8. An orchard produces apples.

The weights, A grams, of its apples are normally distributed with mean μ grams and standard deviation σ grams.

It is known that

$$P(A < 162) = 0.1 \text{ and } P(162 < A < 175) = 0.7508$$

(a) Calculate the value of μ and the value of σ

(5)

A second orchard also produces apples.

The weights, B grams, of its apples have distribution $B \sim N(215, 10^2)$

An outlier is a value that is

$$\text{greater than } Q_3 + 1.5 \times (Q_3 - Q_1) \text{ or smaller than } Q_1 - 1.5 \times (Q_3 - Q_1)$$

An apple is selected at random from this second orchard.

Using $Q_3 = 221.74$ grams,

(b) find the probability that this apple is an outlier.

(5)

3. The weights of women boxers in a tournament are normally distributed with mean 64 kg and standard deviation 8 kg.

(a) Find the probability that a randomly chosen woman boxer in the tournament weighs less than 51 kg.

(3)

In the tournament, women boxers who weigh less than 51 kg are classified as lightweight. Ren weighs 49 kg and she has a match against another randomly selected, lightweight woman boxer.

(b) Find the probability that Ren weighs less than the other boxer.

(4)

In the tournament, women boxers who weigh more than H kg are classified as heavyweight. Given that 10% of the women boxers in the tournament are classified as heavyweight,

(c) find the value of H.

(3)

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3. The distance achieved in a long jump competition by students at a school is normally distributed with mean 3.8 metres and standard deviation 0.9 metres.

Students who achieve a distance greater than 4.3 metres receive a medal.

(a) Find the proportion of students who receive medals.

(3)

The school wishes to give a certificate of achievement or a medal to the 80% of students who achieve a distance of at least d metres.

(b) Find the value of d.

(3)

Of those who received medals, the $\frac{1}{3}$ who jump the furthest will receive gold medals.

(c) Find the shortest distance, g metres, that must be achieved to receive a gold medal.

(4)

A journalist from the local newspaper interviews a randomly selected group of 3 medal winners.

(d) Find the exact probability that there is at least one gold medal winner in the group.

(3)

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4. The random variable $Y \sim \mathrm{N}(\mu, \sigma^2)$

Given that $\mathrm{P}(Y < 17) = 0.6$ find

(a) $\mathrm{P}(Y > 17)$

(1)

(b) $\mathrm{P}(\mu < Y < 17)$

(2)

(c) $\mathrm{P}(Y < \mu \mid Y < 17)$

(2)

5. The distance an athlete can throw a discus is normally distributed with mean 40 m and standard deviation 4 m

(a) Using standardisation, show that the probability that this athlete throws the discus less than 38.8 m is 0.3821

(2)

This athlete enters a discus competition.
To qualify for the final, they have 3 attempts to throw the discus a distance of more than 38.8 m
Once they qualify, they do not use any of their remaining attempts.

Given that they qualified for the final and that throws are independent,

(b) find the probability that this athlete qualified for the final on their second throw with a distance of more than 44 m

(5)

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6. The waiting time, L minutes, to see a doctor at a health centre is normally distributed with $L \sim N(\mu, \sigma^2)$.

Given that $P(L < 15) = 0.9$ and $P(L < 5) = 0.05$

(a) find the value of μ and the value of σ.

(6)

There are 23 people waiting to see a doctor at the health centre.

(b) Determine the expected number of these people who will have a waiting time of more than 12 minutes.

(3)

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