GCSE
STATISTICS
8382/1H

Higher Tier Paper 1

Mark scheme

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I9A8382IH/MS

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.

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Glossary for Mark Schemes

GCSE examinations are marked in such a way as to award positive achievement wherever possible. Thus, for GCSE Statistics 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.
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.
ft	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
SC	Special case. Marks awarded for a common misinterpretation which has some mathematical worth.
M dep	A method mark dependent on a previous method mark being awarded.
B dep	A mark that can only be awarded if a previous independent mark has been awarded.
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.
[a, b)	Accept values a ≤ value < b
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 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.

Question	Answer	Mark	Comments
1	0034	B1	
2	3-point	B1	
3	extraneous	B1	
4	0.6	B1	
5(a)	$\frac{216}{0.75\times3600}$ or $\frac{216}{2700}$ or 0.08	M1	oe
	8%	A1	
	Additional Guidance		
	92% is M0A0 unless recovered		

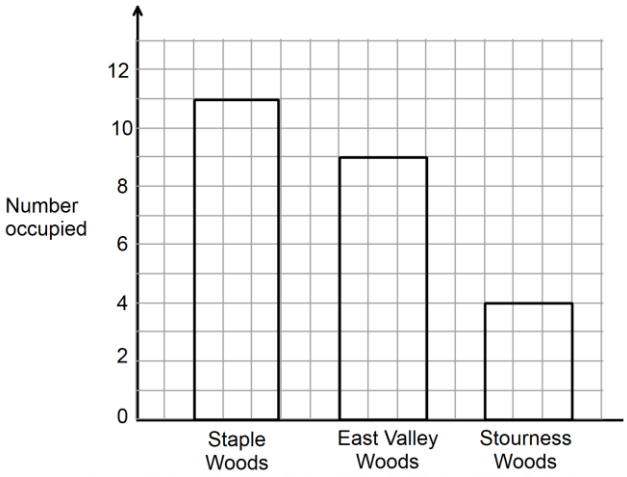
Question	Answer	Mark	Comments
5(b)	Some students will have lied or Some students will not have answered because it's against the rules / not allowed or It's a sensitive/biased/leading question	B1	oe
	Some people did not answer and these could have worked more than 6 hours or Not everyone is represented (and these could have worked more than 6 hours) or Students who work more than 6 hours are less likely to respond or Some students may work full-time	B1	oe
	Additional Guidance		
	Ignore any values which could have been calculated in part (a)		
	Some students may not know how many hours they have worked (implies zero hours contract) - could be 1st or 2nd B1		B1
	Only 75% answered (implies not representative)		B1
	75% of people answered and 25% of people didn't answer		B0
	Some people did not answer		B0

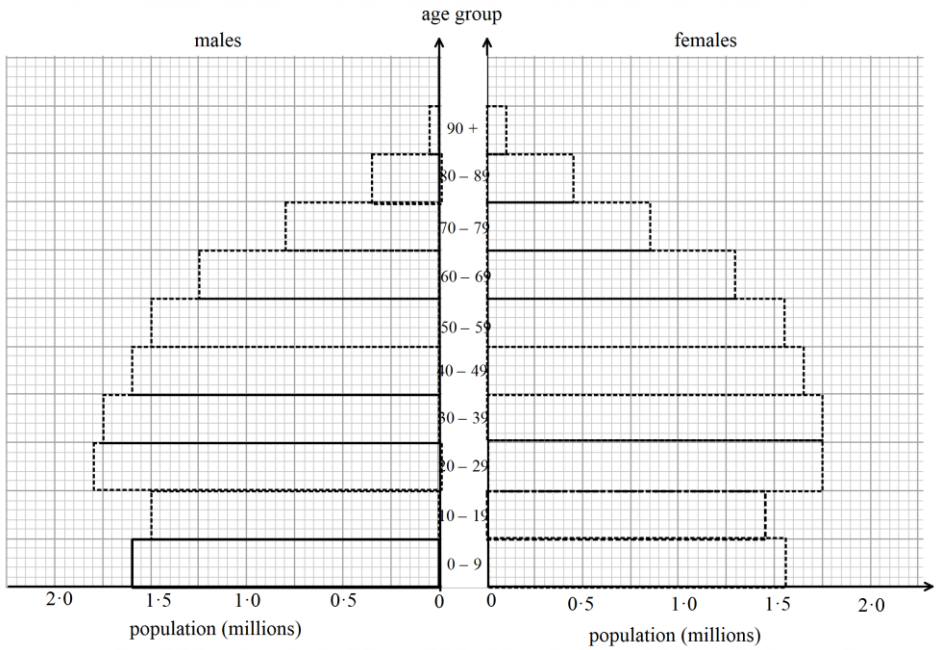
Question	Answer	Mark	Comments
6(a)	$15 \times 5 + \frac{2}{5} \times 15$ or 81 or $15 \times 3 + \frac{4}{5} \times 15$ or 57 or $5.4 - 3.8$ or 1.6 or $1\frac{3}{5}$ or $15 \div 5 = 3$ (may be seen on the diagram)	M1	oe eg 2 parts = 6
	81 – 57 = 24 or 24 ÷ 1.6 = 15 or 15 ÷ 5 = 3 and 3 × 8 = 24	A1	oe
	Additional Guidance		
	57 – 81 = 24		M1A0

Question	Answer	Mark	Comments
6(b)	6.8×15 or 102 or 5.4×15 or 81	M1	oe Implied by 0.10(78….) or 0.11(11….)
	$\frac{11}{\text{their } (6.8 \times 15)}$ or 0.10(78….) or $\frac{11}{102}$ or $\frac{9}{\text{their } (5.4 \times 15)}$ or 0.11(11….) or $\frac{9}{81}$	M1dep	oe
	Ticks 'No' and 0.10(78….) or $\frac{99}{918}$ or $\frac{891}{8262}$ and 0.11(11….) or $\frac{102}{918}$ or $\frac{918}{8262}$	A1	oe
	Additional Guidance		
	Allow 11 out of 102 (or 9 out of 81) for first M1		
	For the A1 mark, the proportions must be written in a form where they can be directly compared (eg decimals, percentages or fractions with a common denominator)		
	Allow decimals or percentages to be correctly truncated to 2sf or better, but with rounding answers must be correct to 3sf or better		
	Example of oe instead of 6.8 or 5.4 $\frac{34}{5}$ or $\frac{27}{5}$		
	Use of reciprocals is M1 max (unless recovered) eg $\frac{102}{11}$		M1M0
	$\frac{11}{34}$ or $\frac{9}{27}$ (is M0 unless recovered by dividing by 3)		M0

Question	Answer	Mark	Comments
6(c)	**Alternative method 1 – using 15**		
	6.8 × 15 + 5.4 × 15 + 3.8 × 15 or 16 × 15 or 102 + 81 + 57 or 240	M1	oe Sum of three products/totals, at least two correct
	(their 240 ÷ 10) – 11 – 9 or 4	M1	oe their 240 must come from the addition of three numbers
	Correctly completed bar chart with height of 4 (must be from correct working) label (Stourness Woods) same gap between 2nd and 3rd bars as between first two bar width equal to the other 2 bars	A1	
	Alternative method 2 – using 10% of 15		
	6.8 × 1.5 + 5.4 × 1.5 + 3.8 × 1.5 or 16 × 1.5 or 10.2 + 8.1 + 5.7 or 24	M1	oe Sum of three products/totals, at least two correct
	their 24 – 11 – 9 or 4	M1	oe their 24 must come from the addition of three numbers
	Correctly completed bar chart with height of 4 label (Stourness Woods) same gap between 2nd and 3rd bars as between first two bar width equal to the other 2 bars	A1	
	Additional guidance for this question is on the next page		

Question	Answer	Mark	Comments

6(c)	**Additional Guidance**	
		
	Do not assume that their bar of height 4 is from correct working	
	Embedded 4 from correct working eg 11 + 9 + 4	M1M1

7(a)	Bar correctly drawn	B1	±0.5 square tolerance
	Additional Guidance		
			

Question	Answer	Mark	Comments
7(b)	**Alternative method 1**		
	$\frac{170\ 000}{170\ 000 + 330\ 000} \times 100$ or 34(%)	B1	Calculating percentage of males in 1997 Allow 0.34
	0.35 + 0.05 (× 1 000 000) or 0.4 (× 1 000 000) or 400 000	M1	Calculating number of males in 2017
	$\left(\frac{0.35+0.05}{0.35+0.05+0.45+0.1}\times 100 =\right)$ [42, 42.11]	A1	Percentage of males in 2017 oe Accept equivalent decimals
	Carla(’s hypothesis) is correct or The percentage (of males) is higher in 2017	A1ft	oe ft from their appropriate decimals or percentages if they are in comparable form and B1 and M1 awarded
	Alternative method 2		
	$\frac{330\ 000}{170\ 000+330\ 000} \times 100$ or 66(%)	B1	Calculating percentage of females for 1997 Allow 0.66
	0.45 + 0.1 (× 1 000 000) or 0.55 (× 1 000 000) or 550 000	M1	Calculating number of females in 2017
	$\left(\frac{0.45+0.1}{0.35+0.05+0.45+0.1}\times 100 =\right)$ [57.89, 58]	A1	Percentage of females in 2017 oe Accept equivalent decimals
	Carla(’s hypothesis) is correct or The percentage (of males) is higher in 2017	A1ft	oe ft from their appropriate decimals or percentages if they are in comparable form and B1 and M1 awarded
	Additional Guidance		
	Choose the scheme that gives the better mark		
	No tolerance allowed on readings		

Question	Answer	Mark	Comments
8(a)	How do you (usually) travel to school?	B1	oe options not required
	Additional Guidance		
	Ignore any options / response boxes		
	Ignore time period		
	Condone school to home		
	Which way do you travel to school? (ignore ambiguity)		B1
	How do you usually travel?		B0

Question	Answer	Mark	Comments
8(b)	True, 3 out of 30 (is 10%) or (True,) 3 out of 30 is 10%	B1	oe
	(Probably) false, there is no way of knowing whether Charlie's data is representative of the whole school	B1	oe
	Additional Guidance		
	Ignore irrelevant statements unless contradictory		
	Accept yes/right/correct for true and no/wrong/incorrect for false etc		
	False can be implied in the second B1 by a full correct description		
	First B1		
	Yes, 1 out of 10 is equal to 3 out of 30		B1
	It is correct because $\frac{1}{10}$ travel to school		B0
	True, 30 ÷ 3 = 10(%)		B0
	Correct, 10% do travel by car		B0
	This is wrong …		B0
	Second B1		
	It's only a sample (implies false)		B1
	It could be different for all students		B1
	Wrong because in every 30 people there isn't always 3 that travel by car		B1
	False because there are a lot more students than friends		B1
	Haven't got enough data to work that out (implies false)		B1
	Should have done a census (implies false)		B1
	A sample isn't always representative (implies false)		B1
	It's a sample (does not imply false)		B0

Question	Answer	Mark	Comments
8(c)(i)	The general trend is increasing (so more people are using cars to travel) or No / not confirmed as the graph only shows increase in (passenger) km travelled (not number of people travelling) or No / not confirmed as increase could be in numbers of taxis/vans	B1	oe
	Additional Guidance		
	Ignore irrelevant statements unless contradictory		
	Positive gradient implies increasing		
	Decision can be implied		
	Allow passenger but not number of passengers for passenger km		
	Do not allow people for passenger km		
	It's likely that more people are using cars to travel as it (implies graph) increases		B1
	No because the line includes cars, vans and taxis		B1
	No because more people could be using taxis and vans		B1
	No, it does not show cars alone		B1
	Condone positive correlation/trend		B1
	Yes, it's increasing (implies graph)		B1
	True as the graph slightly increases (slightly so could be referring to rail travel)		B0
	Reference to car sharing or population increase		B0
	Over time more people have opted for the road rather than rail		B0
	The graph confirms it		B0
	It does confirm as it shows the number of passengers using cars		B0
	It might not be people using their cars but that they are driving further		B0
	There is an increase in the amount of people travelling in a car		B0

Question	Answer	Mark	Comments
8(c)(ii)	There is no information on how many (more) roads have been built / cars on the road so it is not possible to tell (if roads are getting busier) or It is likely that roads are getting busier due to the (large) increase in the (passenger) km travelled	B1	oe
	Additional Guidance		
	Ignore irrelevant statements unless contradictory		
	Allow passenger but not number of passengers for passenger km		
	Do not allow people for passenger km		
	If there is an increase in passengers, there will probably be an increase in cars so the roads are busier (B0 without the 'probably')	B1	
	This might be true but an increase in passengers does not mean an increase in cars	B1	
	We cannot tell as roads might have got bigger	B1	
	It doesn't show that the roads are busier, just that there are more passengers	B1	
	The graph doesn't show that roads are busier but there will probably be a positive correlation with the number of miles travelled	B1	
	True … / Yes … / Confirmed …	B0	
	The graph doesn't show that roads are busier but there will probably be a correlation with the number of miles travelled	B0	
	We cannot tell. This shows the number of passengers not cars	B0	
	Higher number of cars doesn't mean the roads are definitely busier	B0	
	Roads are getting busier because there are more cars, vans and taxis	B0	
	Cannot tell, the number of passengers is increasing but number of cars might be the same or less (implies car sharing)	B0	
	Cannot tell as the graph doesn't tell us anything about how busy the roads are	B0	
	It might be true or it might be that cars are driving further	B0	
	Reference to car sharing	B0	

Question	Answer	Mark	Comments
8(d)	Two correct statements eg (Slight) decrease at the start or (From 1952) train travel was constant/steady (for many years) or (In recent years) it has increased or Numbers always been less than road or Rail travel was never bigger than 100 billion (passenger) km	B2	oe B1 for one correct statement Allow [60, 100] for 100
	Additional Guidance		
	Ignore irrelevant statements unless contradictory		
	Allow passenger but not number of passengers for passenger km		
	Do not allow people for passenger km		
	Do not allow B2 for two comparative statements (about car and rail)		
	Do not allow B2 if there are two contradictory statements eg Steady over the period, increases over the period It's been steady but increased It's been (mostly) steady over the years. It increased at the end / around 2016		 B1 B1 B1
	Both marks can be awarded in the same sentence eg Mostly stayed the same but increased a bit over the last few years It's been steady (but) then increased		 B2 B2
	An increase between 1952 and 2016		B1
	2016 value higher than 1952 value		B1
	It's highest in 2016 (doesn't reference travel over the years)		B0

Question	Answer	Mark	Comments
8(e)(i)	(Arithmetic) mean	B1	
	Sight of 408 ÷ 12 (= 34)	B1	oe
	Additional Guidance		
	408 may be seen as list of additions (with or without zeros)		
	Condone missing brackets when adding numbers and dividing by 12		
	Do not ignore an incorrect answer for 408 or 34		

8(e)(ii)	Not a good measure of average in this case due to the (large) outlier	B1	oe eg not good due to the 387
	Additional Guidance		
	Any additional statements must be correct		
	Accept anomaly, extreme value etc for outlier		
	The mean/average is unrepresentative of the data		B1
	One result is a lot bigger than the rest so not a good measure		B1
	One result is bigger than the rest so not a good measure		B0
	It’s not very accurate due to the outlier		B0
	It’s the odd one out / biggest		B0

Question	Answer	Mark	Comments
8(e)(iii)	Two from: Mode or Median or Geometric mean	B1	This mark can be implied by two following statements
	Use median as it gives a reasonable (middle) value / is not affected by outlier and Mode gives an answer which is the lowest value of the data (so it is not suitable) or Geometric mean gives an answer which is the lowest value of the data (so it is not suitable) or Geometric mean is not suitable in this context	B2	oe B1 for one of Median as it gives a reasonable (middle) value / is not affected by outlier or Mode gives an answer which is the lowest value of the data (so it is not suitable) or Mode is 0 and is representative as it appears 5 times (out of 12) / nearly 50% / frequently or Geometric mean gives an answer which is the lowest value of the data (so it is not suitable) or Geometric mean is not suitable in this context
	Additional Guidance		
	For B3 must choose median (and reject the other average)		
	Allow outlier ignored/eliminated/excluded for ‘not affected by outlier’		
	Mode may be selected as the best measure of average to use for B2 max		
	Mode is 0 is not enough to imply lowest value of the data		
	Median is 1 is not enough to imply a reasonable value		

Question	Answer	Mark	Comments
8(f)	How Charlie's friends travel to school or How many times her friends had used a train	B1	oe eg friends' answers
	Additional Guidance		
	The frequency table (implies how Charlie's friends travel to school)		B1
	Questionnaire answers (implies the answers to the question from part (a))		B1
	Asking her friends (how many times they have used the train) (this is not the data)		B0
	The raw numbers		B0
	The data		B0

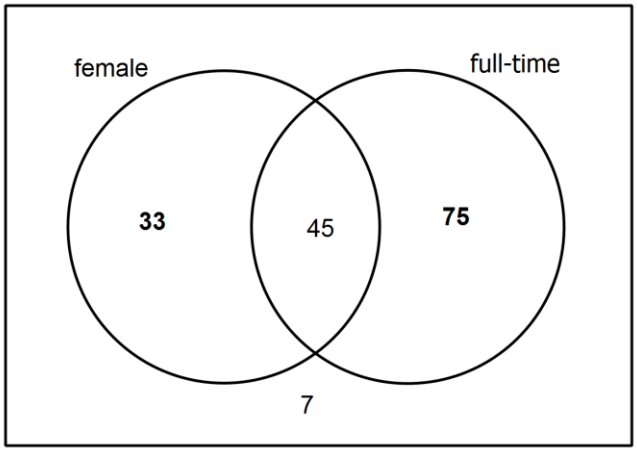
8(g)	The transport information (from the website) or The graph (from the website) or The billion (passenger) km per year	B1	
	Additional Guidance		
	650 billion passenger km in 2016		B0
	The (news) website		B0
	(The) Department for Transport		B0

Question	Answer	Mark	Comments
8(h)	Obtain more data or Don't just ask her friends or Use (random) sampling to choose who to ask or Use more than one website	B1	oe
	Additional Guidance		
	Use a stratified sample (implies asking people other than friends)		B1
	Census (implies everyone in her school)		B1
	Ask more friends		B0
	Reference to the outlier		B0

9(a)(i)	**Alternative method 1**		
	740 + 815 + 795 + 840 or 3190 and 647 + 752 + 691 + 745 or 2835	M1	
	$\frac{2835}{3190}$ or $\frac{567}{638}$ or [0.888, 0.89]	A1	oe SC1 for $\frac{745}{840}$ or $\frac{149}{168}$ or 0.887(…)
	Alternative method 2		
	$\frac{647}{740}+\frac{752}{815}+\frac{691}{795}+\frac{745}{840}$ or 3.55(3…)	M1	
	[0.888,0.89]	A1	oe
	Additional Guidance		
	Ignore attempts to simplify/convert a correct fraction or decimal		
	Accept use of geometric mean		
	Accept answers where students have calculated the mean of both data sets eg 708.75 ÷ 797.5 for at least M1		

Question	Answer	Mark	Comments
9(a)(ii)	Collect data from more than one month or Collect data from a larger sample of orders	B1	oe
	Additional Guidance		
	Ignore irrelevant statements		
	Sample same number of parcels each week B0 (unless also refers to a higher value than 740 in week 1)		
	'Select daily' is B0 unless clear indication of larger sample size		
	Another/additional month		B1
	A different month		B0
	Track all the orders/census		B0

9(b)	More successful in (February) 2019 as $\left(\frac{5}{6}\right)$ = 0.83(3…) and $\frac{2835}{3190}$ = [0.888, 0.89]	B1ft	ft from their 9(a)(i) or allow a restart Their [0.888,0.89] may be seen in 9(a)(i) only
	Additional Guidance		
	Student must change both probabilities to a form that are comparable		
	$6 \times 0.89 = 5.3(4)$ and $5.3(4) > 5$		B1
	Correct comparison of $\frac{5}{6}$ of 3190 with 2835		B1

Question	Answer	Mark	Comments
10(a)	75 in correct position in Venn diagram	B1	
	33 in correct position in Venn diagram	B1ft	Follow through from their 75 as 160 – 45 – 7 – their 75 provided 0 < their 75 < 108
	Additional Guidance		
			
	Do not allow 33 for B1ft if B1 not awarded		

10(b)	Declan will get (nearly) all the full-time workers but only some of the part-time workers	B1	oe Part-time workers will not be properly represented
	Additional Guidance		
	Workers who don't work on Fridays will have no chance of being picked		B1
	Not everyone will be at work that day		B1
	People on a different day / at a different time may have a different opinion		B1
	It will give a biased sample is B0 (unless reason given as to why it will be biased)		

Question	Answer	Mark	Comments
10(c)	$\frac{45}{160} \times 50$ or 0.28125×50 or $\frac{50}{160} \times 45$ or 0.3125×45 or 14.06(25)	M1	oe
	14	A1	
	Additional Guidance		
	Other methods exist which must evaluate to 14.06(25)		

11(a)	$\frac{914(000)}{1049(000)}$ $(\times 100)$ or 100 – [12.8,12.9]	M1	oe
	[87.1, 87.131]	A1	Accept 87 with working.
	Additional Guidance		
	For the A mark, mark any value given in the table; if nothing there then mark any value in the working space $\frac{914(000)}{1049(000)} \times 92$		M0A0

11(b)(i)	45.1(%) or 45(%)	B1	
	Additional Guidance		
	–45.1(%) or –45(%)		B0

Question	Answer	Mark	Comments
11(b)(ii)	The percentage decrease in the number of mining jobs is greater (than the percentage decrease in the amount of coal produced)	B1	oe
	Additional Guidance		
	Numerical values given in answer must be correct eg 72.6%, 45.1% or a 27.5% difference		
	Stating the percentages without a statement		B0
	Lower the number of miners, the lower amount of coal produced		B0
	Correlation		B0

11(c)	$\frac{220}{83.3}$ $(\times 100)$ or $\frac{220\ 000\ 000}{83\ 300\ 000}$ $(\times 100)$	M1	oe eg 220 × 1.2(0..)
	[264, 264.11] (million tons)	A1	Accept 260 with correct working
	Additional Guidance		
	Condone [264 000 000,264 110 000] for M1A1		
	Ignore any rounding errors if correct answer seen eg 264.105 = 264.12		
	220 × 1.167		M0

Question	Answer	Mark	Comments
12	**Alternative method 1**		
	$\frac{774\ 835}{65\ 648\ 000} \times 1000$ or [11.8, 11.803]	B1	Correct method for calculating 2016 birth rate
	12.46 × 53 725 800 or 669 423 468 or 669423 or 10.88 × 5 116 900 or 55 671 872 or 55672 or 13.36 × 1 741 600 or 23 267 776 or 23268 or 748363116 or 748363	M1	Calculating number of births or births per 1000 in 2006
	$\frac{\text{their } 669423468 + \text{their } 55671872 + \text{their } 23267776}{53\ 725\ 800 + 5\ 116\ 900 + 1\ 741\ 600}$ or $\frac{748\ 363\ 116}{60\ 584\ 300}$ $\frac{\text{their } 669423 + \text{their } 55672 + \text{their } 23268}{53\ 725\ 800 + 5\ 116\ 900 + 1\ 741\ 600} \times 1000$ or $\frac{748\ 363}{60\ 584\ 300} \times 1000$	M1dep	Calculating crude birth rate in 2006
	[12.35, 12.4]	A1	Correct answer for the 2006 birth rate Accept 12 if correct working seen
	[12.35, 12.4] and [11.8, 11.803] with a correct conclusion which references at least one of the years eg birth rate higher in 2006	A1	oe Do not accept 12 here
	Alternative method 2 for this question is on the next page		

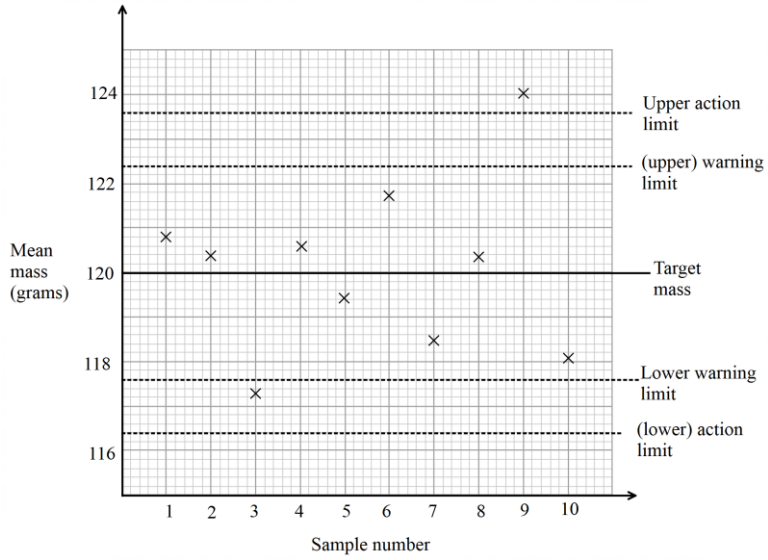
Question	Answer	Mark	Comments
12	**Alternative method 2**		
	$\frac{774\ 835}{65648000} \times 1000$ or [11.8, 11.803]	B1	Correct method for calculating 2016 birth rate
	$\frac{12.46 \times 53725800}{53725800 + 5116900 + 1741600}$ or 12.46 × 0.88… or [11.049,11.05] or $\frac{10.88 \times 5\,116\,900}{53\,725\,800 + 5\,116\,900 + 1741600}$ or 10.88 × 0.08… or [0.92,0.93] or $\frac{13.36 \times 1741600}{53725800 + 5116900 + 1741600}$ or 13.36 × 0.02… or [0.38,0.384]	M1	Calculating proportion of births in one region compared to whole UK in 2006
	their $\frac{12.46 \times 53725800}{53725800 + 5116900 + 1741600}$ + their $\frac{10.88 \times 5116900}{53725800 + 5116900 + 1741600}$ + their $\frac{13.36 \times 1741600}{53725800 + 5116900 + 1741600}$	M1dep	
	[12.35, 12.4]	A1	Correct answer for the 2006 birth rate Accept 12 if correct working seen
	[12.35, 12.4] and [11.8, 11.803] with a correct conclusion which clearly references at least one of the years eg.birth rate higher in 2006	A1	oe Do not accept 12 here
	Additional guidance for this question is on the next page		

Question	Answer	Mark	Comments

	Additional guidance	
	Alternative method 1: First M mark Allow 669 423.468 or 669 423.5 or 55 671.872 or 55 671.9 or 23 267.776 or 23 267.8	
12	Values may be seen in table	
	For final A mark, any percentages/differences stated must be correct	
	If any value stated for M1 or M1dep is incorrect then max B1M2	
	For final A1 do not accept answers where years are not referenced in a final statement but it can be implied eg 2016 = 11.8 and 2006 = 12.4 followed by 11.8 < 12.4	
	Be aware that incorrect values for M1 can still lead to a final answer within range but can only score B1M1M1dep max	

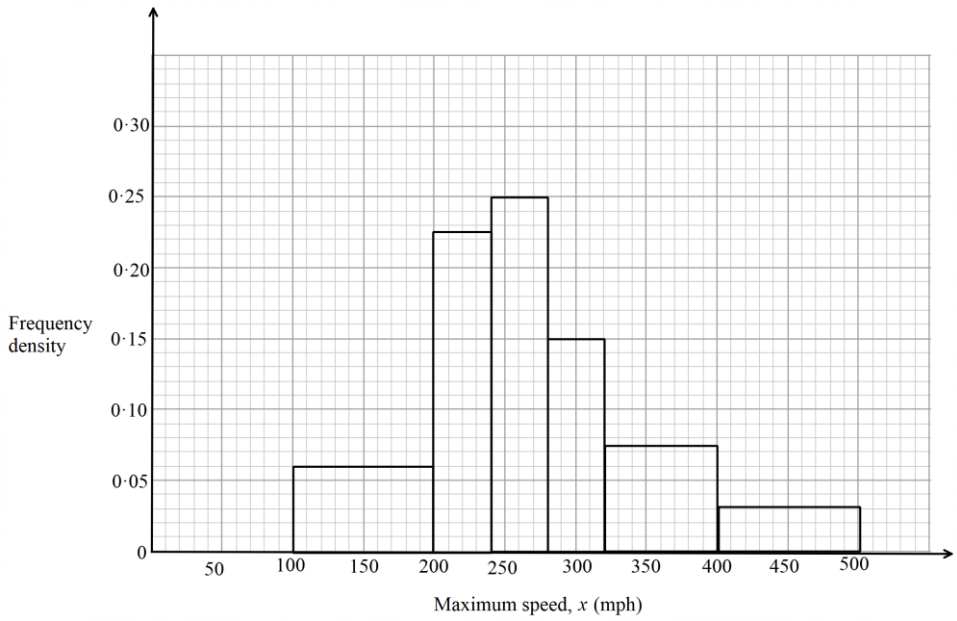
Question	Answer	Mark	Comments
13(a)	(1 –) $\frac{6 \times 50}{10(10^2 - 1)}$	M1	oe eg $\frac{10}{33}$ or 0.303(…)
	[0.696, 0.697]	A1	oe fraction Accept 0.70 Accept 0.7 with working
	Additional Guidance		
	– [0.696, 0.697]		M1A0

13(b)	There is positive correlation between the marks/points/results the dancers received in the two dances or Dancers/pairs who perform well in the first dance also tended to do well in the second dance	B1ft	Interpretation of positive correlation in context ft if –1 ⩽ their 13(a) ⩽ 1 (unless clear restart)
	Additional Guidance		
	Ignore irrelevant statements		
	There is positive agreement between the marks of the dancers in the two performances		B1
	The ranks/positions/results of the dancers after the two dances were similar		B1
	Scores are similar		B0
	Overall improvement from dance 1 to 2		B0
	There is a positive correlation		B0
	Ignore references to the strength of the correlation		

Question	Answer	Mark	Comments
14(a)			
	Upper warning limit marked at 122.4	B1	Allow tolerance of ±0.5 square along length of line
	Lower action limit marked at 116.4	B1	Allow tolerance of ±0.5 square along length of line
	Additional Guidance		
	Line can be solid or dashed/dotted and must extend beyond plotted points		
	Ignore any labels unless used to indicate choice		

14(b)	3(rd sample) or sample 3	B1	

Question	Answer	Mark	Comments
14(c)	It is outside the action limits	B1	oe eg It is above the (upper) action limit
	The machine should be stopped or The machine should be reset/fixed/checked/ adjusted/recalibrated/ serviced/replaced	B1	oe
	Additional Guidance		
	Ignore irrelevant statements		
	Take another sample/retest/recheck		B0
	Needs to be within the warning and action limits		B0
	Beyond acceptable limits		B0
	Take action		B0

15(a)			
	Any 2 of 0.15, 0.075, 0.03 seen or implied by graph	M1	Allow equivalent fractions
	Fully correct graph	A1	Allow ± 0.5 square tolerance
	Additional Guidance		
	Ignore any frequency densities calculated for first three groups		

Question	Answer	Mark	Comments
15(b)	(100 – 90) × 1.8 or 18 or (115 – 100) × 0.6 or 0.75 × 12 or 9	M1	oe
	their ((100 – 90) × 1.8) + their ((115 – 100) × 0.6)	M1dep	With either 18 or 9 correct
	27	A1	
	Additional Guidance		
	Values may be written on diagram		

Question	Answer	Mark	Comments
15(c)	Ticks ‘Cannot tell’ and gives a correct reason eg The bar corresponding to the (fastest) aircraft in WW1 overlaps with the bar corresponding to the (slowest) aircraft in WW2 (could be exemplified by selecting a possible value for speed)	B2	oe B1 Ticks ‘Cannot tell’ and attempts an explanation
	Additional Guidance		
	Values are WW1 [120, 160] and WW2 [100, 200]		
	Condone $100 \leqslant x \leqslant 200$		
	Ticks ‘Cannot tell’: The fastest aircraft in WW1 might be 150 mph and the slowest aircraft in WW2 could be anything from 100mph to 200 mph		B2
	Ticks ‘Cannot tell’: (Slowest) WW1 planes are 120 – 160 (mph) and (fastest) WW2 planes are 100 - 200 (mph)		B2
	Ticks ‘Cannot tell’: The data are grouped		B1
	‘Ticks ‘Cannot tell’: The actual data values / (exact) speeds are not known		B1
	Ticks ‘Cannot tell’: The speeds could be the same		B1
	Ticks ‘Cannot tell’: The fastest aircraft in WW1 could be 140 mph and the slowest aircraft in WW2 could be 150 mph		B1
	‘Ticks ‘Cannot tell’: The actual fastest speed from WW1 and slowest speed from WW2 are not known [this does not clearly hint at an overlap between the distributions]		B1

Question	Answer	Mark	Comments
16(a)	3 sd or 3 × 2.8 or 8.4	B1	oe eg 3σ
	36 + their 3 × 2.8 or 44.4 or 36 – their 3 × 2.8 or 27.6	M1	Allow their 3 if [2, 4] 27.6 or 44.4 implies B1M1
	27.6 and 44.4	A1	Either order
	Additional Guidance		
	Correct answer only		B1M1A1

16(b)(i)	$\frac{34.5-36}{2.8}$ or $\frac{34.5-33.8}{2.2}$	M1	
	$\frac{34.5-36}{2.8}$ and $\frac{34.5-33.8}{2.2}$	M1	
	(–) 0.53(5…) or (–) 0.54 or (–) 0.536 and 0.31(8…) or 0.32 and Statement such as ‘Alice is correct’ or ‘Most likely to be from a female’	A1	oe Accept 0.3 or (–) 0.5 if M2 awarded Concluding sentence needed

Question	Answer	Mark	Comments
16(b)(ii)	Not likely to be valid and a correct reason, eg mean lengths / standard deviations are likely to have changed or people were likely to be shorter (or taller) in Roman times	B1	oe
	Additional Guidance		
	Ignore irrelevant statements or references to animals		
	'No / not likely' and 'the heights of people in the past may have been different'		B1
	'No / not likely' and 'the bone length would be shorter/longer'		B1
	'No / not likely' and 'we are not given the mean and sd for 1900 years ago'		B1
	'No / not likely' and 'we only know the modern mean and sd'		B1
	'No / not likely' and 'it is (more) likely to be male'		B1
	'No / not likely' and 'the values we are given are modern day'		B0
	'No / not likely' and 'the bone may have decayed/broken'		B0

16(c)	B	B1	
	Additional Guidance		
	If no letter circled, check graphs for indication		