

Normal distribution 1 [33 marks]

1. [Maximum mark: 5] 23M.1.AHL.TZ1.9

On a specific day, the speed of cars as they pass a speed camera can be modelled by a normal distribution with a mean of 67.3 km h^{-1} .

A speed of 75.7 km h^{-1} is two standard deviations from the mean.

- (a) Find the standard deviation for the speed of the cars. [2]

It is found that 82% of cars on this road travel at speeds between $p \text{ km h}^{-1}$ and $q \text{ km h}^{-1}$, where $p < q$. This interval includes cars travelling at a speed of 74 km h^{-1} .

- (b) Show that the region of the normal distribution between p and q is **not** symmetrical about the mean. [3]

2. [Maximum mark: 6] 23M.1.AHL.TZ2.5

The lengths of the seeds from a particular mango tree are approximated by a normal distribution with a mean of 4 cm and a standard deviation of 0.25 cm .

A seed from this mango tree is chosen at random.

- (a) Calculate the probability that the length of the seed is less than 3.7 cm . [2]

It is known that 30% of the seeds have a length greater than $k \text{ cm}$.

- (b) Find the value of k . [2]

For a seed of length $d \text{ cm}$, chosen at random,
 $P(4 - m < d < 4 + m) = 0.6$.

- (c) Find the value of m . [2]

3. [Maximum mark: 5] 22N.1.SL.TZ0.8

Roy is a member of a motorsport club and regularly drives around the Port Campbell racetrack.

The times he takes to complete a lap are normally distributed with mean 59 seconds and standard deviation 3 seconds.

- (a) Find the probability that Roy completes a lap in less than 55 seconds. [2]

Roy will complete a 20 lap race. It is expected that 8.6 of the laps will take more than t seconds.

- (b) Find the value of t . [3]

4. [Maximum mark: 6] 22M.1.SL.TZ1.8

A factory produces bags of sugar with a labelled weight of 500 g. The weights of the bags are normally distributed with a mean of 500 g and a standard deviation of 3 g.

- (a) Write down the percentage of bags that weigh more than 500 g. [1]

A bag that weighs less than 495 g is rejected by the factory for being underweight.

- (b) Find the probability that a randomly chosen bag is rejected for being underweight. [2]

- (c) A bag that weighs more than k grams is rejected by the factory for being overweight. The factory rejects 2% of bags for being overweight.

Find the value of k .

[3]

5. [Maximum mark: 5]

22M.1.SL.TZ2.10

The masses of Fuji apples are normally distributed with a mean of 163 g and a standard deviation of 6.83 g.

When Fuji apples are picked, they are classified as small, medium, large or extra large depending on their mass. Large apples have a mass of between 172 g and 183 g.

- (a) Determine the probability that a Fuji apple selected at random will be a large apple.

[2]

Approximately 68% of Fuji apples have a mass within the medium-sized category, which is between k and 172 g.

- (b) Find the value of k .

[3]

6. [Maximum mark: 6]

23M.1.AHL.TZ1.11

A shop sells oranges and lemons. The weights of the oranges are assumed to be normally distributed with mean 205 grams and standard deviation 5 grams. The weights of the lemons are assumed to be normally distributed with mean 105 grams and standard deviation 3 grams.

Nelia selects 1 orange and 2 lemons at random and independent of each other. Calculate the probability that the weight of her orange exceeds the combined weight of her lemons.

[6]

