

1. 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)

(b) Given that $P(X < d) = P(X > 105)$, find the value of d .

(2)

(c) Given that $P(X > 105) = 0.16$ (correct to two significant figures), find $P(d < X < 105)$.

(2)

(Total 6 marks)

2. 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.

(4)

(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)

(Total 9 marks)

3. A random variable X is distributed normally with mean 450 and standard deviation 20.

(a) Find $P(X \leq 475)$.

(2)

(b) Given that $P(X > a) = 0.27$, find a .

(4)

(Total 6 marks)

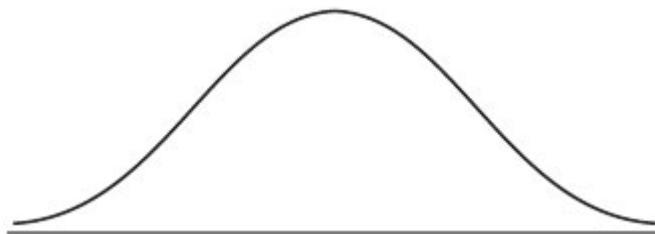
4. The heights of certain plants are normally distributed. The plants are classified into three categories.

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)

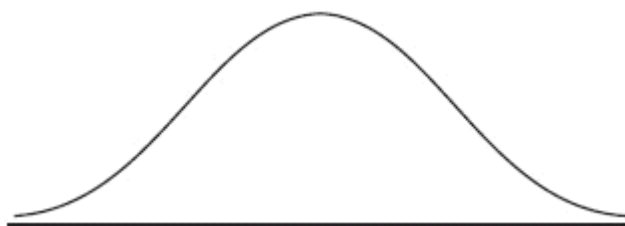
(Total 7 marks)

5. The weights of a group of children are normally distributed with a mean of 22.5 kg and a standard deviation of 2.2 kg.

(a) Write down the probability that a child selected at random has a weight more than 25.8 kg.

(b) Of the group 95% weigh less than k kilograms. Find the value of k .

(c) The diagram below shows a normal curve.



On the diagram, shade the region that represents the following information:

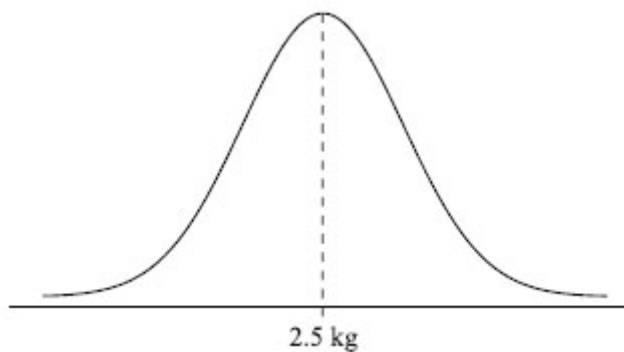
87% of the children weigh less than 25 kg

(Total 6 marks)

6. The heights of a group of students are normally distributed with a mean of 160 cm and a standard deviation of 20 cm.
- (a) A student is chosen at random. Find the probability that the student's height is greater than 180 cm.
- (b) In this group of students, 11.9% have heights less than d cm. Find the value of d .
- (Total 6 marks)

7. Residents of a small town have savings which are normally distributed with a mean of \$3000 and a standard deviation of \$500.
- (i) What percentage of townspeople have savings greater than \$3200?
- (ii) Two townspeople are chosen at random. What is the probability that **both** of them have savings between \$2300 and \$3300?
- (iii) The percentage of townspeople with savings less than d dollars is 74.22%. Find the value of d .
- (Total 8 marks)

8. The weights of chickens for sale in a shop are normally distributed with mean 2.5 kg and standard deviation 0.3 kg.
- (a) A chicken is chosen at random.
- (i) Find the probability that it weighs less than 2 kg.
- (ii) Find the probability that it weighs more than 2.8 kg.
- (iii) Copy the diagram below. Shade the areas that represent the probabilities from parts (i) and (ii).



- (iv) **Hence** show that the probability that it weighs between 2 kg and 2.8 kg is 0.7936 (to four significant figures).
- (7)

- (b) A customer buys 10 chickens.
- (i) Find the probability that all 10 chickens weigh between 2 kg and 2.8 kg.
- (ii) Find the probability that at least 7 of the chickens weigh between 2 kg and 2.8 kg.
- (6)
(Total 13 marks)

9. In a large school, the heights of all fourteen-year-old students are measured.

The heights of the girls are normally distributed with mean 155 cm and standard deviation 10 cm.

The heights of the boys are normally distributed with mean 160 cm and standard deviation 12 cm.

(a) Find the probability that a girl is taller than 170 cm. (3)

(b) Given that 10% of the girls are shorter than x cm, find x . (3)

(c) Given that 90% of the boys have heights between q cm and r cm where q and r are symmetrical about 160 cm, and $q < r$, find the value of q and of r . (4)

In the group of fourteen-year-old students, 60% are girls and 40% are boys.

The probability that a girl is taller than 170 cm was found in part (a).

The probability that a boy is taller than 170 cm is 0.202.

A fourteen-year-old student is selected at random.

(d) Calculate the probability that the student is taller than 170 cm. (4)

(e) Given that the student is taller than 170 cm, what is the probability the student is a girl? (3)

(Total 17 marks)