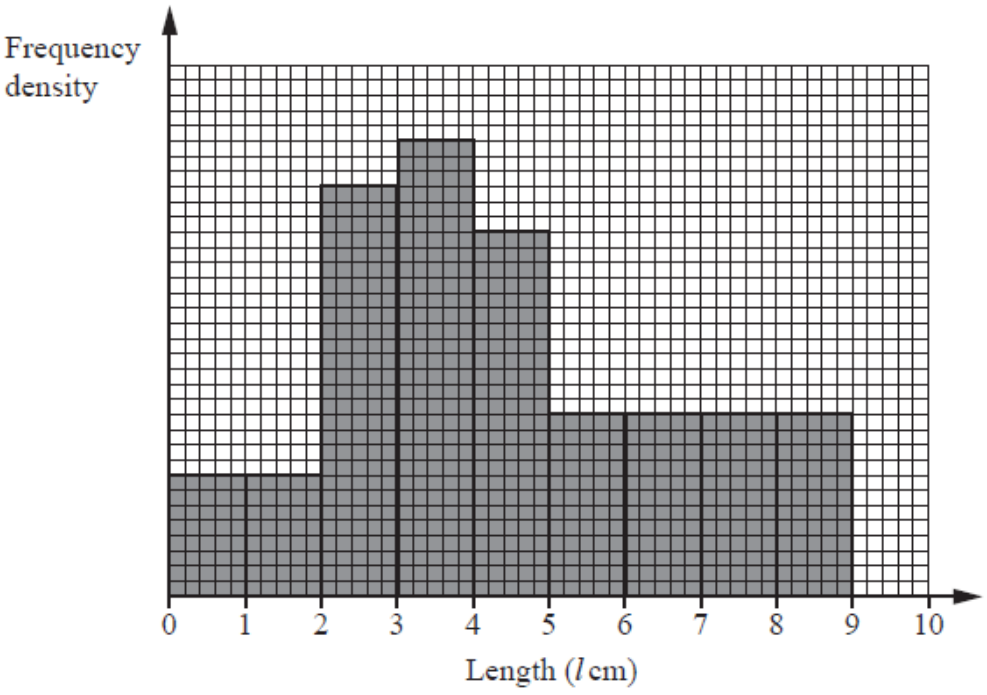
OCR
Oxford Cambridge and RSA

AS Level Mathematics A

H230/01 Pure Mathematics and Statistics

Question Set 6

1 The histogram shows information about the lengths, l centimetres, of a sample of worms of a certain species.



The number of worms in the sample with lengths in the class $3 \leqslant l < 4$ is 30. → Height = 30
width = 1

(a) Find the number of worms in the sample with lengths in the class $0 \leqslant l < 2$. **[2]**

H=8 W=2 ∴16

(b) Find an estimate of the number of worms in the sample with lengths in the range $4.5 \leqslant l < 5.5$. **[3]**

24×0.5+12×0.5=18

2 A researcher is studying changes in behaviour in travelling to work by people who live outside London, between 2001 and 2011.

He chooses the 15 Local Authorities (LAs) outside London with the largest decreases in the percentage of people driving to work, and arranges these in descending order.

The table shows the changes in percentages from 2001 to 2011 in various travel categories, for these Local Authorities.

Local Authority	Work mainly at or from home	Underground, metro, light rail, tram	Train	Bus, minibus or coach	Driving a car or van	Passenger in a car or van	Bicycle	On foot
Brighton and Hove	3.2	0.1	1.5	0.8	−8.2	−1.5	2.1	2.3
Cambridge	2.2	0.0	1.6	1.2	−7.4	−1.0	3.1	0.6
Elmbridge	2.9	0.4	4.1	0.2	−6.6	−0.7	0.3	−0.3
Oxford	2.0	0.0	0.6	−0.4	−5.2	−1.1	2.2	2.1
Epsom and Ewell	1.6	0.4	3.9	1.1	−5.2	−0.9	0.0	−0.6
Watford	0.7	2.0	3.1	0.4	−4.5	−1.2	0.0	−0.1
Tandridge	3.3	0.2	4.0	−0.1	−4.5	−1.1	0.0	−1.3
Mole Valley	3.3	0.1	1.9	0.3	−4.4	−0.7	0.2	−0.3
St Albans	2.3	0.3	3.4	−0.3	−4.3	−1.2	0.3	−0.2
Chiltern	2.9	1.4	1.4	0.1	−4.2	−0.6	−0.2	−0.8
Exeter	0.7	0.0	1.0	−0.6	−4.2	−1.5	1.7	3.4
Woking	2.1	0.1	3.7	0.0	−4.2	−1.3	−0.1	0.0
Reigate and Banstead	1.8	0.1	3.2	0.6	−4.1	−1.0	0.1	−0.2
Waverley	4.3	0.1	2.5	−0.5	−3.9	−0.9	−0.3	−0.9
Guildford	2.7	0.1	2.4	0.2	−3.6	−1.2	0.0	−0.3

1
2
3
4

(a) Explain why these LAs are not necessarily the 15 LAs with the largest decreases in the percentage of people driving to work. **[1]**

Doesn't include London LAs

(b) The researcher wants to talk to those LAs outside London which have been most successful in encouraging people to change to cycling or walking to work.
Suggest four LAs that he should talk to and why. **[2]**

(Labelled)

Largest increase on foot or by bike

(c) The researcher claims that Waverley is the LA outside London which has had the largest increase in the number of people working mainly at or from home.
Does the data support his claim? Explain your answer. **[1]**

Yes as 4.3 is the largest value in this category

Train and working from home – Largest values and all positive

(d) Which two categories have replaced driving to work for the highest percentages of workers in these LAs? Support your answer with evidence from the table. **[3]**

eg 3.2 and 1.5 in Brighton and Hove

(e) The researcher suggested that there would be strong correlation between the decrease in the percentage driving to work and the increase in percentage working mainly at or from home. Without calculation, use data from the table to comment briefly on this suggestion. **[1]**

eg NdeValley 3.3 to 0.7

Likely correct as Large changes in 1 doesn't mean Large changes in the other

3 Some packets of a certain kind of biscuit contain a free gift. The manufacturer claims that the proportion of packets containing a free gift is 1 in 4. Marisa suspects that this claim is not true, and that the true proportion is less than 1 in 4. She chooses 20 packets at random and finds that exactly 1 contains the free gift.

$H_0: p=0.25$ $X \sim B(20, 0.25)$ $0.0243 < 0.025$

$H_1: p<0.25$ $P(X \leqslant 1) = 0.0243$ ∴ reject H_0 and accept H_1

(a) Use a binomial model to test the manufacturer's claim, at the 2.5% significance level. **[7]**

as there is sufficient evidence to suggest the proportion is lower than 0.25

The packets are packed in boxes, with each box containing 40 packets. Marisa chooses three boxes at random and finds that one box contains 19 packets with the free gift and the other two boxes contain no packets with the free gift.

(b) Give a reason why this suggests that the binomial model used in part **(a)** may not be appropriate. **[1]**

Packets aren't independant as depends on the box

4 **In this question you must show detailed reasoning.**

A biased four-sided spinner has edges numbered 1, 2, 3, 4. When the spinner is spun, the probability that it will land on the edge numbered X is given by

$$P(X=x)=\begin{cases}\frac{1}{2}-\frac{1}{10}x & x=1,2,3,4,\\ 0 & \text{otherwise.}\end{cases}$$

x	1	2	3	4
$P(X=x)$	0.4	0.3	0.2	0.1

(a) Draw a table showing the probability distribution of X. **[1]**

The spinner is spun three times and the value of X is noted each time.

(b) Find the probability that the third value of X is greater than the sum of the first two values of X. **[3]**

1,1,3 1,1,4 1,2,4 2,1,4

$0.4^2 \times 0.2 + 0.4^2 \times 0.1 + 2 \times 0.4 \times 0.3 \times 0.1 = 0.072$

Total Marks for Question Set 6: 25