# AQA

# GCSE
# STATISTICS
# 8382/2H

Higher Tier  Paper 2

**Mark scheme**

June 2019

Version 1.0: Final

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead 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 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. <br> 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** | 3.75 | B1 | |

| | | | |
|---|---|---|---|
| **2** | C | B1 | |

| | | | |
|---|---|---|---|
| **3** | 80 | B1 | |

| | | | |
|---|---|---|---|
| **4** | Test A | B1 | |

| | | | |
|---|---|---|---|
| **5(a)** | 2013 | B1 | accept twenty thirteen<br>or two thousand and thirteen |

| | | | |
|---|---|---|---|
| **5(b)** | 4 remaining values correctly plotted | B1 | |
| | Their plots joined by straight lines | B1dep | dependent on at least one correct plot<br>do not accept any part of graph being curved |
| | 'Year(s)' label on horizontal axis | B1 | |
| | 'Attendances (at all A&E hospitals) in millions' label on vertical axis | B1 | oe eg (number of) people in millions<br>'millions' must not be omitted |

**Additional Guidance**

| | |
|---|---|
| First B1 : Plotting to tolerance of half a small square | |
| Second B1 : Mark intention, so, (for example), forgive small areas of double lines | |
| Second B1 : At least one correct plot includes if some or all of the others are omitted | |
| Fourth B1 : Accept # for 'number of'   eg  '# patients – millions'   is  B1 | |
| Fourth B1 :  Accept 'mil' or (1) 000 000(s) for millions  but do not accept 'per million' | |
| Fourth B1 : 'frequency of patients in millions' | B1 |
| Fourth B1 : 'frequency in millions' | B0 |
| Ignore graph before 2008 and after 2016 | |
| Ignore any titles to the graph written | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| | Shows patterns in the data more clearly / Avoids a large area of empty graph / Makes plotting / drawing / reading easier | B1 | oe positive reason |
| | Over-exaggerates differences between years / Might not be understood | B1 | oe negative reason |
| | **Additional Guidance** | | |
| | Ignore irrelevant statements alongside correct ones | | |
| | A correct positive reason given in the negative answer space and vice versa is B0 | | |
| | **For the positive reason** | | |
| | It is more accurate / precise | | B1 |
| | Allows data to be plotted without a long graph | | B1 |
| | It's not bunched at the top | | B1 |
| | Allows you to have a smaller graph | | B1 |
| **5(c)** | Allows you to have a bigger graph | | B0 |
| | It makes it quicker to draw | | B0 |
| | There's no data below 19.5 | | B0 |
| | Shows the correlation in the graph        (it's not a scatter diagram) | | B0 |
| | Only shows relevant information | | B0 |
| | **For the negative reason** | | |
| | It is misleading / confusing / distorts the graph | | B1 |
| | The graph looks very steep when in fact the numbers are quite close together | | B1 |
| | What does it mean? | | B1 |
| | Makes differences appear much bigger than they are | | B1 |
| | Makes differences much bigger than they are | | B0 |
| | Allows you to start from 0 | | B0 |
| | It is too steep between years | | B0 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 5(d) | There could be more doctors / nurses / hospitals<br><br>or<br><br>The hospital could be more efficient<br><br>or<br><br>Quicker treatment may be available<br><br>or<br><br>It will vary between hospitals / patients / emergencies / time of day / time of week (so they won't all have longer waiting times) | B1 | oe |

| | Additional Guidance | |
|---|---|---|
| | Ignore irrelevant statements alongside correct ones | |
| | Answers which only reference their answer to a comparison between Major hospitals and All A&E hospitals score zero | |
| | Hospitals may not have reached capacity | B1 |
| | It will depend upon how serious the problem is | B1 |
| | Some people are now not going to A&E for minor conditions | B0 |
| | They could build more A&E hospitals | B0 |
| | Dan hasn't collected any data / there are no data about waiting times | B0 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 6(a) | North West and South East and no other regions mentioned | B1 | in either order<br>accept NW and SE |

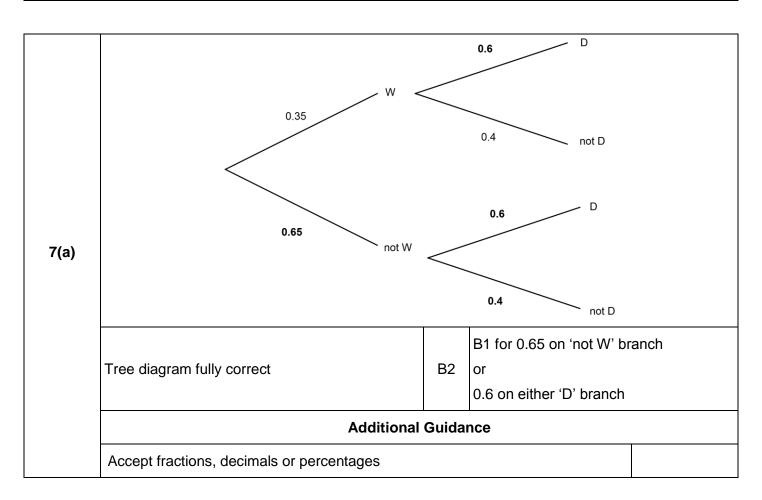| | Additional Guidance | |
|---|---|---|
| | Ignore any numbers given as part of the answer | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| | Two correct reasons<br><br>eg Discusses that bars give misleading impression<br><br>eg The fastest speed has the shortest bar<br><br>eg Discusses that diagram is not to scale<br><br>eg The bars are not drawn to scale<br><br>eg The speeds are quite similar to each other but the bar lengths are quite different<br><br>eg There is no scale | B2 | oe<br>B1 one correct reason |

| Additional Guidance | |
|---|---|
| Accept higher for faster and lower for slower | |
| There are two bars for each region / row | B1 |
| The bars with the numbers on are the same length | B1 |
| The bars are drawn as arrows | B1 |
| The difference in length between the first two bars is the same as between the second two bars, but there is not the same difference in speed | B1 |
| It is not clear how long each bar is | B1 |
| Length of arrows don't match the speed | B1 |
| Doesn't show units | B1 |
| The bars are the wrong way around | B0 |
| Some speeds are the same but the bar lengths are different   (not true) | B0 |
| There should be axes | B0 |
| The length of the bar does not correspond to the ranking  (it shouldn't it should be proportional to the value) | B0 |
| The heading says 'How fast are you?' but the data is for regions / shoppers | B0 |
| The values go in descending order whereas it should be in ascending order | B0 |

**6(b)**

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **6(c)(i)** | Correct diagram, with ordered leaves and numbers vertically aligned<br><br>| **0** | 7 | 7 | 9 | | | | | |<br>| **1** | 0 | 2 | 3 | 4 | 6 | 7 | 8 | 8 | 9 |<br>| **2** | 1 | 2 | 2 | 4 | 5 | 5 | 6 | 7 | |<br>| **3** | 1 | 2 | 2 | 4 | | | | | |<br>| **4** | 1 | | | | | | | | | | B3 | B2 three or four correct, ordered rows<br><br>or<br><br>all numbers correctly placed in rows but not ordered<br><br><br>B1 correct numbers in at least two rows (not necessarily ordered) but does not score B2 |

| | **Additional Guidance** | |
|---|---|---|
| | Condone lack of vertical alignment for B2 and B1 | |
| | Marks can be scored for work in white space below question if grid blank or crossed out | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **6(c)(ii)** | (Walking speeds are) faster (on average) in June | B1 | oe eg,<br>(walking speeds are) slower (on average) in December |

| | **Additional Guidance** | |
|---|---|---|
| | Ignore calculations or average values seen | |
| | Accept higher for faster pace and lower for slower pace | |
| | Most / more walkers are faster in June | B1 |
| | Most / more walkers have a faster pace in June | B1 |
| | Walkers are faster in June | B1 |
| | Walkers are slower in December | B1 |
| | All walkers are faster in June | B0 |
| | Most / more walkers are higher in June | B0 |
| | Incorrect month(s) referenced | B0 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **6(c)(iii)** | The shopping centre is busier in December | B1 | oe<br>it is the run-up to Christmas |

| Additional Guidance | |
|---|---|
| People are Christmas shopping | B1 |
| References to weather can only be to state or imply underfoot conditions<br>eg More difficult to walk in poor weather in December | B1 |
| It might be icy / snow /  be slippery in December | B1 |
| You wear less in June so you will be faster | B0 |
| People have more time in December | B0 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **7(a)** |  | | |
| | Tree diagram fully correct | B2 | B1 for 0.65 on 'not W' branch<br>or<br>0.6 on either 'D' branch |

| Additional Guidance | |
|---|---|
| Accept fractions, decimals or percentages | |

| Question | Answer | Mark | Comments |
|----------|--------|------|----------|
| **7(b)** | 0.35 × their 0.6 or 0.21 <br><br> or 0.35 × 0.4 or 0.14 <br><br> or their 0.65 × their 0.6 or 0.39 <br><br> or their 0.65 × their 0.4 or 0.26 | M1 | oe |
| | (0.35 × their 0.6) + (0.35 × 0.4) + (their 0.65 × their 0.6) <br> or <br> their 0.21 + their 0.14 + their 0.39 <br> or <br> 0.35 + their 0.39 <br> or <br> 1 – their 0.26 | M1dep | oe |
| | 0.74 | A1ft | oe <br> eg $\dfrac{74}{100}$ or $\dfrac{37}{50}$ or 74% <br><br> ft if M2 awarded |
| | **Additional Guidance** | | |
| | Accept equivalent fractions, decimals or percentages throughout | | |
| | Work seen in part (a) may be credited in (b) if appropriate | | |
| | 'Their' probabilities must be [0, 1] or [0, 100]% to allow follow through from (a) | | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **8(a)** | Toby's table covers all possible responses / is exhaustive | B1 | oe<br>eg Maxine's data table does not allow for less than 4 g of fat |
| | Toby's intervals do not overlap / are mutually exclusive | B1 | oe<br>eg with Maxine's data table, it is not clear in which interval 8 g belongs |
| | **Additional Guidance** | | |
| | Both marks can be earned by a single statement<br>eg Toby's intervals do not overlap and cover all possible responses | | B2 |
| | Toby's starts at 0, Maxine's starts at 4   (taken to imply exhaustive) | | B1 |
| | Maxine's starts at 4  **or**  Toby's start at 0   (one of these but not both) | | B0 |
| | Toby's uses (double) inequalities which are better | | B0 |
| | Toby's are easier to understand | | B0 |
| | Toby's go higher | | B0 |
| | Toby's are more accurate | | B0 |
| | Toby's have a greater range | | B0 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 8(b)(i) |  | | |
| | At least 5 points plotted at correct upper class boundaries | B1 | ±0.5 of a small square tolerance |
| | At least 5 points plotted at correct vertical heights | B1 | ±0.5 of a small square tolerance |
| | Fully correct cumulative frequency graph with points joined with straight lines or a curve | B1dep | dep on B1B1 awarded<br>do not accept double lines or "feathering" on graph<br>±0.5 of a small square tolerance on line going through points |

| **Additional Guidance** | |
|---|---|
| Cumulative frequency bar chart or step polygon with no plots seen | B0B1B0 |
| Cumulative frequency bar chart or step polygon with correct plots seen | B1B1B0 |
| Omission of point (5, 0) (and line to second point) | B1B1B0 |
| Ignore graph after (40, 60) | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 8(b)(ii) | 0.7 × 60  or  42  or  0.7 × 61  or  42.7 | M1 | oe<br>may be implied by a mark by 42 (or 42.7) on the vertical axis or by an attempt at a line across at 42 (or 42.7) |
| | Correct 70$^{th}$ percentile for their cumulative frequency graph | A1ft | their graph must be increasing with an attempt to join the points |
| | **Additional Guidance** | | |
| | Answer with no apparent working – check their (appropriate) graph to see if it is correct for M1A1ft | | |

| | | | |
|---|---|---|---|
| 8(b)(iii) | **Alternative Method 1: Use of (b)(ii)** | | |
| | Yes because the 70$^{th}$ percentile is now less than 25 | B1ft | ft their answer to (b)(ii)<br>oe, eg  Yes because now 30% of meals contain more than 23 grams of fat |
| | **Alternative Method 2: Use of their graph** | | |
| | Yes, because now only 20% of meals contain more than 25 grams of fat | B1ft | read from graph and convert to a percentage<br>ft from their graph (must be increasing)<br>oe |
| | **Alternative Method 3: Use of the data table** | | |
| | Yes, because now 80% of meals contain less than 25 grams of fat | B1 | oe |
| | **Alternative Method 4 : Calculating number of meals** | | |
| | Yes<br>and<br>30% of 60 = 18 (5 years ago)<br>and<br>60 – 48 = 12 (now) | B1 | |
| | **Additional Guidance** | | |
| | Accept use of inequalities, eg 20% < 30% and Yes | | B1 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **9(a)** | (Extraneous / explanatory / independent) variables / conditions can be controlled (more easily)<br><br>or<br><br>The experiment is easier to replicate<br><br>or<br><br>More likely / easier to demonstrate a cause and effect | B1 | oe<br><br>eg easier for the experimenter to demonstrate the effect of the independent variable on the response variable |

| **Additional Guidance** | |
|---|---|
| More complex / reliable equipment can be used | B1 |
| It is done in a controlled environment | B1 |
| They are more reliable / valid | B1 |
| Fewer (condone less) random factors | B1 |
| More convenient as you don't have to move from site to site | B1 |
| It's in a closed environment | B0 |
| Response / dependent variables can be controlled | B0 |
| It is done in a laboratory | B0 |
| Quicker / easier / cheaper / more convenient / less biased / accurate | B0 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **9(b)(i)** | To see the difference in the performance with and without coffee / to compare to the others | B1 | oe<br><br>without a control group, Steve would not know whether a change in scores was due to the coffee |

| **Additional Guidance** | |
|---|---|
| To account for extraneous variables | B1 |
| To have something to compare to / with | B1 |
| To see if there is a change / improvement  in the results | B0 |
| So that Steve knows whether his hypothesis is true | B0 |
| To ensure the results are accurate / not biased / fair | B0 |

| Question | Answer | Mark | Comments | |
|---|---|---|---|---|
| **9(b)(ii)** | No<br><br>and<br><br>a correct reason, eg,<br><br>The improvement in the coffee drinkers' scores is less than that of the control group | B1 | oe | |
| | **Additional Guidance** | | | |
| | Must state or imply 'No' or say 'Steve's wrong' (oe) | | | |
| | Allow 'did better' or 'got better marks' (oe) for 'increased by more' | | | |
| | Allow 'those who drink nothing' (oe) for the control group | | | |
| | No, the control group did better | | | B1 |
| | The control group did better | | | B0 |
| | No, they all got similar scores | | | B0 |
| | Yes, though the non-coffee drinkers went up as well | | | B0 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| | (Graph) A | B1 | |
| | A correct reason for A, eg It has the strongest correlation eg Points are closest to the line (of best fit) | B1dep | do not accept strong or close - must be comparative |
| | Accurate reading from their line of best fit (±0.5 of a small square tolerance) | B1ft | ft from their choice of scatter graph |
| **10** | **Additional Guidance** | | |
| | For 3rd B1ft mark : Prediction from Graph A value to be within [4.875, 4.925] Prediction from Graph B value to be within [5.04, 5.09] Prediction from Graph C value to be within [4.935, 4.985] | | |
| | For second mark, ignore irrelevant statements alongside correct ones | | |
| | Condone stronger (not strong) for strongest and closer (not close) for closest | | |
| | A and A's data has the strongest relationship | | B1B1dep |
| | A and the data has the least spread | | B1B0dep |
| | A and the line of best fit is more accurate / more reliable | | B1B0dep |
| | A and it is interpolation / not extrapolation | | B1B0dep |
| | A and it is closest to the (double) mean (point) | | B1B0dep |
| | A and the points are closer together / less scattered | | B1B0dep |
| | A and because they're both about the sepal        (not a statistical reason) | | B1B0dep |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **11(a)** | 12 | B1 | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **11(b)** | D | B1 | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **12(a)** | His population should only be passengers staying in standard class cabins | B1 | oe eg not all passengers on the ship are staying in standard class cabins |

**Additional Guidance**

| | |
|---|---|
| He should only ask people in standard class | B1 |
| Some are in standard, some aren't | B1 |

| Question | | Mark | Comments |
|---|---|---|---|
| **12(b)** | **Alternative Method 1 : using Ran# (or just noting corrections)** | | |
| | Assign every passenger in the population a number from (00)1 to 460 | B1 | oe |
| | Generate random numbers from a calculator by typing Ran# × 460 or Ran# (460) | B1 | oe<br><br>if they choose to multiply by a value greater than 460 they must also reference ignoring numbers above 460 |
| | Round (up) the answer and ignore repeats | B1 | oe    allow truncate for 'round' |
| | **Alternative Method 2 : standard method** | | |
| | Assign every passenger in the population a number from (00)1 to 460 | B1 | oe |
| | (Use the Ran# button to) generate random numbers from a calculator (and take the first 3 digits after the decimal point) | B1 | oe  allow  RANINT# |
| | Ignore any numbers greater than 460 and repeats | B1 | oe  if RANINT used, may not need to ignore numbers greater than 460 |

**Additional Guidance**

| | |
|---|---|
| If student consistently uses 900 instead of 460 (thinking they are sampling from all 900), mark as per scheme with 900 replacing 460 but withhold one mark | |
| An acceptable alternative numbering might be (00)0 to 459 | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **12(c)** | Two separate questions **and** a better balance in the number of positive and negative responses for each of the questions eg<br><br>How would you rate:-<br><br>the value for money of standard class cabins?<br><br> Very poor   Poor   Good    Very good<br><br>the quality of standard class cabins?<br><br> Very poor   Poor   Good    Very good<br><br>or<br><br>Do you think standard class cabins give value for money?<br><br>   Yes ☐        No ☐<br><br>Do you think standard class cabins are good quality?<br><br>   Yes ☐        No ☐<br><br>or<br><br>Standard class cabins provide good value for money<br><br>  Disagree    Neither agree nor disagree<br><br>            Agree<br><br>Standard class cabins are good quality<br><br>  Disagree    Neither agree nor disagree<br><br>            Agree | B2 | oe<br><br>there could be an even or odd number of tick boxes<br><br>B1 two separate questions<br><br>**or**<br><br>a better balance in the number of positive and negative responses in their single question or all their unacceptable questions or without a question |

| Additional Guidance | |
|---|---|
| Allow a scale like, for example,<br><br>☐ ☐ ☐ ☐ ☐ ☐ ☐<br>very                  very<br>poor               good | at least B1 |
| Throughout, ignore any boxes marked 'don't know' or 'would rather not say' (oe)        eg        poor ☐  average ☐   good ☐    don't know ☐ | at least B1 |
| How do rate your cabin for value for money?<br>5 star  4 star  3 star  2 star  1 star   (0 star)   (acceptable as 'better balance') | at least B1 |
| Allow reference to scales such as '0 – 10' as a 'better balance' with a minimum of 0 and 10 defined as a negative and positive respectively | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **13(a)** | 0.2 × 85  or  17<br><br>or 0.35 × 54  or  18.9<br><br>or 0.45 × 70  or  31.5 | M1 | oe<br><br>accept<br><br>20 × 85  or  35 × 54  or  45 × 70 |
| | 0.2 × 85  +  0.35 × 54  +  0.45 × 70 | M1dep | oe<br>accept<br><br>20 × 85  +  35 × 54  +  45 × 70 |
| | 67.4 | A1 | allow 67 with working<br><br>digits 674(0) scores M2A0 |
| | **Additional Guidance** | | |
| | Allow 0.85 for 85 etc for M2 | | |
| | 67 without working | | M0M0A0 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **13(b)** | 0.2 × 40  or  8<br><br>or 0.35 × 32  or  11.2<br><br>or 19.2 | M1 | oe<br><br>accept  20 × 40 or 35 × 32 |
| | 0.2 × 40 + 0.35 × 32 + 0.45 × $n$<br><br>where $n$ is either a letter or a number between $90\frac{2}{3}$ and 100 inclusive<br><br>or<br><br>60 – their 19.2 (= 40.8 (÷ 0.45))<br><br>or<br><br>their 8 + their 11.2 + 45 | M1dep | oe<br>accept eg<br><br>20 × 40 + 35 × 32 + 45 × 100 |
| | Yes with correct working, eg<br>a correct evaluation of<br><br>0.2 × 40 + 0.35 × 32 + 0.45 × $n$<br><br>for $90\frac{2}{3} \leqslant n \leqslant 100$<br><br>or  [90.6, 90.67](%)  or 91(%)<br><br>or  64(.2)<br><br>**or**<br><br>Yes, with correct explanation<br><br>eg 45% still available, 40.8% needed to pass | A1 | oe<br>correct working implied by 64(.2)<br><br>yes can be ticked or implied |
| | **Additional Guidance** | | |
| | Ignore further work carried out on 64(.2) | | |
| | 'No' ticked is a maximum of M2 scored | | |

| Question | Answer | Mark | Comments |
|----------|--------|------|----------|
| **14(a)(i)** | $149.76 \div 24$ (= 6.24) | B1 | oe eg $\dfrac{149.76}{24}$ |
| | **Additional Guidance** | | |
| | Accept $6.24 \times 24 = 149.76$ | | B1 |

| Question | Answer | Mark | Comments |
|----------|--------|------|----------|
| **14(a)(ii)** | $\sqrt{\dfrac{968.72}{24} - (\dfrac{149.76}{24})^2}$  or  $\sqrt{\dfrac{968.72}{24} - 6.24^2}$ | M1 | accept without the square root<br>oe eg<br>$\sqrt{40.363... - 38.9376}$ |
| | 1.19 or better | A1 | must see to at least 2 decimal places |
| | **Additional Guidance** | | |
| | $\sqrt{\dfrac{968.72}{24} - (\dfrac{149.76}{24})^2}$ = 1.2 | | M1A0 |
| | Use of 6.2 instead of 6.24 scores M1A0 if substitution correct unless recovered | | |
| | Condone missing brackets if recovered | | |
| | Missing brackets not recovered | | M0A0 |
| | Condone square roots poorly placed, eg only covering numerator, unless definitely wrong as revealed by calculation done | | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **14(a)(iii)** | Target not met / unlikely to have been met<br>**and either**<br>a reason which references mean **and** standard deviation, eg<br>Her mean is greater than 6 but some of her distances are likely to have been less than 6 km because her standard deviation is 1.2<br>**or**<br>A calculation which shows a correct value below 6 using mean and standard deviation<br>eg 6.24 – 1.2 = 5.04 | B2 | oe<br>B1 for target not met / unlikely to have been met with incomplete reason<br>eg<br>some of her distances must have been less than 6 km<br><br>decision that the target has not been met can be implied |

| **Additional Guidance** | |
|---|---|
| Do not accept | |
| target partially met / met sometimes / almost met | B0 |
| met with mean but not met with standard deviation / other contradictions | B0 |
| Allow 'may not be true' for 'unlikely to have been met'  (oe) | |
| Do not allow 'may not be exactly true' as this infers 'partially met' | B0 |
| The standard deviation shows that some days she walked below 6km | B0 |
| The standard deviation shows that some days she walked below 6km therefore she didn't meet her target | B1 |
| (The standard deviation shows that some days she walked below 6km as)<br>6.24 – 1.2 = 5.04 therefore she didn't meet her target | B2 |
| Allow use of [1,4] standard deviations in these calculations | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| | (Erika's mean is greater than Tomasz's so) Erika walks further on average (than Tomasz) | B1 | oe<br><br>Erika generally walks further than Tomasz |
| | (Tomasz has a greater standard deviation so) the distance walked by Tomasz is more variable (than Erika) | B1 | oe<br><br>the amount Erika walks every day is more consistent |
| **14(b)** | **Additional Guidance** | | |
| | Answers should include an interpretation of the mean / standard deviation in context and cannot simply just re-use the words mean and / or standard deviation only | | |
| | The distances walked by Tomasz range more | | B1 |
| | The distances that Erika walks vary less / are less spread out | | B1 |
| | Erika walks more similar distances each day | | B1 |
| | Erika walks similar distances each day  (not comparative to Tomasz) | | B0 |
| | Tomasz's range / variance is bigger  (not accepted as an interpretation) | | B0 |
| | Erika's mean is greater  (no context or interpretation of mean) | | B0 |
| | Erika walks further | | B0 |
| | The mean distance that Erika walks is greater   (no interpretation of mean) | | B0 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| | Drinking tea and drinking coffee are not exhaustive events | B1 | oe eg<br><br>some people (eg children) are likely to drink neither tea or coffee.<br><br>some people may drink a different drink or a cold drink |
| **15(a)** | **Additional Guidance** | | |
| | Some people might not have a hot drink at breakfast | | B1 |
| | He may be correct but they may not like either | | B1 |
| | It's true 100 – 18 = 82 | | B0 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **15(b)** | $0.18^1 \times 0.82^4$ or $0.08(138\ldots)$ | M1 | oe |
| | $5 \times$ their $0.08(138\ldots)$<br><br>or $^5C_1 \times$ their $0.08(138\ldots)$ | M1dep | oe<br><br>$^5C_1 \times 0.18^1 \times 0.82^4$ is M2 |
| | [0.4069, 0.407] or 0.41 | A1 | oe fraction, decimal or percentage<br>SC2 0.0043 |

| | | |
|---|---|---|
| **Additional Guidance** | | |
| Accept fractions or decimals in working | | |
| Some students are doing more work on 0.41, eg $\dfrac{0.41}{5}$ | | M2A0 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **15(c)** | The choices of the three family members may not be independent<br>or<br>Children may be less likely to drink tea | B1 | oe |

| | |
|---|---|
| **Additional Guidance** | |
| People in families might drink the same thing at breakfast | B1 |
| They might share a big pot of tea | B1 |
| The probability of liking tea is not constant | B1 |
| They may all drink tea | B1 |
| Parents may tell children what to drink | B1 |
| Kids don't like tea / There may be children | B1 |
| None or all of the people may be tea drinkers | B1 |
| The sample is not random | B1 |
| There are three outcomes and the binomial should have two | B0 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **16(a)** | It would not be practical for Luca to collect the data himself<br>or<br>Luca would need to contact every university | B1 | oe<br>it would take too long to collect the data himself |

| **Additional Guidance** | |
|---|---|
| It would be expensive | B1 |
| People (with low grades) may lie | B1 |
| The data has already been collected | B1 |
| May not be able to find everyone / every result | B1 |
| People may not remember | B0 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **16(b)** | They would allow him to compare the proportions of students receiving each degree<br>or<br>They would allow him to compare the number of degrees awarded | B1 | oe |

| **Additional Guidance** | |
|---|---|
| They will allow him to compare the data for the two years | B1 |
| The two populations are different sizes | B1 |
| See differences / changes / increases / decreases (between sets of data) | B1 |
| Gives the correct proportions by using the different radii | B1 |
| Easy to understand | B0 |
| They are representative of the population | B0 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| | $\sqrt{\dfrac{376\,355}{308\,395}}$  or  1.1(047….) or $\sqrt{10.98...}$ | M1 | oe |
| | 3.3(1…) | A1 | seen, or implied by correct radius of pie chart if no working |
| **16(c)** | (First =) $\dfrac{88\,890}{376\,355} \times 360$  or 85(.0)<br><br>or<br><br>(Upper second =) $\dfrac{186\,570}{376\,355} \times 360$<br>or 178(.4….)  or  178.5  or  179<br><br>or<br><br>(Lower second =) $\dfrac{81\,595}{376\,355} \times 360$  or 78(.0….)<br><br>or<br><br>(Third or Pass =) $\dfrac{19\,300}{376\,355} \times 360$<br>or 18(.4….)  or  18.5  or  19 | M1 | |
| | All four angles correct | A1 | may be implied by correct pie chart if no working |
| | Pie chart drawn with<br><br>• radius = 3.3cm<br>• correct angles<br>• sectors labelled | B2 | award B1 for a pie chart satisfying two of the three conditions<br><br>angle values do not need to be shown |
| | **Additional Guidance** | | |
| | Tolerance on drawing is 2 degrees each sector and 1mm on radius<br><br>Tolerance on 178.4 is [176, 180]<br><br>Tolerance on 18.4 is [16, 20] | | |
| | If a circle is drawn free-hand, it is B0, but the other 4 marks may be scored | | |
| | If working is not shown and angles are calculated incorrectly, to judge whether the labelling is appropriate, assume that the largest sector is Upper Second, the next largest is First, the next is Lower Second and the smallest is Third or Pass | | |
| | No working, but pie chart drawn with correct radius, correct angles and correct labelling | | 6 marks |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **16(d)** | $\dfrac{48}{360}$ × 308 395  or  41 119(.3…) | M1 | oe |
| | 88 890 – their 41 119(.3)<br>or  47 770.6(6…)  or  47 770.67  or  47 770.7 | M1dep | oe |
| | 47 770  or  47 771 | A1 | allow  47 800  or  48 000  if no wrong working seen<br>SC2   47 742 |
| | **Additional Guidance** | | |
| | | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **16(e)** | A suitable reason<br>eg<br>Teaching may have improved<br>or<br>Students may be working harder | B1 | oe |
| | **Additional Guidance** | | |
| | The subjects / exams students are taking may have changed | | B1 |
| | Students are more intelligent | | B1 |
| | Students in 2008 performed badly / Students in 2016 performed well | | B1 |
| | There are more students so more will get First Class (doesn't mean it is easier) | | B0 |
| | Hasn't taken into account other / all the Universities | | B0 |

| Question | Answer | Mark | Comments |
|----------|--------|------|----------|
| | $\dfrac{83\,720}{347\,470}$  or 0.24(094….)  or 24(.094…)%  or  $\dfrac{5170}{28\,885}$  or 0.178(9….)  or 17.8(9…)%  or 0.18 or 18% | M1 | oe |
| | $\dfrac{83\,720}{347\,470}$  or 0.24(094….)  or 24(.094…)%  and  $\dfrac{5170}{28\,885}$  or 0.178(9….)  or 17.8(9…)%  or 0.179(0) or 17.9(0)% or 0.18 or 18% | M1dep | oe |
| 16(f) | 0.24(094….)  and  0.178(9….) (or 0.179(0) or 0.18)  and a suitable conclusion  eg  Students studying full-time are more likely to achieve a first class degree (than students studying part-time)  There's a greater proportion / percentage of full-time students achieving a first class degree | A1 | oe  allow equivalent percentages.  allow equivalent fractions if expressed with a common denominator  do not accept 'there are more full-time students getting a first class degree…' |

**Additional Guidance**

| | |
|---|---|
| Condone the incorrect concept of "doing" a first class degree in conclusions  eg full-time students are more likely to do a first class degree  is acceptable as the conclusion | |