(a)

- **1.** A random variable *X* is distributed normally with a mean of 20 and variance 9.
 - (a) Find $P(X \le 24.5)$.
 - (b) Let $P(X \le k) = 0.85$.
 - (i) Represent this information on the following diagram.





(3)

2. Let the random variable *X* be normally distributed with mean 25, as shown in the following diagram.

20



The shaded region between 25 and 27 represents 30 % of the distribution.

- (a) Find P(X > 27).
- (b) Find the standard deviation of *X*.
- **3.** A random variable *X* is distributed normally with mean 450 and standard deviation 20.
 - (b) Given that P(X > a) = 0.27, find *a*.

Find P($X \le 475$).

1

(2)

(5)

(Total 7 marks)

(2)

- 4. Let *X* be normally distributed with mean 100 cm and standard deviation 5 cm.
 - (a) On the diagram below, shade the region representing P(X > 105).



(2)

(2)

(4)

- (b) Given that P(X < d) = P(X > 105), find the value of *d*.
- (c) Given that P(X > 105) = 0.16 (correct to two significant figures), find P(d < X < 105).

(2) (Total 6 marks)

- 5. A box contains a large number of biscuits. The weights of biscuits are normally distributed with mean 7 g and standard deviation 0.5 g.
 - (a) One biscuit is chosen at random from the box. Find the probability that this biscuit
 - (i) weighs less than 8 g;
 - (ii) weighs between 6 g and 8 g.

(b) Five percent of the biscuits in the box weigh less than *d* grams.

(i) Copy and complete the following normal distribution diagram, to represent this information, by indicating *d*, and shading the appropriate region.



(ii) Find the value of *d*.

(5)

(c) The weights of biscuits in another box are normally distributed with mean μ and standard deviation 0.5 g. It is known that 20% of the biscuits in this second box weigh less than 5 g.

Find the value of μ .

(4) (Total 13 marks)

- 6. It is claimed that the masses of a population of lions are normally distributed with a mean mass of 310 kg and a standard deviation of 30 kg.
 - (a) Calculate the probability that a lion selected at random will have a mass of 350 kg or more.
 - (b) The probability that the mass of a lion lies between *a* and *b* is 0.95, where *a* and *b* are symmetric about the mean. Find the value of *a* and of *b*.

7. The heights of certain flowers follow a normal distribution. It is known that 20% of these flowers have a height less than 3 cm and 10% have a height greater than 8 cm.

Find the value of the mean μ and the standard deviation σ .

- 8. The heights of trees in a forest are normally distributed with mean height 17 metres. One tree is selected at random. The probability that a selected tree has a height greater than 24 metres is 0.06.
 - (a) Find the probability that the tree selected has a height less than 24 metres.
 - (b) The probability that the tree has a height less than D metres is 0.06. Find the value of D.
 - (c) A woodcutter randomly selects 200 trees. Find the expected number of trees whose height lies between 17 metres and 24 metres.

(4) (Total 9 marks)

(3)

(2)

(Total 6 marks)

(Total 5 marks)

(2)

(3)

- **9.** The scores of a test given to students are normally distributed with a mean of 21. 80 % of the students have scores less than 23.7.
 - (a) Find the standard deviation of the scores.

A student is chosen at random. This student has the same probability of having a score less than 25.4 as having a score greater than b.

- (b) (i) Find the probability the student has a score less than 25.4.
 - (ii) Find the value of *b*.

(4) (Total 7 marks)

(3)

10. The heights of certain plants are normally distributed. The plants are classified into three categories.

The shortest 12.92% are in category A. The tallest 10.38% are in category C. All the other plants are in category B with heights between r cm and t cm.

(a) Complete the following diagram to represent this information.



(2)

(b) Given that the mean height is 6.84 cm and the standard deviation 0.25 cm, find the value of r and of t.

(5) (Total 7 marks)