

Year 2 Applied Chapter 3: The Normal Distribution
Exam Questions (Total Marks 42)

1) The distributions for the heights for a sample of females and males at a UK university can be modelled using normal distributions with mean 165 cm, standard deviation 9 cm and mean 178 cm, standard deviation 10 cm respectively.

A female's height of 177 cm and a male's height of 190 cm are both 12 cm above their means. Explain which is relatively taller.

(4 marks)

2) A certain type of cabbage has a mass M which is normally distributed with mean 900 g and standard deviation 100 g.

a) Find $P(M < 850)$ **(1 mark)**

10% of the cabbages are too light and 10% are too heavy to be packaged and sold at a fixed price.

b) Find the minimum and maximum weights of the cabbages that are packaged. **(3 marks)**

3) In a town, 54% of the residents are female and 46% are male. A random sample of 200 residents is chosen from the town. Using a suitable approximation, find the probability that more than half the sample are female.

(6 marks)

4) The heights of a population of men are normally distributed with mean μ cm and standard deviation σ cm. It is known that 20% of the men are taller than 180 cm and 5% are shorter than 170 cm.

a) Sketch a diagram to show the distribution of heights represented by this information. **(3 marks)**

b) Find the value of μ and σ . **(7 marks)**

c) Three men are selected at random, find the probability that they are all taller than 175 cm. **(2 marks)**

5)

a) State the conditions under which the normal distribution may be used as an approximation to the binomial distribution $X \sim B(n, p)$.

(2 marks)

b) Write down the mean and variance of the normal approximation to X in terms of n and p .

(2 marks)

A manufacturer claims that more than 55% of its batteries last for at least 15 hours of continuous use.

c) Write down a reason why the manufacturer should not justify their claim by testing all the batteries they produce.

(1 mark)

To test the manufacturer's claim, a random sample of 300 batteries were tested.

d) State the hypotheses for a one-tailed test of the manufacturer's claim.

(1 mark)

e) Given that 184 of the 300 batteries lasted for at least 15 hours of continuous use a normal approximation to test, at the 5% level of significance, whether or not the manufacturer's claim is justified.

(7 marks)

6) The mean body temperature for women is normally distributed with mean 36.73°C with variance $0.1482 (^{\circ}\text{C})^2$. Kay has a temperature of 38.1°C .

a) Calculate the probability of a woman having a temperature greater than 38.1°C .

(2 marks)

b) Advise whether should Kay get medical advice. Give a reason for your advice.

(1 mark)