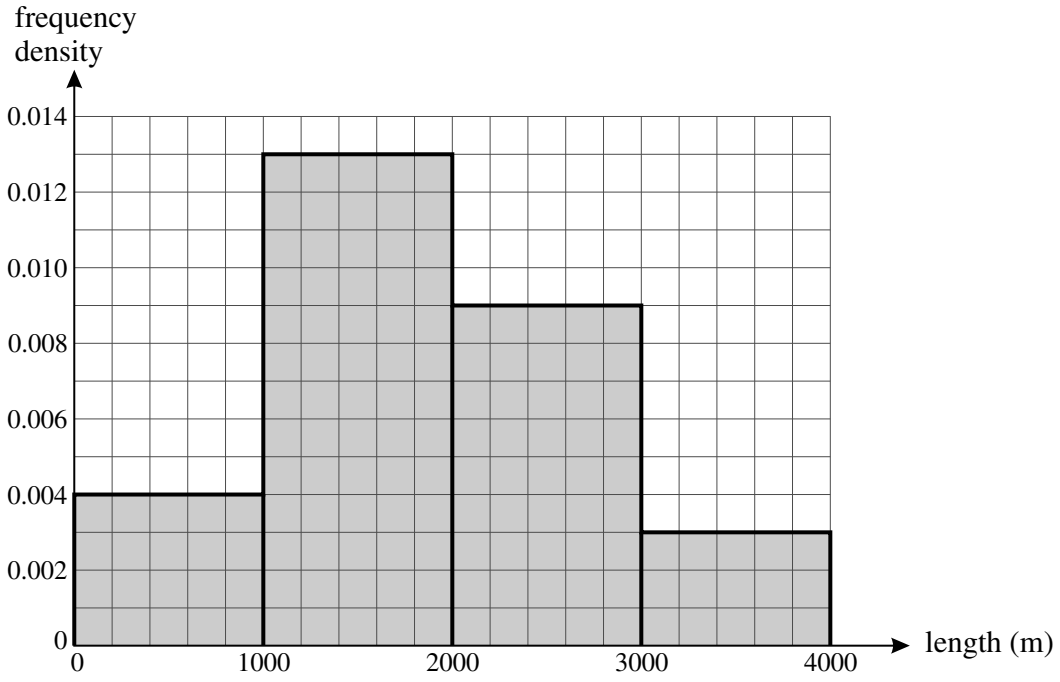
1 In the Paris-Roubaix cycling race, there are a number of sections of cobbled road. The lengths of these sections, measured in metres, are illustrated in the histogram.



(i) Find the number of sections which are between 1000 and 2000 metres in length. **[2]**

(ii) Name the type of skewness suggested by the histogram. **[1]**

(iii) State the minimum and maximum possible values of the midrange. **[2]**

2 Two fair six-sided dice are thrown. The random variable X denotes the difference between the scores on the two dice. The table shows the probability distribution of X.

r	0	1	2	3	4	5
$\mathrm{P}(X = r)$	$\frac{1}{6}$	$\frac{5}{18}$	$\frac{2}{9}$	$\frac{1}{6}$	$\frac{1}{9}$	$\frac{1}{18}$

(i) Draw a vertical line chart to illustrate the probability distribution. **[2]**

(ii) Use a probability argument to show that

(*A*) $\mathrm{P}(X = 1) = \frac{5}{18}$, **[2]**

(*B*) $\mathrm{P}(X = 0) = \frac{1}{6}$. **[1]**

(iii) Find the mean value of X. **[2]**

3 The heating quality of the coal in a sample of 50 sacks is measured in suitable units. The data are summarised below.

Heating quality (x)	$9.1 \leqslant x \leqslant 9.3$	$9.3 < x \leqslant 9.5$	$9.5 < x \leqslant 9.7$	$9.7 < x \leqslant 9.9$	$9.9 < x \leqslant 10.1$
Frequency	5	7	15	16	7

(i) Draw a cumulative frequency diagram to illustrate these data. **[5]**

(ii) Use the diagram to estimate the median and interquartile range of the data. **[3]**

(iii) Show that there are no outliers in the sample. **[3]**

(iv) Three of these 50 sacks are selected at random. Find the probability that

(A) in all three, the heating quality x is more than 9.5, **[3]**

(B) in at least two, the heating quality x is more than 9.5. **[4]**

4 The incomes of a sample of 918 households on an island are given in the table below.

Income (x thousand pounds)	$0 \leqslant x \leqslant 20$	$20 < x \leqslant 40$	$40 < x \leqslant 60$	$60 < x \leqslant 100$	$100 < x \leqslant 200$
Frequency	238	365	142	128	45

(i) Draw a histogram to illustrate the data. **[5]**

(ii) Calculate an estimate of the mean income. **[3]**

(iii) Calculate an estimate of the standard deviation of the incomes. **[4]**

(iv) Use your answers to parts **(ii)** and **(iii)** to show there are almost certainly some outliers in the sample. Explain whether or not it would be appropriate to exclude the outliers from the calculation of the mean and the standard deviation. **[4]**

(v) The incomes were converted into another currency using the formula $y = 1.15x$. Calculate estimates of the mean and variance of the incomes in the new currency. **[3]**