941.8(...) or their 45 589.(40) – 35 302.40 or 10 287	M1	their 45 589.(40) < 63 000 10 287 implies 7 marks (increase in net salary)
	their 3799 .1(...) – their 2941.8(...) or their 10 287 ÷ 12 or 857.(..) or their 3799 .1(...) – 825 or 2794.1(...) or their 2941.8(..) + 825 or 3766.(...) or 825 × 12 or 9900	M1	

	<p>857.(..) and Yes or 2941.8(...) and 2794.(1) and Yes or 3799 .1(.) and 3766.(...) and Yes or 10287 and 9900 and Yes</p>	<p>A1ft</p>	<p>ft their new net salary</p>
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<p><b>9</b> <b>cont'd</b></p>	<p><b>Alternative method 2: calculating new monthly net salary</b></p>		
	<p>63000 ÷ 12 or 5250</p>	<p>M1</p>	
	<p>5250 – 4189 or 1061</p>	<p>M1</p>	<p>calculating monthly amount for higher rate tax and NI</p>
	<p>(4189 – 1048) × 0.2 or 628.2(0) <b>and</b> 1061 × 0.4 or 424.4(0)</p>	<p>M1</p>	<p>oe eg works out annual tax and divides by 12 total tax of 1052.6 is M3 implied by 4197.4(0) after tax deducted</p>
	<p>(4189 – 1048) × 0.12 or 376.92 <b>and</b> 1061 × 0.02 or 21.22</p>	<p>M1</p>	<p>oe total NI of 398.14 implies first and second M1 implied by 4851.86 after NI only deducted</p>
	<p>their 628.2(0) + their 424.4(0) + their 376.9 + their 21. 22 or 1450.74</p>	<p>M1</p>	<p>oe must be higher and standard tax and NI and must be monthly</p>
	<p>5250 – their 1450.74</p>	<p>M1</p>	<p>oe their 1450.74 must include at least one lot of tax and one lot of NI</p>
	<p>3799.(..)</p>	<p>A1</p>	<p>new net salary</p>
	<p>their 3799.(..) – (35302.40 ÷ 12)</p>	<p>M1</p>	<p>their 3799.(..) &lt; 5250</p>
	<p>857.(..) and Yes</p>	<p>A1ft</p>	<p>ft their new net monthly salary</p>

**Additional guidance is on the next page**

<b>Additional Guidance</b>		
<b>9 cont'd</b>	<p>Common error when calculating NI is to use 50 270 instead of 37 700 leading to NI of 6035.60</p> <p>eg</p> <p>correct tax of 12 632 found</p> <p>NI</p> $50\,270 \times 0.12 = 6032.40$ $63\,000 - 12\,570 = 50340$ $(50\,340 - 50\,270) \times 0.02 = 3.20$ $6032.40 + 3.20 = 6035.60$ $63\,000 - (12\,632 + 6035.60) = 44\,332.4$ $(44\,332.4 - 35\,302.4) \div 12 = 752.5 \text{ No}$ <p>(7 marks total)</p>	<p>M1M1</p> <p>M0</p> <p>M1M1A0</p> <p>M1M1A1ft</p>
	<p>857 does not imply correct annual salary. 45 589.(40) must be seen.</p> <p>Similarly for monthly salary 3799.(..) must be seen</p>	
	<p>Ignore attempts to calculate extra above car payment if 857 seen</p>	
	<p>They can work tax annually and NI monthly. When they either divide tax by 12 or multiply NI by 12 their values will be slightly different.</p> <p>For tax divided by 12 the net monthly pay is still 3799.(..) but for NI multiplied by 12 the annual pay is 45 590.(32). These values gain the A1 for that part of the scheme.</p>	
	<p>If a student thinks 35 302.40 is gross pay and attempts tax/Ni ignore these calculations. However, if they use this 'new' salary for the final comparison then only 1 of the final 3 marks is available (for subtracting their 2 monthly values or dividing their difference by 12)</p>	

Q	Answer	Mark	Comments
10	School A mean = 6.1 or total puzzles 183 <b>and</b> 159 <b>and</b> correct comment comparing mean number of puzzles completed eg School A completed more puzzles (on average)	B2	oe B1 School A mean = 6.1 or total puzzles 183 <b>and</b> 159 ignore rounding to 6 if 6.1 seen
	School A sd = 0.94(3..) or 0.95(95..) or 0.96	B2	B1 $\sum fx^2 = 1143$ or (variance) = 0.89
	Correct comment comparing sd's eg School B were more consistent/less varied/less spread out	B1ft	oe ft their sd for School A which must be stated and cannot be the mean
	<b>Additional Guidance</b>		
	Mean 6.1 and School A performed better (on average)		B2
	Mean 6.1 and School A were quicker		B2
	Mean 6.1 and the mean for school A is higher		B1
	Mean 6.1 and the mean number of puzzles solved is lower for School B		B2
Mean 6 (with 6.1 not seen) and any comment		B0	
Ignore extra statements or calculations if non-contradictory			