

Mark scheme

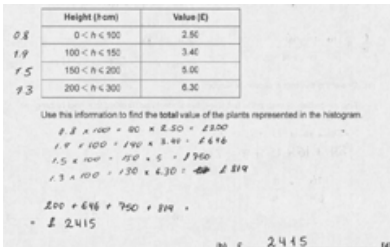
Question			Answer/Indicative content	Marks	Guidance
1	a		52, 70, 80	1	
	b		Correct curve	3	B1 for correct horizontal plots B1FT for correct vertical plots B1FT <i>their</i> (a) for smooth increasing curve through 5 points Condone polygon, ignore curve to left of $m = 5$ Accuracy $\frac{1}{2}$ small sq radially on curve and plots Condone increasing linear graph Ignore blocks
	c		10	1	
	d		Strict FT <i>their</i> curve $\frac{80 - \text{their reading at 17 kg}}{80}$	2	For 2 marks, accept fract/dec/% equivalents isw cancelling/conversion Accept FT polygon for curve For 2 marks or B1 accept <i>their</i> reading ± 1 B1 for $80 - \text{their reading at 17 kg}$ or $\frac{\text{their reading at 17 kg}}{80}$
			Total	7	
2	a		1.2×100	1	Accept $\frac{12}{10}$ fraction for 1.2
	b		1526	4	M3 for $80 \times 3.1 + 95 \times 3.6 + 75 \times 4 + 120 \times 5.3$ or $248 + 342 + 300 + 636$ or M2 for the expression with two errors or B1 for one of 80, 95 and 75 or For M3 condone one error Allow M2 for e.g. $248 + 684 + 600 + 636$

					M1 for $their80 \times 3.1 + their95 \times 3.6 + their75 \times 4 + 120 \times 5.3$	Allow M1 for e.g. $248 + 684 + 600 + 1325$
			Total	5		
3	a		50	1		
	b		25	1		
	c		$\frac{1}{3}$ oe	1		e.g. $\frac{25}{75}$ or $0.33[3\dots]$ or $33[.3\dots]\%$
			Total	3		
4			[a =] 11.2 [b =] 2.4 with correct working	5	B4 for one correct answer <u>with correct working</u> OR M1 for $\frac{a+a+b+a+2b+3a-b}{4} = 18$ oe M1 for $3a - b - a = 20$ oe M1 for equating coefficients of one variable for <i>their</i> linear equations M1 for correct method to eliminate one variable for <i>their</i> original linear equations If 0 , M1 or M2 scored, instead award SC3 for answers 11.2 and 2.4 with no working or insufficient working If 0 or M1 scored, instead award SC2 for $a = 2.4$ and $b = 11.2$ with no working or insufficient working If 0 scored, instead award SC1 for two answers which satisfy one of the original conditions	“Correct working” requires evidence of at least M1M1 for the two equations and M1 for some evidence of solving them e.g. $6a + 2b = 72$ e.g. $2a - b = 20$ dependant on two linear equations e.g. $6a - 3b = 60$ or $4a - 2b = 40$ or $3a + b = 36$ dependant on two linear equations e.g. $10a = 112$ Allow one numerical error in each step of solving <i>their</i> equations A sign error is not an arithmetic error Substitution method: M1 and M1 for the two equations M1 dependant on two linear equations and for rearranging one equation to make one variable the subject e.g. $a = \frac{20+b}{2}$ M1 for substituting it into <i>their</i> other equation Trials (need to see the mean or total, and the range evaluated for each): M1 for each correct trial up to

						a maximum of 3 After three correct trials, correct final answers score 5
			Total	5		
5			30 nfw	4	B1 for freq density 0.2 for 45-60 bar soi M2 for 1.8×10 and 0.6×15 may be implied by 18 and 9 or M1 for 1.8×10 may be implied by 18 OR For $k \neq 1$ M3 for <i>their</i> $(18k + 9k + 3k) \div k$ or M2 for $18k + 9k + 3k$ or M1 for two from 18k, 9k, 3k	Figures may be seen on bars Could be implied by correct fd used for 20-30 and 30-45 bars or from scale on diagram e.g. M3 for $(36 + 18 + 6) \div 2$ or M2 for $36 + 18 + 6$ or M1 two from 36, 18, 6 M3 for $(90 + 45 + 15) \div 5$ or M2 for $90 + 45 + 15$ or M1 two from 90, 45, 15
			Total	4		
6	a		60, 74, 80	1	Examiner's Comments There were a variety of responses and a number of candidates omitted this part. Candidates that understood the term cumulative frequency were generally successful apart from a few with arithmetic errors. Others wrote the frequency values or added pairs of frequencies or treated the frequency values as a sequence and tried to continue the pattern.	
	b		Correct curve	3	B1 for correct horizontal plots B1FT for correct vertical plots B1FT <i>their</i> (a) for smooth increasing curve through 5 points	Condone polygon, ignore curve to left of $m = 5$ Accuracy $\frac{1}{2}$ small sq radially on curve and plots Condone increasing linear graph Ignore blocks
					Examiner's Comments	

				Those candidates with a correct table in part (a) often gave a correct graph. A common misconception however was to draw a cumulative bar graph which is incorrect. Other candidates were given credit for plotting points from their table in the correct position on the graph. Exemplar 1 (a) Complete the cumulative frequency table. <table><tr><th>Mass (in kg)</th><th>$m < 5$</th><th>$m < 10$</th><th>$m < 15$</th><th>$m < 20$</th><th>$m < 25$</th></tr><tr><td>Cumulative frequency</td><td>10</td><td>32</td><td>60</td><td>74</td><td>80</td></tr></table> (b) Draw the cumulative frequency graph to represent these results	Mass (in kg)	$m < 5$	$m < 10$	$m < 15$	$m < 20$	$m < 25$	Cumulative frequency	10	32	60	74	80
Mass (in kg)	$m < 5$	$m < 10$	$m < 15$	$m < 20$	$m < 25$											
Cumulative frequency	10	32	60	74	80											
				This example shows a common misconception for those candidates that completed the cumulative frequency table correctly in part (a). The graph has been drawn with bars rather than points plotted at the upper bound of the intervals and then joined with a smooth curve. Candidates received no credit from drawing bars on a cumulative frequency graph Exemplar 2 (a) Complete the cumulative frequency table. <table><tr><th>Mass (in kg)</th><th>$m < 5$</th><th>$m < 10$</th><th>$m < 15$</th><th>$m < 20$</th><th>$m < 25$</th></tr><tr><td>Cumulative frequency</td><td>10</td><td>32</td><td>60</td><td>74</td><td>80</td></tr></table> (b) Draw the cumulative frequency graph to represent these results	Mass (in kg)	$m < 5$	$m < 10$	$m < 15$	$m < 20$	$m < 25$	Cumulative frequency	10	32	60	74	80
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c		15	1	1 Examiner's Comments												

					Some candidates were successful, but many omitted this part.
	d		Strict FT <i>their</i> curve $\frac{80 - \text{their reading at 18 kg}}{80} \text{ oe}$	2	B1 for 80 – <i>their</i> reading at 18 kg or $\frac{\text{their reading at 18 kg}}{80}$ For 2 marks, accept fract/dec/% equivalents isw cancelling/conversion Accept FT polygon for curve For 2 marks or B1 accept <i>their</i> reading ± 1 <u>Examiner's Comments</u> Examiners gave credit for candidates that used their curve to obtain the answer to this part provided a line or curve had been drawn and not a bar graph.
			Total	7	
7	a		0.8×100	1	accept $\frac{8}{10}$ oe fraction for 0.8 <u>Examiner's Comments</u> It was encouraging to see that many gave the correct answer to find the area of the bar, 0.8×100. Some gave no response to this question. The purpose of part (a) Part (a) may seem a simple question to ask at this point in the paper but it does have an important purpose. It is there to assist candidates to answer part (b) correctly and to remind them how to find the frequencies in a histogram.
	b		1 654	4	M3 for $80 \times 2.5 + 95 \times 3.4 + 75 \times 5 + 120 \times 6.3$ or $200 + 323 + 375 + 756$ or M2 for the expression with two errors or B1 for one of 95, 75 and 120 or M1 for $80 \times 2.5 + \text{their} 95 \times 3.4 + \text{their} 75 \times 5 + \text{their} 120 \times 6.3$ for M3 condone one error allow M2 for $200 + 646 + 750 + 756$ allow M1 for e.g. $200 + 646 + 750 + 1575$ <u>Examiner's Comments</u>

					Some candidates who answered part (a) correctly, did not use the frequency of 80 here nor did they use the same method to calculate the other frequencies. Many did use the correct method of frequency $\times$ value but for the frequencies they would use either the group width of 100, 50, 50 and 100, the frequency calculated from the frequency density $\times$ 100 for each group or 80, 40, 40 and 80. Exemplar 2  Here this candidate has answered part (a) correctly and uses 80 correctly but they have calculated the other three frequencies using 100 as the column width for all bars.
			Total	5	
8	a		Correct box plot	3	B2 for 4 or 5 correct markers or B1 for 3 correct markers or 14 or 60 soi Markers must be associated with the correct statistic e.g. do not allow median marked as UQ
	b		10R [because] it has a smaller IQR oe	1	Accept: 10R [because] its IQR is 16 but the IQR of 10Q is 24 or 25 Do not accept if median also mentioned or if incorrect values given
			Total	4	
9			32.5 with correct working	5	B1 for at least 4 correct frequencies from 4, 11, 17, 19, 9, 12 B1 for at least 4 correct midpoints from 5, 15, 25, 35, 45, 55 Accept 33 with correct working Correct working requires at least evidence of B1 B1 M1 May be implied by correct products seen 20, 165, 425, 665, 405, 660 May be implied by correct products seen 20, 165, 425, 665, 405, 660

					M1 for Σmf using <i>their</i> midpoints and <i>their</i> frequencies soi by $20+165+425+665+405+660$ or by 2340 M1dep for <i>their</i> $\frac{\Sigma mf}{72}$ If 0 or 1 scored, instead award SC2 for final answer 32.5 with no working or insufficient working If 0 scored, instead award SC1 for 2340 with no working or insufficient working	<i>Their</i> midpoints must lie in the range of <i>t</i> for each interval Lower: [0 or 4]+110+340+570+360+600 Upper: 40+220+510+760+450+720 Allow one error in calculation <i>Their</i> frequencies must not be the cumulative frequencies dep on first M1
			Total	5		
1 0			Correct bar width and height of 0.8	5	M2 for $10 \times 1.5 + 10 \times 1.2 + 30 \times 0.9$ or better e.g. $15 + 12 + 27$ or 54 or M1 for one correct frequency calculated e.g. one of 15 or 12 or 27 AND M1 for $70 - \text{their } 54$ soi by 16 M1 for <i>their</i> $16 \div 20$ soi by 0.8 or a correct bar drawn from <i>their</i> frequency	
			Total	5		
1 1			40 nfw	4	B1 for freq density 3.2 for 0–5 bar soi M2 for 1.4×10 and 2×5 may be implied by 14 and 10 or M1 for 1.4×10 may be implied by 14	Figures may be seen on bars Could be implied by correct fd used for bars 2 and 3 or from scale on diagram

				OR For $k \neq 1$ M3 for <i>their</i> $(16k + 10k + 14k) \div k$ or M2 for $16k + 10k + 14k$ or M1 for two from 16k, 10k, 14k e.g M3 for $(40 + 25 + 35) \div 2.5$ or M2 for $40 + 25 + 35$ or M1 two from 40, 25, 35 M3 for $(80 + 50 + 70) \div 5$ or M2 for $80 + 50 + 70$ or M1 two from 80, 50, 70	
				Examiner's Comments Success here was dependent on candidates approaching it as a histogram and not as a frequency diagram. Those approaching it as a histogram almost always found the correct number of students, with the only errors being numerical slips. The most successful candidates first identified the frequency density of the first bar via $16 \div 5$, often marking 3.2 on the vertical scale; they then completed the scale or showed working for the other two areas (5×2 and 10×1.4). Other successful candidates used a proportional approach, either finding the areas of the bars in terms of the number of little squares (40, 25 and 35) or by multiplying the widths in minutes by the heights in little squares (leading to 80, 50 and 70). Final answers of 100 and 200 quite often arose from these methods, due to a lack of appreciation for the scaling impact of what they had done. A few used a valid method, but calculated one bar too many or one too few, often scoring 2 or 3 marks. Others scored B1 for identifying the frequency density of the first bar as 3.2 without further progress. Those not approaching it as a histogram almost always gave the answer 33, from reading the heights as representing the frequencies (this scored 0). ? Misconception Candidates should know that histograms use area to represent frequency.	
			Total	4	
1 2	a		40	1	

					<u>Examiner's Comments</u> There were many correct answers. The most common error was 60.
	b		25	1	<u>Examiner's Comments</u> There were fewer correct answers here than in part (a). The most common incorrect answer was 20.
	c		$\frac{1}{3}$ oe	1	e.g. $\frac{25}{75}$ or 0.33[3...] or 33[.3...]% <u>Examiner's Comments</u> Few candidates gave the correct answer, which should come from working such as $\frac{25}{75}$. The main error was to multiply their fractions together, so we saw $\frac{3}{4} \times \frac{1}{4} = \frac{3}{16}$.
			Total	3	
1 3			[a =] 15.6 [b =] 7.2 with correct working	5	B4 for one correct answer <u>with correct working</u> OR M1 for $\frac{a+a+b+a+2b+3a-b}{4} = 27$ oe M1 for $3a - b - a = 24$ oe M1 for equating coefficients of one variable for <i>their</i> linear equations M1 for correct method to eliminate one variable for <i>their</i> original linear equations If 0, M1 or M2 scored, instead award SC3 for answers 15.6 and 7.2 with no working or insufficient working If 0 or M1 scored, instead award “Correct working” requires evidence of at least M1M1 for the two equations and M1 for some evidence of solving them e.g. $6a + 2b = 108$ e.g. $2a - b = 24$ dependant on two linear equations e.g. $6a - 3b = 72$ or $4a - 2b = 48$ or $3a + b = 54$ dependant on two linear equations e.g. $5b = 36$ Allow one numerical error in each step of solving <i>their</i> equations A sign error is not an arithmetic error

					SC2 for $a = 7.2$ and $b = 15.6$ with no working or insufficient working If 0 scored, instead award SC1 for two answers which satisfy one of the original conditions Substitution method: M1 and M1 for the two equations M1 dependant on two linear equations and for rearranging one equation to make one variable the subject e.g. $a = \frac{24+b}{2}$ M1 for substituting it into <i>their</i> other equation Trials (need to see the mean or total, and the range evaluated for each): M1 for each correct trial up to a maximum of 3 After three correct trials, correct final answers score 5
					Examiner's Comments Those who attempted this using trials were always unsuccessful. The most successful method was to write down the two linear equations and to solve them algebraically. When writing the equations, the first one was often seen as $a + a + b + a + 2b + 3a - b \div 4 = 27$, which often ended up as $6a + 2b = 27$ (where the '$\div 4$' had been forgotten) or $6a - 2b = 108$ (where there is a sign error). Many were unable to solve these equations algebraically. While most candidates multiplied or divided correctly, when adding or subtracting then they would make an error, usually in the bs. For example, they might subtract the as and the numbers, but add the bs.
			Total	5	
1 4	a	i	15	1	
		ii	25	1	
	b		Box plot drawn with: Lowest = 30 Lower Quartile = 45 Median = 50 Upper quartile = 60 Highest = 70	3	B2 for 4 or 5 correct markers or B1 for 3 correct markers If more than 5 markers, mark the worst 5 Award the markers even if not correctly representing the information
			Total	5	

1 5	a	Correct cumulative frequency curve	5	B2 for 6 21 30 44 60 64 can be implied from plots Or M1 for cf calculated with one arithmetic error M2 for accurately plotting these frequencies against the upper group values Or M1 for accurately plotting these frequencies against a group value condoning one error B1 for an accurate curve FT <i>their</i> frequencies and dep on increasing frequencies	Tolerance for plotting and drawing the curve is $\pm \frac{1}{2}$ small square and ignore curve before (20, 6) If they draw bars award M1 if the bars are the same widths as the groups
	b	Cycling and medians [cycling] 40 to 43 [tennis] 51	2	FT <i>their</i> curve for medians providing it is increasing frequencies B1 for one correct median or a statement with one error Response Mark Cycling + curve is higher for smaller values 2 Cycling + they have more under 40 2 Cycling + have a higher cf at 30 2 Cycling + earlier end of graph is higher than tennis 2 Cycling + the curve for younger members is steeper 2 Tennis + tennis has less members under the age of 40 1 Tennis + tennis curve is below cycling curve for lower ages 1 Tennis + tennis curve is less steep for lower ages 1 bod Tennis + its curve is below the other one 1 bod Anything to do with spread 0	Condone a statement which is equivalent and condone tennis median of 50 to 52 and condone 'average' for 'median'
		Total	7		
1 6		Calculation/reasoning/use of figures Correct interpretation	1 1dep	Comment Mark Reason Use of figures or reasoning needed to score any marks Use of figures or reasoning may be 1 mark. Interpretation is dependent on figures/reasoning (50+58)/2=54. Incorrect, new mean will be less than 53. 2 Useful calculation; correct interpretation (50+58)/2=54. Incorrect, new mean will be more than 53. 1 Useful calculation; wrong interpretation (50+58)/2=54. 1 Useful calculation Incorrect. The mean of the two apples is 54, so the mean of the remaining apples will fall. 2 Implied calculation; correct interpretation 53–50=3; 58–53=5. Incorrect, new mean will be less than 53. 2	

					Useful calculation; correct interpretation $53-50=3$; $58-53=5$. Incorrect, new mean will be more than 53. 1 Useful calculations; wrong interpretation $53-50=3$; $58-53=5$. 1 Useful calculations If there were 10 apples, then new mean = $(53 \times 10 - 50 - 58)/8 = 52.75$. The mean would decrease 2 Useful calculation; correct interpretation Useful figures/calculations/reasoning and “no” 1 “No” is insufficient interpretation Useful figures/calculations/reasoning and “the mean will change” 1 The interpretation is equivalent to “no” Mean will be smaller because Mia ate 2 apples 0 Insufficient use of figures No, because the total weight and the number of apples have changed 0 No calculations/reasoning/use of figures. No, the mean will change 0 No calculations/reasoning/use of figures.
			Total	2	
1 7	a		Correct histogram with four bars with frequency densities 2.8, 2.3, 2.1, [0].8 and correct width bars	3	B2 for two correct bar heights Or B1 for one correct bar height or two correct frequency densities from 2.8, 2.3, 2.1, [0].8 soi Bar heights should be accurate, tolerance for plotting and drawing the bars is $\pm \frac{1}{2}$ small square
	b		e.g. the mean should be higher because these people would have taken longer than 40 minutes	1	Response Mark The mean should be higher because these people would have taken longer than 40 minutes 1 The recorded time is less than the actual time 1 They might have taken a lot longer 1 bod Actual time [for some people] is over 40 minutes 1 There are some people more than 40 who are counted as 40 1 bod She used the mid-interval values 0 Results are not uniformly distributed within each group 0 She did not use all the results 0
			Total	4	
1 8	a	i	32	3	M1 for $12 \div 40$ soi by 0.3 M1 for $0.9k \times 20$ [+] $1.4k \times 10$ implied by 18 and 14 may be on diagram May be soi on the vertical axis (e.g. labelling the scale with [0.5,]1, [1.5, 2]. Where k is a consistent scaling of the height of the bars e.g. 3.6×20 [+] 5.6×10, 18×20 [+] 28×10 etc

						Ignore extras
		ii	Unlikely the largest value will be 60 oe or The longest distance could be anywhere between 40 and 80 oe or Unlikely the smallest value will be 10 oe or The shortest distance could be anywhere between 0 and 20 oe	1		Accept: Exact distances are not known The data is in groups
	b		Median for July = 38 July distances were higher [on average] oe IQR for July = 34 July distances were more varied oe	1 1dep 1 1dep	Condone mean or average for July = 38 If 0 scored overall SC1 for two correct comparisons lacking values Response Mark The median in Dec is 30 compared to July 38. This means on average people ran further in July. The IQR in Dec is 20 compared to July 34 This means the distances run were more variable in July. Value. Compare the meaning of “on average” with “average” in the ninth example. We want a general interpretation in context. Value. Interpretation in context. 1 1 1 1 The median in Dec is 30 compared to July 38. This means the distances run in July were greater. The IQR in Dec is 20 compared to July 34. More people tended to run similar distances in December. Value. A general interpretation in context. Value. Interpretation in context. 1 1 1 1 In July the runners on average ran longer distances at 38 km, while in December they ran shorter distances at 30km. In July the runners had a much larger IQR of distances at 34 km, while in December they had a smaller IQR. Value. Comparison in	Condone not repeating the given values for December Need figures in comment/work space Comparison comment must be general and have context for second and fourth marks Accept for first mark “median is 8 more in July” oe Accept for third mark “IQR is 14 less in Dec” oe e.g. SC1 for “median for Dec was lower” and “IQR for July was higher” oe

				context. “on average” is a general comparison, which is what is looked for. Value. IQR not interpreted as a measure of variation. 1 1 1 0 July has a higher median distance run (38 km > 30 km). December has a smaller IQR compared to July (20 km < 34 km). This means December has a smaller spread of distances compared to July. Value. Not an interpretation. Value. Interpretation in context. 1 0 1 1 The mean in July is 38. The range in July is 34. Condone mean for value mark. Condone range for value mark. 1 0 1 0 The mean in July is 38. The IQR in July is 34. This means there is a bigger range of distances in July. Condone mean for value mark. Not accepting “range” in the interpretation as it also has a technical meaning. 1 0 1 0 The median distance run in July was 38 compared to 30 in December The IQR in July is 34 compared to 20 in December Value. Not an interpretation. Value. Not an interpretation. 1 0 1 0 The median distance in July was 8 km more than in December. The IQR is 14 km higher in July than in December. Implies July is 38 km. Not an interpretation. Implies July is 34 km. Not an interpretation. 1 0 1 0 The median distance run in Dec is 30 km compared to July 38 km. This means their average is less than July. The IQR for December is less than July so it’s more consistent. Value. “average” being used as another word for “median” rather than as a general descriptor. No value. No context; dependent on the previous mark in any case. 1 0 0 0 There was a higher average of km in July. More spread out results in July. No values. Comparison marks are dependent on value marks. However, they have two correct comparisons lacking values and context. SC1 July had a higher median meaning people were running further. July had a larger average compared to December. No value. Correct comparison in context but mark is dependent on value mark. The second statement is not about IQR. Therefore, SC1 cannot be awarded. 0 0 0 0	
			Total	8	
1 9			Only have data on students up to 14 years old oe	1	Accept e.g. The trend may not continue The line of best fit should not extend beyond the data provided Outside range of data provided oe Small sample Do not accept e.g. 16 is not on the graph The graph does not go to 16 (alone) Ignore incorrect statements

					Reason must refer to or imply <u>no data</u> above 14 and not just refer to <u>the graph</u> not going above 14 alone. Accept children, plots/points as implying data. Response Mark 1 It is extrapolated and not in the data provided 1 2 The diagram has no ages/<u>data above 14</u> (underlined part gets the mark) 1 3 Insufficient data (small sample reference) 1 4 The graph does not go up to 16 <u>as there is no data above 14</u> (underlined part gets the mark) 1 5 We do not know that the pattern of growth will continue above 14 (implies trend may not continue) 1 6 The graph <u>does not cover that data range</u> (allow for the underlined part) 1 7 There are no children on the graph above 14 (accept children for data) 1 8 There are no plots/points on the graph above 14 (accept plots/points for data) 1 9 Medical deficiencies (not sufficient to describe trend may not continue) 0 10 Doesn't have a growth disorder (not sufficient to describe trend may not continue) 0 11 Grows normally (not sufficient to describe trend may not continue) 0 12 The graph reaches up to 14 (not referring to data) 0 13 Extrapolated (needs explanation) 0 14 As you may stop growing by 16 (not sufficient to describe trend may not continue) 0 15 The graph only goes up to 14 (not referring to data) 0 16 The graph does not show information for 16 year olds 0 17 By 16 they won't be growing at the same rate (not referring to data) 0 18 Because it goes beyond the value on the axes 0 19 Because they could grow more or stop growing 0 20 There is no data 0
			Total	1	
20	a		18, 38, 60, 72, 80	2	M1 for cf calculated with one arithmetic error Allow 80 or <i>their</i> 80 FT
	b		Plots at right-hand end of intervals Plots at correct heights Join with smooth curve or straight line segments	1 1 1	Tol ½ square; FT if M1 in (a) Tol ½ square; FT their ascending plots only Plots of frequencies scores 0 across the whole of (b) 0 for bars at correct heights since must miss off one end; if cf graph as well as bars, ignore bars

					Condone curve or absence of curve below $t = 25$	
	c	i	For 2 marks must say right/correct/true not yes Sight of 20 or 60 $20/80 = \frac{1}{4}$ or $\frac{1}{4}$ of 80 = 20 $60/80 = \frac{3}{4}$ or $\frac{3}{4}$ of 80 = 60	1 1	Must be separate from the fraction comment. Do not accept more than/less than 60/20. Accept equivalent in words Reason Judgement Mark Correct, $\frac{1}{4}$ of 80 is 20 and 20 cyclists took more than 40 minutes. 1 1 True, $\frac{3}{4}$ of 80 = 60 and 60 cyclists took 40 minutes or less, leaving $\frac{1}{4}$ to take more than 40 minutes. 1 1 Right, 20 cyclists completed the race in over 40 minutes and $20/80 = \frac{1}{4}$. 1 1 Right, 60 cyclists took less than 40 minutes and $\frac{3}{4}$ of 80 = 60. 1 1 Wrong, 60 cyclists took less than 40 minutes and $\frac{3}{4}$ of 80 = 60. Despite "wrong", mark the comments but do not award full marks 1 0 Yes, 20 cyclists took more than 40 minutes and $\frac{1}{4}$ of 80 = 20. Do not award 2 marks with "yes" 1 0 Correct, if you add the amount of times after 40 you get 20 and there's 80 cyclists. 1 0 Right, 60 cyclists took less than 40 minutes. 1 0 Wrong, 20 cyclists took more than 40 minutes. Despite "wrong", mark the comment 1 0 True, the upper quartile is at 40 mins. Implies 60 1 0 $\frac{1}{4}$ of 80 = 20. 0 1	
		ii	wrong/incorrect/false and correct reason	1	e.g. cannot be sure as exact data not given; it could be anywhere between 45 and 50 etc Reason Judgement Mark Wrong, all we know is that it is between 45 and 50 Condone 46 and 50 1 Wrong, there is a range of values for the time so not definitely 50 1 Wrong, as the time is given as a range 1 Wrong, we are not given the accurate values 1 Wrong, it might be but we need to know the exact values to find out 1 Wrong, they may have all been less than 50 all 1 Wrong, some cyclists may have taken 49.5 minutes some 0 Wrong, we need more data Ambiguous 0 Right, 50 is the highest value 0 Right [with any comment] 0	

			Total	8	
2 1	a		Two correct different observations from these three categories No values shown e.g. Pie chart only shows proportions not totals 3D aspect e.g. 3D distorts perspective oe Colours/key unclear e.g. The colour/key are too similar oe	2	B1 for one correct observation e.g. We have no total/numbers/figures/frequency e.g. It's tilted, slanted, seen from an angle, etc Where more than two reasons are given, mark the best unless contradicted e.g. ignore all references to missing angles Do not allow 2 marks for two reasons that refer to the same category Two reasons may appear in the same statement e.g. Its slanted and it does not show the total number [gets 2 marks] Comments about no numbers 1 There are no numbers/figures/scale [to indicate total or numbers in sector] 1 2 You don't know what it's out of. You need to total [frequency] 1 3 It's difficult to tell the size of each fraction of the pie chart <u>and we need the total</u> (<i>we need the total gets the mark</i>) 1 4 We need to know the angle sizes <u>and what it's out of</u> (<i>and what it's out of gets the mark provided they don't say it's out of 360</i>) 1 5 Pie charts show proportions/fractions/%'s but do not show quantities 1 Comments about 3D aspect 6 Morgan is viewing the chart from the side not the front 1 7 It's 3D 1 8 It is hard to see the fractions/proportions 1 9 The sections at the front look larger than those at the back 1 10 <u>It's slanted</u> so it's hard to measure the angles (<i>It's slanted gets the mark</i>) 1 11 Not able to measure angles <u>owing to the positioning of the pie chart</u> (<i>gets it for the underlined part</i>) 1 Comments about key/colours 12 Segments are not <u>clearly</u> labelled (ref to colour reason) 1 13 The colours look the same. Some of the years are the same colour. 1 14 The parts need to be <u>clearly</u> labelled <i>BOD related to colour</i> 1 15 The colours are confusing 1 16 It does not tell us the size of each sector (<i>size does not imply number – could be angles</i>) 0 17 Pie charts are for discrete data only 0

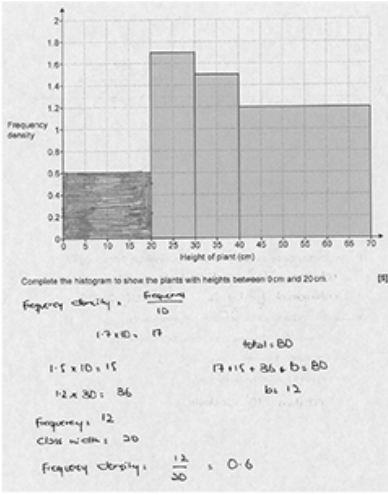
				18 It might not be accurate 0 19 We need to know the angle sizes 0 20 There are better ways to present the data 0 21 It doesn't have any labels (<i>Not true – there are labels but not very clear</i>) 0 22 It is an estimated number of users 0 23 The data is not in percentages. 0 24 The sectors have no angles/percentages/fractions 0 25 The sections are similar in size making it unclear 0 26 Not exact figures/data lost 0
	b	60	4	B1 for 0.5 and 0.8 or 3 [rows] and 5 [rows] oe AND M2 for $\frac{\text{their } 0.8 - \text{their } 0.5}{\text{their } 0.5}$ or $\frac{\text{their } 0.8 - \text{their } 0.5}{\text{their } 0.5} \times 100$ or for $\frac{\text{their } 0.8}{\text{their } 0.5} \times 100$ [–100] oe or M1 for $\frac{\text{their } 0.8}{\text{their } 0.5}$ Accept work in thousands for B and M marks i.e. 500 000 and 800 000 M2 soi by 0.6[0] or 160 M1 soi by 1.6[0]
		Total	6	
2 2	a	Any correct criticism e.g. small sample sample not random as many in the population cannot be in the sample i.e. they may be at work no control over the number of adults and children	3	B1 for each Response Mark small size small sample condone use of 'population') 1 only collect from 20 people 1 need a larger sample size 1 bias introduced as many are at work/school so not in sample 1 not random only collect on one day / should collect on many days / collect at different times / collect at different places 1BOD People are excluded mostly older people in library at that time 1 test is random so it is biased/unfair 1BOD many people work on Monday afternoon 1 data collected from one set of people 1 all children at school so not in sample 1 Question asks for criticisms so criteria is: i.e. larger sample size i.e. not randomly selected as some are excluded i.e. reasonable proportions of adults and children do not allow a repeated point

					only interviewing people from the same area 1 people in the library don't exercise 0 don't know if people tell the truth 0 some people would have been out before 2 pm 0 No control over strata no control over number of adults and children 1 might be all/many adults 1 might be no children in the sample as all at school 1 needs to be 'enough' adults and 'enough' children in sample 1 number of adults and children not equal/must be equal 1BOD they should interview the same amount of children and adults 1BOD there may be an uneven number of adults and children 1BOD children are at school so they will interview more adults 1
	b		overlapping groups oe or there is no option for over 18h	1	e.g. where does 3 go? select best comment
			Total	4	
2 3	a		0.62	2	M1 for 8.6 – 7.98 or 7.98 to 8.6
	b		15	2	M1 for 0.25×60 oe
	c	i	Azmi's hamster/median is shorter than the box plot's median oe	1	With no incorrect statement Accept 'middle' for 'median' Accept $8.25 < 8.32$ It is below the box plot median [8.32]
		ii	Spread/range/IQR of Azmi's lengths is not known oe or sample is too small oe	1	With no incorrect statement Accept 'They only measured the middle hamster' oe Accept 'Lengths of Azmi's other hamsters are not known' oe Azmi only has 5 hamsters, which makes the data unreliable for comparison
			Total	6	
2 4			First bar < ($170 \leq h < 180$) at 'height' 1.8	6	

			Second bar ($180 \leq h < 200$) at height 0.4		M2 for $\frac{2.4 \times 3 \times 10}{4 \times 10}$ oe Or M1 for 2.4×10 AND B1 for <i>their</i> bar correctly drawn at $\frac{\text{their } 18}{10}$ AND M2 for $\frac{\text{their } 60 - \text{their } 18 - 24 - \text{their } 0.5 \times 20}{20}$ oe Or M1 for <i>their</i> $60 - \text{their } 18 - 24 - \text{their } 0.5 \times 20$ oe AND B1 for <i>their</i> bar correctly drawn at $\frac{\text{their } 8}{20}$	M2 implied by 'first bar height' 1.8 M1 implied by 18, 24 or 60 M2 implied by 'second bar' height 0.4 M1 implied by 8
			Total	6		
2 5			31.6[2...] with correct working	5	Accept 32 with correct working Correct working requires at least evidence of B1 B1 M1 B1 for at least 4 correct frequencies from 6, 18, 11, 13, 12, 14 B1 for at least 4 correct midpoints from 5, 15, 25, 35, 45, 55 M1 for Σmf using <i>their</i> midpoints and <i>their</i> frequencies soi by $30+270+275+455+540+770$ or by 2340 May be implied by correct products seen 30, 270, 275, 455, 540, 770 May be implied by correct products seen 30, 270, 275, 455, 540, 770 <i>their</i> midpoints must lie in the range of <i>t</i> for each interval Lower: [0 or 6]+180+220+390+480+700 Upper:60+360+330+520+600+840 Allow one error in calculation <i>their</i> frequencies must not be the cumulative frequencies	

					M1dep for <i>their</i> $\frac{\Sigma mf}{74}$ If 0 or 1 scored, instead award SC2 for final answer 31.6[2...] with no working or insufficient working If 0 scored, instead award SC1 for 2340 with no working or insufficient working dep on first M1
					Examiner's Comments Few candidates were able to complete this question correctly, although just under half managed to gain some of the part marks. Candidates could gain B1 for the correct mid-points of each interval, but many subsequently used the end points of each interval. Candidates needed to find the frequency of each interval to gain further marks, with B1 given for the correct frequencies and then M1 for multiplying these by the mid-points and summing the answers. Finally, candidates needed to divide by 74 (the number of customers), but many instead divided by 6 (the number of intervals) or 60 (the end of the final time interval).
			Total	5	
2 6	a		Correct box plot	3	B2 for 4 or 5 correct markers or B1 for 3 correct markers or 16 or 60 soi Markers must be associated with the correct statistic e.g do not allow median marked as UQ Examiner's Comments This was generally well answered. Many candidates were able to calculate that the lowest value is 16 and the upper quartile is 60 from the given information. Errors included misinterpreting the scale when drawing the diagram, or in some cases not having a '5 point' box plot.
	b		11Q [because] it has a smaller IQR oe	1	

					Accept: 11Q [because] its IQR is 18 but the IQR of 11P is 24 or 25 Do not accept if median also mentioned or if incorrect values given <u>Examiner's Comments</u> Few candidates were successful here. Many said 11P and referred to it as having a greater range or interquartile range. Those that chose 11Q often gave an incorrect reason and referred to median or range and not the interquartile range being smaller.
			Total	4	
2 7			Correct bar width and height of 0.6	5	M2 for $10 \times 1.7 + 10 \times 1.5 + 30 \times 1.2$ or better e.g. $17 + 15 + 36$ or 68 or M1 for one correct frequency calculated e.g. one of 17 or 15 or 36 AND M1 for $80 - \text{their } 68$ soi by 12 M1 for $\text{their } 12 \div 20$ soi by 0.6 or a correct bar drawn from <i>their</i> frequency <u>Examiner's Comments</u> Few candidates knew how to work out the frequency from a histogram. Those that did know usually made a very good attempt at this question with many correct responses seen. Some did find the missing frequency of 12 but they calculated the frequency density by dividing 20 by 12 instead of the other way round. Exemplar 2

					 Complete the histogram to show the plants with heights between 0 cm and 20 cm. Frequency density = $\frac{\text{Frequency}}{\text{Class width}}$ $1.7 \times 10 = 17$ Total = 80 $1.5 \times 10 = 15$ $17 + 15 + 36 + b = 80$ $1.2 \times 30 = 36$ $b = 12$ Frequency = 12 Class width = 20 Frequency density = $\frac{12}{20} = 0.6$
			Total	5	
2 8	a	i	32	3	M1 for $18 \div 20$ soi by 0.9 M1 for $2k \times 10$ [+] $0.3k \times 40$ implied by 20 and 12 may be on diagram May be soi on the vertical axis (eg. labelling the scale with [0.5,]1, [1.5, 2]. Where k is a consistent scaling of the height of the bars eg 4×10 [+] 0.6×40, 40×10 [+] 6×40 etc Ignore extras Examiner's Comments About half of the candidates were able to find 0.9 as the frequency density for the first bar, often marking this on the vertical axis without working. Most of these candidates were then able to find the sum of the areas of the two required bars as $20 + 12 = 32$, again with minimal working being shown. Despite having 0.9 correct on their scale, it was common for these candidates to make errors in continuing the scale, with the equivalent of 0.5, 1, 2, 3, 4 being frequently seen. This then leads to an answer of $30 + 12 = 42$, but if working was not shown then M marks could not be given for these wrong values. A very common incorrect scale was 10, 20, 30, 40, 50, which was really just using the bar height as the frequency and then

					summing the heights of the two bars as $40 + 6 = 46$ scoring 0 marks. A little better with the same scale were those who found areas $40 \times 10 + 6 \times 40 = 640$ and these candidates scored M1 if working was shown.
		ii	Unlikely the largest value will be 80 oe or The longest distance could be anywhere between 40 and 80 oe or Unlikely the smallest value will be 0 oe or The shortest distance could be anywhere between 0 and 20 oe	1	Accept: Exact distances are not known The data is in groups <u>Examiner's Comments</u> About a third of candidates gave a sufficiently clear explanation. The response most frequently seen was that it was 'unlikely that someone would run 0 km' (or '80 km'). Many responses were too definite in phrasing, such as 'nobody will run...'. Some showed lack of understanding of the range by saying 'not everyone will run 80 km'. The safest answer, with less chance of unclear wording, was to say, 'it is grouped data and so exact values are not known'. This was seen occasionally, but not frequently.
		b	Median for July = 26 July distances were lower [on average] oe IQR for July = 36 July distances were more varied oe	1 1 dep 1 1 dep	Condone mean or average for July = 26 If 0 scored overall SC1 for two correct comparisons lacking values Condone not repeating the given values for December Need figures in comment/work space Comparison comment must be general and have context for second and fourth marks Accept for first mark "median is 4 more in Dec" oe Accept for third mark "IQR is 16 less in Dec" oe eg SC1 for "median for July was lower" and "IQR for July was higher" oe

				For additional information refer to 2023 June (J56006) Mark scheme Appendix within downloadable additional mark guidance. <u>Examiner's Comments</u> Most candidates realised they were being asked to comment on the median and IQR and gave the correct values of each for July, scoring 2 marks. Far fewer explained what they meant in terms of the distances run in the two months. Despite part (a)(ii) highlighting that the range for December is not known, a few candidates tried to compare the ranges. Other candidates did not heed the instructions to include values and were thus limited to a maximum of SC1. The best responses gave interpretations in context, such as ‘the median for July is 26 km, which means members ran further on average in December’ and ‘the IQR for July is 36 km, which means the spread of distances ran in July was much greater than in December’. Assessment for learning Candidates need to be careful in the language used when interpreting statistical data. For example, something like ‘July’s median of 26 is less than the median for December’ was often followed by ‘so the average for July is less’ despite this adding nothing to the first part. Similarly, referencing July’s IQR as showing a ‘greater range of distances run’ is ambiguous and is better expressed as showing a ‘greater variation in distances run’.	
			Total	8	
2 9			Only have data on students up to 14 years old oe	1	Accept e.g. The trend may not continue The line of best fit should not extend beyond the data provided Outside range of data provided oe Small sample Do not accept e.g.

					17 is not on the graph The graph does not go to 17 (alone) Ignore incorrect statements Response For additional information refer to 2023 June (J56005) Mark scheme Appendix within downloadable additional mark guidance. <u>Examiner's Comments</u> Most candidates were aware why the data would be unreliable to estimate the height of a 17-year-old, but a number did not score that mark. One common reason for not scoring the mark was to not reference the data provided and only refer to the graph. Careful reading of the question would identify the importance of referencing the given data in the answer. A second type of response was to write about rates of growth of 17-year-olds compared to 14-year-olds; again, as no reference to the data was made, no mark was given. Exemplar 1 <i>It is outside the list of collected data. No data is collected past 14 years.</i> This is an example of an acceptable explanation that refers to 17 being outside the range of the data provided. Reasons that just referred to the graph not going to 17 were not enough. Responses needed to reference no data at 17, or that the value 17 was beyond the data provided in the question.
			Total	1	
30	a	i	20	1	<u>Examiner's Comments</u> Few candidates could deduce the interquartile range. A wide variety of wrong answers were given.
		ii	25	1	<u>Examiner's Comments</u>

				It was extremely rare for a candidate to know that the interval between the lower quartile and the median contained 25% of the apples. Instead, answers of 50% and 37.5% were both very common.  Misconception The very low success rate in parts (a)(i) and (a)(ii) suggests that candidates of all abilities may be mechanically constructing or reading the key statistics from box plots without really appreciating what the quartiles and median actually represent in terms of percentage.
	b	Box plot drawn with: Lowest = 25 Lower Quartile = 45 Median = 60 Upper quartile = 65 Highest = 75	3	B2 for 4 or 5 correct markers or B1 for 3 correct markers Examiner's Comments Most candidates plotted markers at the given values of 45, 60 and 75. Errors commonly seen included not finding the weight of the lightest apple correctly, marking the mean in addition to the median, or not marking 65 as the upper quartile. When candidates had the five correct markers, they usually produced a correctly drawn box plot. If more than 5 markers, mark the worst 5 Award the markers even if not correctly representing the information
	c	Calculation/reasoning/use of figures Correct interpretation	1 1dep	For additional information refer to 2022 November (J56006) Mark scheme Appendix within downloadable additional mark guidance. Examiner's Comments Candidates needed to engage with the context, and this was best done by using the figures and then interpreting the outcome. Good responses found the mean of the two apples as 62 g and then reasoned that the mean of the remaining apples must therefore be greater than 63 g. Similarly, for arguments based on one eaten apple being 5 g below the mean and one being 3 g above the mean. Many worked with the figures correctly but then interpreted that the mean of the remaining apples will be less than 63 g.

			Total	7	
3 1	a		correct histogram with four bars with frequency densities 2.4, 1.9, 1.2, [0].55 and correct width bars	3	B2 for two correct bar heights or B1 for one correct bar height or two correct frequency densities from 2.4, 1.9, 1.2, [0].55 so bar heights should be accurate, condone for height $0.5 \leq \text{bar} \leq 0.6$ tolerance for plotting and drawing the bars is $\pm \frac{1}{2}$ small square Examiner's Comments There were some excellent answers, but some incorrect approaches too. Some candidates divided all the frequencies by 10. A few found the midpoint of each group and then calculated the mean. A few plotted a frequency curve.
	b		e.g. the mean should be higher because these people would have taken longer than 50 minutes	1	For additional information refer to 2022 November (J56004) Mark scheme Appendix within downloadable additional mark guidance. Examiner's Comments There were some good responses including a comment about the low total time due to so many not solving the puzzle. Some incorrectly stated that as it was an estimate, it cannot be correct.
			Total	4	
3 2	a		Correct cumulative frequency curve	5	B2 for 8 22 30 42 59 64 can be implied from plots or M1 for cf calculated with one arithmetic M2 for accurately plotting these frequencies against the upper group values or M1 for accurately plotting these frequencies against a group value condoning one error B1 for an accurate curve FT their frequencies and dep on increasing frequencies tolerance for plotting and drawing the curve is $\pm \frac{1}{2}$ small square and ignore curve before (20, 8), if they draw bars award M1 if the bars are the same widths as the groups. Examiner's Comments Most candidates did not work out the cumulative frequencies and produced a frequency graph. Some did calculate the cumulative

					frequencies, but they tended to plot them against the group mid-values.
	b		cycling and medians [cycling] 40 to 43 [tennis] 51	2	FT <i>their</i> curve for medians providing it is increasing frequencies B1 for one correct median or a statement with one error See appendix condone a statement which is equivalent and condone tennis median of 50 to 52 and condone 'average' for 'median' For additional information refer to 2022 November (J56004) Mark scheme Appendix within downloadable additional mark guidance. <u>Examiner's Comments</u> Most candidates interpreted the graph correctly and chose the cycling club. Many struggled to give evidence to support their decision. The words 'on average' in the question were meant to encourage the use of the graph to find the medians. The use of the shape of the graphs and comparison of frequencies were also both accepted.
			Total	7	
3 3	a		Any correct criticism e.g. small sample sample not random as many in the population cannot be in the sample i.e. they may be at work no control over the number of adults and children	3	B1 for each Question asks for criticisms so criteria is : i.e larger sample size i.e not randomly selected as some are excluded i.e reasonable proportions of adults and children do not allow a repeated point Response Mark small sample (condone use of 'population') 1 only collect from 25 people 1 need a larger sample size 1 bias introduced as many are at work/school so not in sample 1 only collect on one day/ should collect on many days/ collect at different times/collect at different places 1BOD mostly older people on the street at that time 1 test is random so it is biased/unfair 1BOD many people work on Monday morning 1 data collected from one set of people 1 all children at school so not in sample 1 only interviewing people from the same area 1

				people in the High Street don't exercise 0 don't know if people tell the truth 0 some people would have been out before 11 am 0 no control over number of adults and children 1 might be all/many adults 1 might be no children in the sample as all at school 1 needs to be 'enough' adults and 'enough' children in sample 1 number of adults and children not equal/must be equal 1BOD they should interview the same amount of children and adults 1BOD there may be an uneven number of adults and children 1BOD children are at school so they will interview more adults 1 <u>Examiner's Comments</u> The question was quite clear about criticising the method of data collection but many candidates included comments about the truth of the answers given by the subjects and about where and how people exercised. Question 10 is not about what questions were asked but the people who were asked these questions. However most candidates gave at least one acceptable response and many gave at least two acceptable criticisms. Many repeated a point and this prevented them from gaining all the marks.
	b		overlapping groups or there is no option for over 20h	1 e.g where does 2 go? select best comment <u>Examiner's Comments</u> Some candidates were concerned about the table being empty or that there were no totals rather than the limit to the hours in a week or the overlapping nature of the classes.
			Total	4
3 4	a		20, 44, 69, 76, 80	2 M1 for cf calculated with one arithmetic error Allow 80 or <i>their</i> 80 FT <u>Examiner's Comments</u> The majority of candidates completed the cumulative frequency table correctly, with a few others having one arithmetic slip. Some candidates had little idea on how to complete the table, with some repeating the frequencies, some dividing each <i>t</i> limit by 5 and a few attempting frequency densities.
	b		Plots at right-hand end of intervals	1

			Plots at correct heights Join with smooth curve or straight line segments	1 1	Tol $\frac{1}{2}$ square; FT if M1 in (a) Tol $\frac{1}{2}$ square; FT their ascending plots only Condone curve or absence of curve below $t = 25$ <u>Examiner's Comments</u> Most candidates with correct values in part (a) usually plotted their points correctly. However, a significant proportion of these candidates did not join the points with a curve or straight-line segments. Although there was some follow through permitted from part (a), most candidates who had struggled there either omitted this part, or they produced a bar chart or other incorrect plot.	Plots of frequencies scores 0 across the whole of (b) 0 for bars at correct heights since must miss off one end; if cf graph as well as bars, ignore bars
	c	i	For 2 marks must say right/correct/true not yes Sight of 20 or 60 $20/80 = \frac{1}{4}$ or $\frac{1}{4}$ of 80 = 20 $60/80 = \frac{3}{4}$ or $\frac{3}{4}$ of 80 = 60	1 1	Must be separate from the fraction comment. Do not accept more than/less than 60/20. <u>Exemplar Responses</u> Reason, Judgement, Marks Correct, $\frac{3}{4}$ of 80 is 60 and 20 cyclists completed within 30 minutes, leaving the remaining $\frac{1}{4}$ of cyclists taking over 30 minutes 1,1 True, $\frac{3}{4}$ of 80 = 60 and 60 cyclists took more than 30 minutes 1,1 Right, 20 cyclists completed the race in under 30 minutes and $20/80 = \frac{1}{4}$. 1,1 Right, 60 cyclists took more than 30 minutes and $\frac{3}{4}$ of 80 = 60. 1,1 Wrong, 60 cyclists took more than 30 minutes and $\frac{3}{4}$ of 80 = 60. Despite "wrong", mark the comments but do not award full marks. 1,0 Yes, 60 cyclists took more than 30 minutes and $\frac{3}{4}$ of 80 = 60. Do not award 2 marks with "yes". 1,0 Correct, if you add the amount of times after 30 you get 60 and there's 80 cyclists. 1,0 Right, 60 cyclists took more than 30 minutes. 1,0	Accept equivalent in words

					Wrong, 60 cyclists took more than 30 minutes. Despite “wrong”, mark the comment. 1,0 True, the lower quartile is at 30mins. Implies 20. 1,0 $\frac{3}{4}$ of 80 = 60. 0,1 <u>Examiner’s Comments</u> The distribution of marks was quite uniform. For full marks, candidates needed to answer “right” and reference the cumulative frequency of 20 cyclists completing in less than or equal to 30 minutes and link this to $\frac{3}{4}$ of 80 being the remaining 60 cyclists taking more than 30 minutes. Equivalent statements were accepted.
		ii	wrong/incorrect/false and correct reason	1	e.g. cannot be sure as exact data not given; it could be anywhere between 45 and 50 etc <u>Exemplar Responses</u> Reason. Judgement. Mark Wrong, all we know is that it is between 45 and 50. Condone 46 and 50. 1. Wrong, there is a range of values for the time so not definitely 50. 1 Wrong, as the time is given as a range. 1 Wrong, we are not given the accurate values. 1 Wrong, it might be but we need to know the exact values to find out. 1 Wrong, they may have all been less than 50. all. 1 Wrong, some cyclists may have taken 49.5 minutes. some. 0 Wrong, we need more data. Ambiguous. 0 Right, 50 is the highest value. 0 Right [with any comment]. 0 <u>Examiner’s Comments</u> Most candidates incorrectly answered “right”. Even with “wrong”, the reason was often incorrect; “the graph may not show all the cyclists” being common. Misconception

					 Many candidates did not have an understanding of what a cumulative frequency table, cumulative graph and the associated inequality notation actually represents.
			Total	8	
3 5	a		Two correct different observations from these three categories No values shown e.g. Pie chart only shows proportions not totals 3D aspect e.g. 3D distorts perspective oe Colours/key unclear e.g. The colour/key are too similar oe	2	B1 for one correct observation e.g. We have no total/numbers/figures/frequency e.g. It's tilted, slanted, seen from an angle etc Where more than two reasons are given, mark the best unless contradicted e.g. ignore all references to missing angles Do not allow 2 marks for two reasons that refer to the same category Two reasons may appear in the same statement e.g. Its slanted and it does not show the total number [gets 2 marks] <u>Exemplar Responses</u> Comments about no numbers There are no numbers/figures/scale [to indicate total or numbers in sector] 1 You don't know what its out of. You need to total [frequency] 1 Its difficult to tell the size of each fraction of the pie chart and we need the total (we need the total gets the mark) 1 We need to know the angle sizes and what its out of (and what its out of gets the mark provided they don't say its out of 360) 1 Pie charts show proportions/fractions/%'s but do not show quantities 1 Comments about 3D aspect She is viewing the chart from the side not the front 1 Its 3D 1 It is hard to see the fractions/proportions 1 The sections at the front look larger than those at the back 1 Its slanted so its hard to measure the angles (Its slanted gets the mark) 1

				Not able to measure angles owing to the positioning of the pie chart (gets it for the underlined part) 1 Comments about key/colours Segments are not clearly labelled (ref to colour reason) 1 The colours look the same. Some of the years are the same colour. 1 The parts need to be clearly labelled BOD related to colour 1 The colours are confusing 1 It does not tell us the size of each sector (size does not imply number – could be angles) 0 Pie charts are for discrete data only 0 It might not be accurate 0 We need to know the angle sizes 0 There are better ways to present the data 0 It doesn't have any labels (Not true – there are labels but not very clear) 0 It is an estimated number of users 0 The data is not in percentages. 0 The sectors have no angles/percentages/fractions 0 The sections are similar in size making it unclear 0 Not exact figures/data lost 0 <u>Examiner's Comments</u> The majority of candidates gave one correct reason, usually that they needed numbers for the sectors or a total for the pie chart. The 3D aspect was also recognised by some. Insufficient reasons often mentioned the need for percentages or angles or stating that a bar chart would be a better option without explaining why.
b	75	4	B1 for 0.8 and 1.4 or 3 [rows] and 4 [rows] oe AND M2 for $\frac{\text{their } 1.4 - \text{their } 0.8}{\text{their } 0.8}$ or $\frac{\text{their } 1.4 - \text{their } 0.8}{\text{their } 0.8} \times 100$ or for $\frac{\text{their } 1.4}{\text{their } 0.8} \times 100$ [-100] oe or M1 for $\frac{\text{their } 1.4}{\text{their } 0.8}$ <u>Examiner's Comments</u>	Accept work in billions for B and M marks i.e 800 000 000 and 1 400 000 000 M2 soi by 0.75 or 175 or M1 soi by 1.75

					Many scored full marks here and almost all candidates scored at least 1 mark. The most common error was to use 1.4 as the denominator in their fraction when converting to a percentage. Many others gave the correct fraction and conversion $\frac{0.6}{0.8} \times 100$ but then used longer division methods with decimals instead of recognising that $\frac{0.6}{0.8}$ was equivalent to $\frac{3}{4}$ which would give an easily recognisable conversion to 75%. The longer methods often led to arithmetic errors.  Misconception When calculating a percentage change, the change is always measured against the original value. So when forming a fraction to convert to a percentage, the original value should always be the denominator.
			Total	6	
3 6	a		Four correct plots (70, 86) (44, 60) (37, 48) (38, 50)	2	B1 for 2 or 3 correct plots Overlay gives guidance, tolerance $\pm \frac{1}{2}$ small square
	b		Positive	1	Ignore embellishments
	c	i	Circles (30, 66) only	1	Accept any clear indication
		ii	120	3	M2 for $\frac{66-30}{30}[\times 100]$ oe or for $\frac{66}{30} \times 100 [-100]$ oe or M1 for $\frac{66}{30}$ oe or for $66 - 30$ oe For M2 and M1 FT <i>their</i> (c)(i), point <u>must</u> be chosen for FT (table or graph) M2 implied by 1.2 or 220 M1 implied by 2.2 or 36
	d		No and line of best fit should not extend beyond data provided oe	1	eg only have data up to 70 marks. No one scored that high [so the trend may not continue]. He would need to extrapolate beyond the line of best fit. Do not accept e.g. the graph

						only goes up to 90 for the second test
			Total	8		
3 7	a		0.64	2	M1 for $7.64 - 7$ or 7 to 7.64	
	b		45	2	M1 for 0.75×60 oe	
	c	i	Sam's mouse/median is longer than the box plot's median oe	1		With no incorrect statement Accept 'middle' for 'median' Accept $7.35 > 7.28$ It is above the box plot median [7.28]
		ii	Spread/range/IQR of Sam's lengths is not known oe or sample is too small oe	1		With no incorrect statement Accept 'He only measured the middle mouse' oe Accept 'Lengths of Sam's other mice are not known' oe Sam only has 5 mice which makes the data unreliable for comparison
			Total	6		
3 8			First bar($170 \leq h < 180$) at 'height' 2.4 Second bar($180 \leq h < 200$) at height 0.5	6	M2 for $\frac{3.2 \times 3 \times 10}{4 \times 10}$ oe or M1 for 3.2×10 B1 for <i>their</i> bar correctly drawn at $\frac{\text{their } 24}{10}$ AND M2 for $\frac{\text{their } 80 - \text{their } 24 - 32 - \text{their } 0.7 \times 20}{20}$ oe or M1 for <i>their</i> $80 - \text{their } 24 - 32 - \text{their } 0.7 \times 20$ oe AND B1 for <i>their</i> bar correctly drawn at $\frac{\text{their } 10}{20}$	M2 implied by 'first bar height' 2.4 M1 implied by 24, 32 or 80 M2 implied by 'second bar' height 0.5 M1 implied by 10
			Total	6		