Level 3 Statistics: practice paper 2026

AS 91585 Apply probability concepts in solving problems · Vertex Academy practice paper, not an NZQA paper

Attempt ALL the questions. Show ALL working. Use NZQA's Level 3 formulae sheet. Write your answers on lined paper, or in the space under each question.

QUESTION ONE

(a) A Queenstown tourism survey asked 1500 visitors which of three activities they did during their stay: a bungy jump, a jet boat ride, or the gondola.

- 420 did a bungy jump, 610 rode a jet boat and 880 rode the gondola.
- 240 did both a bungy jump and a jet boat ride.
- 300 did both a jet boat ride and the gondola.
- 220 did both a bungy jump and the gondola.
- 90 did all three.

Estimate the probability that a randomly selected visitor from the survey did exactly one of the three activities.

(b) A Queenstown tourism survey asked 1500 visitors which activities they did. 420 did a bungy jump, 610 rode a jet boat, and 240 did both a bungy jump and a jet boat ride.
Interpret the relationship between the events 'visitor did a bungy jump' and 'visitor rode a jet boat'. As part of your answer, explain whether these two events are independent, and whether they are mutually exclusive.
Use calculations and statistical reasoning to support your answer.

(c) A Queenstown tourism survey asked 1500 visitors which of three activities they did: a bungy jump (420 visitors), a jet boat ride (610) or the gondola (880). 240 did bungy and jet boat, 300 did jet boat and gondola, 220 did bungy and gondola, and 90 did all three.
(i) A visitor is randomly selected from those who did at least two of the activities. Find the probability that they did all three.
(ii) A tour operator claims that more than half of the visitors who did a bungy jump also rode the gondola. Does the survey support this claim?

(d) A Queenstown jet boat company takes bookings two ways. 35% of bookings are made online and the rest are made in person at an i-SITE visitor centre. Records show that 6% of online bookings are no-shows (the customer does not turn up), and 2% of i-SITE bookings are no-shows.
(i) Given that a booking was a no-show, calculate the probability that it was made online.
(ii) The manager says: 'Most of our no-shows are online bookings, even though most of our bookings are made at the i-SITE.' Use probabilities to explain how both parts of this statement can be true.

(e) A Queenstown jet boat company's records show that 35% of bookings are made online and 65% at an i-SITE. 6% of online bookings and 2% of i-SITE bookings are no-shows, so overall 3.4% of bookings are no-shows.

The boat has 12 seats. The company is thinking of selling 13 tickets for each trip. It will only do this if the probability that someone is turned away (all 13 ticket holders turn up) is less than 0.5.

(i) Estimate the probability that all 13 ticket holders turn up, using the overall no-show rate. State the assumption you have made.

(ii) The company is also thinking of overbooking only trips sold entirely online. Find the probability that all 13 turn up for such a trip, and advise the company.

(iii) Many tickets are bought by families and groups travelling together. Discuss how this affects your answers and your advice.

QUESTION TWO

(a) Detector dogs at Auckland Airport sniff incoming bags for undeclared biosecurity risk goods, such as fruit or meat. If a dog sits beside a bag, it 'indicates' the bag. In a trial, 2000 bags were checked by a dog and then searched by hand. The results are in the table.
Find the probability that a randomly selected bag from the trial had risk goods or was indicated by the dog (or both).

	Risk goods	**No risk goods**	**Total**
Dog indicates	152	216	368
Dog does not indicate	38	1594	1632
Total	190	1810	2000

(b) In a trial at Auckland Airport, 2000 bags were checked by a detector dog and then searched by hand for biosecurity risk goods. The results are in the table.

Two claims are made about the dog.

Claim A: 'The dog finds four out of every five bags that contain risk goods.'

Claim B: 'When the dog sits beside a bag, the bag usually contains risk goods.'

Does the trial data support each claim? Support your answers with statistical reasoning.

	Risk goods	**No risk goods**	**Total**
Dog indicates	152	216	368
Dog does not indicate	38	1594	1632
Total	190	1810	2000

(c) A study followed 840 Auckland adults who cycle to work for one year. 360 of them rode mostly on separated bike lanes, and 18 of these were injured in a crash during the year. The other 480 rode mostly on roads with traffic, and 48 of these were injured.

(i) Calculate the relative risk of injury for road riders compared with bike-lane riders, and interpret it in context.

(ii) Give one reason why this study cannot show that riding on roads causes the extra injuries.

(d) A study followed 840 Auckland adults who cycle to work for one year. Of 360 who rode mostly on separated bike lanes, 18 were injured in a crash. Of 480 who rode mostly on roads with traffic, 48 were injured. The study also recorded how far each person rode: the bike-lane riders averaged 45 km a week and the road riders averaged 90 km a week.

A news website reports: 'Riding on the road doubles your risk of injury. Moving all 480 road riders onto bike lanes would prevent 24 injuries a year.'

Evaluate this report. Use calculations and statistical reasoning to support your answer.

(e) In a trial at Auckland Airport, a detector dog correctly indicated 80% of bags that contained biosecurity risk goods. It also wrongly indicated 216 of the 1810 bags that had no risk goods.
The same dog is moved to an arrivals hall where only 2% of bags contain risk goods.
(i) Assuming the dog performs as it did in the trial, find the probability that a bag the dog indicates in the new hall contains risk goods.
(ii) Biosecurity staff decide that every bag the dog indicates is also X-rayed, and the bag is only opened if the X-ray also flags it. The X-ray flags 90% of bags with risk goods and 5% of bags without. Find the probability that an opened bag contains risk goods, and the probability that a bag with risk goods is not opened. State the assumption you need, and evaluate this two-step system.

QUESTION THREE

(a) A Hamilton driving school recorded how many attempts its learners needed to pass the practical test for a restricted licence. The random variable X is the number of attempts a learner needs. Its probability distribution is shown in the table.
Find the value of k, and the probability that a learner needs three or more attempts.

X (attempts)	1	2	3	4	5 or more
P(X = x)	0.42	0.28	0.15	0.08	k

(b) A Hamilton driving school recorded how many attempts its learners needed to pass the practical test for a restricted licence. X is the number of attempts. The distribution is in the table.
The school makes two claims in an advertisement.
Claim 1: 'Twice as many of our learners pass first time as need three or more attempts.'
Claim 2: 'If you fail your first attempt, you are more likely than not to pass on your second.'
Does the distribution support each claim? Use probabilities to justify your answers.

X (attempts)	1	2	3	4	5 or more
P(X = x)	0.42	0.28	0.15	0.08	0.07

(c) A cereal company puts one of six native bird cards (kākāpō, tūī, kea, kererū, pīwakawaka and takahē) in each box. A student assumes each card is equally likely and simulates collecting the full set by rolling a fair dice, counting rolls until all six numbers have appeared. One trial gives the number of boxes needed. The results of 40 trials are in the table.

(i) Use the simulation to estimate the probability that a family needs more than 15 boxes to collect the full set.

(ii) The company claims that most families will collect all six cards within 12 boxes. Does the simulation support this claim? Comment on how reliable your conclusion is.

Boxes needed	**6 to 9**	**10 to 12**	**13 to 15**	**16 to 18**	**19 to 21**	**22 to 24**	**25 or more**
Number of trials	6	10	9	7	4	2	2

(d) A cereal company puts one of six native bird cards in each box. A student simulated collecting the cards assuming all six are equally likely, so P(kākāpō card) = $\frac{1}{6}$.

The company later reveals that it printed 90 000 cards for the promotion, of which 9000 were kākāpō cards. A Year 13 class opened 75 boxes bought from local shops and found 6 kākāpō cards.

Compare the true probability, the model estimate and the experimental estimate of getting a kākāpō card in a box. Discuss which is the most reliable, and what this means for the student's simulation. The student's simulation estimated that 40% of families would collect all six cards within 12 boxes, and the company claims that most families will collect all six within 12 boxes.

(e) A cereal company printed 90 000 native bird cards: 9000 kākāpō cards and 16 200 each of the other five birds (tūī, kea, kererū, pīwakawaka and takahē). One card goes in each box.
(i) Describe how to carry out ONE trial of a simulation, using random whole numbers from 1 to 100, to estimate the number of boxes needed to collect all six cards with these probabilities.
(ii) The company also claims: 'Buy one box a week for 12 weeks and you are almost certain (at least 95%) to get a kākāpō card.' Evaluate this claim using the true probability, and compare with the answer you would get if all cards were equally likely. Find the least number of boxes needed to give at least a 95% chance of a kākāpō card. State the assumption you have made.

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