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4. A researcher is studying the birth weights of babies. A random sample of 98 babies was taken and their birth weights, w kg, are summarised in the table below.

Birth weight (w kg)	Frequency (f)	Birth weight midpoint (x)
$1.50 \leqslant w < 2.50$	16	2.00
$2.50 \leqslant w < 3.00$	24	2.75
$3.00 \leqslant w < 3.50$	32	3.25
$3.50 \leqslant w < 4.00$	14	3.75
$4.00 \leqslant w < 5.50$	12	4.75

(You may use $\sum fx = 311.5$ and $\sum fx^2 = 1051.125$)

A histogram is drawn to represent these data.

The bar representing the birth weight $1.50 \leqslant w < 2.50$ has a width of 1 cm and a height of 4 cm.

(a) Calculate the width and height of the bar representing birth weight $3.50 \leqslant w < 4.00$

(3)

(b) Use linear interpolation to estimate the lower quartile of the birth weights of the 98 babies.

(2)

The researcher estimated the median to be 3.14 kg and the upper quartile to be 3.55 kg.

(c) Use the median and quartiles to describe the skewness of these data.

(2)

(d) Find an estimate for (i) the mean birth weight
(ii) the standard deviation of the birth weights.

(3)

(e) Use the formula

$$\text{skewness} = \frac{3(\text{mean} - \text{median})}{\text{standard deviation}}$$

to estimate a value for the skewness of these data. Give your answer to 2 significant figures.

(2)

The researcher read that birth weights should be approximately normally distributed and decides to split the class $3.00 \leqslant w < 3.50$

The frequency for $3.00 \leqslant w < 3.25$ is 9 and the frequency for $3.25 \leqslant w < 3.50$ is 23

(f) (i) State, giving a reason, what the effect would be on the estimate of the median.

(ii) Without carrying out any further calculations state, giving a reason, what the effect of this change would be on the estimate of the mean.

(2)

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Question 4 continued

(Total 14 marks)

Q4