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

(ii) Find the value of $k$.
2. Let the random variable $X$ be normally distributed with mean 25 , as shown in the following diagram.


The shaded region between 25 and 27 represents $30 \%$ of the distribution.
(a) Find $\mathrm{P}(X>27)$.
(b) Find the standard deviation of $X$.
3. A random variable $X$ is distributed normally with mean 450 and standard deviation 20.
(a) Find $\mathrm{P}(X \leq 475)$.
(b) Given that $\mathrm{P}(X>a)=0.27$, find $a$.
4. Let $X$ be normally distributed with mean 100 cm and standard deviation 5 cm .
(a) On the diagram below, shade the region representing $\mathrm{P}(X>105)$.

(b) Given that $\mathrm{P}(X<d)=\mathrm{P}(X>105)$, find the value of $d$.
(c) Given that $\mathrm{P}(X>105)=0.16$ (correct to two significant figures), find $\mathrm{P}(d<X<105)$.
(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 $d$.
(c) The weights of biscuits in another box are normally distributed with mean $\mu$ 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 $\mu$.
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 $\mu$ and the standard deviation $\sigma$.
(Total 6 marks)
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.
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 $b$.
(Total 7 marks)
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 $r \mathrm{~cm}$ and $t \mathrm{~cm}$.
(a) Complete the following diagram to represent this information.

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

