Write your name here

Surname	Other Names

AS/A Level Mathematics

Mean of Normal Distribution Hypothesis Testing

Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

• Use **black** ink or ball-point pen.
• If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
• **Fill in the boxes** at the top of this page with your name.
• Answer **all** questions and ensure that your answers to parts of questions are clearly labelled..
• Answer the questions in the spaces provided
– there may be more space than you need.
• You should show sufficient working to make your methods clear.
Answers without working may not gain full credit.
• Answers should be given to three significant figures unless otherwise stated.

Information

• The marks for **each** question are shown in brackets
– use this as a guide as to how much time to spend on each question.

Advice

• Read each question carefully before you start to answer it.
• Try to answer every question.
• Check your answers if you have time at the end.

1 The weight of beans in a tin produced by company A normally distributed with a mean of 415 g and a standard deviation of 3.4 g.

(a) Find the probability that a randomly selected tin of beans has a weight of less than 409 g. **(2)**

Company A suspects that the mean weight of tins from a machine is lower than it should be.

(b) Write down the company's null and alternative hypothesis. **(1)**

A sample of 20 tins is taken and the mean weight is found to be 413 g .

(c) Carry out a test at the 1% significance level to see if there is evidence that the machine is producing tins with a mean of less than 415 g. **(3)**

(Total for question 1 is 6 marks)

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2 The length of the bus journey from Leeds to London is normally distributed with a mean of 220 minutes and a standard deviation of 8 minutes.

(a) Find the probability of a bus taking longer than 235 minutes. **(2)**

The bus company suspect that the mean bus time has changed.

(b) Write down a null and alternative hypothesis for a two-tailed test. **(1)**

They take a sample of 10 bus journeys and find a mean time of 230 minutes.

(c) Test at the 1% significance level whether there is evidence that the mean time has changed. **(3)**

(Total for question 2 is 4 marks)

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3 A company advertised phone batteries with a mean standby time of 235 hours.

A phone shop manager feels that the batteries have a standby time of less than 235 hours.

The manager conducts an experiment and collects the following summary statistics:

$$n = 200 \qquad \sum x = 46313 \qquad \sum x^2 = 10861255$$

(a) Find the mean and standard deviation of the sample. **(3)**

(b) Carry out a hypothesis test to test the manager's claim at the 1% significance level. State your assumptions clearly. **(5)**

(Total for question 3 is 8 marks)
