

Topic Test

Summer 2022

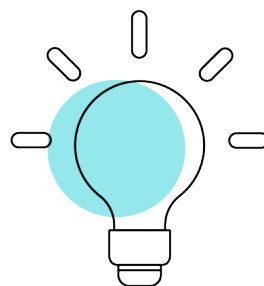
Pearson Edexcel GCE Mathematics (9MA0)

Paper 3 – Statistics

Topic 5: Normal distribution AND Hypothesis testing

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Question T5_Q1

- (5)

Question T5_Q2

5. A machine puts liquid into bottles of perfume. The amount of liquid put into each bottle, D ml, follows a normal distribution with mean 25 ml

Given that 15% of bottles contain less than 24.63 ml

- (a) find, to 2 decimal places, the value of k such that $P(24.63 < D < k) = 0.45$ (5)

A random sample of 200 bottles is taken.

- (b) Using a normal approximation, find the probability that fewer than half of these bottles contain between 24.63 ml and k ml

The machine is adjusted so that the standard deviation of the liquid put in the bottles is now 0.16ml

Following the adjustments, Hannah believes that the mean amount of liquid put in each bottle is less than 25 ml

She takes a random sample of 20 bottles and finds the mean amount of liquid to be 24.94 ml

- (c) Test Hannah's belief at the 5% level of significance.
You should state your hypotheses clearly.

[illegible]

Question T5_Q3

5. A health centre claims that the time a doctor spends with a patient can be modelled by a normal distribution with a mean of 10 minutes and a standard deviation of 4 minutes.

(a) Using this model, find the probability that the time spent with a randomly selected patient is more than 15 minutes.

(1)

Some patients complain that the mean time the doctor spends with a patient is more than 10 minutes.

The receptionist takes a random sample of 20 patients and finds that the mean time the doctor spends with a patient is 11.5 minutes.

(b) Stating your hypotheses clearly and using a 5% significance level, test whether or not there is evidence to support the patients' complaint.

(4)

The health centre also claims that the time a dentist spends with a patient during a routine appointment, T minutes, can be modelled by the normal distribution where $T \sim N(5, 3.5^2)$

(c) Using this model,

(i) find the probability that a routine appointment with the dentist takes less than 2 minutes

(1)

(ii) find $P(T < 2 \mid T > 0)$

(3)

(iii) hence explain why this normal distribution may not be a good model for T .

(1)

The dentist believes that she cannot complete a routine appointment in less than 2 minutes.

She suggests that the health centre should use a refined model only including values of $T > 2$

(d) Find the median time for a routine appointment using this new model, giving your answer correct to one decimal place.

(5)

Question T5_Q4

5. The heights of females from a country are normally distributed with
- a mean of 166.5 cm
 - a standard deviation of 6.1 cm

Given that 1% of females from this country are shorter than k cm,

- (a) find the value of k (2)
- (b) Find the proportion of females from this country with heights between 150 cm and 175 cm (1)

A female, from this country, is chosen at random from those with heights between 150 cm and 175 cm

- (c) Find the probability that her height is more than 160 cm (4)

The heights of females from a different country are normally distributed with a standard deviation of 7.4 cm

Mia believes that the mean height of females from this country is less than 166.5 cm.

Mia takes a random sample of 50 females from this country and finds the mean of her sample is 164.6 cm

- (d) Carry out a suitable test to assess Mia's belief.
You should
- state your hypotheses clearly
 - use a 5% level of significance
- (4)**

