Question Number	Scheme	Marks
1 (a)	$\bar{x} = \frac{58}{40} = \underline{\mathbf{1.45}}$	B1
	$\sigma^2 = \frac{84.829}{40} - 1.45^2$	M1
	$= 0.018225$ = awrt $\underline{\mathbf{0.0182}}$	A1
		(3)
(b)	New mean = $\underline{\mathbf{145}}$	B1ft
	New σ = $\underline{\mathbf{13.5}}$	B1
		(2)
(c)(i)	**Reason** e.g. mean of two extra children is the same as the original mean	M1
	Conclusion the mean is therefore unchanged or = $\underline{\mathbf{145}}$	A1
(ii)	**Reason** e.g. extra children <u>more than 1 sd</u> from mean so increased spread	M1
	Conclusion therefore standard deviation will increase	A1
		(4)
		[9]

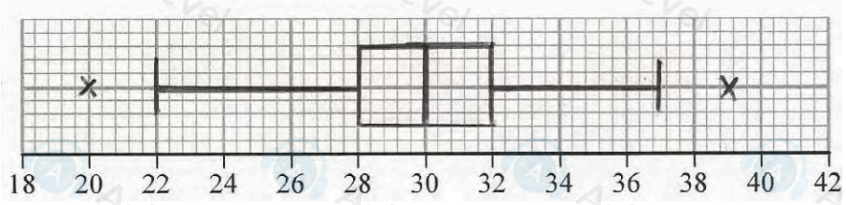
Question	Scheme	
2(a)	$\left[\sum x_B =\right] 54\times 45 - 24\times 47 \left[= 1302\right]$ or $\frac{24\times 47 + 30b}{54} = 45$	M1
	$\left[\bar{x} =\right] \frac{54\times 45 - 24\times 47}{30} = 43.4$ *	A1*
		(2)
(b)	$\sqrt{\frac{66876+73826}{54} - 45^2} =$ or $\sqrt{\frac{(66876+73826) - \frac{2430^2}{54}}{54}}$	M1
	24.095…. awrt 24.1	A1
		(2)
(c)(i)	No effect as e.g. adding 2 to each does not change the variance	B1
(ii)	Increase as e.g. the total mark will increase	B1
(iii)	Decrease as e.g. the mean mark of class B is closer to the mean mark of class A	B1
		(3)

Question Number	Scheme	Marks
5(a)	$0.9 < x \leq 1.1$ group - width **0.5** (cm)	B1
	1.5 cm^2 is 2 seeds or 6.75 cm^2 is 9 seeds or $0.5c = 6.75$ or $\frac{9}{0.2} \times 0.3$ oe	M1
	$0.9 < x \leq 1.1$ group - height **13.5** (cm)	A1 (3)
(b)	The data/weights are continuous	B1 (1)
(c)	Mean = 1.4125 awrt **1.41**	B1
	$\sigma = \sqrt{\frac{101.56}{48} - \left(\frac{113}{80}\right)^2} = 0.347...$ awrt **0.347** (s = awrt 0.351)	M1M1A1 (4)
(d)	Median = $[1.3] + \frac{3}{11} \times 0.2$ allow $(n+1) = [1.3] + \frac{3.5}{11} \times 0.2$	M1
	= awrt **1.35 or 1.355** (or if using $(n+1)$ allow awrt **1.36**)	A1 (2)
(e)	$\frac{27}{48}$ oe 0.5625 (allow 0.563)	B1 (1)
(f)	Mean increases **and** standard deviation decreases e.g. '$\sum fy$ increases (so the mean increases) **and** an extreme value has been replaced/data is more concentrated around the mean (so the standard deviation decreases)'	B1 depB1 (2)
	Notes	Total 13

Question Number	Scheme		Marks
5 (a)	[Time is] continuous		B1 (1)
(b)	16 photographers = 160 small squares or 64 photographers = 640 small squares or $\frac{16}{160} = 0.1$ or $\frac{64}{640} = 0.1$ or $\frac{160}{16} = 10$ or $\frac{640}{64} = 10$ Frequency density = 1.6 or Correct scale on the frequency density axis		M1
	$\frac{x}{240} = \frac{16}{160}$ oe or $\frac{(20-12)}{10} \times 16 + \frac{(24-20)}{5} \times 14$		M1
	= 24		A1 (3)
(c)	**Using n**	**Using $n+1$**	
	$[Q_2 =] 20 + \frac{(32-21)}{35-21} \times (25-20)$ oe or $25 - \frac{35-32}{35-21} \times (25-20)$ oe	$[Q_2 =] 20 + \frac{(32.5-21)}{35-21} \times (25-20)$ oe or $25 - \frac{35-32.5}{35-21} \times (25-20)$ oe	M1
	= awrt 23.9	= awrt 24.1	A1 (2)
(d)	Mean = Median or Mean ≈ Median		M1
	e.g. Appropriate decision. Consistent with expectation for a normal distribution.		A1ft (2)
	Notes		**Total 8**

1(a)	eg 60 people = 1.5 large squares/6 medium squares/150 small squares **or** eg 1 person = 0.025 large squares/0.6 medium squares/2.5 small squares **or** eg [1 small square =] 0.4 people/[1 medium square =] 10 people/[1 large square =] 40 people eg a correct f.d. eg 60/(20 – 10) [= 6] eg a correct frequency, 100, 70, 20, 24 associated with the appropriate bar	B1
	eg $\frac{8}{10}\times 20$ **or** $\frac{15}{30}\times 24$ **or** 8×2 **or** 0.8×15 **or** $\frac{40}{2.5}$ **or** $\frac{30}{2.5}$ **or** $8\times 5\times 0.4$ $2\times 15\times 0.4$ **or** 16 **or** 12 **or** 70×0.4	M1
	28 people	A1
		(3)
(b)	$\text{Median} = [5] + \frac{5}{70}\times 37$ or $[10] - \frac{5}{70}\times 33$	M1
	$= 7.642...$ **awrt 7.64**	A1
		(2)
(c)	$\sum \text{midpoint} \times \text{freq} = 2.5\times 100 + 7.5\times 70 + 15\times 60 + 25\times 20 + 45\times 24 [= 3255]$	M1
	$\text{Mean} = \frac{"3255"}{274}$	dM1
	$= 11.879...$ **awrt 11.9**	A1
		(3)
	Notes	**Total 8**

Question Number	Scheme	Marks
3 (a)	Width = **2.5 (cm)**	B1
	1.5 cm² for freq of 5 so $6\times 1.5 = 9$ cm² for freq of 30 or fd $= \frac{5}{3}\ w \times h = 9$	M1
	So $h = 9 \div 2.5$ or $6 \div \frac{5}{3}$ = **3.6 (cm)**	A1
		(3)
(b)	$Q_2 = [12] + \frac{16}{25}\times 3$ allow use of $(n+1)$ giving $[12] + \frac{16.5}{25}\times 3$	M1
	$= 13.92 =$ awrt **13.9**	A1
		(2)
(c)(i)	$\sum fx = 5\times 6.5 + 13\times 9 + 16\times 11 + 25\times 13.5 + 30\times 17.5 + 11\times 24 = 1452$	M1
	$\bar{x} = 14.52 =$ awrt **14.5**	A1
		(2)
(ii)	$\sum fx^2 = 6.5^2\times 5 + 9^2\times 13 + 11^2\times 16 + 13.5^2\times 25 + 17.5^2\times 30 + 24^2\times 11 = 23\,280$	M1
	$\sigma_x = \sqrt{\frac{"23\,280"}{100} - ("14.52")^2}$ or $\sqrt{21.9696}$	M1
	$\sigma_x = 4.687... =$ awrt **4.69**	A1
		(3)
(d)	$\frac{1}{2}\times 13 + 16 + 25 + 30 + \frac{1}{4}\times 11$	M1
	So proportion is 80.25 % or 0.8025 awrt **0.803**	A1
		(2)
(e)	Profit = $2.2\times "0.8025" + 0.8\times \frac{0.75\times 11}{100} - 1.2\times "\left(1 - \left[0.8025 + \frac{0.75\times 11}{100}\right]\right)"$	M1
	= 1.6935 awrt **1.7 (p)**	A1 (2)

Question Number	Scheme	Marks
2.(a)	29	B1 (1)
(b)	Median = 30 IQR = 32 – 28 = 4	B1 M1 A1 (3)
(c)	$'32'+1.5('4')[=38]$ or $'28'-1.5('4')[=22]$  	M1 B1 B1ft A1 (4)
(d)	*Westyou*: $[Q_2-Q_1=3,\ Q_3-Q_2=1$ or $(Q_2-Q_1)>(Q_3-Q_2)]\Rightarrow$ -ve(skew) *Eastyou*: $[Q_2-Q_1=2,\ Q_3-Q_2=2$ or $(Q_2-Q_1)=(Q_3-Q_2)]\Rightarrow$ symmetrical	B1B1ft depB1 (3)
	Notes	Total 11

Question Number	Scheme	Marks
4.(a)	Width: 15 minutes is 0.5 cm so 60 mins will be $4\times0.5=$ **2** (cm)	B1
	Height: freq of 25 represented by $6\times0.5=3$ (cm^2) so freq of 24 is $\frac{24}{25}\times3$	M1
	So height $=\frac{1}{"2"}\times\frac{24}{25}\times3=$ **1.44** (cm)	A1 (3)
(b)	$[Q_2=]\ \{30\}+\frac{(50-[25+17])}{28}\times30$ or e.g. $\frac{60-30}{70-42}=\frac{m-\{30\}}{50-42}$	M1
	$=38.571\ldots$ awrt **38.6**	A1 (2)
(c)	Use of midpoints to get $\sum fx=5070$ (allow 5000 to 1 sf)	M1
	$[\bar{t}$ or $\bar{x}]=$ **50.7**	A1 (2)
(d)	$[\sigma]=\sqrt{\frac{455\,512.5}{100}-"50.7"^2}$ or $\sqrt{1984.635}$	M1
	$=44.5492\ldots$ awrt **44.5**	A1 (2)
(e)	$\bar{t}$ or $\bar{x}>Q_2$ [allow "50.7" > "38.6" or formula] so positive (skew)	B1 (1)
(f)(i)	Median: **no change** Since e.g. all 18 values or all changes are still below the median	B2/1/0
(ii)	Mean: will be **smaller** Since e.g. changes will reduce total of x (7×7.5 not 25×7.5 in 1st class)	B1
(iii)	Standard deviation: will be **greater** Since e.g. (18 zeros means) data more spread out	(3) **[13 marks]**