GCSE
STATISTICS
8382/2H

Higher Tier Paper 2

Mark scheme

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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 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.

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Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

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 $a \leq$ 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.

Q	Answer	Marks	Comments
1	$\frac{2}{9}$	B1	

Q	Answer	Marks	Comments
2	Consumer price index	B1	

Q	Answer	Marks	Comments
3	6	B1	

Q	Answer	Marks	Comments
4	D	B1	

Q	Answer	Marks	Comments
5(a)	Two valid criticisms: Reference to nowhere for 18 and / or 40 and / or 60-year-olds to respond or Reference to the notation that might not be understood by ordinary people or Class widths are too large for meaningful analysis	B2	oe B1 for one valid criticism
		B1	oe
	Additional Guidance		
	Allow two valid comments to be written within the same criticism It is a sensitive question		B0

Q	Answer	Marks	Comments
5(b)	Two valid criticisms Reference to option of 'never' when they are all at the cinema or Reference to the limited number of options, giving little information or Reference to no time frame being given	B2	oe B1 for one valid criticism
	Additional Guidance		
	Allow two valid comments to be written within the same criticism		

Q	Answer	Marks	Comments
6(a)	$\frac{86\,000}{32\,000\,000}$ or 0.0026(875) or 0.0027	M1	oe
	[0.268, 0.27](%)	A1	allow 0.3% with working

Q	Answer	Marks	Comments
6(b)(i)	The risk (of being stolen) was greater in 2017	B1ft	ft from their 13(a) provided 0 < their 13(a) ≤ 100%
	Additional Guidance		
	Ignore any adjectives describing how much greater		
	The risk is 0.6% greater in 2017		B1

Q	Answer	Marks	Comments
6(b)(ii)	0.21 × 30 900 000 or 30 900 000 ÷ 100	M1	oe
	64 890 or 64 900 or 65 000	A1	

Q	Answer	Marks	Comments
7(a)(i)	Two appropriate comments	B2	B1 one appropriate comment eg the general (overall) trend is for a reduction (in conceptions) between 1992 and 2016… or there was a (large) drop (in conceptions) between about 2008 and 2016 … (however) between about 1996 and 2008 there was little change (in conceptions) or reference the small increases from 1996 to 2000
	Additional Guidance		
	Do not accept a comment relating to a single data point		
	If more than two comments given and at least one is incorrect		B1B0
	Reference to “number” rather than “number per 1000”		B0

Q	Answer	Marks	Comments
7(a)(ii)	Suitable reason	B1	eg better education about the effects of having children young contraceptive more available women having careers first

Q	Answer	Mark	Comments
7(b)	Three correct	B2	B1 one or two correct
	Additional Guidance		
	Less than 5% of women under 20 became pregnant in 2012 — Definitely correct There were fewer than 40 babies born to women under 20 in 2016 — Probably correct Fewer women **under 21** became pregnant in 2016 compared to 1992 — Definitely incorrect		B2

Q	Answer	Marks	Comments
8	Allocate each of the players a (different) number pair from (1,1) to (6, 6)	B1	oe
	Uses at least one dice	B1	oe
	Match the number (pair) rolled with the player with that number	B1dep	oe dependent on second B1 (having rolled a dice) SC1 Allow the number on the dice to determine which group a player is allocated to

Q	Answer	Marks	Comments
9(a)	$\frac{5}{6}$ correctly placed on tree diagram	B1	oe

Q	Answer	Marks	Comments
9(b)	The probability Darcey goes to the gym if she is home early	B1	oe
	Additional Guidance		
	Probability she goes to the gym given that she is home early		B1
	Must refer to “home early” and “go to gym”		

Q	Answer	Marks	Comments
9(c)	$\frac{1}{3}\times\frac{1}{6}$	M1	oe
	$\frac{1}{18}$	A1	oe

Q	Answer	Marks	Comments
9(d)	$\frac{2}{3}\times\frac{3}{4}$ or $\frac{1}{2}$	M1	oe
	their $\frac{1}{18}$ + their $\frac{1}{2}$ or $\frac{5}{9}$	M1 dep	oe ft their value in (c) if < 0.5
	225 × their $\frac{5}{9}$	M1	their $\frac{5}{9}$ should be from the sum of two products of probabilities
	125	A1ft	ft their value in (c) if < 0.5

Q	Answer	Marks	Comments
10(a)	The data is quarterly	B1	oe
	Additional Guidance		
	There are four seasons There is variation between each quarter		B1 B1

Q	Answer	Marks	Comments
10(b)	**Alternative method 1**		
	$\frac{354+284+208+398}{4}$ or $\frac{284+208+398+374}{4}$	M1	oe
	311 and 316 in that order	A2ft	A1ft 311 or 316 in correct cell
	Alternative method 2		
	$\frac{299\times4-350+398}{4}$ or $\frac{\text{their } 311\times4-354+374}{4}$	M1	oe
	311 and their 316 in that order	A2ft	A1ft 311 or their 316 in correct cell

Q	Answer	Marks	Comments
10(c)	Plots at correct sales values	B1ft	ft their values in (b)
	Plots at correct time point	B1	ie midway between 2019 Q2 and Q3 for first point etc
	Additional Guidance		
	Tolerance is half a small square		

Q	Answer	Marks	Comments
10(d)	Appropriate trend line drawn by eye	B1	roughly equal number of points either side of their trend line
	Additional Guidance		
	The line should start from halfway between 2019 Q2 and Q3 or earlier and end at halfway between 2020 Q3 and Q4 or later Ignore any additional points		

Q	Answer	Marks	Comments
10(e)	Sales are increasing over time	B1	oe
	Additional Guidance		
	The sales increase slightly each year There is an overall rise		B1 B1

Q	Answer	Marks	Comments
10(f)(i)	For one correct row in the table **2019 Q2:** 260 and [270, 280] and 260 – [270, 280] or **2020 Q2:** 284 and [300, 310] and 284 – [300, 310]	B1	oe
	$\frac{1}{2}$ (their [-20, -10] + their [-26, -16])	M1	oe accept subtractions wrong way
	Fully correct table and calculation and negative answer	A1	
	Additional Guidance		
	Condone values for the table seen elsewhere		B1

Q	Answer	Marks	Comments
10(f)(ii)	Read off extended trend line to get [330, 350]	M1	
	their [330, 350] + their answer to (f)(i) correctly evaluated with M1 awarded	A1ft	

Q	Answer	Marks	Comments
11	False True True False	B3	B2 any three correct B1 any two correct

Q	Answer	Marks	Comments
12(a)	0.872 × 3 800 (000) or 3 313 600	M1	oe accept 0.872 × 3.8
	3 314	A1	oe

Q	Answer	Marks	Comments
12(b)(i)	$\frac{102.3\times87.2+109.2\times8.3(0)+99\times4.5(0)}{100}$ or $102.3\times0.872+109.2\times0.083(0)+99\times0.045(0)$	M2	oe M1 any correct product
	102.7 or better	A1	102.7242
	Additional Guidance		
	mark this and next part together Ignore any rounding after a correct answer is seen		

Q	Answer	Marks	Comments
12(b)(ii)	their 1.027242 × 3 800 000 or [3 902 600, 3 906 400]	M1	ft their (b)(i) if M1 awarded in previous part
	£3 900 000 or £3.90 m(illion) or better	A1ft	oe
	Additional Guidance		
	Ignore any rounding after a correct answer is seen		

Q	Answer	Marks	Comments
13(a)	One correct frequency density calculated	M1	may be implied by a correct bar
	All frequency densities correct 9, 20, 14.5, 9, 4, 0.9	A1	may be implied by a correct graph
	• All bars drawn correctly • Both axes labelled correctly • Both axes scaled appropriately	B2dep	dep on M1 scored B1dep any one of the bullets correct

Q	Answer	Marks	Comments
13(b)(i)	First box ticked	B1	

Q	Answer	Marks	Comments
13(b)(ii)	**Alternative method 1**		
	$\frac{37.9-21.6}{5(.0)}$ or 3.26	M1	oe
	3.26 and > 3 and Yes	A1	
	Alternative method 2		
	21.6 + 3 × 5(.0)	M1	oe
	36.6 and Yes	A1	SC1 31.6 and No SC1 41.6 and Yes
	Alternative method 3		
	37.9 – 3 × 5(.0)	M1	oe
	22.9 and Yes	A1	SC1 27.9 and No SC1 17.9 and Yes
	Additional Guidance		
	The Special Cases are for the full and correct use of 2 standard deviations and 4 standard deviations respectively		

Q	Answer	Marks	Comments
13(c)	45 + 20 + $\frac{29}{2}$ (= 79.5)	M1	oe
	$\frac{\text{their } 79.5}{150} \times 100$ (= 53.5(%)) or half of 150 is 75	M1dep	oe
	Bob is likely to be correct, but we are not sure as we are estimating the %	A1	oe

Q	Answer	Marks	Comments
14(a)	$(\frac{1}{2})^5 \times 2$	M1	oe
	$\frac{1}{16}$ or 0.0625 or 6.25%	A1	oe
	Additional Guidance		
	Rounded or truncated answer, eg 0.06		M1A0
	$(\frac{1}{2})^5$ or 0.03125 oe		SC1

Q	Answer	Marks	Comments
14(b)	Two from • independent tosses • fixed number of coin tosses • constant probability of winning • two outcomes – win or lose	B2	oe B1 any one from the list
	Additional Guidance		
	The reasons must refer back to the context of the question		
	Two outcomes to the coin toss - heads and tails		B1
	Fixed number of trials		B0
	It is independent		B0
	Two outcomes		B0
	Constant probability		B0

Q	Answer	Marks	Comments
15(a)	Multivariate	B1	

Q	Answer	Marks	Comments
15(b)(i)	Problem: One of the trucks has been recorded as having 1 wheel Solution: Delete this data value or Assume this truck has 4 wheels (given its mass and length)	B2	oe B1 for identifying the problem of truck with 1 wheel
	Problem: Inconsistency of units for length Solution: Convert the measurements in feet and inches to metres	B2	oe eg ensure all lengths are recorded in the same unit B1 for identifying the problem of inconsistency of units

Q	Answer	Marks	Comments
15(b)(ii)	The proportion of trucks using the road with 6 or fewer wheels is unlikely to be exactly 0.5 or Mark's sample is not a random sample of trucks using the road	B1	oe
	Additional Guidance		
	Mark does not know the proportion of trucks with 6 of fewer wheels. Mark's data is not a stratified sample	B1 B1	

Q	Answer	Marks	Comments
15(c)(i)	$\frac{3(10.20-9.18)}{2.90}$	M1	oe
	[1.05, 1.06] or 1.1	A1	oe

Q	Answer	Marks	Comments
15(c)(ii)	Ticks No with a correct reason, e.g. (It does show positive skew but this means) the values greater than the median are more variable than the values below the median.	B1	oe eg the lower half of the data are less spread out (than the top half).
	Additional Guidance		
	Accept a diagram. Any mention of the skew being negative is B0		

Q	Answer	Marks	Comments
15(d)	(Mean for trucks on A229 =) 8.9(04)	B1	oe
	$\frac{2538.52}{30}-\left(\frac{267.12}{30}\right)^2$ or $\frac{2538.52}{30}-(\text{their } 8.904)^2$ or 5.3(36…)	M1	oe
	(s.d. for trucks on A229 =) 2.3(10…)	A1	
	The data for truck lengths on the A229 are less (positively) skewed (than the data for the A2).	B1ft	oe comparison of values of skew ft from their part (c)(i)
	The trucks using the A229 are on average shorter (than the trucks using the A2)	B1ft	oe eg Trucks on the A2 are generally shorter Comparison should be in context. ft from their mean.
	The trucks using the A229 are less variable in length (than the trucks using the A2)	B1ft	oe eg trucks on the A2 have a greater spread of lengths. comparison should be in context. ft from their (positive) s.d.
	Additional Guidance		
	Allow the A1 for calculation of variance = 5.3(36…) provided that the variance for the truck lengths on the A2 is also seen. Allow comparison of variances for the final B mark. <u>Comparison of mean:0</u> The mean for trucks on the A2 mean is greater (no context or interpretation of mean) The mean length of trucks on the A229 is smaller (no interpretation of mean) <u>Comparison of s.d.:</u> The range of truck lengths on the A2 is greater (use of range as a noun – taken as no interpretation of a measure of spread) The truck lengths using the A2 range more (use of range as a verb – taken as interpretation) Trucks on the A229 vary less in length/ have lengths that are less spread out.		B0 B0 B0 B0 B1

Q	Answer	Marks	Comments
15(e)	The data are skewed	B1	oe