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NEW ZEALAND QUALIFICATIONS AUTHORITY
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Tick this box if there is no writing in this booklet

Level 1 Mathematics and Statistics 2020

91037 Demonstrate understanding of chance and data

9.30 a.m. Friday 20 November 2020
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 2–16 in the correct order and that none of these pages is blank.

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

TOTAL

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QUESTION ONE

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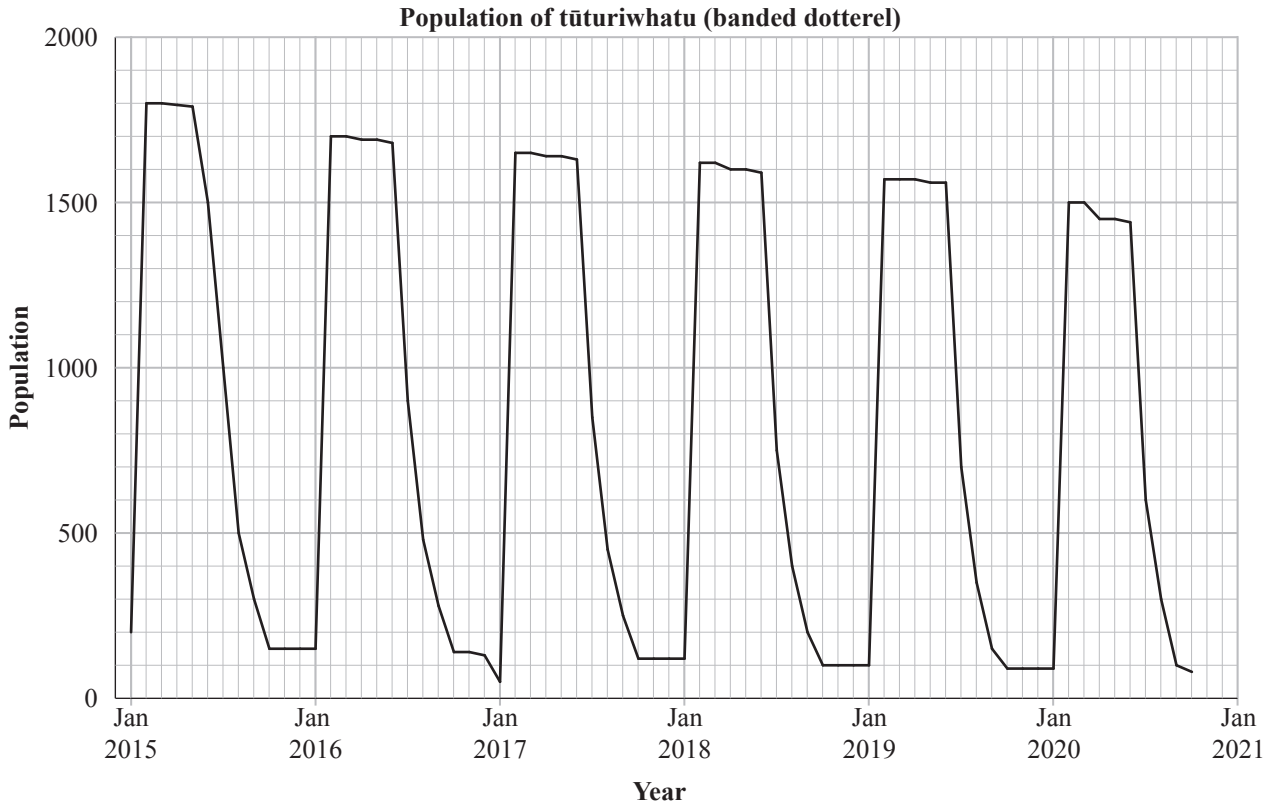
The tūturiwhatu (also known as the banded dotterel) is a small New Zealand bird. It is typically found along seashores, estuaries, and riverbeds. The population of these birds changes during certain times of the year as they move within New Zealand and as far away as Australia.

http://nzbirdsonline.org.nz/species/banded-dotterel

The graph below shows the population of tūturiwhatu at one location in New Zealand between January 2015 and October 2020.



(a) When was the lowest number of tūturiwhatu recorded?

Justify your answer.

(b) Discuss any trends, regular patterns, and unusual features that you notice in the graph of the data of the number of tūturiwhatu at this location.

Provide evidence from the graph to back up your statements.

Justify your answer using statistical reasons.

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(c) Some of the tūturiwhatu will not move to other areas because they are too sick or too old to travel far.

The table below shows a random sample of 1350 tūturiwhatu on Stewart Island during 2019 that either moved away or stayed.

This sample was recorded by gender.

	Moved away	**Stayed**	**Totals**
Female	690	165	855
Male	410	85	495
Totals	1100	250	1350

(i) One tūturiwhatu was selected from this sample.

What is the probability that it is a female that stayed?

(ii) One of the tūturiwhatu that stayed was selected. What is the probability that it is male?

(iii) Is a female or male tūturiwhatu more likely to move away?

Justify your answer using the data provided in the table on page 4.

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QUESTION TWO

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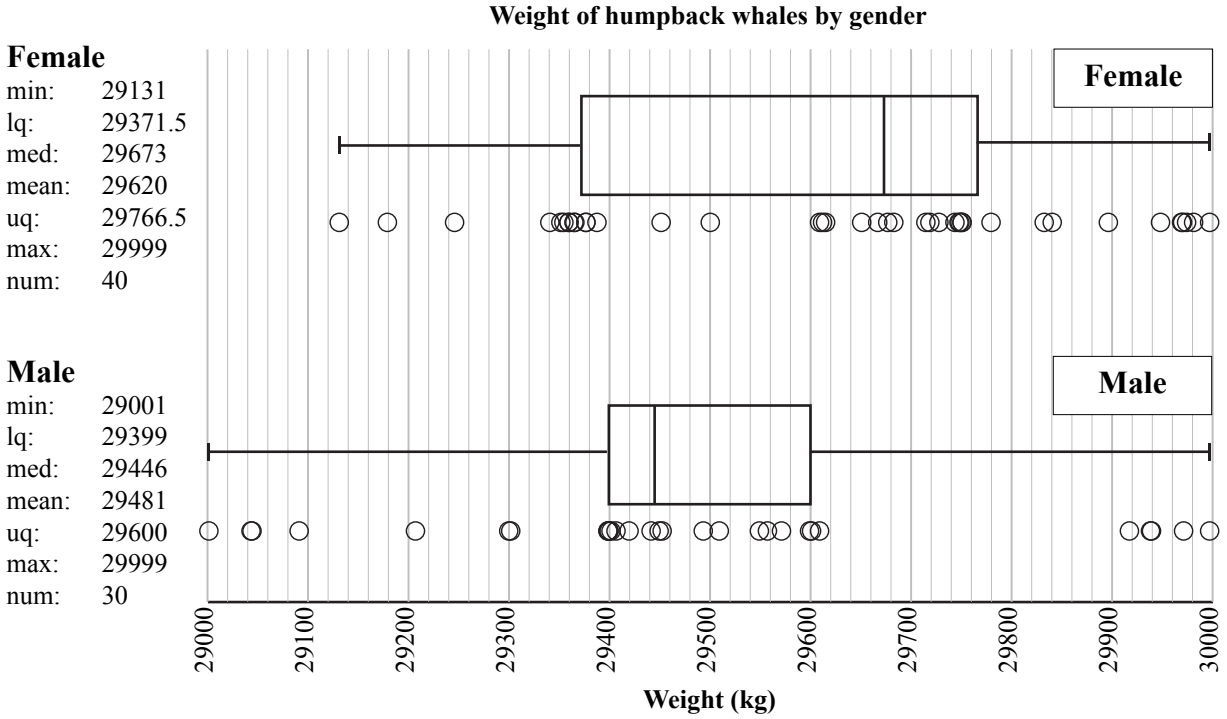
(a) Humpback whales are found in oceans and seas all around the world.

The graph below compares the weights of a random sample of male and female humpback whales, measured in kilograms.

The data has been collected from humpback whales found along the west coast of New Zealand during spring in 2019.



(i) A student comments that the box of the female humpback whales is wider than the box of the male humpback whales.

Interpret what this means when considering this sample of humpback whales.

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(ii) Clearly describe at least two different key features in the sample distribution of the weights for both male and female humpback whales.

Note any similarities and differences.

(iii) A claim is made that in the spring of 2019, female humpback whales tended to weigh more than male humpback whales around all of the coasts of New Zealand.

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

Justify your answer using statistical reasons.

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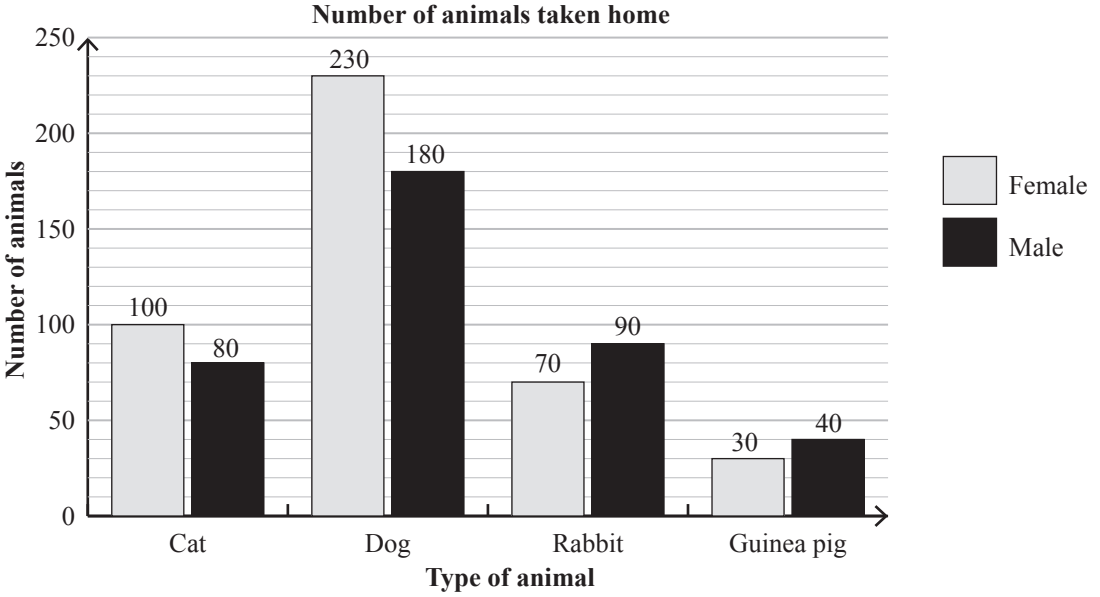
(b) The Society for the Prevention of Cruelty to Animals (SPCA) in New Zealand has a special open day every year, when people are encouraged to visit their local centre and take home a pet.

The graph below compares a random sample of 820 animals that were taken home from one local SPCA centre on its last open day.



(i) What is the probability that an animal taken home from this SPCA centre was a guinea pig?

(ii) What is the probability that if a dog was taken home from this SPCA centre, it was female?

(iii) An article on the internet claims that female animals have more chance than male animals of being taken home on one of these open days.

Evaluate this claim using statistical reasoning, providing at least three comments.

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QUESTION THREE

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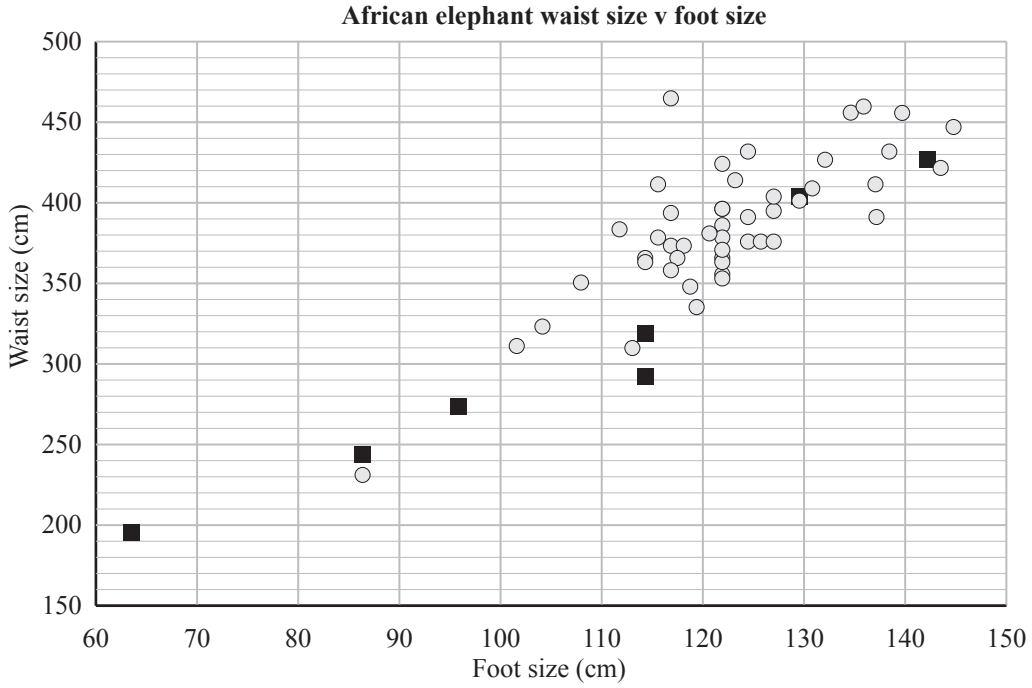
(a) African elephants are one of several species of elephant. A random sample of 55 African elephants from zoos and from the wild are selected.

The scatter graph below shows the relationship between the foot size of elephants and their waist size. Foot size and waist size are both measured in cm.

The black squares are measurements taken from male African elephants. The grey dots are from female African elephants.



(i) Comment on the chance of an African elephant having a waist size greater than 450 cm.

Justify your answer using statistical reasons.

(ii) On the scatter graph above, draw a line that best fits the relationship between the "foot size" and "waist size" of African elephants.

Comment on the strength of the relationship.

Justify your answer using statistical reasons.

If you need to redraw this graph, use the grid on page 14.

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(iii) Describe and interpret at least two different features visible in the graph of the data of "waist size" versus "foot size" in this sample of African elephants.

Justify your answer using statistical reasons.

(iv) Difyr believes that this scatter graph would be very useful to predict the waist size of **all** elephants based on their foot size.

Evaluate Difyr's claim using statistical reasoning, giving at least three different justified statements.

Please turn over ➤

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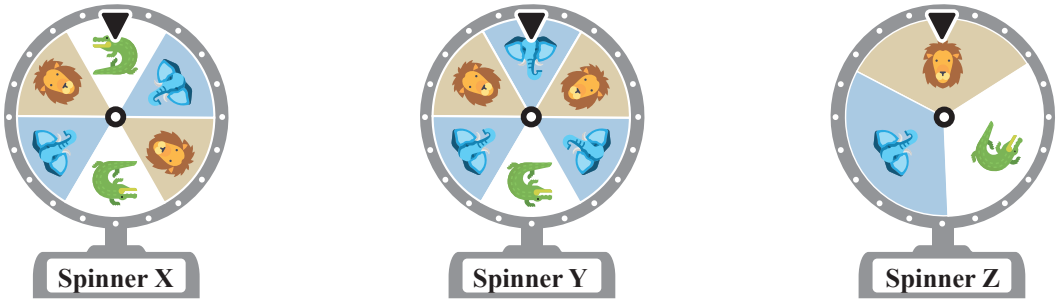
(b) At the zoo, Maia, Teina, and Nikau play a game that will allow them to win an animal badge if they spin a picture of that animal.

There are three different spinners, with pictures of elephants, lions, and crocodiles on them.

On Spinner **X**, there are six pictures – two of elephants, two of lions, two of crocodiles.

On Spinner **Y**, there are also six pictures – three of elephants, two of lions, one of a crocodile.

Spinner **Z** has only three faces with a single picture on each face – one of an elephant, one of a lion, one of a crocodile.



(i) Maia thinks that she has more chance of winning a crocodile badge (by spinning a picture of a crocodile) if she uses Spinner X. Do you agree?

Justify your answer.

(ii) Teina spins Spinner Z five times, hoping to win an elephant badge.

His results after five spins were: lion crocodile crocodile lion crocodile

Teina believes that Spinner Z must be biased in some way because the elephant picture did not appear at all after his five spins. Do you agree?

Justify your answer.

Icons: www.flaticon.com

(iii) Nikau spins all three spinners once each. What is the chance that all three spinners will win an elephant badge?

Justify your answer.

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SPARE GRIDS

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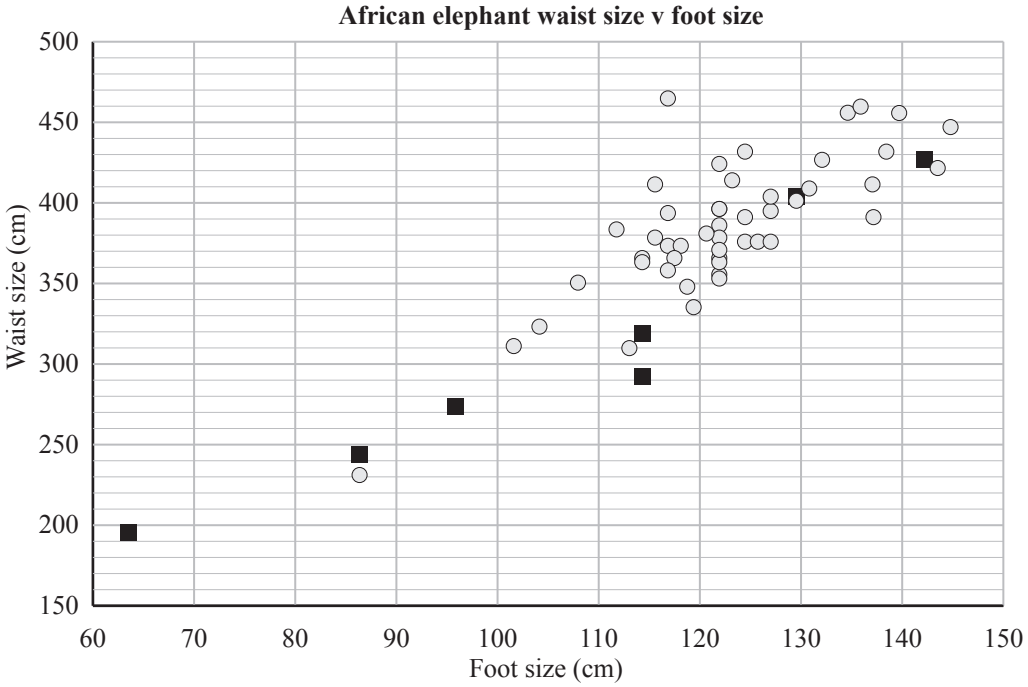
If you need to redo Question Three (a)(ii), use the graph below. Make sure you make it clear which answer you want marked.



Extra space if required.
Write the question number(s) if applicable.

QUESTION NUMBER

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