Level 2 Mathematics and Statistics: practice paper 2026

AS 91267 Apply probability methods in solving problems · Vertex Academy practice paper, not an NZQA paper

Attempt ALL the questions. Show ALL working. Use NZQA's Level 2 formulae sheet. Write your answers on lined paper, or in the space under each question.

QUESTION ONE

(a) The weights of kiwifruit from a Bay of Plenty orchard are normally distributed with mean 105 g and standard deviation 12 g. Find the z-value for a kiwifruit weighing 125 g, and the probability that a randomly chosen kiwifruit weighs more than 125 g.

(b) The weights of kiwifruit from a Bay of Plenty orchard are normally distributed with mean 105 g and standard deviation 12 g.
(i) Kiwifruit that weigh less than 90 g are sent for juice. How many of the fruit in a bin of 2400 would you expect to be sent for juice?
(ii) The heaviest 15% of kiwifruit are packed as "jumbo". Find the minimum weight of a jumbo kiwifruit.

(c) The weights of kiwifruit from a Bay of Plenty orchard are normally distributed with mean 105 g and standard deviation 12 g. The grower wants no more than 3% of fruit to weigh less than 90 g. Changing how the vines are thinned can raise the mean weight without changing the standard deviation. Find the smallest mean weight that would meet the grower's target.

(d) Samples of 300 kiwifruit were weighed from two orchards, A and B. The table gives the summary statistics. A histogram of Orchard A's weights is roughly bell-shaped with one peak at 100 to 110 g. A histogram of Orchard B's weights has one peak at 90 to 100 g, with fruit bunched to the left and a long tail stretching out to the right.

(i) Compare the distributions of kiwifruit weights from the two orchards. Discuss shape, centre and spread, with numbers, in context.

(ii) A packer wants to model Orchard B's weights with a normal distribution with mean 102.6 g and standard deviation 15.8 g. Use a calculation to explain whether this model is suitable.

Statistic (g)	**Orchard A**	**Orchard B**
Minimum	72	80
Lower quartile	97	92
Median	105	98
Upper quartile	113	110
Maximum	139	162
Mean	105.2	102.6
Standard deviation	12.1	15.8

(e) At a Te Puke packhouse, 10% of a grower's kiwifruit weigh less than 90 g and 5% weigh more than 130 g. Assume the weights are normally distributed.

(i) Find the mean and standard deviation of the weights.

(ii) The packhouse expects 20 000 of this grower's fruit this season. How many would you expect to weigh between 100 g and 120 g?

(iii) In a random sample of 400 of the grower's fruit, 34 weighed less than 90 g. Compare this with the model and comment.

QUESTION TWO

(a) A surf school at Mount Maunganui runs one beginners' lesson each day. On 70% of days the swell is suitable. When the swell is suitable, the lesson goes ahead 90% of the time (otherwise strong wind cancels it). When the swell is not suitable, the lesson is moved to a calmer beach and goes ahead 30% of the time. Draw a probability tree and find the probability that the lesson goes ahead on a randomly chosen day.

(b) A surf school at Mount Maunganui runs one beginners' lesson each day. On 70% of days the swell is suitable. When the swell is suitable, the lesson goes ahead 90% of the time. When the swell is not suitable, the lesson goes ahead 30% of the time.
(i) Given that the lesson went ahead on a particular day, what is the probability that the swell was suitable?
(ii) The summer season has 40 days. How many lessons would you expect to go ahead?

(c) The number of students, X, who turn up to a surf lesson has the probability distribution in the table, where k is a constant. Each student pays $65.

(i) Find k.

(ii) On how many of 200 lessons would you expect the school to take at least $260?

(iii) Find the probability that at least 5 students turn up.

Number of students, x	**2**	**3**	**4**	**5**	**6**
P(X = x)	0.10	0.25	k	0.20	0.15

(d) Of the students at a surf school, 40% are complete beginners and the rest have surfed before. Of those who have surfed before, 85% stand up on the board during their lesson. Overall, 67% of all students stand up during their lesson.

(i) Draw a probability tree and find the probability that a complete beginner stands up during the lesson.

(ii) A student stood up during the lesson. What is the probability that this student is a complete beginner?

(iii) In a group of 25 students, how many complete beginners would you expect NOT to stand up?

(e) After each lesson, the surf school gives the student a wristband in one of four colours. The colour is chosen at random, and each colour is equally likely. A student wants all four colours. A simulation using random whole numbers from 1 to 4 was run 50 times. Each trial counted how many lessons were needed to collect all four colours. The table shows the results.

(i) Use the table to estimate the probability that exactly 4 lessons are needed, the probability that more than 10 lessons are needed, and the mean number of lessons needed.

(ii) Find the theoretical probability that exactly 4 lessons are needed. Compare it with your estimate from (i), and explain the difference. (The theoretical mean is 8.33 lessons.)

Lessons needed	Number of trials
4	2
5	7
6	8
7	7
8	5
9	4
10	3
11	4
12	4
13	2
14	1
16	2
17	1

QUESTION THREE

(a) A study followed 800 secondary school rugby players for one season. The table shows whether each player wore a mouthguard and whether they had a dental injury.

(i) What percentage of the players had a dental injury?

(ii) A player who had a dental injury is chosen at random. What is the probability that this player did not wear a mouthguard?

	Dental injury	**No dental injury**	**Total**
Wore a mouthguard	18	582	600
No mouthguard	27	173	200
Total	45	755	800

(b) A study followed 800 secondary school rugby players for one season. Of the 600 players who wore a mouthguard, 18 had a dental injury. Of the 200 players who did not wear a mouthguard, 27 had a dental injury. Calculate the relative risk of a dental injury for players who wore a mouthguard compared with players who did not, and interpret it in context.

(c) 800 secondary school rugby players were recorded by position and whether they were concussed during the season. Some of the table is missing.

(i) Complete the table.

(ii) What is the probability that a randomly chosen player is a back or was concussed?

(iii) A player who was not concussed is chosen at random. What is the probability that this player is a forward?

	Concussed	**Not concussed**	**Total**
Forwards	36		480
Backs		304	
Total	52		800

(d) In a season, 36 of 480 school rugby forwards and 16 of 320 backs were concussed. A coach says: "36 forwards were concussed but only 16 backs, so forwards are more than twice as likely to be concussed as backs."

(i) Explain the error in the coach's reasoning.

(ii) Use relative risk to evaluate the coach's claim, and interpret your relative risk in context.

(iii) If backs had the same risk of concussion as forwards, how many backs would you expect to have been concussed?

(e) A dentist says: "Players with a custom-fitted mouthguard are 0.4 times as likely to have a dental injury as players with a shop-bought mouthguard." In a large rugby competition where every player wears one of these two types, 30% of players wear a custom-fitted mouthguard. The probability that a randomly chosen player wears a shop-bought mouthguard AND has a dental injury is 0.042.
Assume the dentist's claim is correct.
(i) Find the probability that a randomly chosen player has a dental injury.
(ii) A player has a dental injury. What is the probability that this player wears a custom-fitted mouthguard?
(iii) The competition has 1500 players. How many dental injuries would you expect in a season?

© Vertex Academy 2026. Free to copy for study. vertexacademy.co.nz/ncea-level-2-probability-practice-paper