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NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

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Level 1 Mathematics and Statistics 2021

91037 Demonstrate understanding of chance and data

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of chance and data.	Demonstrate understanding of chance and data, justifying statements and findings.	Demonstrate understanding of chance and data, showing statistical insight.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

Show ALL working.

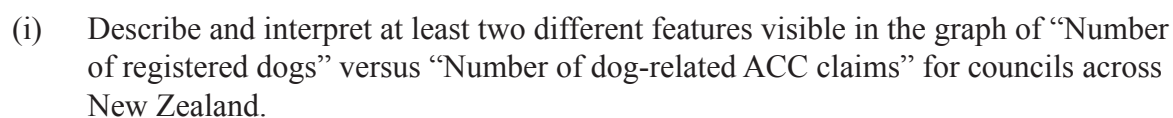If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–15 in the correct order and that none of these pages is blank.

Do not write in any cross-hatched area ( ). This area may be cut off when the booklet is marked.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

QUESTION ONE

(a) If a person is injured, they can contact ACC (Accident Compensation Corporation) to request financial help. This is called "making an ACC claim".

Dog-related ACC claims are made for injuries caused by dogs. The graph below shows the relationship between the number of registered dogs and the number of dog-related ACC claims for a sample of councils across New Zealand.

In the scatter graph below, each dot represents one of the councils.

Dog-related ACC claims v registered dogs in 2019

(i) Describe and interpret at least two different features visible in the graph of "Number of registered dogs" versus "Number of dog-related ACC claims" for councils across New Zealand.

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(ii) On the scatter graph on the previous page, draw a line that best fits the relationship between "Number of registered dogs" and "Number of dog-related ACC claims".

Comment on the appropriateness of this model and whether some other model would best fit.

Justify your answer using statistical reasons.

> If you need to redraw your line, use the grid on page 14.

(iii) How useful is this graph to predict the number of dog-related ACC claims that will be made for one council based on the number of registered dogs in that area?

Justify your answer using statistical reasons, giving at least TWO different statements to support your decision.

(b) A random sample of some of the dog breeds registered with the Auckland City Council in 2019 has been selected. There are a total of 180 dogs in this random sample.

The bar graph below shows the number of dogs registered in each of these selected breeds.

Auckland-registered dogs by breed
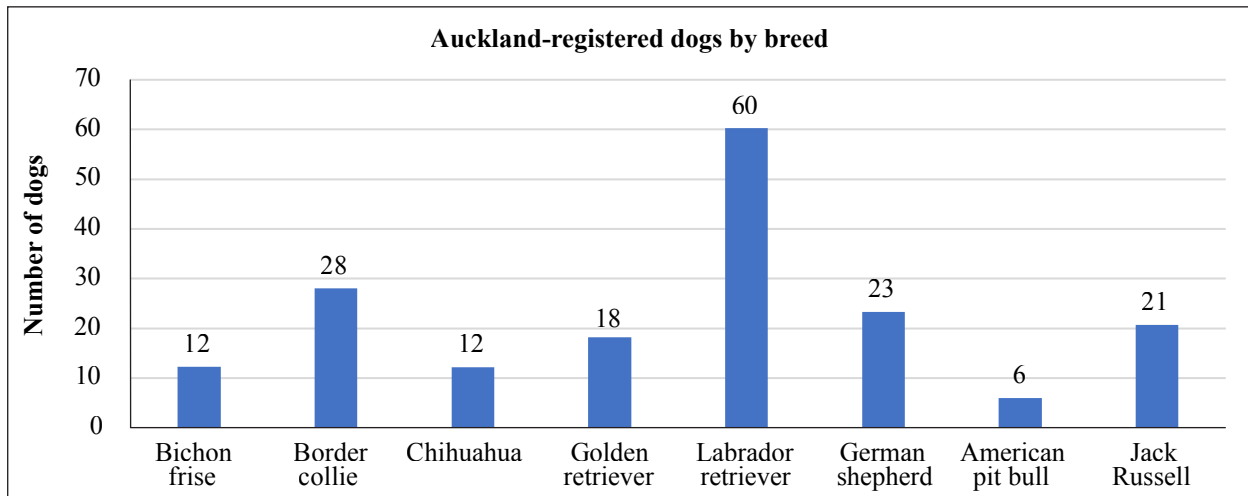
(i) If a dog is randomly selected from this sample, what is the probability that it is NOT a chihuahua?

(ii) Narnia enjoys daily walks along the beach.

One day, Narnia saw 20 dogs on her walk; 6 of these were American pit bulls.

She thought it was very unusual to see so many American pit bulls. She believes that there must be an error in the Auckland City Council data collection shown above.

Do you agree?

Justify your answer using statistical reasons, giving at least THREE different supporting statements.

(iii) A magazine article claims that people are twice as likely to own a Jack Russell compared to a bichon frise in New Zealand.
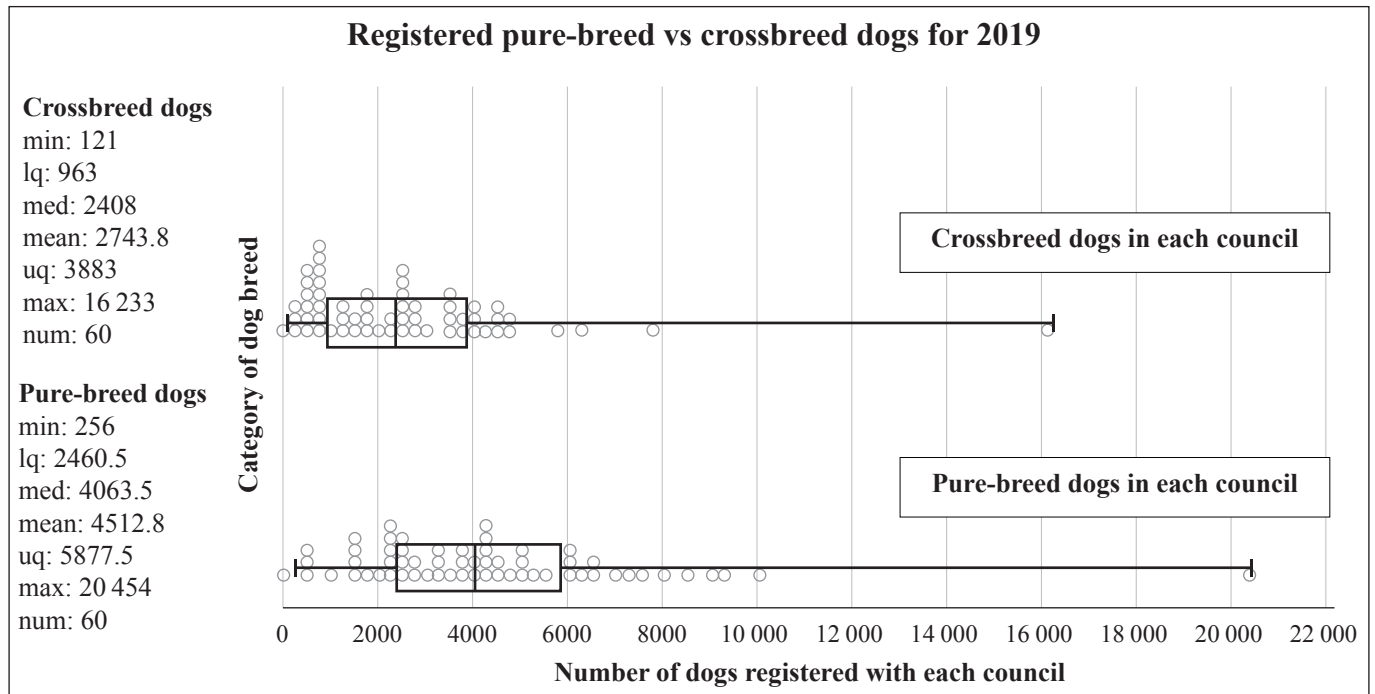
Comment on this claim.

Justify your answer using statistical reasons.

QUESTION TWO

(a)   In New Zealand, all dogs over three months old must be registered with their local council.

A random sample of 60 councils has been selected, using data collected from 2019. The display below compares the number of crossbreed dogs and pure-breed dogs registered with these councils.

Registered pure-breed vs crossbreed dogs for 2019

Crossbreed dogs
min: 121
lq: 963
med: 2408
mean: 2743.8
uq: 3883
max: 16 233
num: 60

Pure-breed dogs
min: 256
lq: 2460.5
med: 4063.5
mean: 4512.8
uq: 5877.5
max: 20 454
num: 60

Crossbreed dogs in each council

Pure-breed dogs in each council

Category of dog breed

Number of dogs registered with each council

(i)   The New Zealand Dog Breed Association wants to know the average number of pure-breed dogs registered with each council in 2019.

Which average would most accurately reflect this required information?

Justify your answer using statistical reasons.

(ii) Compare the sample distributions of the numbers of crossbreed dogs and pure-breed dogs registered with councils.

Note any similarities and differences; considering centre, shift, shape, spread; and provide numerical evidence where appropriate.

In your answer, describe at least THREE different key features.

(iii) Rhys said that it is not possible to tell from this data that in 2019 all New Zealand councils tended to have more pure-breed dogs registered with them than crossbreed dogs.

Comment on this claim, based on the sample of councils provided.

Justify your answer using statistical reasons.

(iv) The data in the 2019 survey was collected from 60 different councils. To save money in 2021, the New Zealand Dog Breed Association decided to use data collected from a random sample of 10 councils.

Would you expect the same conclusion?

Justify your answer using statistical reasons.

(b) The table below shows the numbers of registered dogs in 2019 by gender and breed-type for one of the small councils in New Zealand.

There were only 190 dogs registered with this council in 2019.

	Male dogs	Female dogs	Total
Pure-breed dogs	36	14	50
Crossbreed dogs	84	56	140
Total	120	70	190

(i) What is the probability that a dog selected at random from this council is a pure-breed dog?

(ii) One of the male dogs was selected at random from this sample of dogs that were registered with this council.

What is the probability that a male dog registered with this council is a crossbreed?

(iii) What is the probability that two randomly selected dogs from this sample of dogs that were registered with this council are both female dogs?

Give your answer as a fraction or as a decimal correct to 4 decimal places.

QUESTION THREE

(a) ACC (Accident Compensation Corporation) pays for medical costs that relate to personal injuries that occur in New Zealand.

The graph below shows the total amount paid out by ACC each year (in New Zealand dollars $) for dog-related injuries in New Zealand between 2001 and 2018.

Total amount paid out by ACC for dog-related injuries
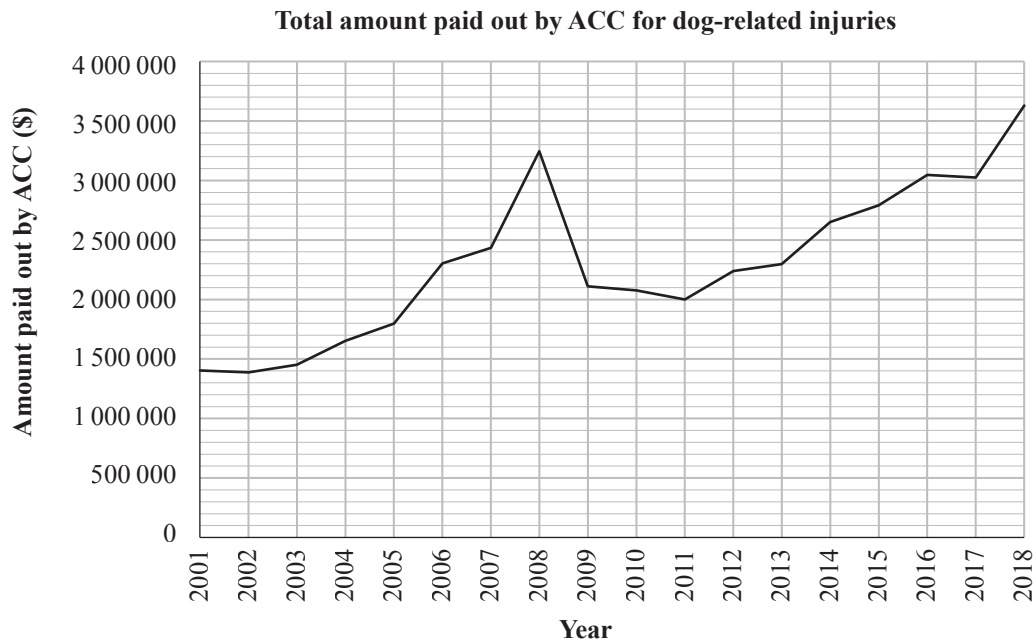
(i) In which year was the most money paid out by ACC for dog-related injuries?

Justify your answer.

(ii) Use the information presented in the graph to predict how much the total amount paid out by ACC for dog-related injuries will be in 2021.

Justify your prediction using statistical reasons.

(iii)   Discuss any trends and unusual features that you notice in the graph on the previous page.

Provide evidence from the graph to back up your statements.

Justify your answer using statistical reasons.

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(b) The graph below shows the total amount of money paid out by ACC for dog-related injuries in each of the years from 2001 to 2018 for Auckland, Christchurch, and Wellington.

Total amount paid out by ACC for dog-related injuries
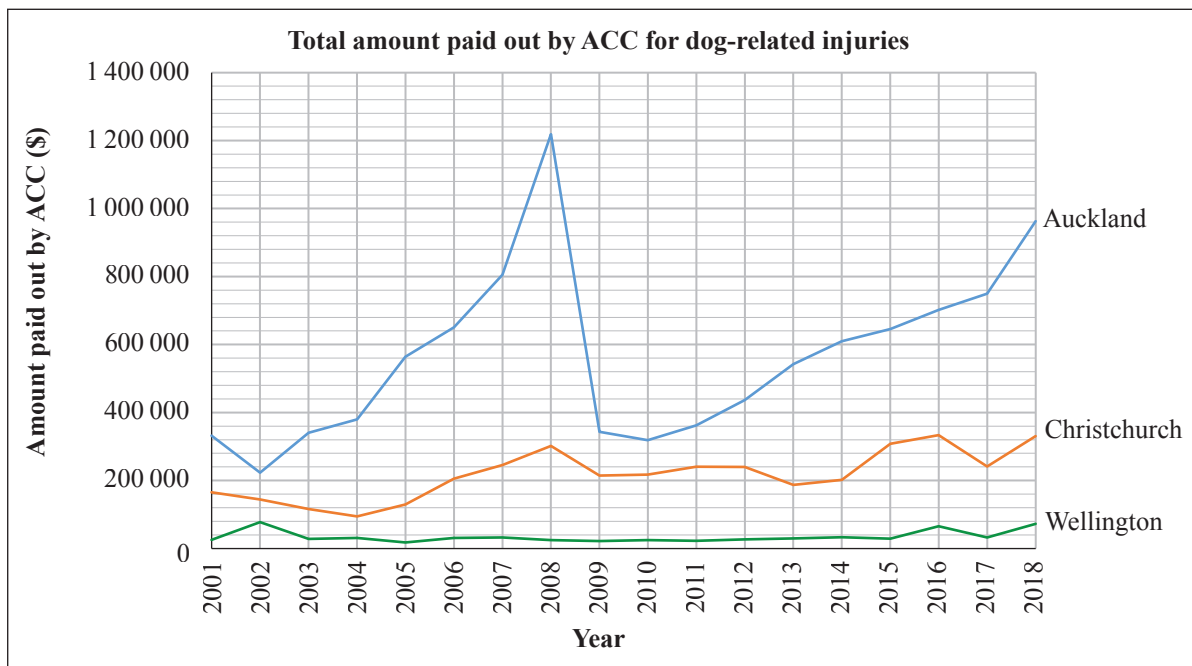
ACC notices a concerning trend from Auckland regarding the amount of money paid out for dog-related injuries compared to Christchurch and Wellington.

Give statistical reasons why you think ACC should be concerned about the amount of money spent on dog-related injuries in Auckland.
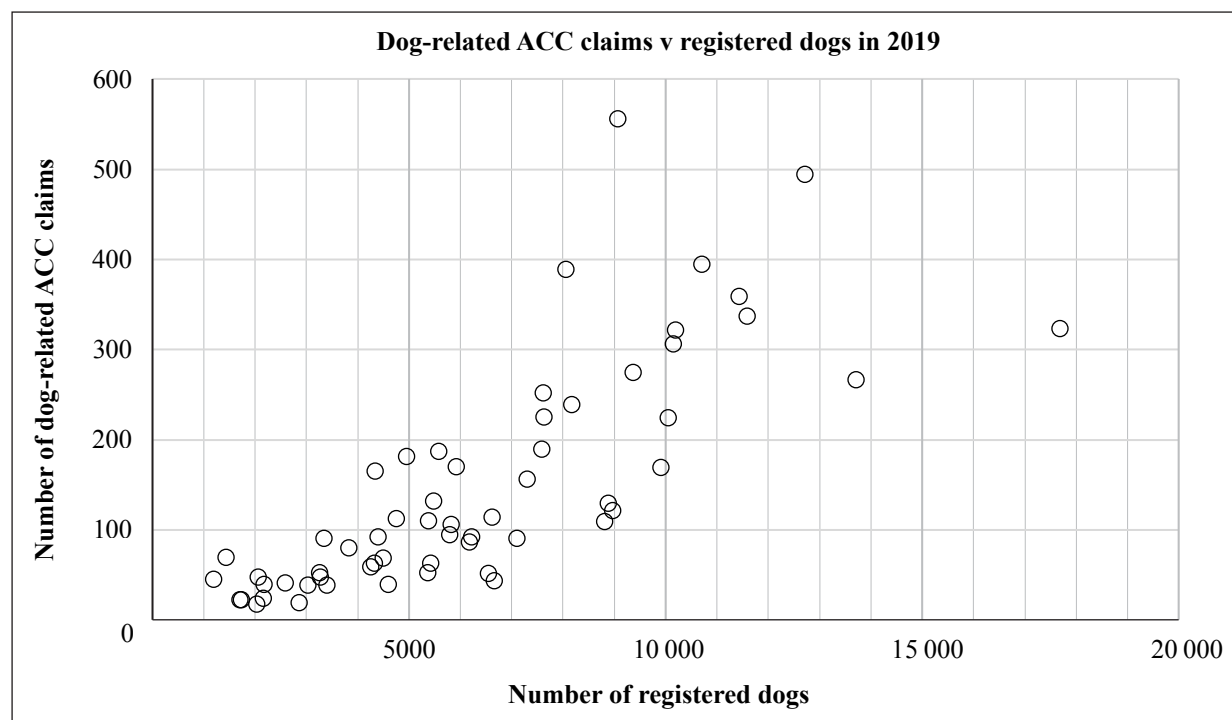
(c)   When the amount paid out by ACC for dog-related injuries in Auckland is compared to that for dog-related injuries for the whole of New Zealand, the trends seem similar.

Total amount paid out by ACC for dog-related injuries
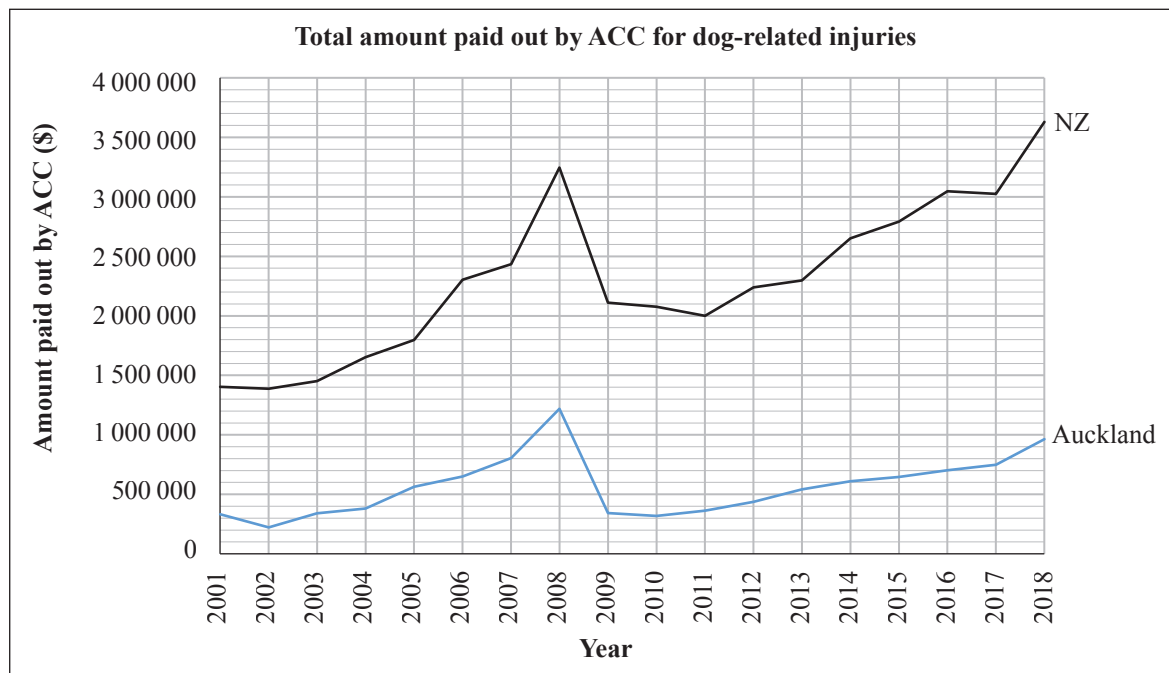
Interpret and explain why these two trends, shown in the graph above, might have a similar shape.

Justify your answer using statistical reasons.

SPARE GRIDS

If you need to redo Question One (a)(ii), use the grid below. Make sure you make it clear which answer you want marked.

QUESTION
NUMBER