AQA

GCSE

Statistics

43101H: Higher Tier

Mark scheme

43101H

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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

GCSE examinations are marked in such a way as to award positive achievement wherever possible. Thus, for GCSE 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	Method marks are awarded for a correct method which could lead to a correct answer.
M dep	A method mark dependent on a previous method mark being awarded.
A	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	Marks awarded independent of method.
B dep	A mark that can only be awarded if a previous independent mark has been awarded.
E	Explain marks are awarded for a full and detailed explanation
ft	Follow through marks. Marks awarded following a mistake in an earlier step.
SC	Special case. Marks awarded within the scheme for a common misinterpretation which has some mathematical worth.
oe	Or equivalent. Accept answers that are equivalent. eg, accept 0.5 as well as $\frac{1}{2}$
[*a*, *b*]	Accept values between *a* and *b* inclusive.
3.14 …	Accept answers which begin 3.14 eg 3.14, 3.142, 3.1416.
Use of brackets	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 candidate has used an incorrect method to obtain an answer, as a general principle, the benefit of doubt must be given to the candidate. In cases where there is no doubt that the answer has come from incorrect working then the candidate should be penalised.

Questions which ask candidates to show working

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

Questions which do not ask candidates to show working

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

Misread or miscopy

Candidates often copy values from a question incorrectly. If the examiner thinks that the candidate 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 candidate intended it to be a decimal point.

Q	Answer	Mark	Comments
1(a)	15 ÷ 5 or sight of $\frac{1}{5}$ oe	M1	
	3	A1	
	Additional guidance		
	Likely equivalents of $\frac{1}{5}$ include $\frac{2}{10}$, $\frac{3}{15}$, 0.2 or 20%		
	6, 6, 3 or 3, 6, 6 or 6, 3, 6 or 12, 3 or 6 : 6 : 3 etc		M1
1(b)	6 2 1 4 9 6 7 5 0 2 3 1 7 4 0 L S S L B L L L S S S S L L S	B2	B1 for 12 additional simulated values filled in correctly.
1(c)	(S) 7 (L) 7 (B) 1	B1ft	Follow through from their part (b)
	Additional guidance		
	In this part you must follow through from part (b)		
	Do not accept tallies unless the total is given		

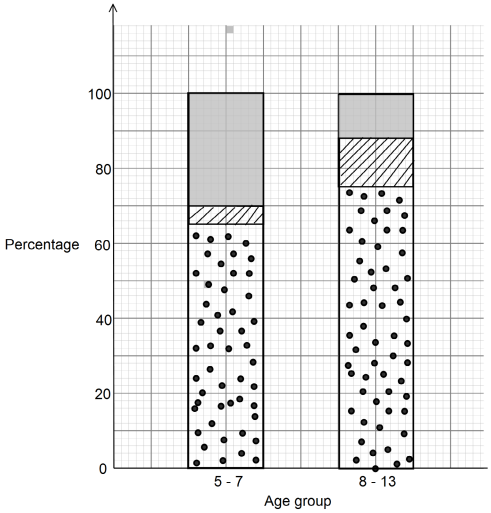
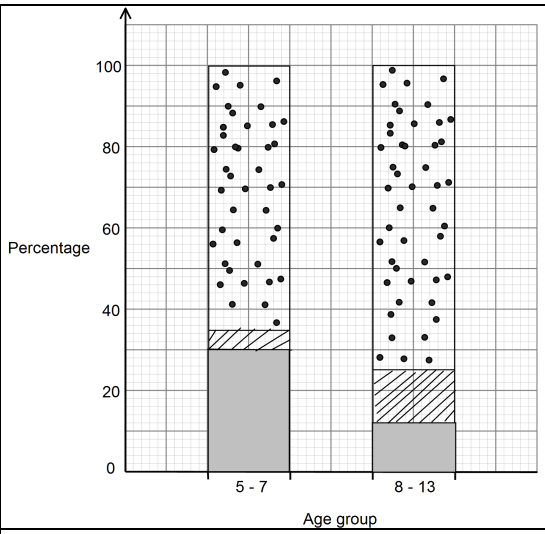
Q	Answer	Mark	Comments

1(d)	Fewer baskets (than expected) or More small/ large trolleys (than expected)	B1ft	oe Ignore any numbers saying how many fewer baskets there were than expected etc Follow through from previous parts
	Additional guidance		
	The number of people choosing a small trolley is not twice the number choosing a basket	B1	
	Only 1 B (should be 3)	B1	
	He had 1 B	B0	
	Fewer people choose baskets than (small/large) trolleys	B0	
	ft totals or tallies from their part (c), if part (c) is blank ft their part (b)		

1(e)	There are equal numbers of small trolleys and large trolleys	B1ft	oe Follow through from previous parts
	Additional guidance		
	Fewer people choose baskets than (small/large) trolleys	B1	
	If part (c) contains an error, follow through can be given from part (c) if statements are true for their results eg 6S, 8L, 1B There are similar numbers of small trolleys and large trolleys There are 6 small trolleys which is as expected	 B1ft B1ft	
	Number of people asked is 15	B0	
	ft totals or tallies from their part (c), if part (c) is blank ft their part (b)		
	If part c is incorrect, eg 6 small trolleys and 8 large trolleys, if a mark has been given in part (d) for noting a difference in those numbers, do not allow a mark in part (e) for noting they are similar		

Q	Answer	Mark	Comments
2(a)	(Boys) Keyboard and (Girls) Recorder	B1	
2(b)	Any correct different comparison, eg A higher proportion of boys played Drum kit than girls The proportion of girls playing Violin is about twice the proportion of boys	B1	The least popular for boys is flute, the least popular for girls is drums More boys played Electric guitar than Violin, but it was the other way round for girls
	Additional guidance		
	Do not accept statements that simply state percentages without giving a comparison		
	It must be clear which instrument(s) the candidate is referring to		
	Overall, a greater proportion of girls played instruments than boys	B1	
	Given that the numbers of boys and girls should be approximately equal, condone comparisons such as More girls play the piano than boys (Over) twice the number of girls play flute than boys Girls tend to play more instruments than boys	 B1 B1 B1	
	A similar percentage of boys and girls play keyboard/ piano/ classical guitar	B1	
	Condone statements such as Boys play the drums a lot more than girls	B1	
	Only 8% of boys play violin but 15% of girls play violin ('only' implies a comparison here)	B1	
	8% of boys play violin, 15% of girls play violin	B0	

Q	Answer	Mark	Comments
2(c)	Ticks No and gives a suitable reason, eg The categories are not mutually exclusive Some children play more than one instrument Someone who plays the piano may also play the keyboard	B1	
	Additional guidance		
	No, the column doesn't add up to 100		B1
	No, the actual percentage is 61/160 × 100 = 38%		B0

Q	Answer	Mark	Comments
2(d)			
	Bars drawn up to 100% for each age group – bars should have equal widths and should be separated	B1	± ½ square tolerance
	One bar accurately divided	B1	± ½ square tolerance
	Second bar accurately divided and both bars shaded	B1	Accept equivalent labelling of parts ± ½ square tolerance
			SC1 for an accurate and correctly shaded multiple bar chart drawn with equal width bars provided there is a gap separating the bars for ages 5-7 from those for 8-13
	Additional guidance		
	For the third B1 allow inconsistent order of shading so long as the proportions are correct and the shading matches the key		

Q	Answer	Mark	Comments
3(a)	B	B1	

3(b)	To see the range of answers people give or To see if the questionnaire works/ questions are clear or To see if there are any errors/ problems or To see how many people respond	B1	oe
	Additional guidance		
	To test the questions		B1
	To see if it is effective (it refers to the questionnaire)		B1
	To make sure that the questions give him the information/data/answers that he wants		B1
	To see if his questionnaire would give the right answers		B1
	To see how big the sample size needs to be		B1
	To test the data collection method		B1
	To see if it is worthwhile to carry out the (full) study		B1
	To see if the answers are right		B0
	It's a test run (attempt at a definition, not a reason)		B0
	To check results will be accurate/reliable (not specific enough)		B0
	To see if questions are biased		B0
	To get better results (detail lacking as to why results will be better)		B0
	To see if he should open the stall		B0

Q	Answer	Mark	Comments
3(c)(i)	A closed question has response boxes/ a choice of answers	B1	oe An open question does not have response boxes
	Additional guidance		
	Any correct difference mentioned is B1 unless accompanied by a clearly incorrect or contradictory statement, eg An open question allows you to write in your own words, a closed question is yes/no (correct statement about open questions)		B1
	A closed question has response boxes, an open question allows you to give an opinion (correct statement about closed questions)		B1
	A closed question is multiple choice, an open question is yes/no (correct statement about closed questions, but statement about open questions is clearly incorrect)		B0
	Closed questions have pre-chosen answers such as Yes/No		B1
	Closed questions are multiple choice / have set answers		B1
	Closed questions have a response section (unless qualified)		B0
	Closed questions have only one short answer / a specific answer		B0
	Closed questions are answered either Yes/ No		B0
	A closed question is one where there are only a few answers		B0

Q	Answer	Mark	Comments
3(c)(ii)	Two different reasons: **Ease at answering/collecting** Easier to answer / collect the data/ carry out the survey Quicker to answer / collect the data Response options can help clarify meaning of questions **Ease of Analysis** Makes analysis of data simpler/ quicker/ cheaper Limits possible answers/ people stick to the point Problems due to poor handwriting lessened Easier to make comparisons Easier to graph **Response Rate** Improves response rate Less likely to miss out questions	B2	oe B1 for each advantage Advantages should come from different categories
	Additional guidance		
	Note, two different reasons can be in one statement		
	Ignore irrelevant or incorrect statements unless contradictory		
	People are more willing to tell you information	B1	
	Smaller amount of data to work with (lacks detail)	B0	
	It's quicker / easier (unless they explain why)	B0	
	Answers to the questionnaire are more accurate/ reliable (unless more detail is given explaining why)	B0	

Q	Answer	Mark	Comments
3(d)	Include a pre-paid envelope/ collect questionnaires in person or Give an incentive to answer (e.g. prize draw, donation to charity) or Interview people (face-to-face, by telephone)	B1	oe Make the questionnaire shorter Allow people to answer online Sending a reminder
	Additional guidance		
	Give a deadline for returning the questionnaire		B1
	Interview people in the market		B1
	Give it out to people using the market		B0
4(a)	55 × 3 + 75 or 240	M1	oe
	60	A1	SC1 183.75 or 198.75 or 116.25
4(b)	Systematic (sampling)	B1	
	Additional guidance		
	Ignore any additional words so long as systematic is seen		
	Condone incorrect spelling so long as intention is clear		

Q	Answer	Mark	Comments
4(c)	It should be pick every 20th seat	B1	Oe None of the people seated in the last 400 seats will be picked.
	Additional guidance		
	Allow any reference to it should be 20		
	It won't give 40		B1
	Some people have no chance of being picked.		B1
	No random start		B0

4(d) Alt 1 or 2	**Alternative method 1**		
	$\frac{321}{800}$ or 0.401(25) or 40.1(25%) or $\frac{800}{321}$ or 2.492(…) or 2.5	M1	oe
	$\frac{321}{800}$ × 40 or their 0.401(25) × 40 or 40 ÷ $\frac{800}{321}$ or 40 ÷ their 2.492(…) or 16.05	M1dep	oe
	16	A1	SC2 for 18 or 4 or 2 SC1 for 3.6 or 2.35

Q	Answer	Mark	Comments
4(d) Alt 2 of 2	**Alternative method 2**		
	$\frac{800}{40}$ or 20 or $\frac{40}{800}$ or 0.05	M1	oe
	$\frac{321}{\text{their } 20}$ or 321 × their 0.05 or 16.05	M1dep	oe
	16	A1	SC2 for 18 or 4 or 2 SC1 for 3.6 or 2.35
	Additional guidance		
	16 from no clearly incorrect working		M1M1A1
5(a)	$\frac{18}{25}$ or 0.72 or 72%	B1	oe
	Additional guidance		
	Ignore subsequent working if one of these values is seen, e.g. $\frac{18}{25}$ = 0.7		B1
	Do not allow answers written as ratios, e.g. 18 : 25		B0

Q	Answer	Mark	Comments
5(b)	**Alternative method 1**		
	$\left(\text{their } \frac{18}{25}\right)^3$ or 0.37(32…)	M1	
	1 – their 0.37(32…)	M1 dep	
	[0.62, 0.63]	A1	Allow equivalent percentage
	Alternative method 2		
	$3\left(\text{their } \frac{18}{25}\right)^2\left(\text{their } \frac{7}{25}\right)$ or [0.43, 0.44] or $3\left(\text{their } \frac{7}{25}\right)^2\left(\text{their } \frac{18}{25}\right)$ or [0.16, 0.17] or $\left(\text{their } \frac{7}{25}\right)^3$ or 0.02(1952)	M1	
	$3\left(\text{their } \frac{18}{25}\right)^2\left(\text{their } \frac{7}{25}\right)$ or [0.43, 0.44] **+** $3\left(\text{their } \frac{7}{25}\right)^2\left(\text{their } \frac{18}{25}\right)$ or [0.16, 0.17] **+** $\left(\text{their } \frac{7}{25}\right)^3$ or 0.02(1952)	M1	There should be an indication that the three probabilities should be added
	[0.62, 0.63]	A1	Allow equivalent percentage

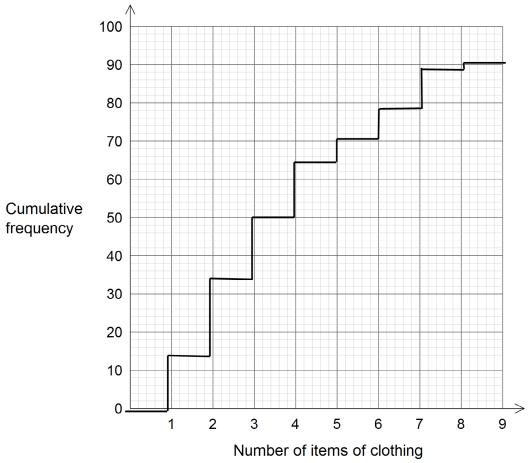
Q	Answer	Mark	Comments
	Alternative method 3		
	$\frac{7}{25}+\frac{18}{25}\times\frac{7}{25}+\left(\frac{18}{25}\right)^2\times\frac{7}{25}$	M2	
	[0.62, 0.63]	A1	Allow equivalent percentage
	Additional guidance		
	Some indication of the method should be shown.		
	An answer of $\frac{9793}{15625}$ is M1 M1 A0 unless the fraction is converted to a form that can be compared with 0.6		
5(c)	60 total Small	B1	
	30 total Cola	B1	
	All 9 remaining values correct	B3ft	B2ft 5-8 remaining values correct B1ft 2-4 remaining values correct

	Fruit juice	Cola	Lemonade	Total
Small	25	8	27	**60**
Large	20	22	18	**60**
Total	**45**	**30**	**45**	**120**

	Additional guidance
	ft their 60 for total Small and their 30 for total Cola, do not allow negative or decimal answers
5(d)	$\frac{8}{60}$ or $\frac{2}{15}$ or 0.13(3333) or 13(.333)% — B2ft — Follow through from part (c) for B2 provided that their answer lies in (0, 1) and their 8 and their 60 are positive integers B1ft for correct numerator or denominator (follow through from non-zero positive integer values in table)
	Additional guidance
	ISW from a correct unsimplified fraction

Q	Answer	Mark	Comments
5(e)	A player is more likely to win a small bottle (but Kira has the same number of each)	B1	oe A player is more likely to get 5 stars than 6 stars
	Additional guidance		
	It is easier to win a small bottle		B1
	The probability of winning a small bottle is $\frac{5}{25}$ and the probability of winning a large bottle is $\frac{2}{25}$		B1
	There is only a small probability of winning a large bottle		B0
	There's a lot less small cola bottles than large cola bottles		B0
6(a)	54 (miles)	B1	
6(b)(i)	The number of miles travelled by car has decreased	B1	oe
	Additional guidance		
	Negative correlation		B0
6(b)(ii)	Increasing cost of motoring or Pressure on household budgets or Introduction of free bus passes for over 60s	B1	oe e.g rise in unemployment worries about pollution/ climate change pay freezes congestion charges increased cost of petrol better public transport/ increased use of public transport
	Additional guidance		
	People are choosing to walk (table shows decrease in distance walked)		B0
	People are travelling less		B1

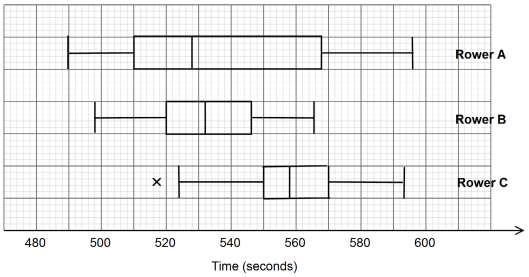
Q	Answer	Mark	Comments
6(c)	31 (miles) as final answer	B2	B1 for sight of 339 or 370
6(d)	1500 (allow ± 20) and 640 (allow ± 20) or 860	M1	Check graph for sight of these numbers
	$\frac{\text{their } 1500}{\text{their } 640}$ or 2.34(375) or 234(.375) or $\frac{\text{their } 1500 - \text{their } 640}{\text{their } 640}$ or 1.34(375)	M1	their 1500 must be between 1400 and 1600 exclusive their 640 must be between 600 and 700 exclusive
	[129, 140] (%)	A1	Accept any answer between 129 and 140
6(e)	**Alternative method 1**		
	[960, 995] (million) and 413 seen	B1	Check graph for sight of these numbers
	413 × 54.7 (million) or 22591 (million)	M1	
	[22.69, 23.54] (miles)	A1	
	Alternative method 2		
	[960, 995] (million) and 413 seen	B1	Check graph for sight of these numbers
	$\frac{[950, 995]\,(\text{million})}{54.7\,(\text{million})}$ or [17.36, 18.2]	M1	
	[22.69, 23.54] (miles)	A1	
	Additional guidance		
	The M mark could be awarded for correct methods but involving an incorrect conversion of [950, 995] million or 54.7 million, e.g allow $\frac{99000000}{54700000}$		

Q	Answer	Mark	Comments
7(a)	Cumulative frequencies seen in table or implied by graph 14, 34, 50, 64, 70, 78, 88, 90	B1	
	Correct horizontal plots	M1	
	At least 5 correct vertical plots and an attempt at steps	M1	Follow through from their cumulative frequencies provided that they are increasing
	Fully correct step polygon.	A1	 Condone lack of horizontal line at 90 so long as a vertical line is seen at 8 going up from 88 to 90 Condone lack of horizontal line at 0 provided there is a vertical line at 1 going up from 0 to 14
	Additional guidance		
	Cumulative frequencies plotted to form a cumulative frequency polygon/curve scores a maximum of the first 2 marks		

Q	Answer	Mark	Comments
7(b)	(Median =) 3	B1ft	If answer is not 3, follow through from their c.f. step polygon reading across at 45 (provided it is increasing) Do not follow through from a cumulative frequency polygon/ curve
	(2^{nd} decile) = 2 and (8^{th} decile) = 6	B1ft	If answers are not 2 and/or 6, follow through from their c.f. step polygon (provided it is increasing) reading across at 18 and 72 Do not follow through from a frequency polygon/ curve
	Their 8^{th} decile – their 2^{nd} decile evaluated correctly	B1ft	4 if step polygon is correct Follow through from their decile values provided their deciles are integers between 1 and 8 inclusive and the answer is positive
	Additional guidance		
	All answers must be integers		
7(c)	Neither satisfied nor dissatisfied	B1	oe e.g. Neutral, Neither
	Additional guidance		
	If no answer is given on answer line, check questionnaire for an answer.		
	If a choice of answers is given, they must all be acceptable		
	Don't know, don't care, ok, a bit satisfied, other, borderline, average, in the middle	B0	

Q	Answer	Mark	Comments
8(a)	A suitable hypothesis e.g. Children do better in their tables test if they learn a song	B1	Do not accept a research question
	Additional guidance		
	Children learn their tables faster if they learn them with a song	B1	
	I predict that children will learn tables better if they learn a song	B1	
8(b)	Method 2	B1	
8(c)	An outline of a method that implies that pupils in each pair should be allocated randomly e.g. Get one pupil in each pair to toss a coin (and if they get Heads then they get the song to learn)	B1	
	Additional guidance		
	Choose at random	B1	
	Put the two names in a hat (and pick a name out at random)	B1	
	One pupil in each pair chooses to be number 1 and the other is number 2 and the teacher decides at random which number in the pair learns the song	B1	
	Systematic sampling / (random) stratified sampling / quota sampling	B0	
	Tallest in each pair learns song/ person first alphabetically learns song/ oldest learns song etc	B0	
8(d)	Extraneous	B1	

Q	Answer	Mark	Comments
9(a)	**Alternative method 1**		
	570 – 20 or 550	M1	
	their 550 – 1.5 × 20 or 520	M1	their 550 should be a value between 525 and 557
	520 **and** a suitable conclusion, e.g 517 < 520 517 is an outlier/ It's an outlier	A1	oe Can be implied by a statement such as 'Anything below 520 is an outlier'
	Alternative method 2		
	570 – 20 or 550	M1	
	$\frac{517 - \text{their } 550}{20}$ or (−)1.65	M1	Accept the subtractions on the numerator performed the opposite way round their 550 should be a value between 525 and 557
	-1.65 < -1.5 or 1.65 > 1.5	A1	oe
	Alternative method 3		
	570 – 20 or 550	M1	
	1.5 × 20 or 30 and their 550 – 517 or 33	M1	their 550 should be a value between 525 and 557
	33 and 30 and a correct conclusion, e.g. 517 is more than 30 away from 550 33 > 30 517 is an outlier	A1	oe

Q	Answer	Mark	Comments
9(b)	Box correctly drawn with median marked at 558	B1	 Allow ± 0.5 square tolerance
	Outlier marked at 517 (not as a line) and separated from rest of diagram	B1	
	Correct whiskers not joined to any outlier shown	B1	
9(c)(i)	Rower B	B1	
9(c)(ii)	Rower A The interquartile range is more than 40 (seconds)	B1	oe, e.g. The interquartile range was 58 (allow ±2) (seconds)
	Rower C Their median time was greater/ slower than 540 (seconds)	B1	oe, e.g Under half of the times were less than 540
	Additional guidance		
	For Rower A: If a value if given for the IQR it must be within the range [56, 60] Rower A doesn't meet the 2nd condition Their IQR was too big (the word 'too' implies the comparison) The IQR was big		 B1 B1 B0
	For Rower C: If a value is given for the median it must be 558 (secs) Rower C doesn't meet the 1st condition Their median was too big (the word 'too' implies a comparison) 50% of times are under 558 seconds Over 75% of times are more than 540 75% of times are more than 550 The median was big The median is 558 secs 50% of times are slower than 540 (secs)		 B1 B1 B1 B1 B1 B0 B0 B0

Q	Answer	Mark	Comments
10(a)	Run-up to Christmas	B1	Black Friday/ sales Yearly bonus Less people go out to shop when it is cold oe
10(b)	One different pattern in sales identified, e.g. Increasing trend in internet sales or Sales lowest in Q1 or Sales are lower in Q2 than Q3	B1	oe
	Additional guidance		
	Do not accept a comment based on a single time point or just two time points, e.g The lowest sales were in Q1 2011 Sales in Q1 2011 were lower than in Q2 2011		 B0 B0
	Positive correlation		B0

Q	Answer	Mark	Comments
10(c)	Q1 2012: 6.5 (±0.05) **and** 6.9 (±0.05) **and** their 6.5 – their 6.9 correctly evaluated	B1	Their seasonal effect should be consistent with the two readings from the graph.
	Q1 2013: 7.4 (±0.05) **and** 7.9 (±0.05) **and** their 7.4 – their 7.9 correctly evaluated	B1	Their seasonal effect should be consistent with the two readings from the graph.
	−0.4(3)	B1ft	Follow through as $\frac{-0.4 + (\text{their } - 0.4) + (\text{their } - 0.5)}{3}$ rounded to at least one decimal place
10(d)	[8.9, 9] seen	M1	
	[8.9, 9] + their average seasonal effect evaluated correctly	A1ft	Their answer must be between 5 and 11 Allow answers to be rounded to 1 (or more) decimal places
	Additional Guidance		
	M0 A0 for answers found using a method that does not use their mean seasonal effect from 10(c)/ trend line		
	If no working is seen leading to answer on answer line: M1 A1 can be given for their answer provided that part (c) has been attempted and their 10(d) – their mean seasonal effect lies within the range [8.9, 9]		

Q	Answer	Mark	Comments
11(a)	38.5 (g)	B1	Allow $\frac{77}{2}$ (g)
11(b)	$\frac{573\,300}{360}$ or 1592.5	M1	
	$\sqrt{\text{their } \frac{573300}{360} - (\text{their } 38.5)^2}$ or their $\frac{573\,300}{360}$ – (their 38.5)^2 or 110.25	M1 dep	A correct method for the standard deviation or variance
	10.5 (g)	A1	Allow $\frac{21}{2}$ (g)
	Additional Guidance		
	Allow misread in the digits of $\sum x^2$ for the M marks e.g. $\frac{5\,733\,000}{360}$ **or** $\frac{57\,330}{360}$ Condone use of 440 instead of 360 for the M marks		
	For 2nd M mark: if a square root sign is present, it must be correctly placed unless subsequent working implies correct positioning Missing brackets can also be implied by subsequent working		

Q	Answer	Mark	Comments

11(c)	The female frogs are heavier on average (than male frogs)	B1ft	oe Follow through from 11 (a) provided the mean is positive
	The masses of the male frogs are less variable (than female frogs)	B1 ft	oe e.g. The female frogs have a greater spread of masses than male frogs Follow through from 11(b) provided that the s.d. is positive
	Additional Guidance		
	There must be an attempt at interpreting in context. There should be an implicit or explicit reference to mass or weight		
	Comparing mean values: Male frogs tend to/ generally/overall have a smaller mass Male frogs are smaller on average (smaller taken as implicit reference to mass) The average mass for male frogs is smaller Mean for females is greater (no interpretation of mean and no reference to mass) Female frogs are heavier (this is not universally true… some male frogs will be heavier than some female frogs)		 B1 B1 B1 B0 B0
	Comparing sd values: Male frogs are more consistent in weight Female frogs have a wider range of weights The masses for female frogs have a larger standard deviation/ range Female frogs are more spread out		 B1 B1 B0 B0

Q	Answer	Mark	Comments

11(d)	$\frac{48}{600}$ or 0.08 or $\frac{600}{48}$ or 12.5 or $\frac{48}{800}$ or 0.06 or $\frac{800}{48}$ or 16.6(666)	M1	oe Accept ratios, e.g 48 : 600
	Forming a correct equation, e.g. $\frac{800}{N} = \frac{48}{600}$ oe	M1 dep	This M mark implies previous mark Accept (N =) $\frac{600 \times 800}{48}$ oe or 8% = 800
	10 000	A1	

11(e)	The number of frogs is likely to be lower than estimated in (d)	B1	

12(a)	200 (m)	B1	

12(b)	Ticks No and indicates that there is no correlation	B1	oe Ticks No and indicates 0.02 is (very) close to 0
	Additional Guidance		
	reference to almost no correlation/ very weak correlation etc		B0

Q	Answer	Mark	Comments
12(c)	Diagram 3	B1	
13(a)	18.3 (%)	B1	Accept 18(%) Condone -18(.3)
13(b)	**Alternative method 1**		
	78.4 and 81.7 used together in a calculation	B1	Could be implied by sight of 3.3 or 1.033 or 103.3 or 4.2(09…) or 0.042(09…) or 1.042(09…) or 104.2(09…)
	$\frac{81.7}{78.4}$ or 1.042(09…) or 104.2(09…) or $\frac{81.7 - 78.4}{78.4}$ or 0.042(09…) or 4.2(09…)	M1	
	$\frac{36}{34.50}$ or 1.043(47..) or 104.3(47…) or $\frac{36 - 34.50}{34.50}$ or 0.043(47…) or 4.3(47…)	M1	
	1.042(09…) and 1.043(47…) or 0.042(09…) and 0.043(47…) or 104.2(09…) and 104.3(47…) or 4.2(09…) and 4.3(47…) and a suitable comparison, e.g Price of jeans increased by (slightly) more than the CPI Price increase of jeans is in line with the CPI	A1	Both method marks must have been awarded. Allow both the price of the jeans and the clothing index have increased by 4% (oe)

Q	Answer	Mark	Comments
13(b)	**Alternative method 2**		
	78.4 and 81.7 used together in a calculation	B1	Could be implied by sight of 3.3 or 1.033 or 103.3 or 4.2(09…) or 0.042(09…) or 1.042(09…) or 104.2(09…)
	$\frac{81.7}{78.4}$ or 1.042(09…) or $\frac{81.7 - 78.4}{78.4}$ or 0.042(09…)	M1	Accept percentage equivalents
	34.5 × their 1.042(09…) or their 0.042(09) × 34.5 or 36 ÷ their 1.042(09…)	M1 dep	
	35.95(2…) or 1.45(…) or 34.54(5…) and a suitable comparison, e.g Price of jeans increased by (slightly) more than the CPI Price increase of jeans is in line with the CPI	A1	

Q	Answer	Mark	Comments
13(b)	**Alternative method 3**		
	34.5 and 36 used in a calculation also involving either 78.4 or 81.7	B1	Could be implied by sight of 81.8(08…) or 3.4(0…) or [78.2, 78.3]
	$\frac{36}{34.50}$ or 1.043(47…) or $\frac{36 - 34.50}{34.50}$ or 0.043(47…)	M1	Accept percentage equivalents
	78.4 × their 1.043(47…) or their 0.043(47) × 78.4 or 81.7 ÷ their 1.043(47…)	M1 dep	
	81.8(08…) or 3.4(0…) or [78.2, 78.3] and a suitable comparison, e.g Price of jeans increased by (slightly) more than the CPI Price increase of jeans is in line with the CPI	A1	

Q	Answer	Mark	Comments
13(b)	**Alternative method 4**		
	34.5 and 78.4 used together in a calculation and 36 and 81.7 used together in a calculation	B1	
	$\frac{34.5}{78.4}$ or 0.4400(…) or 0.4401 or $\frac{78.4}{34.5}$ or 2.272(…)	M1	
	$\frac{36}{81.7}$ or 0.4406(…) or $\frac{81.7}{36}$ or 2.269(…)	M1	
	0.4400(…) or 0.4401 and 0.4406(…) or 2.272(…) and 2.269(…) and a suitable comparison, e.g Price of jeans increased by (slightly) more than the CPI Price increase of jeans is in line with the CPI	A1	Both method marks must have been awarded. Allow both ratios evaluated as 0.44 or 2.27

Q	Answer	Mark	Comments
14(a)	3 × 1.7 or 5.1	M1	or $\frac{17-11.9}{1.7}=3$ oe
	11.9 + 3×1.7 and 17 or $\frac{17-11.9}{1.7}=3$ and suitable conclusion, e.g. So nearly all data is below 17 (mm) So Alex is correct	A1	oe Accept a preliminary statement instead of a conclusion, e.g. Nearly all data lie within 3 standard deviations (of the mean)
	Additional Guidance		
	For the A mark allow the use of percentages, e.g. 99.9% of bluebells will be below 17 (mm) (allow 99.5% to 99.95%) 99.8% of data lie within 3 standard deviations (of the mean) (allow 99.5% to 99.95%)		A1 A1
	For the A mark do not allow incorrect statements such as All bluebells are below 17 mm so Alex is correct All data lies within 3 standard deviations of the mean 98% of bluebells are below 17 mm		A0 A0 A0

Q	Answer	Mark	Comments
14(b)	$\frac{23.5 - 26.1}{3.6}$ or -0.72(2…) or $\frac{23.5 - 19.6}{4.5}$ or 0.86(66…) or 0.87	M1	Condone $\frac{26.1 - 23.5}{3.6}$ or 0.72
	(−)0.72(2…) **and** 0.86(66….) or 0.87	A1	
	(The bluebell is) more likely to be a Spanish bluebell	A1ft	oe Both standardised scores must be attempted for this mark to be awarded. Follow through from their (–)0.72 and 0.87 provided that M1 mark earned.