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Mana Tohu Mātauranga o Aotearoa
 New Zealand Qualifications Authority

Level 2 Mathematics and Statistics 2025

91267 Apply probability methods in solving problems

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Apply probability methods in solving problems.	Apply probability methods, using relational thinking, in solving problems.	Apply probability methods, using extended abstract thinking, in solving problems.

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.

Make sure that you have the Formulae Sheet L2–MATHF.

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.

Do not write in the margins (✂✂✂). This area will be cut off when the booklet is marked.

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

QUESTION ONE

Research has shown that people in New Zealand prefer having breakfast at cafes to having it at home. One popular item on the breakfast menu is muffins.

- (a) A local cafe, YARAS, makes muffins that have a mean weight of 118 g and a standard deviation of 19 g. Assume that the weights of the muffins can be approximately modelled by a normal distribution.

- (i) Find the probability that a randomly chosen muffin weighs more than 100 g.

- (ii) What percentage of muffins weigh between 100 g and 120 g?

- (iii) 10% of muffins are below the minimum weight requirement and cannot be sold.

What is the maximum weight of a muffin that cannot be sold?

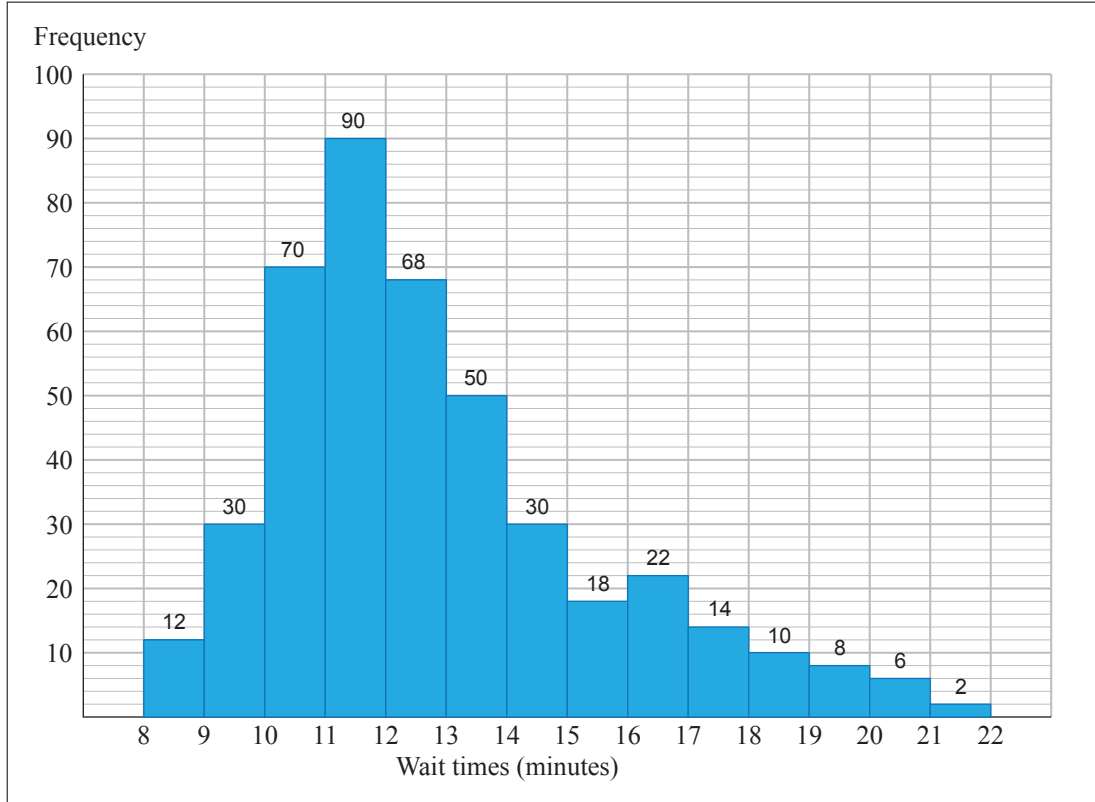
- (b) The cafe wants to decrease the percentage of muffins that fall below the minimum weight requirement. They want to ensure that no more than 2% of their muffins weigh less than 100 g, while still maintaining a mean weight of 118 g.

Calculate a new standard deviation for the muffin weights that would ensure no more than 2% of the muffins weigh less than 100 g.

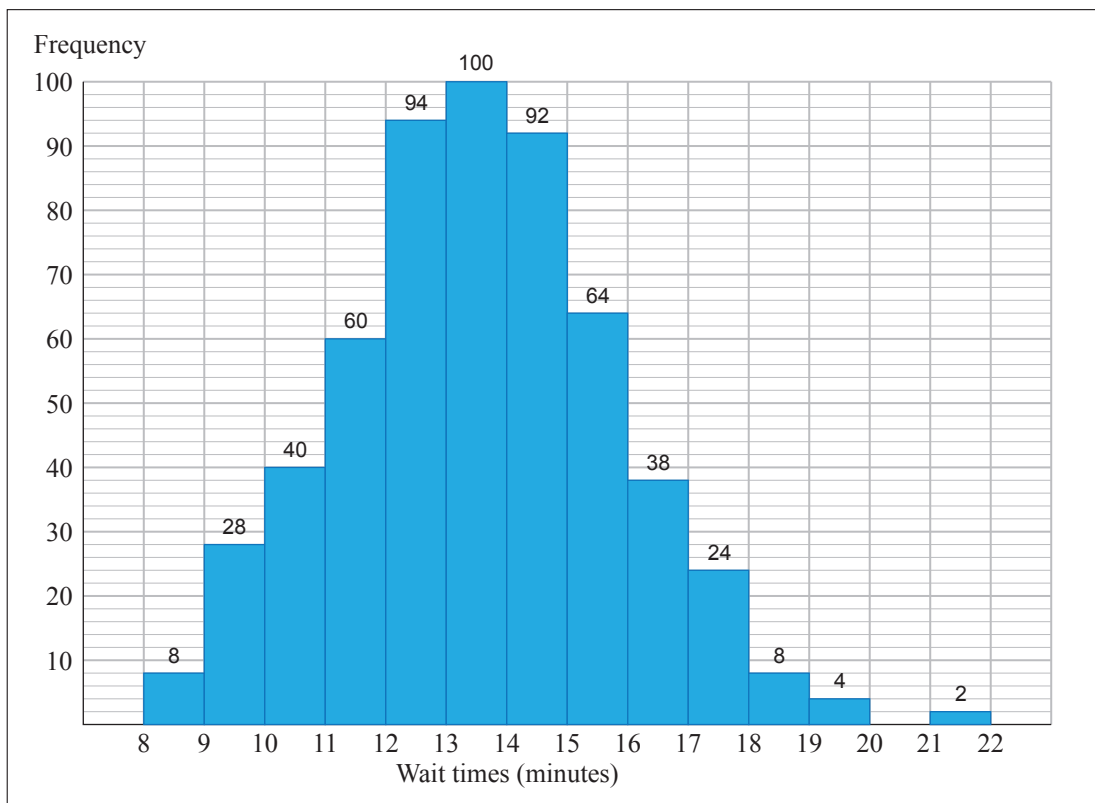
- (c) At YARAS, customers have to wait for their breakfasts to be prepared after their orders are placed.

The graphs below show the time in minutes that customers had to wait for their breakfast to arrive on a Saturday and Sunday during one weekend.

Saturday wait times for breakfast



Sunday wait times for breakfast



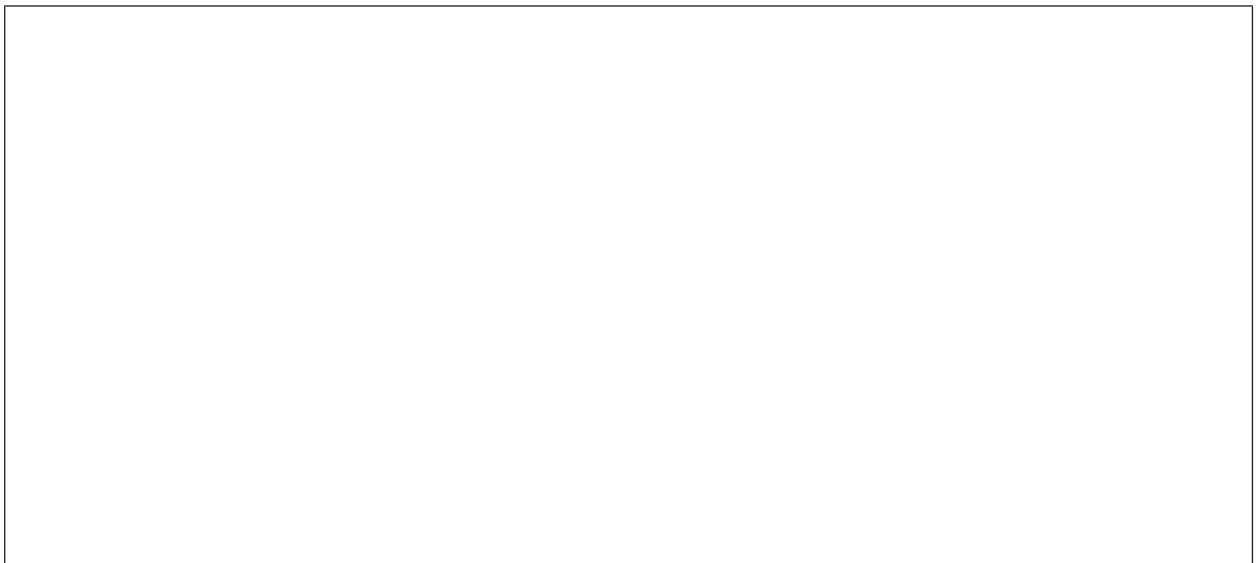
- Use the graph to calculate the probability to support or reject this claim.

- You should discuss shape, centre, and spread in relation to the context.

QUESTION TWO

- (a) YARAS also did a survey to determine which breakfast options were preferred by their customers. Their main choices were muesli, pancakes, or bacon & eggs. They then had a choice of fresh fruit or yoghurt.
- 25% of customers chose muesli, 30% chose pancakes, and the rest chose bacon & eggs.
 - $\frac{2}{5}$ of the customers preferred fruit with their muesli.
 - 18% preferred yoghurt with their pancakes.
 - Customers who chose bacon & eggs were equally likely to choose the fruit or yoghurt with their breakfast.

Draw a probability tree and use it to answer the parts below.



- (i) What is the probability that a customer chooses pancakes and fruit for breakfast?

- (ii) For a randomly selected group of 250 customers, how many customers would you expect to choose yoghurt?

- (b) The cafe is running a loyalty promotion for each month, where customers who spend over \$100 at the cafe will go into a draw to win a prize. Each month:
- 35% of all cafe customers spend over \$100.
 - $\frac{1}{5}$ of those who spend over \$100 win a prize.
 - Of the prize winners, 40% receive a \$20 discount voucher, and others win a free coffee.

Draw a probability tree, and use it to answer the following parts.



- (i) What proportion of the cafe's customers do not win?

- (ii) What is the probability that a customer who spends over \$100 next month wins a free coffee?

- (iii) Those customers who spent over \$100, but did not win a free coffee or \$20 voucher, can now win one of two consolation prizes, a badge or a sticker. The probability of a random customer winning a badge is 0.21.

What is the probability of a customer winning a sticker, given they have won a consolation prize?

QUESTION THREE

- (a) The cafe records the following information from customers, based on the most popular coffee selections.

	Teenagers	Adults	Total
Mocha	76	150	226
Latte	184	115	299
Cappuccino	20	105	125
Total	280	370	650

- (i) What percentage of customers ordered a cappuccino?

- (ii) What is the probability that a randomly selected teenager orders a latte?

- (iii) What is the probability that a randomly selected customer is either an adult or a cappuccino drinker?

*Question Three continues
on the following page.*

- (b) From the data, the owner believes that it is twice as likely for an adult than for a teenager to order a mocha. His manager thinks that he is wrong.

- (i) Explain why the owner believes this.

- (ii) Show with appropriate calculations how the manager can prove to the owner that he is wrong.

- (c) Research shows that there is a strong link between coffee consumption and anxiety in both adults and teenagers. Some findings suggest that there is a greater impact of coffee consumption on teenagers' anxiety than on adults'. The table shows some of these findings.

	Coffee induced anxiety	No anxiety	Total
Teenagers	267		390
Adults		130	
Total	347		600

A researcher claimed that teens are 80% more likely to be affected by anxiety due to coffee drinking than adults.

By first completing the table, evaluate this claim using calculations based on the data, and interpret the relative risks in context.

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