







2. A bank reviews its customer records at the end of each month to find out how many customers have become unemployed,  $u$ , and how many have had their house repossessed,  $h$ , during that month. The bank codes the data using variables  $x = \frac{u-100}{3}$  and  $y = \frac{h-20}{7}$ . The results for the 12 months of 2009 are summarised below.

$$\sum x = 477 \quad S_{xx} = 5606.25 \quad \sum y = 480 \quad S_{yy} = 4244 \quad \sum xy = 23\,070$$

- (a) Calculate the value of the product moment correlation coefficient for  $x$  and  $y$ . **(3)**

- (b) Write down the product moment correlation coefficient for  $u$  and  $h$ . **(1)**

The bank claims that an increase in unemployment among its customers is associated with an increase in house repossessions.

- (c) State, with a reason, whether or not the bank's claim is supported by these data. **(2)**

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3. A scientist is researching whether or not birds of prey exposed to pollutants lay eggs with thinner shells. He collects a random sample of egg shells from each of 6 different nests and tests for pollutant level,  $p$ , and measures the thinning of the shell,  $t$ . The results are shown in the table below.

$p$	3	8	30	25	15	12
$t$	1	3	9	10	5	6

[You may use  $\sum p^2 = 1967$  and  $\sum pt = 694$ ]

- (a) Draw a scatter diagram on the axes on page 7 to represent these data. **(2)**
- (b) Explain why a linear regression model may be appropriate to describe the relationship between  $p$  and  $t$ . **(1)**
- (c) Calculate the value of  $S_{pt}$  and the value of  $S_{pp}$ . **(4)**
- (d) Find the equation of the regression line of  $t$  on  $p$ , giving your answer in the form  $t = a + bp$ . **(4)**
- (e) Plot the point  $(\bar{p}, \bar{t})$  and draw the regression line on your scatter diagram. **(2)**

The scientist reviews similar studies and finds that pollutant levels above 16 are likely to result in the death of a chick soon after hatching.

- (f) Estimate the minimum thinning of the shell that is likely to result in the death of a chick. **(2)**

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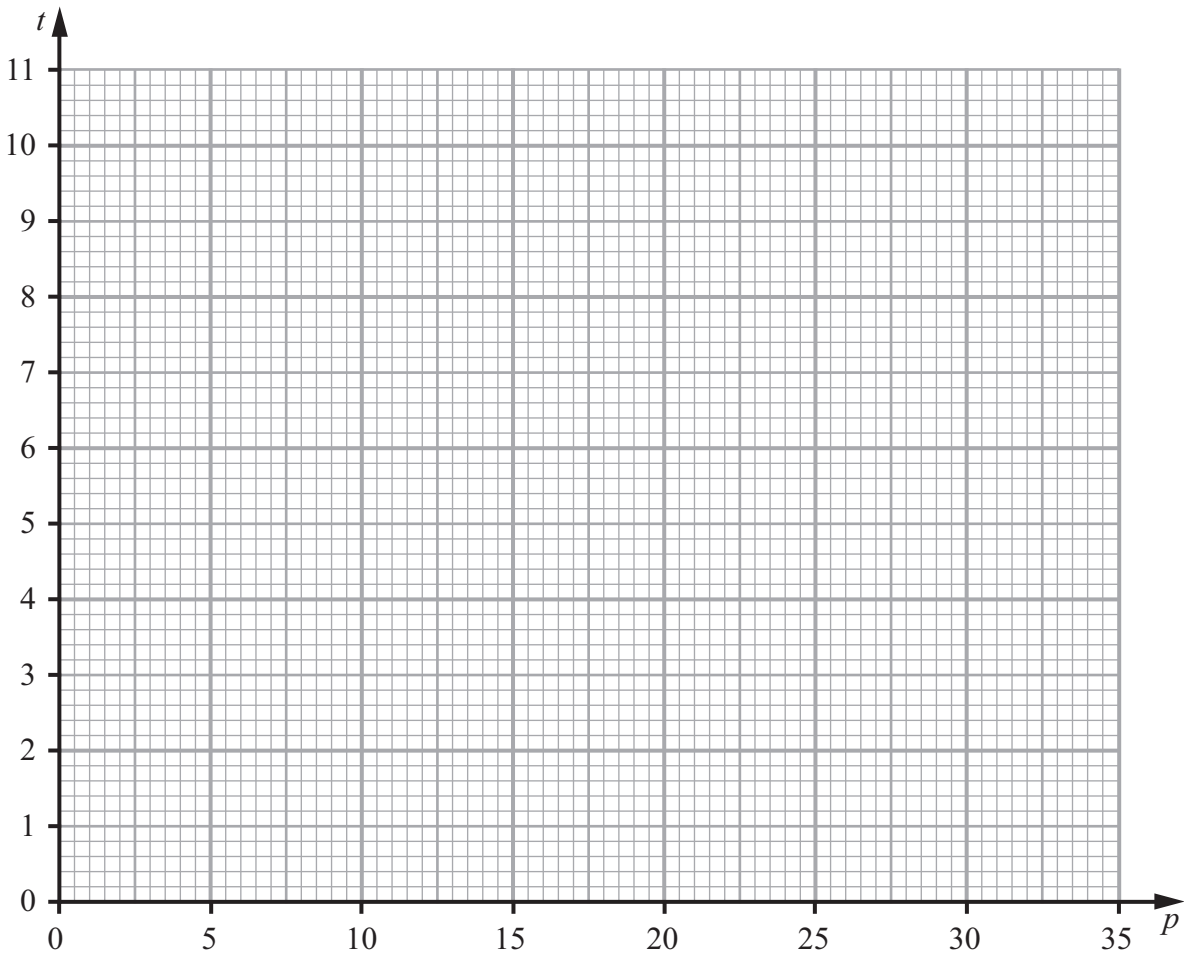
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**Question 3 continued**




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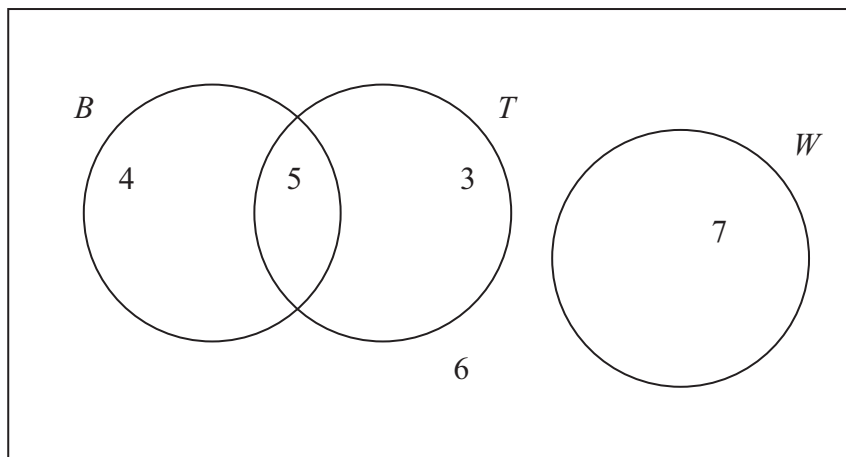
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4.



**Figure 1**

Figure 1 shows how 25 people travelled to work.

Their travel to work is represented by the events

$B$  bicycle

$T$  train

$W$  walk

(a) Write down 2 of these events that are mutually exclusive. Give a reason for your answer. **(2)**

(b) Determine whether or not  $B$  and  $T$  are independent events. **(3)**

One person is chosen at random.

Find the probability that this person

(c) walks to work, **(1)**

(d) travels to work by bicycle and train. **(1)**

(e) Given that this person travels to work by bicycle, find the probability that they will also take the train. **(2)**

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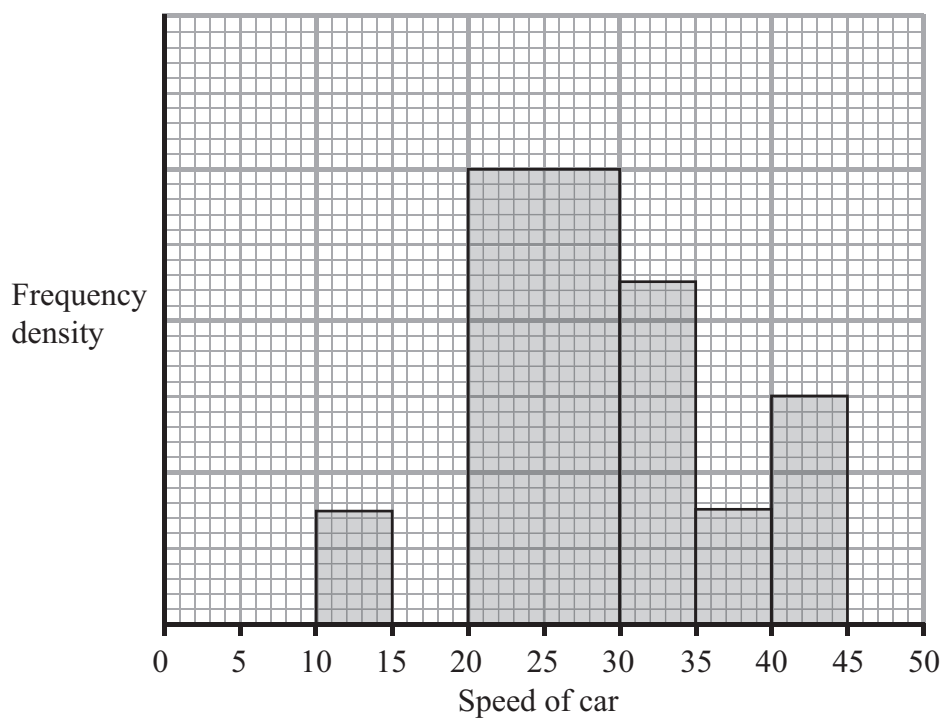








5.



**Figure 2**

A policeman records the speed of the traffic on a busy road with a 30 mph speed limit. He records the speeds of a sample of 450 cars. The histogram in Figure 2 represents the results.

- (a) Calculate the number of cars that were exceeding the speed limit by at least 5 mph in the sample. **(4)**
- (b) Estimate the value of the mean speed of the cars in the sample. **(3)**
- (c) Estimate, to 1 decimal place, the value of the median speed of the cars in the sample. **(2)**
- (d) Comment on the shape of the distribution. Give a reason for your answer. **(2)**
- (e) State, with a reason, whether the estimate of the mean or the median is a better representation of the average speed of the traffic on the road. **(2)**

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**Question 6 continued**

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**Question 6 continued**

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**Q6**

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**(Total 10 marks)**



7. A manufacturer carried out a survey of the defects in their soft toys. It is found that the probability of a toy having poor stitching is 0.03 and that a toy with poor stitching has a probability of 0.7 of splitting open. A toy without poor stitching has a probability of 0.02 of splitting open.

(a) Draw a tree diagram to represent this information. **(3)**

(b) Find the probability that a randomly chosen soft toy has exactly one of the two defects, poor stitching or splitting open. **(3)**

The manufacturer also finds that soft toys can become faded with probability 0.05 and that this defect is independent of poor stitching or splitting open. A soft toy is chosen at random.

(c) Find the probability that the soft toy has none of these 3 defects. **(2)**

(d) Find the probability that the soft toy has exactly one of these 3 defects. **(4)**

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**Question 7 continued**

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**Q7**

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**(Total 12 marks)**

**TOTAL FOR PAPER: 75 MARKS**

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