# Probability

**1** The table below shows the results of rolling a dice 200 times.

| Number | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Frequency | 54 | 12 | 38 | 9 | 61 | 26 |

a) What is the relative frequency of rolling an odd number? Give your answer as a decimal.

.....

*[2]*

b) Desmond says, "If I roll the dice I am likely to get a 5." Criticise Desmond's statement.

.....

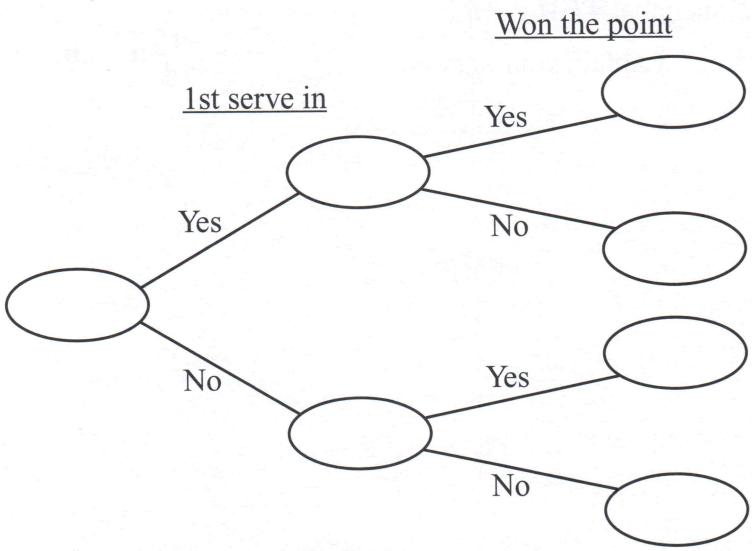
.....

*[1]*

*[Total 3 marks]*

**2** Roger is looking at his serving statistics from a recent tennis match.
He served 150 points in total and on 70% of the points his first serve was in.
He won 80% of the points when his first serve was in
and he won 40% of the points when his first serve wasn't in.

a) Complete the frequency tree below to show this information.




*[3]*

b) A sports TV channel randomly chooses one of the points that Roger served to analyse on their highlights show. What is the probability that Roger won the chosen point? Give your answer as a decimal.

.....

*[2]*

*[Total 5 marks]*

**3** An ice cream man states, "I sell over 5000 different combinations of ice cream". He has 16 different flavours of ice cream. You can either get 1, 2 or 3 scoops and you can combine different flavours. The ice cream man considers 'vanilla, chocolate' to be a different combination to 'chocolate, vanilla'.

Is the ice cream man's statement correct? Show working to support your answer.

.....

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.....

*[Total 3 marks]*

**4** Anya spins a spinner that has four sections numbered 1-4.
She is three times as likely to spin a 1 as to spin a 3.
She is twice as likely to spin an even number as an odd number.

a) What is the probability that she spins a 3?

.....

*[2]*

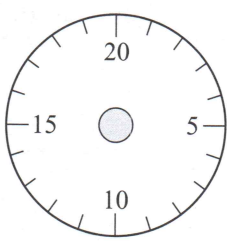
b) What is the probability that, in two spins, she gets one even number and one odd number?

.....

*[2]*

*[Total 4 marks]*

**5** To break into a safe, Zane must find the correct 3-number combination (e.g. 17-6-11) for the combination lock shown on the right (numbered 1-20).




a) How many possible 3-number combinations are there for this lock?

.....

*[1]*

Zane finds out that:
- the first number is prime,
- the second number is odd,
- the third number is a square number.

b) What is the percentage decrease in the number of possible combinations?

.....

*[4]*

*[Total 5 marks]*

**6** At a school, there are two Year 9 classes, A and B. Each class contains 30 students.
Mrs Dawson randomly selects one student from each class.
The probability that she selects a girl from class A ($G_A$) and a girl from class B ($G_B$) is 0.24.
The probability that she selects a girl from class A ($G_A$) and a boy from class B ($B_B$) is 0.56.

How many girls are there in Year 9?

Form two simultaneous equations — remember that P(boy) = 1 – P(girl).

.....

*[Total 4 marks]*

**7** Jill has two bags containing blue and red balls.

| **Bag A** |
|---|
| 14 blue |
| *n* red |

| **Bag B** |
|---|
| *n* blue |
| 30 red |

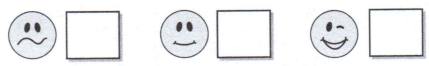
When two blue balls are taken from Bag A and placed into Bag B, the probability of picking a red ball is the same for both bags.

Show that the original probability of picking a red ball from Bag B is $\frac{5}{8}$.

*[Total 6 marks]*

**Score:** ☐/**30**

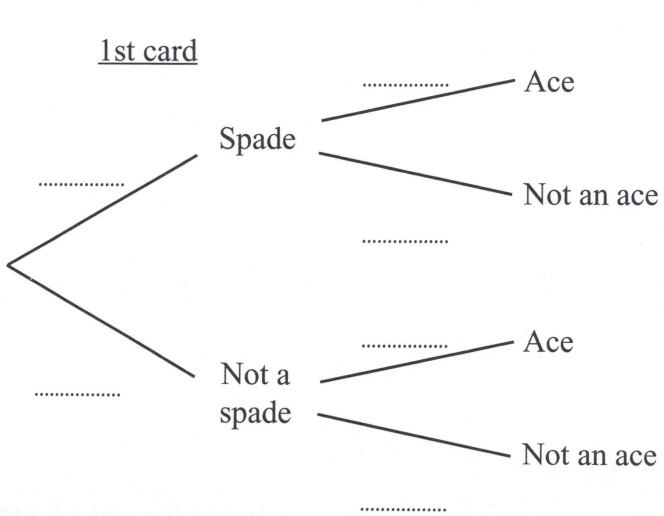




# Tree Diagrams

**1** A card is chosen at random from a standard pack of 52 cards. It is then replaced and another card is chosen at random.

a) Complete the tree diagram below. Give probabilities as fractions in their simplest form.




*[2]*

b) What is the probability that the first card is not a spade and the second card is not an ace? Give your answer as a fraction in its simplest form.

.....

*[1]*

*[Total 3 marks]*

**2** A fair 12-sided dice numbered 1-12 is rolled three times.

a) What is the probability that all three rolls produce prime numbers? Give your answer as a fraction in its simplest form.

.....

*[2]*

b) What is the probability that exactly one of the numbers is less than 5? Give your answer as a fraction in its simplest form.

.....

*[3]*

*[Total 5 marks]*

**3** Mark is fishing for mackerel. He has 2 hooks on his line, so each time he casts his line he can catch either 0, 1 or 2 mackerel. On any cast, the probability that he catches 0 mackerel is 0.2, 1 mackerel is 0.5 and 2 mackerel is 0.3.

What is the probability that in 3 casts he catches less than 5 fish?

Hint: P(less than 5 fish) = 1 – P(5 or more fish).

.....

*[Total 4 marks]*

**4** A game at a fund-raising event involves throwing a dice twice and adding the scores together. The player wins a prize if the total is 11 or more.

a) It costs £2 to play the game and there are 20 prizes to be won. Explain why the stall can expect to take about £480.

*[3]*

b) Pablo plays the game twice. Find the probability than he wins at least one prize. Give your answer as a fraction.

.....

*[3]*

*[Total 6 marks]*

***Exam Practice Tip***

Even when questions don't mention tree diagrams, it's often a good idea to draw one so that you don't make any silly mistakes. If you're feeling confident, you don't need to draw the whole diagram — just draw the branches that you think you'll need to be able to answer the question.

**Score** ____ / **18**

# Conditional Probability

**1** A biscuit barrel contains 8 chocolate biscuits and 6 plain biscuits. Graham selects two biscuits at random without replacement.

What is the probability that both biscuits are the same?

.....

*[Total 3 marks]*

**2** A shop has 12 tubs of ice cream left. Five of the tubs are chocolate (C), four of the tubs are vanilla (V) and three of the tubs are strawberry (S). Two tubs are selected at random without replacement.

a) Calculate the probability that one chocolate tub and one strawberry tub are chosen. Give your answer as a fraction in its simplest form.

.....

*[3]*

b) Work out the probability that at least one tub is vanilla. Give your answer as a fraction in its simplest form.

.....

*[3]*

*[Total 6 marks]*

**3** The probability that Martyn goes to aerobics any evening is 0.4. If he doesn't go to aerobics, the probability that he goes for a run the next morning is 0.7.

What is the probability that he doesn't go to aerobics and doesn't go for a run the next morning?

.....

*[Total 3 marks]*

**4** In a tombola there are 100 tickets numbered 1-100.
You win a prize if you pick a ticket that ends in 0 or 5.

a) Amy is the first person to play and picks two tickets at random.
What is the probability that she wins at least one prize?

.....

*[4]*

b) Carla plays after 40 tickets have been chosen and 5 prizes have been won.
She picks two tickets at random.
Are her chances of winning at least one prize better or worse than Amy's? Explain your answer.

.....

.....

.....

.....

.....

*[3]*

*[Total 7 marks]*

**5** A bag contains counters that are either green or blue.

- There are $n$ green counters.
- The number of blue counters is one more than the number of green counters.

Two counters are taken out of the bag at random without replacement.

Show that the probability that both counters are the same colour is $\frac{n}{2n+1}$.

*[Total 5 marks]*

**Score:** ☐/**24**



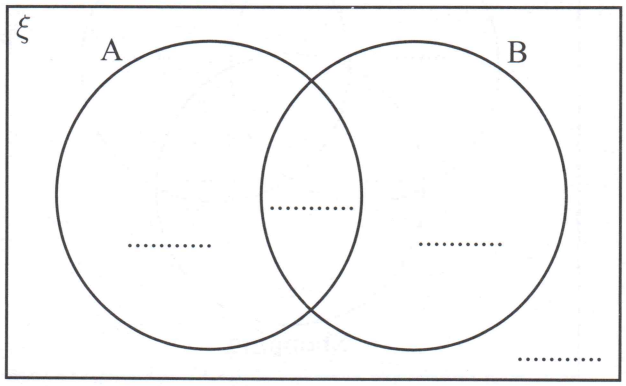
# Venn Diagrams

**1** The universal set $\xi$ is the integers 1-20.

Set A is made up of the numbers generated by the sequence $2n + 1$ where $n$ is a positive integer.

Set B is made up of the numbers generated by the sequence $\frac{n(n+1)}{2}$ where $n$ is a positive integer.

a) Complete this Venn diagram to show the number of elements in each set.




*[3]*

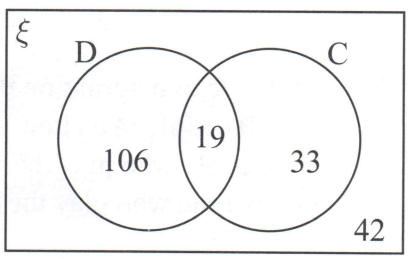
b) What is the probability that a randomly chosen element is in both set A and set B?

.....

*[1]*

*[Total 4 marks]*

**2** The Venn diagram on the right shows the number of students at a school who attended the school disco (D) and chess club (C).




a) What is the ratio of students attending the disco to the total number of students? Give your answer in its simplest form.

.....

*[2]*

b) What is the probability that a randomly chosen student

(i) attended chess club, given that they also went to the school disco?

.....

*[2]*

(ii) attended the disco, given that they only attended one event?

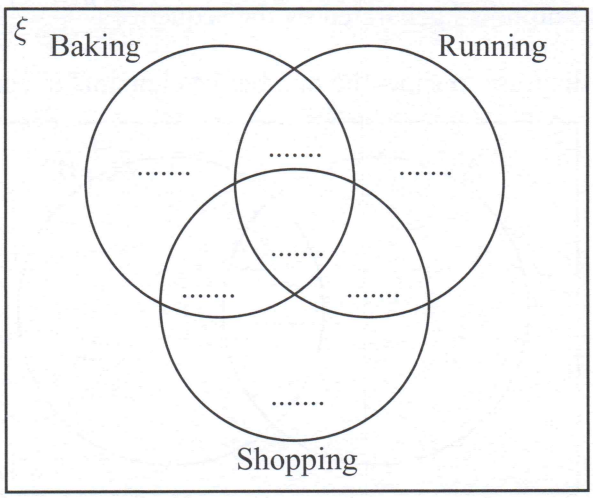
.....

*[2]*

*[Total 6 marks]*

**3** Jack asked 80 people whether they like baking, running and shopping.
Half of the people only liked one activity. 10% of people liked all three activities.
22 people liked baking and running. 18 people liked shopping and running.
43 people liked baking and 35 liked shopping. Everyone liked at least one activity.

a) Complete this Venn diagram to show the number of elements in each set.




*[5]*

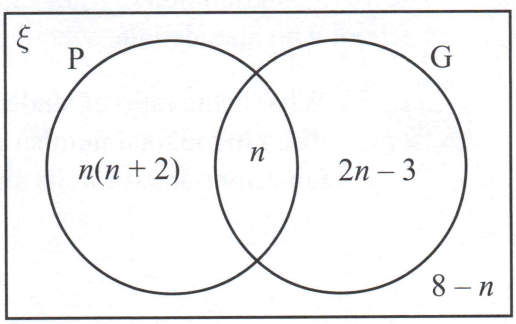
b) What is the probability that a randomly selected person liked baking, given that they liked at least two activities? Give your answer as a fraction in its simplest form.

.....

*[2]*

*[Total 7 marks]*

**4** In the Venn diagram on the right,
ξ = 50 people in a choir
P = people who play the piano
G = people who play the guitar.




Two different people in the choir are chosen at random.
Find the probability that they can both play the piano.

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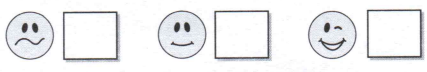
*[Total 5 marks]*

**Score:** ☐ / **22**

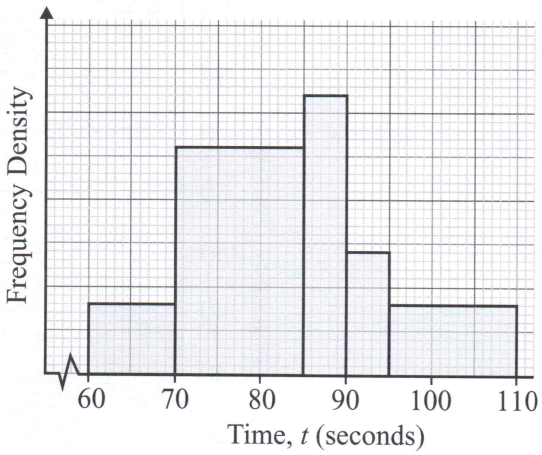




# Histograms

**1** A cycling club decided to measure how long it took each of its members to complete a 1 mile course. 39 members took between 70 and 85 seconds to complete the course.

The histogram on the right shows the times recorded by the members.
How many members does the cycling club have?



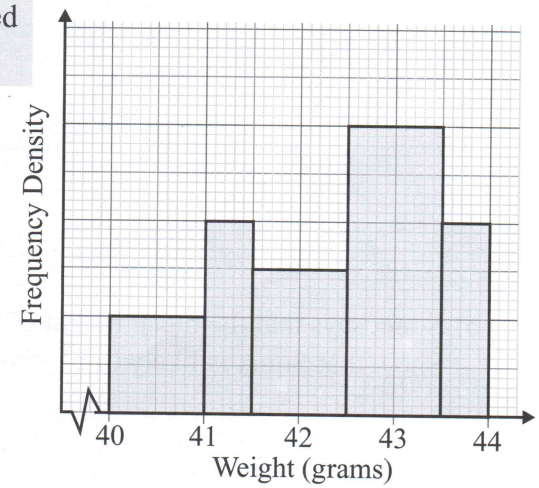

.....

*[Total 4 marks]*

**2** A sample of 600 bouncy balls were individually weighed and the results are shown on the histogram below.

a) Estimate the mean weight of the bouncy balls. Give your answer to 1 d.p.

Find the frequencies of each class by working out the proportion of the graph that each bar takes up.




..... g

*[5]*

b) Sumi says, "The median weight of the bouncy balls is over 42.5 g." Is she correct? Explain your answer.

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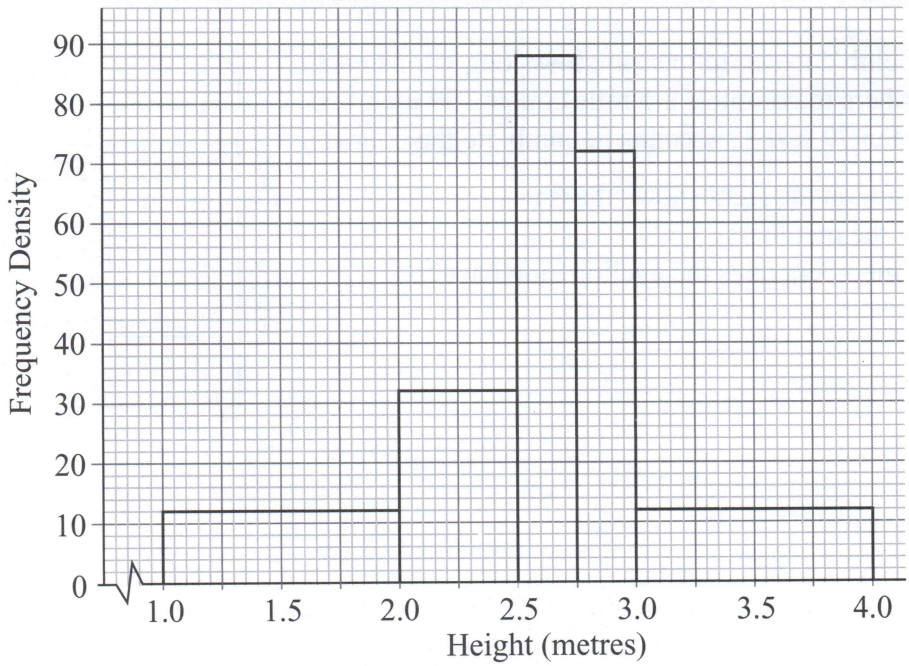
*[2]*

*[Total 7 marks]*

**3** The histogram shows the heights of the statues in a palace.




a) Work out an estimate for the percentage of statues that have a height between 1.75 metres and 2.75 metres.

..... %

*[3]*

b) Sonia says that the mean height of the statues is less than 2.5 metres. Show that Sonia is likely to be wrong.

*[3]*

c) What is the probability that a randomly chosen statue is over 3 metres tall, given that it's over 2 metres tall?

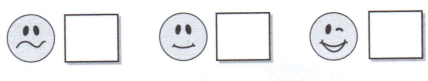
.....

*[2]*

*[Total 8 marks]*

**Score:** ☐ / **19**

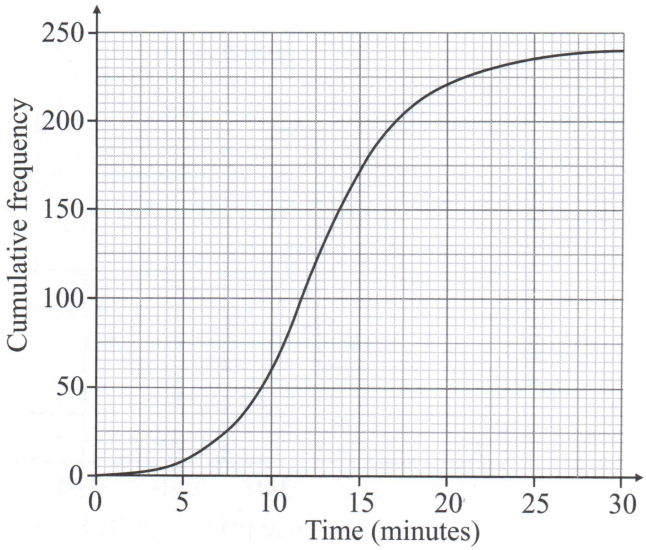




# Comparing Data Sets

**1** This cumulative frequency graph shows how quickly tickets for a pantomime sold out in 2013. The table below summarises how quickly tickets for the same pantomime sold out in 2014.

| Ticket Sales in 2014 | |
|---|---|
| Time it took to sell out | 24 minutes |
| Median | 16 minutes |
| Interquartile range | 3 minutes |




Compare the times it took tickets for the pantomime to sell in 2013 and 2014.

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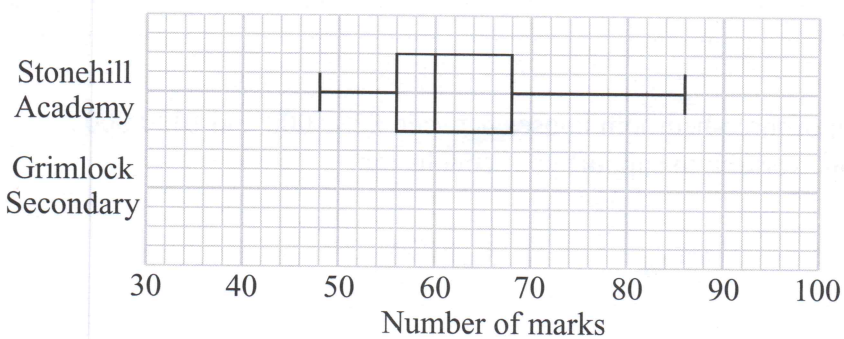
.....

*[Total 4 marks]*

**2** The box plot below shows the distribution of GCSE maths marks of pupils at Stonehill Academy. The table shows summary statistics of GCSE maths marks of pupils at Grimlock Secondary.




| GCSE Maths Marks at Grimlock Secondary | |
|---|---|
| Lowest mark | 36 |
| Range | 60 |
| Median | 72 |
| Upper quartile | 82 |
| Interquartile range | 14 |

a) Draw the box plot for Grimlock Secondary on the diagram above.

*[2]*

b) Compare the average and spread of the marks at Stonehill Academy and Grimlock Secondary.

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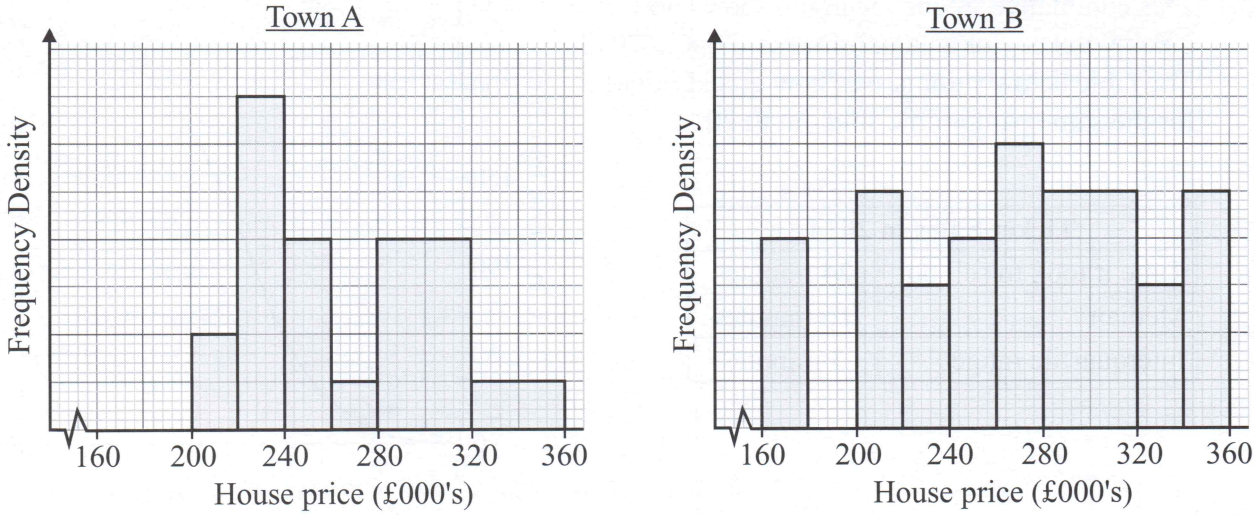
.....

.....

*[2]*

*[Total 4 marks]*

**3** The house prices of three-bedroom houses in two towns, A and B, are shown in the histograms.




a) Decide whether each of these statements is correct. Give reasons for your answers.

(i) "There is a greater range of three-bedroom house prices in town A."

.....

.....

.....

*[2]*

(ii) "There are more three-bedroom houses priced between £320 000 and £360 000 in town B than town A."

.....

.....

.....

*[2]*

b) Is there a higher proportion of three-bedroom houses between £280 000 and £320 000 in town A or town B? Show working to support your conclusion.

*[4]*

*[Total 8 marks]*

**Score:** ☐ / **16**