

1 Given that $X \sim N(20, 25)$ find the following probabilities

(a) $P(X > 25)$

(1)

(b) $P(X < 14.8)$

(1)

(c) $P(13 < X < 19)$

(1)

(Total for question 1 is 3 marks)

- 2** The distribution of the weights of coffee in a jar is normally distributed with a mean of 200 g and a standard deviation of 4.2 g.

Find the probability that the weight of the coffee is:

(a) More than 205 g

(1)

(b) Less than 195 g

(1)

(c) Between 195 g and 205 g

(1)

(Total for question 2 is 3 marks)

- 3** The times it takes students to complete a test are normally distributed with a mean of 58 minutes and a standard deviation of 12 minutes.
Find the time by which 90% of students complete the test.

(Total for question 3 is 2 marks)

- 4** The heights of a group of people are normally distributed with a mean of 164 cm and 10% of the people have a height of less than 150 cm.
Find the standard deviation of the heights of the people.

(Total for question 4 is 4 marks)

- 5** A variable Y is normally distributed with a standard deviation of 2.8. Given $P(Y < 26) = 0.3$
Find the mean of Y .

(Total for question 5 is 4 marks)

- 6** The 100m race times an athlete records are normally distributed.
16% of the time the athlete is faster than 10 seconds.
23% of the time the athlete is slower than 11 seconds.
Find the mean and standard deviation of the times.

(Total for question 6 is 6 marks)

- 7 A variable X is normally distributed. Given $P(X < 52) = 0.2$ and $P(X > 60) = 0.3$
Find the mean and standard deviation of X .

(Total for question 7 is 6 marks)

8 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)

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

(1)

(c) A sample of 20 tins is taken and the mean weight is found to be 413 g. 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 8 is 6 marks)

9 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)

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

(1)

(c) They take a sample of 10 bus journeys and find a mean time of 230 minutes. Test at the 1% significance level whether there is evidence that the mean time has changed.

(3)

(Total for question 9 is 6 marks)

- 10** 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:

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

- (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 10 is 8 marks)

11 The battery life, in hours, for a fully charged wireless keyboard is normally distributed with mean 50 hours and standard deviation 6 hours. Hannah has a fully charged wireless keyboard.

(a) Find the probability that the keyboard lasts longer than 45 hours.

(1)

(b) Hannah uses her keyboard for 45 hours. Find the probability that Hannah's keyboard lasts for another 10 hours.

(4)

- (c) Hannah believes that the mean battery life of the wireless keyboards are longer than 50 hours. She took a random sample of 20 of these keyboards and found that their mean lifetime was 51.1 hours. Stating your hypotheses clearly and using a 5% level of significance, test Hannah's belief.

(5)

(Total for question 11 is 10 marks)

12 A machine fills bottles with water. The amount of water in each bottle, W ml, is normally distributed with mean 500 ml. Given that 30% of bottles contain more than 504 ml

(a) Find the value of k such that $P(k < W < 505) = 0.45$

(5)

- (b) The machine is adjusted so that the standard deviation of the amount of water in each bottle is now 6 ml. Following the adjustments the company manager now believes that the mean amount of water in each bottle is less than 500 ml. She takes a random sample of 20 bottles and finds the mean amount of water to be 498.1 ml. Test the company manager's belief at the 5% significance level. You should state your hypotheses clearly.

(5)

(Total for question 12 is 10 marks)

13 A call centre claims that the amount of time a worker spends on each phone call can be modelled by a normal distribution with a mean of 8 minutes and a standard deviation of 2 minutes.

- (a) Using this model, find the probability that the time the worker spends on a randomly selected phone call is more than 11 minutes.

(1)

- (b) The call centre manager thinks that the mean time for each phone call is more than 8 minutes. The manager takes a random sample of 20 phone calls and finds that the average time is 8.8 minutes. Test the manager's belief at the 5% significance level. You should state your hypotheses clearly.

(4)

(Total for question 13 is 5 marks)
