

**Year 12 Methods 3,4
Test 5 2021**

**Calculator Assumed
Normal Distribution**

STUDENT'S NAME _____

DATE: Friday 13 August

TIME: 40 minutes

MARKS: 38

INSTRUCTIONS:

Standard Items: Pens, pencils, drawing templates, eraser

Special Items: Three calculators, notes on one side of a single A4 page (these notes to be handed in with this assessment)

Questions or parts of questions worth more than 2 marks require working to be shown to receive full marks.

1. (4 marks)

(a) Given Z is the standard normal variable, determine k if $P(-0.234 \leq Z < k) = 0.7768$

[2]

(b) Given $X \sim N(102, 9)$, determine k if $P(102 - k \leq X \leq 102 + k) = 0.36$

[2]

2. (20 marks)

A rock lobster fishing boat is pulling up pots at the back of Rottneest for the catch on a particularly successful day. Legal size rock lobsters must measure at least 76 mm along their shell (carapace). Past data indicates a mean length of 81 mm and standard deviation of 9 mm for rock lobsters in this area.

(a) Calculate the probability that a randomly chosen rock lobster from a pot is a legal size. [2]

(b) For a day when 278 rock lobsters are pulled up in pots, determine the expected number that are of a legal size. [1]

(c) Calculate the probability a randomly chosen rock lobster from a pot will have a carapace length more than one quarter of the variance from the mean. [2]

(d) For the distribution of rock lobster carapace lengths, calculate the 0.72 quantile and explain what this means. [3]

- (e) A rock lobster can be seen to be a legal size. What is the probability it will be recorded as a jumbo? Jumbo rock lobsters must have a carapace length of at least 100 mm. [3]
- (e) 20 rock lobsters are pulled up in one pot. What is the probability that no more than 2 of them are not a legal size [3]
- (f) In measuring rock lobsters at random from a pot, what is the probability that the second rock lobster not of legal size is the twelfth rock lobster measured. [3]
- (g) Rock lobsters caught at the Abrolhos Islands have a mean carapace length of 86 mm. It is known that 98.3% of these rock lobsters measure over 56 mm. What is the standard deviation of carapace length of these rock lobsters? [3]

3. (14 marks)

A company manufactures shoelaces for joggers (shoes) which claim to be 45 cm long. The shoelaces are normally distributed with a mean of 44.9 cm and a standard deviation of 3 mm.

(a) What proportion of the shoelaces are the actual claimed length of 45 cm? [1]

(b) Josh is interested in purchasing shoelaces for his joggers. In order to tie his shoelaces with ease, they must be at least 45 cm long.

(i) Josh purchases a packet of 2 shoelaces from this company. Determine the probability that they both suit his requirements. [3]

(ii) What is the minimum number of shoelaces needed to be purchased so that there is a 95% chance that at least two shoelaces suit Josh's requirements? [3]

- (c) The company also manufactures multi coloured shoelaces. A recent production run showed that 10% of these laces were less than 44.5 cm and 15% were greater than 45.6 cm. Show the mean and standard deviation of the multi coloured laces are 45.1 cm and 4.7 mm respectively. [4]

- (d) Determine the value of k such that the probability the laces are longer than k cm is the same for the laces of both the joggers and the multi coloured laces. [3]