Question Number	Scheme	Marks
3 (a)	Width = 1.6[cm]	B1
	$[\text{their}'h \times w'=]$awrt 21.0 or Area of 21[cm^2 for a frequency of 14] or FD = 1.6 or k = 1.75 or 1.5	M1
	Height = 13.125 (cm)	A1
		(3)
(b)	$[20.5]+\frac{32-21}{14}\times 5$ or $[20.5]+\frac{32.5-21}{14}\times 5$	M1
	= awrt 24.4 or = awrt 24.6	A1
		(2)
(c) (i)	$\frac{1517.25}{64}=23.707...=23.71*$	B1*
(ii)	$\sqrt{\frac{41368.3125}{64}-\left('\frac{1517.25}{64}'\right)^2}=9.1845....$ awrt 9.18	M1 A1
		(3)
(d)	Exact values are not known	B1
		(1)
(e)	Mean < Median so negative skew or Mean ≈ Median so no skew or $\frac{3("23.71"-"24.4"/"24.6")}{"9.1845"}$ so negative skew	B1ft
		(1)

	Notes	Total 10
(a)	**B1**	for width = 1.6 oe ignore units
	M1	for sight of 21 or 1.6 (provided this is not the width) or 1.75 or 1.5 which may be part of a calculation and may be unsimplified e.g. $21=14\times1.5$ so you may need to check this): Examples: $\left[\frac{\text{Height}}{\text{F.D.}}\Rightarrow\right]\frac{\text{Height}}{\frac{14}{5}(=2.8)}=\frac{7.5}{'1.6'}\Rightarrow\text{Height}=\frac{21}{'1.6'}$ (cm) **Using areas of the bars** $7.5\times3.2=24\,\text{cm}^2=16\,\text{photographers}\Rightarrow'1.6'\times h=\frac{14}{16}\times24\Rightarrow h=13.125$ **Using area proportional to frequency:** Frequency ratio: $\frac{14}{16}$ Width ratio is $\frac{5}{10}=\frac{1}{2}$ $\Rightarrow\frac{\text{Height}}{7.5}\times\frac{1}{2}=\frac{14}{16}\Rightarrow\text{Height}=\left(\frac{14}{16}\times2\right)\times7.5[=13.125]$ **Direct ratio formula:** $\frac{h_2}{h_1}=\frac{\frac{f_2}{w_2}}{\frac{f_1}{w_1}}\Rightarrow\frac{\text{Height}}{7.5}=\frac{\frac{14}{5}}{\frac{16}{10}}\Rightarrow\text{Height}=7.5\times\frac{\frac{14}{5}}{\frac{16}{10}}[=13.125]$ May be implied by 13.1 or better
	A1	13.125 oe (e.g. allow the exact fraction $\frac{105}{8}$ and allow 13.1 ignore units)
	SC	width = awrt 1.42 and height = awrt 14.8 score B0M1A0

(b)	**M1**	for a correct fraction including the sign to find the median using either n or $n + 1$ or allow the fraction including the sign if working from the upper limit e.g. $[25.5]-\frac{3}{14}\times 5$ Alternatively allow the equation: $\frac{32-21}{m-20.5}=\frac{14}{5}$ oe. May be implied by $\frac{171}{7}$ or $\frac{689}{28}$ or a correct answer.
	A1	for awrt 24.4 or awrt 24.6 Do not accept a fraction for this mark.
(c)(i)	**B1***	for a correct expression for the mean **or** 23.707… or better. Cannot be scored if only seen within the calculation for the standard deviation.
(ii)	**M1**	for a correct method to find the standard deviation including the square root i.e. $\sqrt{\frac{41368.3125}{64}-\mu^2}$. Follow through on their mean. May be implied by awrt 9.18 or $\sqrt{84.356..}$ May attempt $\sum fx^2$ using the table – look for an attempt with at least 3 correct products. Allow attempt at finding the s e.g. $\sqrt{\frac{41368.3125-64\times'23.707...'^2}{63}}=9.257...$ which may be implied by awrt 9.25 or awrt 9.26 or e.g. $\sqrt{85.6955...}$
	A1	awrt 9.18 or accept 9.185 or if using sample sd then awrt 9.26 or awrt 9.25 (correct answer scores 2/2)
(d)	**B1**	a correct reason given which explains that the exact values are not known. Do not allow references to the midpoints/exact values to score without further explanation that they are being used **because the exact values are not known** oe
(e)	**B1ft**	a correct comparison of the mean and median with a correct conclusion, ft their median or a correct calculation involving the **given** mean, their median and their standard deviation with a correct conclusion for their values. Note they may attempt to find the LQ and UQ for the data – they must be correct to at least 3sf if using n: $Q_1=17.4, Q_3=29.3$ if using $n+1$ $Q_1=17.5, Q_3=29.5$ $Q_2-Q_1>Q_3-Q_2\Rightarrow$ negative skew but condone incorrect values in this attempt if they have also made a comparison of the mean with their median which is correct and the conclusion using the quartiles is consistent with this. Any comparison with the mode only is B0