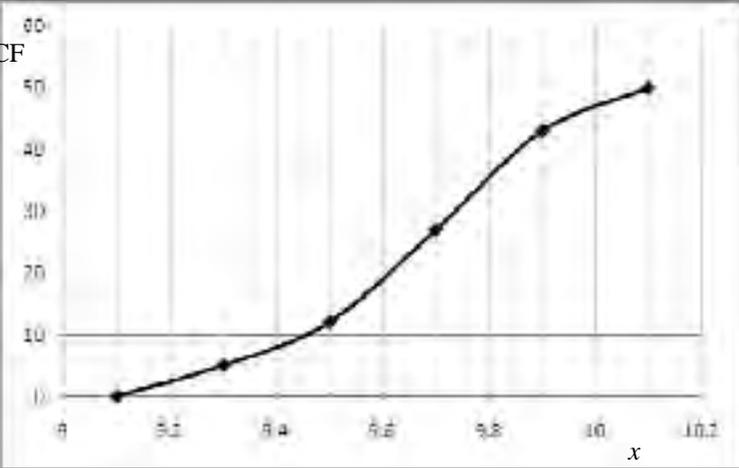


1		<p>Inter-quartile range = $18.1 - 17.8 = 0.3$</p> <p>Lower limit $17.8 - (1.5 \times 0.3) (= 17.35)$ No outliers at lower end.</p> <p>Upper limit $18.1 + (1.5 \times 0.3) (= 18.55)$ (Max is 18.6) so at least one outlier at upper end.</p>	<p>B1</p> <p>M1 A1</p> <p>M1 A1</p>	<p>dep on 17.35</p> <p>dep on 18.55</p>	<p>FT their IQR for M marks only Allow 'No values below 17.35 for first A1 Allow 'Lower limit = 17.35 so no outliers (at lower end)' Watch for use of median giving 17.45 which gets MOA0 You must be convinced that comments about no outliers refer to lower tail only.</p> <p>Allow 'At least one value above 18.55' for second A1 Allow 'any value above 18.55 is an outlier' so at least one outlier.</p>
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<p>2 (a)</p>	<table border="1" data-bbox="219 178 958 269"> <tr> <td>Upper Bound</td> <td>9.1</td> <td>9.3</td> <td>9.5</td> <td>9.7</td> <td>9.9</td> <td>10.1</td> </tr> <tr> <td>Cumulative frequency</td> <td>0</td> <td>5</td> <td>12</td> <td>27</td> <td>43</td> <td>50</td> </tr> </table> 	Upper Bound	9.1	9.3	9.5	9.7	9.9	10.1	Cumulative frequency	0	5	12	27	43	50	<p>B1 for cumulative frequencies</p> <p>G1 for scales</p> <p>G1 for labels</p> <p>G1 for points (Provided plotted at correct UCB positions)</p> <p>G1 for joining points</p> <p>All G's dep on attempt at cumulative frequency but not cumulative fx's or other spurious values.</p>	<p>May be implied from graph. Condone omission of 0 at this stage.</p> <p>Linear horizontal scale. Linear vertical scale: 0 to 50 (no inequality scales - Not even <9.1, <9.3, $<9.5 \dots$)</p> <p>Heating quality or x and Cumulative frequency or just CF or similar but not just frequency or fd nor cumulative fd</p> <p>5 Plotted as (UCB, their cf). Ignore (9.1,0) at this stage. No midpoint or LCB plots. Plotted within $\frac{1}{2}$ small square</p> <p>For joining all of 'their points' (line or smooth curve) AND now including (9.1,0) dep on previous G1</p> <p>Mid point or LCB plots may score first three marks</p> <p>Can get up to 3/5 for cum freq bars Allow full credit if axes reversed correctly</p> <p>Lines of best fit could attract max 4 out of 5.</p>
Upper Bound	9.1	9.3	9.5	9.7	9.9	10.1											
Cumulative frequency	0	5	12	27	43	50											
<p>(b)</p>	<p>Median = 9.67</p>	<p>B1 FT Allow answers between 9.66 and 9.68 without checking curve. Otherwise check curve.</p>	<p>3 Based on 25th to 26th value on a cumulative frequency graph ft their mid-point plot (not LCB's) approx 9.57 for m.p. plot Allow 9.56 to 9.58 without checking B0 for interpolation</p>														

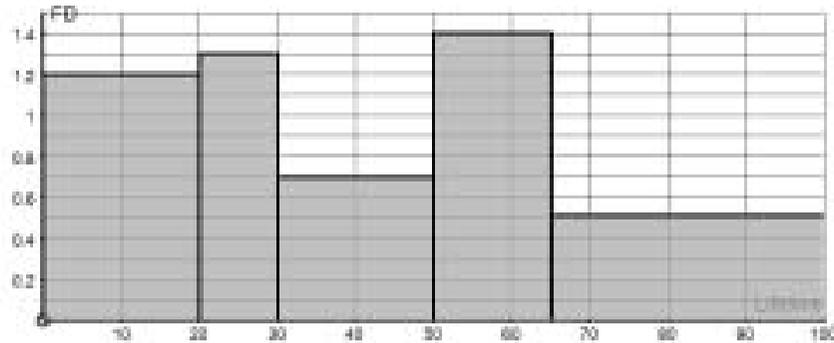
	<p>$Q1 = 9.51$ $Q3 = 9.83$ Inter-quartile range = $9.83 - 9.51 = 0.32$</p>	<p>B1 FT for Q3 or Q1 B1 FT for IQR providing both Q1 and Q3 are correct Allow answers between 9.50 and 9.52 and between 9.82 and 9.84 without checking curve. Otherwise check curve.</p>		<p>Based on 12th to 13th and 37th to 38th values on a cumulative frequency graph fit their mid -point plot (not LCB's) approx $Q1 = 9.42$; $Q3 = 9.73$ Allow 9.41 to 9.43 and 9.72 to 9.74 without checking B0 for interpolation Allow correct IQR from graph if quartiles not stated</p> <p>Lines of best fit: B0 B0 B0 here.</p>
(c)	<p>Lower limit $9.51 - 1.5 \times 0.32 = 9.03$ Upper limit $9.83 + 1.5 \times 0.32 = 10.31$ Thus there are no outliers in the sample.</p>	<p>B1 FT their Q_1, IQR B1 FT their Q_3, IQR E1 NB E mark dep on both B marks</p>	3	<p>Any use of <u>median</u> ± 1.5 IQR scores B0 B0 E0</p> <p>If FT leads to limits above 9.1 or below 10.1 then E0 No marks for ± 2 or 3 IQR</p> <p>In this part FT their values from (ii) if sensibly obtained (eg from LCB plot) or lines of best fit, but not from location ie 12.5, 37.5 or cumulative fx's or similar. For use of mean $\pm 2s$, Mean = 9.652, $s = 0.235$, Limits 9.182, 10.122 gets M1 for correct lower limit, M1 for correct upper limit, zero otherwise, but E0 since there could be outliers using this definition</p>

Question		Answer								Marks	Guidance																			
3	(a)	<table border="1"> <tr> <td>Upper Bound</td> <td>20</td> <td>30</td> <td>40</td> <td>50</td> <td>60</td> <td>70</td> <td>80</td> <td>90</td> </tr> <tr> <td>Cumulative Freq</td> <td>0</td> <td>10</td> <td>40</td> <td>82</td> <td>105</td> <td>114</td> <td>119</td> <td>120</td> </tr> </table>								Upper Bound	20	30	40	50	60	70	80	90	Cumulative Freq	0	10	40	82	105	114	119	120	B1	Cumulative frequencies All correct	
		Upper Bound	20	30	40	50	60	70	80	90																				
		Cumulative Freq	0	10	40	82	105	114	119	120																				
								G1	For plotted points (Provided plotted at correct UCB positions)																					
									G1	For joining points (within ½ a square)																				
										G1	For scales																			
								G1			For labels																			
									All marks dep on good attempt at cumulative frequency, but not cumulative fx's or other spurious values.																					
									[5]	Plotted within ½ small square If cf not given then allow G1 for good attempt at cf. e.g. if they have 0,10,40,72,95,104,109,110																				

Question		Answer	Marks	Guidance
3	(b)	<p>Median = 45</p> <p>Q1 = 37 Q3 = 53</p> <p>Inter-quartile range = $53 - 37 = 16$</p>	<p>B1</p> <p>B1</p> <p>B1</p> <p>[3]</p>	<p>Allow answers between 44 and 46 without checking curve. Otherwise check curve. No marks if not using diagram.</p> <p>For Q3 or Q1 Allow Q1 between 37 and 38 without checking Allow Q3 between 52 and 54 without checking</p> <p>For IQR providing both Q1 and Q3 are correct</p> <p>Based on 60th value ft their curve (not LCB's) Allow 40 for m.p. plot without checking graph B0 for interpolation If max value wrong (eg 110) FT their max value for all 3 marks</p> <p>Based on 30th and 90th values ft their curve (not LCB's) Allow Q1 = 32; Q3 = 48 without checking graph</p> <p>B0 for interpolation B2 for correct IQR from graph if quartiles not stated but indicated on graph Allow from mid-point plot Must be good attempt at cumulative frequency in part (i) to score any marks here Lines of best fit: B0 B0 B0 here. Also cumulative frequency bars: B0 B0 B0 here</p>

4**(a)**

Lifetime (x hours)	Frequency	Width	FD
$0 < x \leq 20$	24	20	1.2
$20 < x \leq 30$	13	10	1.3
$30 < x \leq 50$	14	20	0.7
$50 < x \leq 65$	21	15	1.4
$65 < x \leq 100$	18	35	0.51



M1 for fds
A1 CAO

Accept any suitable unit
for fd such as eg freq
per 10 hours.

L1 linear scales on both
axes and label on vert
axis

W1 width of bars
H1 height of bars

5**(b)**

Median lies in third class interval ($30 < x \leq 50$)

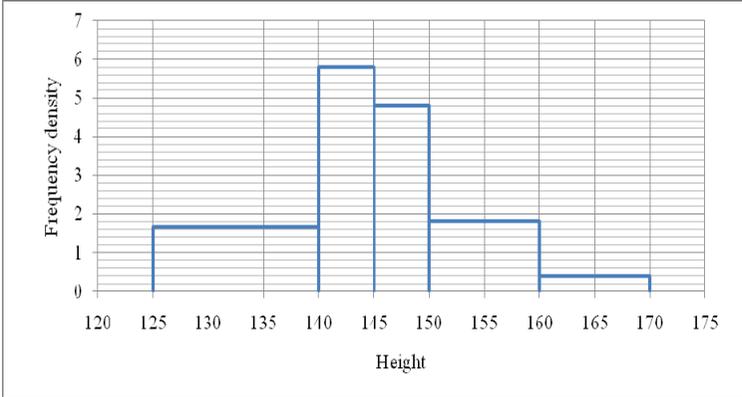
Median = 45.5th lifetime (which lies beyond 37 but not as far
as 51)

B1 CAO

E1 *dep* on B1

2**TOTAL****7**

Question		Answer	Marks	Guidance
5	(a)	$4 + \frac{1}{2} \text{ of } 18 = 4 + 9 = 13$	M1 A1 [2]	For $\frac{1}{2}$ of 18 cao 13/100 gets M1A0
	(b)	(Median) = 50.5 th value $\text{Est} = 140 + \left(\frac{25.5}{29}\right) \times 5 \quad \text{or} = 140 + \left(\frac{50.5 - 25}{54 - 25}\right) \times 5$ $= 144.4$	M1 M1 A1 [3]	For 50.5 seen For attempt to find this value SC2 for use of 50 th value leading to Est = $140 + (25 / 29 \times 5) = 144.3$ (SC1 if over-specified) or Est = $145 - \left(\frac{3.5}{29}\right) \times 5 = 144.4$ NB no marks for mean = 144.35 NB Watch for over-specification

Question	Answer	Marks	Guidance																								
5 (c)	<table border="1" data-bbox="389 235 1131 515"> <thead> <tr> <th>Height</th> <th>Fre</th> <th>Group width</th> <th>Frequency density</th> </tr> </thead> <tbody> <tr> <td>$125 \leq x \leq 140$</td> <td>25</td> <td>15</td> <td>1.67</td> </tr> <tr> <td>$140 < x \leq 145$</td> <td>29</td> <td>5</td> <td>5.80</td> </tr> <tr> <td>$145 < x \leq 150$</td> <td>24</td> <td>5</td> <td>4.80</td> </tr> <tr> <td>$150 < x \leq 160$</td> <td>18</td> <td>10</td> <td>1.80</td> </tr> <tr> <td>$160 < x \leq 170$</td> <td>4</td> <td>10</td> <td>0.40</td> </tr> </tbody> </table> 	Height	Fre	Group width	Frequency density	$125 \leq x \leq 140$	25	15	1.67	$140 < x \leq 145$	29	5	5.80	$145 < x \leq 150$	24	5	4.80	$150 < x \leq 160$	18	10	1.80	$160 < x \leq 170$	4	10	0.40	<p>M1 For fd's - at least 3 correct</p> <p>A1 Accept any suitable unit for fd such as eg freq per cm. correct to at least one dp allow 1.66 but not 1.6 for first fd</p> <p>G1 linear scales on both axes and label on vertical axis</p> <p>W1 width of bars</p> <p>H1 height of bars</p>	<p>M1 can be also be gained from freq per 10 – 16.7, 58, 48, 18, 4 (at least 3 correct) or freq per 5 – 8.35, 29, 24, 9, 2 for all correct. If fd not explicitly given, M1 A1 can be gained from all heights correct (within one square) on histogram (and M1A0 if at least 3 correct)</p> <p>Linear scale and label on vertical axis IN RELATION to first M1 mark ie fd or frequency density or if relevant freq/10, etc (NOT eg fd/10). However allow scale given as fd×10, or similar Accept f/w or f/cw (freq/width or freq/class width) Can also be gained from an accurate key G0 if correct label but not fd's. Must be drawn at 125, 140 etc NOT 124.5 or 125.5 etc NO GAPS ALLOWED Must have linear scale. No inequality labels on their own such as $125 \leq S < 140$, etc but allow if a clear horizontal linear scale is also given. Ignore horizontal label.</p> <p>Height of bars – must be linear vertical scale. FT of heights dep on at least 3 heights correct and all must agree with their</p>
Height	Fre	Group width	Frequency density																								
$125 \leq x \leq 140$	25	15	1.67																								
$140 < x \leq 145$	29	5	5.80																								
$145 < x \leq 150$	24	5	4.80																								
$150 < x \leq 160$	18	10	1.80																								
$160 < x \leq 170$	4	10	0.40																								

Question			Answer	Marks	Guidance												
				[5]	fds If fds not given and at least 3 heights correct then max M1A0G1W1H0 Allow restart with correct heights if given fd wrong (for last three marks only)												
5	(d)	4 boys 0.6×15 = 9 girls So 5 more girls	M1 A1 A1 [3]	For 0.6×15 For 9 girls cao	Or $45 \times 0.2 = 9$ (number of squares and 0.2 per square)												
	(e)	Frequencies and midpoints for girls are <table border="1" style="margin-left: 20px;"> <tr> <td>Height</td> <td>132.5</td> <td>142.5</td> <td>147.5</td> <td>155</td> <td>167.5</td> </tr> <tr> <td>Frequency</td> <td>18</td> <td>23</td> <td>31</td> <td>19</td> <td>9</td> </tr> </table> So mean = $\frac{(132.5 \times 18) + (142.5 \times 23) + (147.5 \times 31) + (155 \times 19) + (167.5 \times 9)}{100}$ $= \frac{(2385) + (3277.5) + (4572.5) + (2945) + (1507.5)}{100}$ $= 146.9$ (Exact answer 146.875)	Height	132.5	142.5	147.5	155	167.5	Frequency	18	23	31	19	9	B1 B1 M1 M1* Dep on M1 A1 [5]	For at least three frequencies correct At least three midpoints correct For attempt at $\sum xf$ For division by 100 Ca NB Watch for over-specification	No further marks if not using midpoints For sight of at least 3 xf pairs Allow answer 146.9 or 147 but not 150 NB Accept answers seen without working (from calculator) Use of 'not quite right' midpoints such as 132.49 or 132.51 etc can get B1B0M1M1A0
Height	132.5	142.5	147.5	155	167.5												
Frequency	18	23	31	19	9												

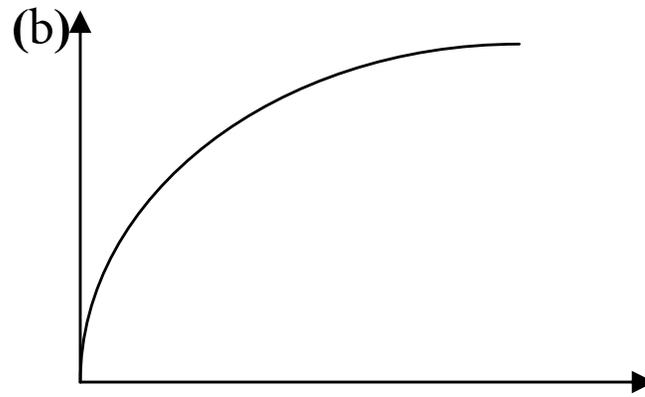
<p>6 (a)</p>	<p>Median = 4.06 – 4.075 (inclusive)</p> <p>$Q_1 = 3.8$ $Q_3 = 4.3$</p> <p>Inter-quartile range = $4.3 - 3.8 = 0.5$</p>	<p>B1cao</p> <p>B1 for Q_1 (cao) B1 for Q_3 (cao)</p> <p>B1 ft for IQR must be using t-values not locations to earn this mark</p>	<p>4</p>
<p>(b)</p>	<p>Lower limit ‘ their 3.8’ – $1.5 \times$ ‘their 0.5’ = (3.05) Upper limit ‘ their 4.3’ + $1.5 \times$ ‘their 0.5’ = (5.05) Very few if any temperatures <u>below 3.05</u> (but not zero) None <u>above 5.05</u> ‘So few, if any outliers’ scores SC1</p>	<p>B1ft: must have -1.5 B1ft: must have +1.5 E1ft dep on -1.5 and Q_1 E1ft dep on +1.5 and Q_3</p> <p>Again, must be using t-values NOT locations to earn these 4 marks</p>	<p>4</p>
<p>(c)</p>	<p>Valid argument such as ‘Probably not, because there is nothing to suggest that they are not genuine data items; (they do not appear to form a separate pool of data.)’ Accept: exclude outlier – ‘measuring equipment was wrong’ or ‘there was a power cut’ or ref to hot / cold day [Allow suitable valid alternative arguments]</p>	<p>E1</p>	<p>1</p>
<p>(d)</p>	<p>Missing frequencies 25, 125, 50</p>	<p>B1, B1, B1 (all cao)</p>	<p>3</p>
<p>(d)</p>	<p>Mean = $(3.2 \times 25 + 3.6 \times 125 + 4.0 \times 243 + 4.4 \times 157 + 4.8 \times 50) / 600$ $= 2432.8 / 600 = 4.05(47)$</p>	<p>M1 for at least 4 midpoints correct and being used in attempt to find $\sum ft$ A1cao: awfw (4.05 – 4.055) ISW or rounding</p>	<p>2</p>

<p>7</p> <p>(a)</p>	<p>Median = 3370</p> <p>$Q_1 = 3050 \quad Q_3 = 3700$</p> <p>Inter-quartile range = $3700 - 3050 = 650$</p>	<p>B1</p> <p>B1 for Q_3 or Q_1</p> <p>B1 for IQR</p>	
<p>(b)</p>	<p>Lower limit $3050 - 1.5 \times 650 = 2075$</p> <p>Upper limit $3700 + 1.5 \times 650 = 4675$</p> <p>Approx 40 babies below 2075 and 5 above 4675</p> <p>so total 45</p>	<p>B1</p> <p>B1</p> <p>M1 (for either)</p> <p>A1</p>	
<p>(c)</p>	<p>Decision based on convincing argument:</p> <p>eg 'no, because there is nothing to suggest that they are not genuine data items and these data may influence health care provision'</p>	<p>E2 for convincing argument</p>	
<p>(d)</p>	<p>All babies below 2600 grams in weight</p>	<p>B2 CAO</p>	

<p>8 (a) axes and labels points</p> <p>(3,0) (15,160) (20,320) (35,480) (60,640)</p> <p>(b) accept 60 – 70 for straight lines 40 – 70 for curve</p>	<p>B1</p> <p>B1 B1</p> <p>3</p> <p>M1</p> <p>A1</p> <p>2</p>	<p>For correct uniform scales and labels on both axes, accept Frequency, %CF, Number of people, allow axes reversed, allow halves</p> <p>For 3 correct points</p> <p>All points correct and reasonable graph incl straight lines</p> <p>For subtracting from 640 can be implied</p> <p>For correct answer, reasonably compatible with graph</p>
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<p>5 (i) 30-35 years</p>	<p>B1</p> <p>1</p>	
<p>(ii) 4.8×5 $= 24$</p>	<p>M1</p> <p>A1</p> <p>2</p>	<p>Multiplying by 5</p> <p>Correct answer</p>
<p>(iii) $4 + 18 + 24 + 28 + 26 + 10$ $= 110$</p>	<p>M1</p> <p>A1</p> <p>2</p>	<p>Summing their 6 attempts at frequencies</p> <p>Correct answer</p>

10 (a) $a = 494$
 $b = 46$



(c) median is
13.5 to 14.6 min

A1