



Mark Scheme (Results)

Summer 2025

Pearson Edexcel GCSE (9 – 1)
In Statistics (1ST0) Higher Paper 1H

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General marking guidance

These notes offer general guidance, but the specific notes for examiners appertaining to individual questions take precedence.

- 1 All candidates must receive the same treatment. Examiners must mark the last candidate in exactly the same way as they mark the first.

Where some judgement is required, mark schemes will provide the principles by which marks will be awarded; exemplification/indicative content will not be exhaustive. When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the response should be sent to review.

- 2 All the marks on the mark scheme are designed to be awarded; mark schemes should be applied positively. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme. If there is a wrong answer (or no answer) indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.

Questions where working is not required: In general, the correct answer should be given full marks.

Questions that specifically require working: In general, candidates who do not show working on this type of question will get no marks – full details will be given in the mark scheme for each individual question.

- 3 **Crossed out work**

This should be marked **unless** the candidate has replaced it with an alternative response.

- 4 **Choice of method**

If there is a choice of methods shown, mark the method that leads to the answer given on the answer line.

If no answer appears on the answer line then mark both methods **as far as they are identical** and award these marks.

- 5 **Incorrect method**

If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks.

- 6 **Follow through marks**

Follow through marks which involve a single stage calculation can be awarded without working as you can check the answer, but if ambiguous do not award.

Follow through marks which involve more than one stage of calculation can only be awarded on sight of the relevant working, even if it appears obvious that there is only one way you could get the answer given.

- 7 **Ignoring subsequent work**

It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question or its context. (eg an incorrectly cancelled fraction when the unsimplified fraction would gain full marks).

It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect (eg incorrect algebraic simplification).

8 Probability

Probability answers must be given as a fraction, percentage or decimal. If a candidate gives a decimal equivalent to a probability, this should be written to at least 2 decimal places (unless tenths).

Incorrect notation should lose the accuracy marks, but be awarded any implied method marks.

If a probability fraction is given then cancelled incorrectly, ignore the incorrectly cancelled answer.

9 Range of answers

Unless otherwise stated, when an answer is given as a range (eg 3.5 – 4.2) then this is inclusive of the end points (eg 3.5, 4.2) and all numbers within the range.

Guidance on the use of abbreviations within this mark scheme

M	method mark awarded for a correct method or partial method
A	accuracy mark (awarded after a correct method; if no method is seen then full marks for the question are implied but see individual mark schemes for more details)
B	unconditional accuracy mark (no method needed)
oe	or equivalent
cao	correct answer only
ft	follow through (when appropriate as per mark scheme)
sc	special case
dep	dependent (on a previous mark)
indep	independent
awrt	answer which rounds to
isw	ignore subsequent working

Question number	Answer	Additional guidance	Mark
1(a)	B1 for e.g. - Supported as the <u>mode</u> for France is greater than the <u>mode</u> for Italy - Supported as the most frequent litter size in Italy is 4 and in France it is 5	B1 for a complete evaluation of the conclusion including decision and reason Condone eg supported as the <u>median</u> for France is greater or supported as the <u>mean</u> for France is greater B0 for supported as the wild boars in France have higher average sizes Do not accept reference to greater highest value for France or greater frequencies for France.	(1)
(b)	B1 for e.g. (Wild boar litter sizes in) France have a greater range than (wild boar litter sizes in) Italy - Wild boar litter sizes are more variable in France / litter sizes are more consistent in Italy	B1 for a correct comparison of range Do not accept comparison of highest values or frequencies. Condone 'wider' range. Condone 'greater spread' for more variable. B0 for 'more distributed' or 'wider distributed'. If figures are given these must be correct.	(1)
(c)	B1 for e.g. - Small sample size for Italy - Do not know how the original data was collected - Data is secondary data - Might not be a reliable source - Collected from more than one source / data may not have been collected in a consistent manner - Data could be out of date - Data has been collected from the internet so may have been changed	B1 for a comment identifying an issue with the data collection which would reduce the reliability. Accept reference to an example of a potential issue with the original data collection e.g. may only have been in one area of each country. Do not accept sample size for Italy smaller than France or unequal sample sizes. Do not accept reference to biased alone, reference to people lying, reference to not including all wild boars.	(1)

Question number	Answer	Additional guidance	Mark
2(a)	M1 $\frac{18.5-16.6}{16.6} [\times 100]$ or $\frac{18.5}{16.6} \times 100 [-100]$ A1 11.4...% and in the 10-12% category	M1 for calculation of percentage change A1 for correct value and indication of the correct interval for the choropleth shading Accept $10 < 11.4 \dots < 12$ Accept 11% and in the 10-12% category if method shown.	(2)
(b)	B1 Yorkshire and the Humber	B1 accept any unambiguous indication.	(1)
(c)	B1 for e.g. • (both areas have the same shading, however) the percentages could be different as the shading indicates a range of percentage values. • both have between 13% and 14% change, but may not be exactly the same percentage. • they could have different percentages e.g. 13.4% and 13.7% • in an interval so it is not possible to tell individual values.	B1 for correct evaluation of the conclusion Accept 'it's in intervals' or 'grouped data'. Do not accept totals not known.	(1)
(d)	B2 for e.g. • (the choropleth) doesn't show information about the number of motor vehicles using the roads AND not supported • we only know the percentage change of mileage (not motor vehicles) AND not supported • it could be that people are driving further rather than there being more cars AND not supported (B1 for e.g. • the percentage has changed the most in Scotland • we don't know if the change is negative or positive • we only know percentage change of mileage with no decision or incorrect decision)	B2 for a full evaluation of conclusion including reference to knowledge of percentage mileage change rather than numbers of motor vehicles (B1 for a correct relevant comment based on the choropleth map with no decision or incorrect decision) Accept Scotland has the darkest shading for B1 Do not accept don't know the number of cars in 2020 or total for Scotland unknown.	(2)

Question number	Answer	Additional guidance	Mark																
3(a)	B1 for e.g. data that is collected by somebody else / that you do not collect yourself	B1 for a correct description of secondary data	(1)																
(b)	B2 for correctly completing the Best Actor stem and leaf diagram B1 for a suitable key <table><thead><tr><th></th><th>Best Actor</th></tr></thead><tbody><tr><td>2</td><td>9</td></tr><tr><td>3</td><td>2 6 7 7 8 9</td></tr><tr><td>4</td><td>0 1 1 3 4 5 7 8</td></tr><tr><td>5</td><td>0 0 3 4 5 9</td></tr><tr><td>6</td><td>0</td></tr><tr><td>7</td><td></td></tr><tr><td>8</td><td>3</td></tr></tbody></table> Key: 3 6 represents (an age of) 36		Best Actor	2	9	3	2 6 7 7 8 9	4	0 1 1 3 4 5 7 8	5	0 0 3 4 5 9	6	0	7		8	3	B2 for a fully correct stem and leaf diagram OR if B2 not earned B1 for unordered diagram or ordered diagram with at most 2 errors AND B1 for a suitable key for the stem and leaf diagram. Condone missing units in key but units must be correct if present.	(3)
	Best Actor																		
2	9																		
3	2 6 7 7 8 9																		
4	0 1 1 3 4 5 7 8																		
5	0 0 3 4 5 9																		
6	0																		
7																			
8	3																		
(c)	B1 for 35	B1 cao	(1)																
(d)	B1 for e.g. - there is an outlier / extreme value in the Best Actor data - interquartile range won't include any outliers / extreme values	B1 for correct reason why it is more appropriate to use the IQR than the range Condone anomaly for outlier. B0 for it is a measure of spread.	(1)																

(e)	M1 54 – 29 A1 25	M1 for $54 - k$ or $k - 29$ or for both 29 and 54 identified or for $55.5 - k$ or $k - 28.75$ or for both 28.75 and 55.5 identified (leads to IQR = 26.75) A1 accept 25 or 26.75 If working is seen then it must be consistent with their answer for award of M1A1.	(2)
(f)	B2 Complete comparison of medians e.g. - the <u>median</u> age for Best Actor is always / consistently greater than for Best Actress - the <u>median</u> age for Best Actor was (9 years) greater than for Best Actress before 2000 and it is still (9 years) greater in 2000 to 2022 (B1 Comparison of medians between two groups e.g. - the <u>median</u> age for Best Actor from 2000 to 2022 is greater than the <u>median</u> age for Best Actress from 2000 to 2022 - the <u>median</u> age for Best Actor before 2000 is greater than the <u>median</u> age for Best Actress before 2000 - the <u>median</u> age for Best Actor has increased (from 42 to 44 / by 2 years) and the <u>median</u> age for Best Actress has increased (from 33 to 35 / by 2 years) - the <u>median</u> age for Best Actor has remained fairly similar (over time) and the <u>median</u> age for Best Actress has remained fairly similar (over time)) B1 Interpretation - the winners of the Best Actor category are (consistently) older (on average) than the winner of the Best Actress category - the ages of the winners for Best Actress remained similar over time and the ages of the winners for Best Actor remained similar over time	FT their median for Best Actress from 2000 to 2022 B2 for complete comparison of medians between Best Actor & Best Actress (considering all four), may be done in stages (B1 for partial comparison of medians – considering 2 only) B0 for just identifying greatest median If no reference is made to <u>always</u> (indicating both time periods) or a particular time period then treat the comment as referencing just one time period. Ignore figures if included. B1 for interpretation in the context of age If commenting on the change within the Best Actor / Best Actress categories must refer to both. Do not award mark for interpretation if clearly linked to incorrect statistical measure.	(6)

	B2 Complete comparison of interquartile range e.g. - the <u>interquartile range</u> for Best Actress is always greater than the <u>interquartile range</u> for Best Actor, (but the difference is increasing) - before 2000 the <u>interquartile range</u> for Best Actor was (2.5 years) less/fairly similar to than the <u>interquartile range</u> for Best Actress, for the results between 2000 and 2022 this difference has increased (to 10 years) (B1 Comparison of <u>interquartile range</u> or <u>range</u> between two groups e.g. - before 2000 the <u>interquartile range</u> for Best Actress was greater than/fairly similar to the <u>interquartile range</u> for Best Actor (by 2.5 years) - between 2000 and 2022 the <u>interquartile range</u> for Best Actress was greater than the <u>interquartile range</u> for Best Actor (by 10 years) - the <u>interquartile range</u> for Best Actor increased (from 10.75 to 15) and the <u>interquartile range</u> for Best Actress increased / almost doubled (from 13.25 to 25) - the <u>range</u> for Best Actor (54) was greater than the <u>range</u> for the Best Actress (35)) B1 Interpretation - the ages of the winners of the Best Actor category are more consistent than the ages of the winners of the Best Actress category - the ages of the winners of the Best Actor category are becoming more variable and the ages of the winners of the Best Actress category are becoming (much) more variable	FT their interquartile range for Best Actress from 2000 to 2022 Accept IQR for interquartile range. B2 for complete comparison of interquartile range between Best Actor & Best Actress (considering all four), may be done in stages (B1 for partial comparison of interquartile range – considering 2 only – or for comparison of range for the data from 2000 to 2022) B0 for just identifying greatest interquartile range. If no reference is made to <u>always</u> (indicating both time periods) or a particular time period then treat the comment as referencing just one time period. Ignore figures if included. B1 for interpretation in the context of age If commenting on the change within the Best Actor / Best Actress categories must refer to both. Accept spread of ages / range of ages for both has increased. Do not award mark for interpretation if clearly linked to incorrect statistical measure.	
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Question number	Answer	Additional guidance	Mark
4(a)	B2 for e.g. • appropriate (to use a correlation coefficient) to test for association • appropriate as the data is bivariate (B1 for e.g. • correlation coefficient will measure association • data is bivariate)	B2 for a complete answer assessing the appropriateness of the calculation including identifying the data as bivariate (B1 for a partial assessment of the appropriateness of the use of a correlation coefficient) Allow reference to relationship in place of association Do not accept 'yes' for appropriate. Do not accept show agreement / disagreement. B0 for it will measure correlation	(2)
(b)	M1 for labelling the frequency density axis A1 for 33	M1A1 for answer 33 For labelling axis minimum is one non-zero value in correct place with none incorrect. Major gridlines vertically increase in 1's.	(2)
(c)	B1 for plotting the bar correctly on the histogram with correct scale	B1 for bar with height 5.5 with correct scale Award for a bar between 5.4 and 5.6 in height (inclusive) Condone freehand bar as long as width and height are correct. For correct scale minimum is one non-zero value in correct place with none incorrect.	(1)

(d)	B2 for e.g. - not supported, $5 \times 2 + 5 \times 2 + 11 \times 2 = 42$ and $(42 >)31$ - not supported, $10 + 10 + 22 = 42$ and $(42 >)31$ - not supported $5 \times 2 + 5 \times 2 = 20$ and $5 \times 2 + 3 \times 2 + 1.5 \times 2 + 0.5 \times 2 = 20$ so it would lie in the $48 < t \leq 50$ interval - not supported, the 44 – 46 bar and 46 – 48 bar have the same total area as the 50 – 52 bar, 52 – 54 bar, 54 – 56 bar and 56 – 58 bar altogether so would lie in the 48 – 50 time interval (B1 for a reason with no or incorrect conclusion or for correct method to find frequencies to compare e.g. $5 \times 2 + 5 \times 2 + 11 \times 2$ and $\frac{5 \times 2 + 5 \times 2 + 11 \times 2 + 5 \times 2 + 3 \times 2 + 1.5 \times 2 + 0.5 \times 2}{2}$ or for correct method to find the median position and concluding the $48 < t \leq 50$ interval)	B2 for a complete answer assessing whether the conclusion is supported with any calculated values correct. Accept comparison to 31.5 Condone comparison to 32 Accept work which is based on calculations without multiplication by 2 for B2 or B1 e.g. for B2 allow not supported, $5 + 5 + 11 = 21$ and $(21 >)15.5$ (accept comparison to 15.75, condone comparison to 16) (B1 for a partial answer giving a statistical reason but no or incorrect conclusion) B0 for indicating that the median should be 51 or in the $48 < t \leq 50$ interval without supporting working	(2)
(e)	B2 for e.g. - appropriate and identifying that this would control for differing level of equipment - appropriate and identifying that this would control for differences in skier performance (B1 for e.g. - appropriate so you can see the effect of changing the wax - appropriate as using matched pairs prevents other variables affecting the results - reduces the effect of different equipment - reduces the effect of variation in skier performance)	Allow eg ‘good idea’ for ‘appropriate’ B2 for a complete answer assessing the appropriateness of using matched pairs which identifies how this controls for extraneous variables (B1 for assessing the appropriateness with reference to general extraneous variables OR for reference to one (or more) of the variables controlled with no/incorrect conclusion) B0 for stating appropriate alone.	(2)

Question number	Answer	Additional guidance	Mark
5(a)	B2 for e.g. - Not suitable since only including customers who are using the leisure centres - Not suitable as not every leisure centre will be represented - Not suitable as the customers at different leisure centres could have different opinions (B1 for e.g. - Not suitable as not representative - Not suitable as biased / not everyone can be selected - Only includes customers of the leisure centre - Customers at different leisure centres might have different opinions)	Allow e.g. not appropriate in place of not suitable. Do not accept not sustainable in place of not suitable. B2 for identifying that cluster sampling is not appropriate with a correct statistical reason in context (B1 for identifying not appropriate with a non-contextualised reason OR for a correct contextualised statistical reason with no/incorrect evaluation of appropriateness) If both appropriate and not appropriate are given in the answer then maximum B1 B0 for identifying another type of sampling with a justification Ignore references to time to collect, cost or sample size.	(2)
(b)	B1 for e.g. - To get an idea of the response rate - To see if the data obtained will be suitable for their investigation / to get an idea of the types of answers - Can see if questions are understood / can be answered / to check for issues with the questions - To identify any problems with the questionnaire / to see if the questionnaire works / to see if changes need to be made to the questionnaire - To see how long the questionnaire takes to answer	B1 for a reason why a pilot study would be appropriate Allow to predict results Allow for reference to specific potential issues with questions e.g. to check if questions are too personal B0 for a description of what a pilot study is	(1)

(c)	B1 for e.g. • People may (be embarrassed by the question and) not want to answer honestly • People may not answer it otherwise	B1 for a reason why the random response technique would be appropriate Accept it is a sensitive question, makes it anonymous B0 for it is a personal question	(1)
(d)	B1 e.g. have you used free admission vouchers more than once for your child? B1 e.g. roll a dice / spin a spinner / flip a coin B2 e.g. • if the dice roll is a 1 or 2 tick yes, if the dice roll is a 3 or 4 tick no, if the dice roll is a 5 or 6 answer the question • if the dice roll is a 1 or 2 tick yes, if the dice roll is a 3, 4, 5 or 6 answer the question (B1 e.g. if the number is odd then answer the question)	B1 for a suitable question relevant to the information required. Accept e.g. collected for used. B1 for an instruction to generate a random outcome B2 for a complete method to respond to the random response question For B2 the instruction must indicate ticking/answering <u>yes</u> for some outcomes and if using response boxes the labels must allow answering of the question (B1 for indicating to answer the question for some outcomes) Ignore other superfluous questions.	(4)

(e)	B1 Comments on data collection: • Census (of leisure centres) gives good data reliability • (Reasonably) long time frame • Includes data from before the offer started / needs to ensure that includes data from before the offer started • Data will be representative as all leisure centres are involved / census is (fully) representative • Need to ensure that all leisure centres record the data in the same way / number of people using the leisure centre may be recorded differently by different centres • Leisure centre data is a reliable source • Data may need cleaning depB1ft for appropriate comment on appropriateness of method of data collection consistent with the observations made.	B1 for a correct comment relating to the methods of data collection Do not allow leisure centres may not have the data he needs / may not give him the data he needs. depB1ft for comment on appropriateness of data collection consistent with their observations Allow 'good' for appropriate. Dependent on previous B mark being awarded for data collection Allow B1ft for comments linked to individual aspects including if some are identified as appropriate and some identified as not appropriate.	(6)
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	B1B1B1 Comments on processing and presenting data: • Time series graph will show changes over time/shows patterns over time • A trend line would show the overall change for all leisure centres • Each leisure centre may show different trends so a separate time series graph for each leisure centre would be better • Moving averages allow for potential seasonality / weekly patterns in data / smooth out daily fluctuations • Should use 7 point moving averages rather than 4 point moving averages • Looking for seasonality is appropriate as there may be trends during the week / weekends may have more customers • Making predictions may involve extrapolation which would be unreliable / predictions should only be made close to the time frame of the data collected / predictions may be unreliable due to advertisements and vouchers stopping • Description of how to use the trend line and mean seasonal variation to make a prediction is incorrect • If making a prediction then using the trend line with the mean seasonal variation would account for overall trend and differences in customer numbers on different days of the week depB1ft for appropriate comment on appropriateness of at least one of the methods of processing and presenting data consistent with the observations made.	B1B1B1 for each correct comment relating to the methods of processing and presenting data Do not allow for trend line will allow to predict the future alone (see predictions comments) Do not allow comments relating to variation due to time of year / season of the year depB1ft for comment on appropriateness of use of time series / moving averages / seasonal variation / extrapolation & prediction consistent with their observations Dependent on at least one previous B mark being awarded for processing and presenting data Allow B1ft for comments linked to individual aspects including if some are identified as appropriate and some are identified as not appropriate. Allow 'good' for appropriate. Maximum 2 marks for comments on data collection Maximum 4 marks for comments on analysis	
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Question number	Answer	Additional guidance	Mark
6(a)	M1 for the Yellowness of cheese rank 5, 10, 8, 9, 7, 6, 1, 2, 3, 4 M1 for difference in ranks: −4, −8, −5, −5, −2, 0, 6, 6, 6, 6 depM1 for use of formula $(r_s =) 1 - \frac{6 \times 278}{10 \times (10^2 - 1)}$ A1 −0.684(84 ...) Reverse ranks M1 for the Yellowness of cheese rank 6, 1, 3, 2, 4, 5, 10, 9, 8, 7 M1 for difference in ranks: −5, 1, 0, 2, 1, 1, −3, −1, 1, 3 depM1 for use of formula $(r_s =) 1 - \frac{6 \times 52}{10 \times (10^2 - 1)}$ A1 0.684(84 ...)	M1 for ranking Yellowness of cheese. Condone one error in ranking (two ranks reversed is one error). M1 for difference in their ranks (condone one slip and allow $\pm$). Can be implied by $\sum d^2 = 278$ depM1 for demonstrating correct use of formula for Spearman's rank correlation coefficient (allow use of their $\sum d^2$ which comes from an attempt to sum their 10 positive values of d^2) Dep on M1M1 scored A1 for awrt −0.68 or −0.685 Accept −0.7 with correct working or with −0.68 or better seen M1 for ranking Yellowness of cheese. Condone one error in ranking (two ranks reversed is one error). M1 for difference in their ranks (condone one slip and allow $\pm$). Can be implied by $\sum d^2 = 52$ depM1 for demonstrating correct use of formula for Spearman's rank correlation coefficient (allow use of their $\sum d^2$ which comes from an attempt to sum their 10 positive values of d^2) Dep on M1M1 scored A1 for awrt 0.68 or 0.685 Accept 0.7 with correct working or with 0.68 or better seen	(4)

(b)	B1 Salt content B1 e.g. • as the salt content increases the customer overall liking scores increased • customers like cheese more when it is salty	B1 for identifying salt content as the attribute most closely related to customer overall liking scores B0 if more than one attribute identified B1 for interpreting in context the correlation We need to see reference to an increase of salt content or the cheese being salty / high salt content linked to customers liking the cheese. B1B0 for they liked the salt content of the cheese	(2)
(c)	B1 for 1		(1)

Question number	Answer	Additional guidance	Mark
7(a)	M1 for $\frac{690}{n} = \frac{73}{2017}$ oe A1 for 19065	M1 for method to estimate the number of bears A1 for 19064 or 19065 M1A0 for answer of 19064.7(9...)	(2)
(b)	B1 for identifying the impact on the number of tags e.g. - there would be a greater number of tagged bears in the recapture / second capture B1 for identifying the impact on the estimate e.g. - the estimated population would be lower / answer to (a) would decrease	B1 for identifying the impact on the number of tags Accept the denominator of the calculation would increase B1 for identifying the impact on the estimate Condone e.g. 'population/total would be smaller' as reference to impact on estimated population.	(2)
(c)	B1 for e.g. - the population doesn't change / no births /no deaths / no migration / closed population - the tagged bears mix back into the population - all bears have an equal chance of being captured / tagging doesn't change the probability of capture	B1 for one assumption of the Petersen capture recapture method other than no loss of tags B0 for reference to hibernation Do not allow answers which would mean the assumptions were not met e.g. more bears could have been born. Allow animals for bears.	(1)

Question number	Answer	Additional guidance	Mark
8(a)	M1 $13.53 \pm 3 \times 1.839$ A1 8.013 and 19.047 A1 for identifying no values below 8.5 or above 18 on the histogram so no outliers	M1 for calculation of outlier limits. Allow for calculation of only one limit. A1 for finding both outlier limits. CAO A1 for conclusion using histogram Allow for $8.5 > 8.013$ and $18 < 19.047$	(3)
(b)	B1B1B1B1B1 for each of six comparisons or contextual interpretations Comparison of average e.g. • <u>mean</u> for Ironman UK is greater • <u>median</u> for Ironman UK is greater Interpretation e.g. • ...on average competitors took longer to complete the Ironman UK • ...on average competitors were faster in the Ironman Canada Comparison of standard deviation e.g. • <u>standard deviation</u> for Ironman UK is lower	B1B1B1B1B1 for each of six comparisons or contextual interpretations Underlined words must be seen. For contextual comments we are looking for reference to times, results or speed. B1 for comparison of measure of central tendency. Award mark for comparison of means or for comparison of medians. B0 if just state values for each country without comparison Comparison may be implied from the interpretation depB1 for correct contextual interpretation of comparison of central tendency B1 for comparison of standard deviation Allow for comparison of range e.g. <u>range</u> for Ironman Canada is greater B0 if just state values for each country without comparison Comparison may be implied from the interpretation	(6)

	Interpretation e.g. ...times to complete Ironman UK were more consistent ...competitors were closer together when they finished Ironman UK Comparison of skew e.g. - times Ironman UK are <u>negatively skewed</u>, times for Ironman Canada are <u>not skewed</u> / have <u>little skew</u> / (slightly) <u>positive skewed</u> / are <u>symmetrical</u> Interpretation e.g. ...finishing times for Ironman Canada are equally spread on either side of the median, whereas times for Ironman UK are more spread out below the median / faster times are more spread out ...Ironman UK had a greater proportion of longer times than Ironman Canada ...finishing times for Ironman Canada are (slightly) more spread out above the median / slower times are more spread out, whereas times for Ironman UK are more spread out below the median / faster times are more spread out ...for Ironman UK more than half the runners take more than the <u>mean</u> time to run the race, for Ironman Canada equal numbers of runners take more than and less than the mean time	depB1 for correct contextual interpretation of comparison of standard deviation Allow for contextual interpretation of comparison of range. B1 for comparison of skew Do not accept symmetrical skew or normal skew depB1 for correct contextual interpretation of comparison of skew B0 for reference to more times above median or more times below median For all marks, ignore additional non-contradictory comments. Contextual comments should refer to results or time(s) or grouping of competitors.	
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(c)	M1 $\frac{5.64-5.18}{0.95}$ A1 0.484... B2FT for e.g. Swim was the best performance (relative to other competitors) as it has the most negative standardised score / the lowest standardised score AND Run was the worst performance (relative to other competitors) as it has the most positive standardised score / the highest standardised score (B1FT for an incomplete answer e.g. - Swim was the best performance as it had the most negative standardised score / the lowest standardised score - Run was the worst performance as it had a positive standardised score / the highest standardised score - Performance in swim was better than performance in bike as it had a more negative standardised score - Faster than average for both swim and bike as he had a negative standardised score - Slower than average in the run as the standardised score was positive)	M1 for using $\frac{\pm(X-\mu)}{\sigma}$ A1 awrt 0.48 B2FT for complete conclusion in context using the standardised scores. Must compare performance in the three stages of the race. FT their standardised score for the run. (B1FT for an incomplete conclusion which only refers to the best performance OR the worst performance OR compares only two stages) Allow ‘by x standard deviations’ as reference to standardised score where x is the correct number of standard deviations.	(4)
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Question number	Answer	Additional guidance	Mark
9(a)	B1 0.3, 0.4, p , $1 - p$ oe in the correct places on the tree diagram	B1 for correctly completing the tree diagram. Allow 0.45 for p and 0.55 for $1 - p$	(1)
(b)	M1 $\frac{0.4 \times p}{0.6 \times 0.7 + 0.4 \times p} = 0.3$ A1FT ($p =$) 0.45 oe	M1 for forming an equation using conditional probability A1FT follow through <i>their</i> 0.3, 0.4 and p (must be an expression involving p) from (a) If $p = 0.45$ is obtained but spoilt by further working award M1A0	(2)
(c)	M1 $1 - {}^4C_0 \times 0.05^0 \times 0.95^4$ oe OR ${}^4C_1 \times 0.95^3 \times 0.05 + {}^4C_2 \times 0.95^2 \times 0.05^2 + {}^4C_3 \times 0.95 \times 0.05^3 + {}^4C_4 \times 0.95^0 \times 0.05^4$ oe A1 0.185 oe	M1 for method to find the probability of at least one failure using the Binomial distribution A1 awrt 0.185	(2)

(d)	M1M1 $1 - 0.84^6 - 6 \times 0.84^5 \times 0.16 - 15 \times 0.84^4 \times 0.16^2$ OR $20 \times 0.84^3 \times 0.16^3 + 15 \times 0.84^2 \times 0.16^4$ $+ 6 \times 0.84 \times 0.16^5 + 0.16^6$	M1 for method to find one appropriate probability using the Binomial distribution	(4)																		
	A1 0.056 oe B1FT Yes/Dina is correct ($0.056 < 0.185$)	<table><tr><td>0.84^6</td><td>0.351(298...)</td></tr><tr><td>$6 \times 0.84^5 \times 0.16$</td><td>0.401(483...)</td></tr><tr><td>$15 \times 0.84^4 \times 0.16^2$</td><td>0.191(182...)</td></tr><tr><td>$20 \times 0.84^3 \times 0.16^3$</td><td>0.048(554...)</td></tr><tr><td>$15 \times 0.84^2 \times 0.16^4$</td><td>0.0069(363...)</td></tr><tr><td>$6 \times 0.84 \times 0.16^5$</td><td>0.00052(848...)</td></tr><tr><td>0.16^6</td><td>0.0000167(772...)</td></tr></table> M1 for method to find the probability of 3 or more failures using the Binomial distribution Allow M marks for correct calculations including e.g. 6C_0 A1 awrt 0.056 B1FT for conclusion consistent with their answers to (c) and (d) which must be probabilities Comparison of probabilities does not have to be seen, but if seen must be correct using <i>their</i> probabilities. FT their (c) and their probability in (d). There must be an attempt at use of Binomial distribution and $-1 \leq \textit{their (c)} \leq 1$ and $-1 \leq \textit{their (d)} \leq 1$ For FT: <table><tr><td>Relative value of (c) and (d)</td><td><i>their (d) < their (c)</i></td><td><i>their (d) > their (c)</i></td></tr><tr><td>Conclusion</td><td>Yes / Dina is correct</td><td>No / Dina is incorrect</td></tr></table>		0.84^6	0.351(298...)	$6 \times 0.84^5 \times 0.16$	0.401(483...)	$15 \times 0.84^4 \times 0.16^2$	0.191(182...)	$20 \times 0.84^3 \times 0.16^3$	0.048(554...)	$15 \times 0.84^2 \times 0.16^4$	0.0069(363...)	$6 \times 0.84 \times 0.16^5$	0.00052(848...)	0.16^6	0.0000167(772...)	Relative value of (c) and (d)	<i>their (d) < their (c)</i>	<i>their (d) > their (c)</i>	Conclusion
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