UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

STATISTICS **4040/01**

Paper 1 **For Examination from 2009**

SPECIMEN PAPER

2 hours 15 minutes

Additional Materials: Mathematical Tables
Pair of compasses
Protractor

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions in Section A and not more than **four** questions from Section B.
If working is needed for any question it must be shown below that question.
The use of an electronic calculator is expected in this paper.

The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use

This document consists of **17** printed pages and **1** blank page.

Section A [36 marks]

Answer **all** of the questions 1 to 6.

For Examiner's Use

1 The table below gives the population (in millions, correct to 1 decimal place) of each of the four countries of the United Kingdom at the Census in the year 2001.

Country	*Population (millions)*
England	49.1
Scotland	5.1
Wales	2.9
Northern Ireland	1.7
TOTAL	58.8

The data are to be illustrated by a pie chart.

(i) Calculate, each to the nearest degree, the sector angles of the pie chart.

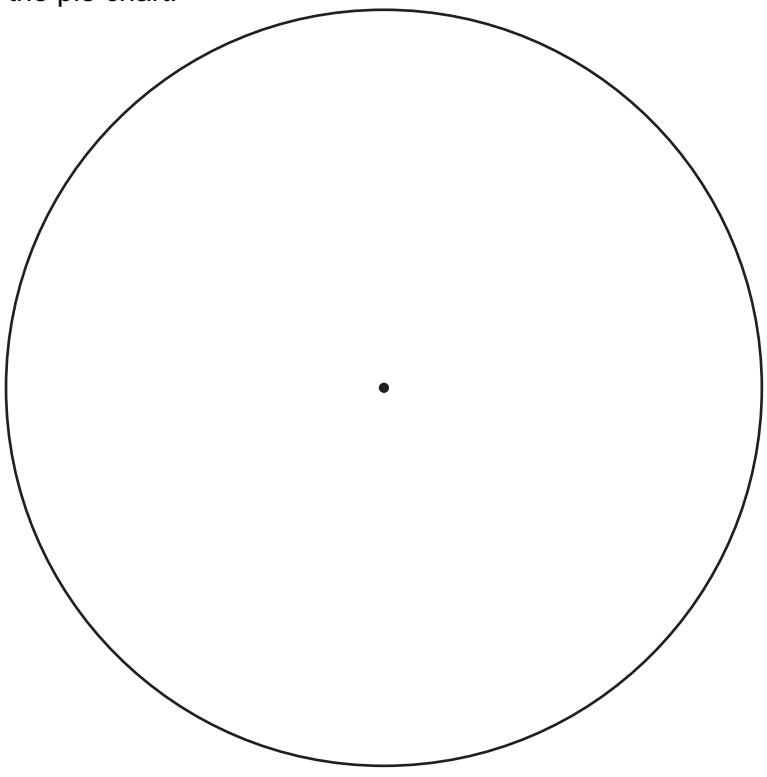
England .....

Scotland .....

Wales .....

Northern Ireland ..... [2]

(ii) Draw the pie chart.



[2]

In the Census in the year 1951 the population of the United Kingdom was 50.3 million (correct to 1 decimal place).

For Examiner's Use

(iii) Calculate, to 2 significant figures, the radius of the comparable pie chart which could be used to represent the population in 1951.

.....

[2]

2 A bus company was carrying out an investigation into the demand for its services. An observer standing at one bus stop recorded the number of people waiting in the queue when each bus arrived. The numbers recorded for nine consecutive buses on one day were as follows.

15 15 17 3* 20 18 17 15 13

The largest number, shown here as 3*, had not been recorded clearly, although it was definitely a two-digit number with first digit 3.

For these data,

(i) name and calculate **two** measures of average (central tendency) which can still be found,

.....

.....

[4]

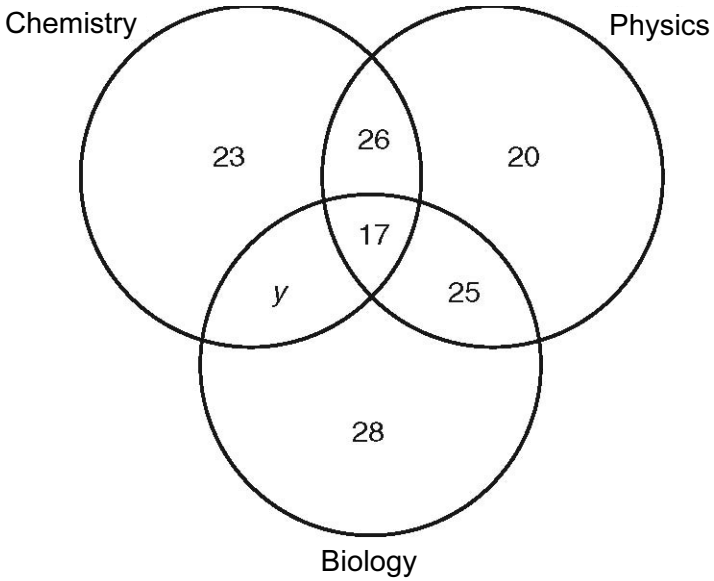
(ii) name and calculate **one** measure of dispersion which can be found.

.....

[2]

For Examiner's Use

3 The Science Department of a college offers courses in three subjects, Biology, Chemistry and Physics. There are 170 students who take courses in at least one of these subjects. The following diagram gives, for these 170 students, information on the number of students taking the different subjects.



(i) Find the value of y.

.....[2]

(ii) State what the value of y represents.

.....

.....[1]

(iii) Calculate how many of the students do not study Biology.

.....[2]

(iv) Calculate the total number of students who study Chemistry.

.....[1]

For Examiner's Use

4 **(a)** Give one advantage which quota sampling has over simple random sampling, and one advantage which simple random sampling has over quota sampling.

.....

.....

.....

..... [2]

(b) The names of the 100 pupils in a small school are arranged in alphabetical order and then two-digit numbers in the range 00 to 99 are allocated, one to each pupil, in that order.

(i) It is required to select a **systematic sample of size 5** from the pupils. The number of the first pupil to be selected is obtained from a random number table and is found to be 17. Write down the numbers of the other pupils selected for the sample.

..... [2]

(ii) Briefly explain the situation which can lead to the **method** of systematic sampling being biased, and state, with a reason, whether it is likely to occur in this case.

.....

.....

.....

..... [2]

For Examiner's Use

5 The table below summarises how many O level subjects at grade C were obtained by each of the 120 pupils who sat the examinations at one school in a particular year.

Number of subjects	0	1	2	3	4	5	6	7	8	9
Number of pupils	2	2	11	17	24	25	22	12	4	1

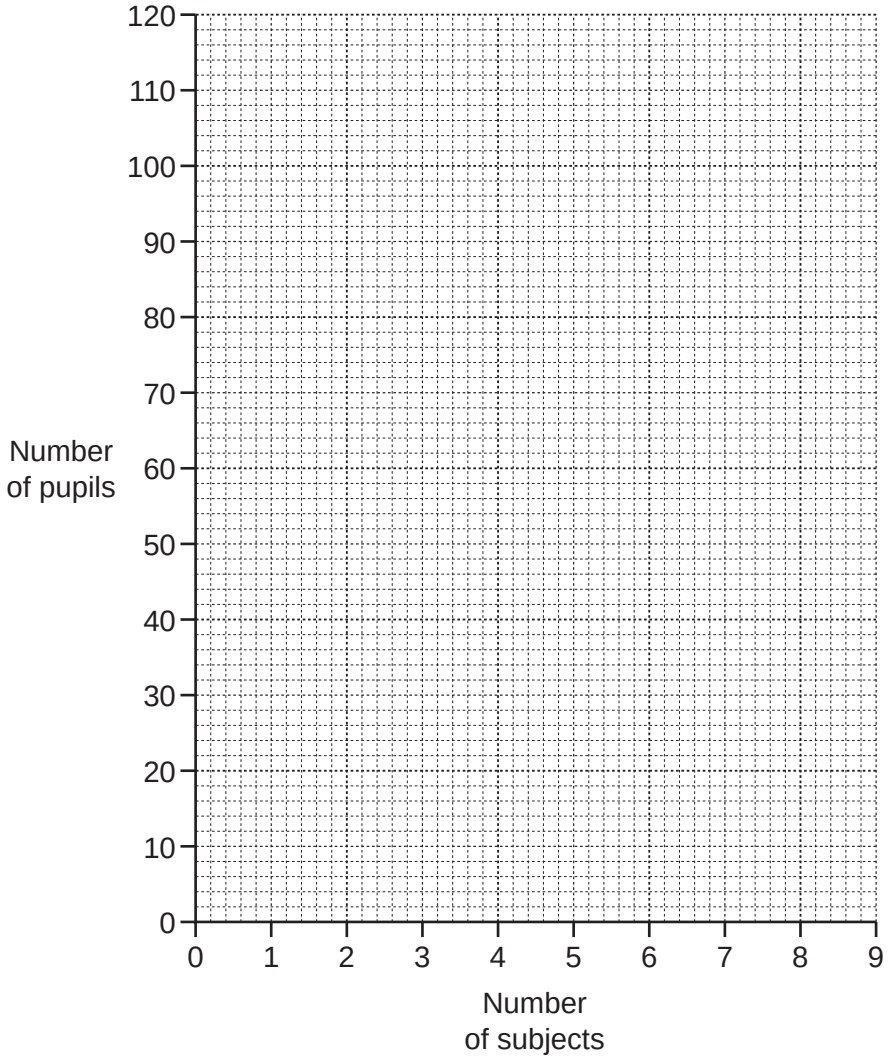
For example, 17 pupils each obtained 3 subjects at grade C.

(i) Calculate the cumulative frequencies for these data.

.....

[2]

(ii) Draw an **appropriate** cumulative frequency graph to illustrate these data.



[4]

For Examiner's Use

6 Give your answers in this question either as exact fractions or as decimals correct to 3 significant figures.

Holly has three cards numbered 1, 3 and 5.

Akinyi has three cards numbered 2, 3 and 4.

(i) Each girl selects one of her three cards at random, and then the numbers on the two selected cards are added together to give a total.

Find the probability that the total is

(a) 7,

..... [1]

(b) at most 6.

..... [2]

(ii) Each girl selects one of her three cards at random, and then the numbers on the two selected cards are multiplied together to give a product.

Find the probability that the product is

(a) 20,

..... [1]

(b) more than 6.

..... [2]

Section B [64 marks]

Answer not more than **four** of the questions 7 to 11.

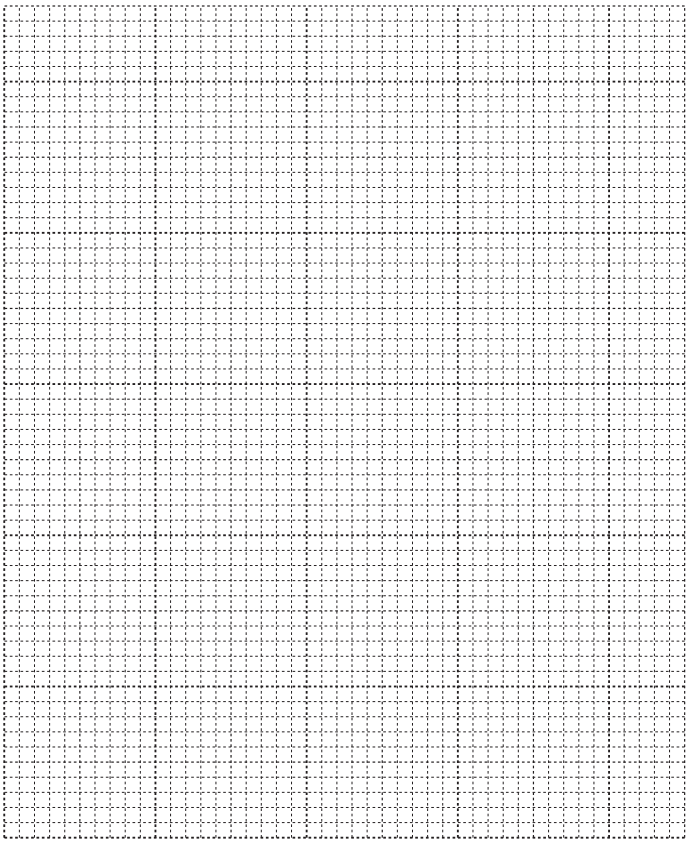
Each question in this section carries 16 marks.

For Examiner's Use

7 A man found an old weighing machine and, in order to test its accuracy, he placed a number of loads of known mass on it and recorded the readings which it showed. The results are given in the table below.

Reading of weighing machine (x kg)	1.1	2.0	3.6	4.9	6.8	8.0
Actual mass of load (y kg)	0.5	1.4	3.5	5.0	7.6	9.0

(i) Using 2 cm to represent 2 kg on both axes, and starting the y-axis at the value –1, plot on the grid below a scatter diagram of the above data.



[2]

(ii) By calculating and plotting $(\bar{x}, \bar{y})$ and the two semi-averages, draw the line of best fit.

[6]

For Examiner's Use

(iii) **Using your graph**, obtain the equation of the line of best fit in the form $y = mx + c$.

..... [4]

(iv) **Use your equation** to estimate, to 1 decimal place, the actual mass of an item for which the reading on the machine was 6 kg.

..... [1]

(v) By drawing an appropriate line on your graph, estimate the value for which the reading on the machine would equal the actual mass.

..... [2]

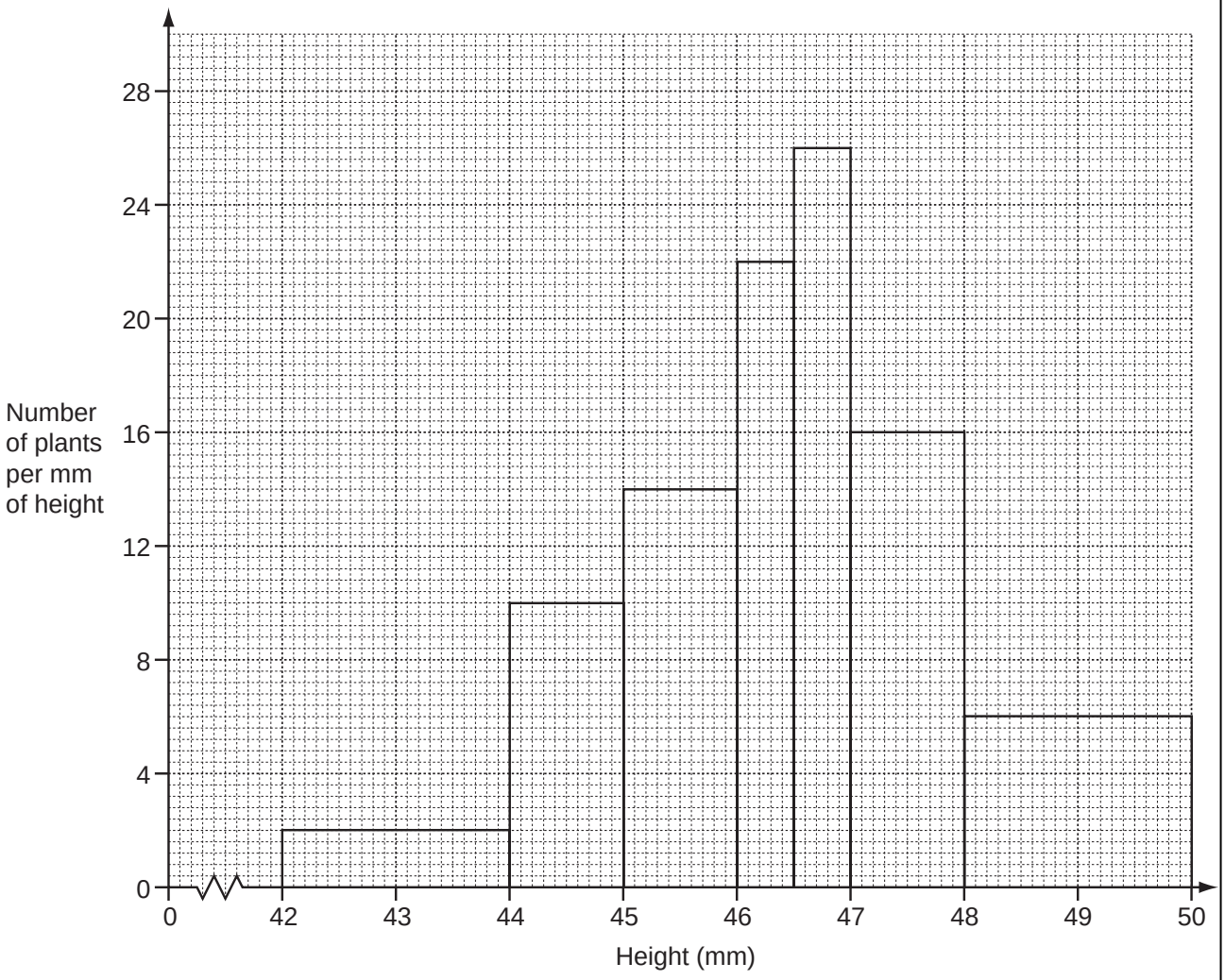
(vi) Use the two lines you have drawn to comment on the accuracy of the machine.

.....

..... [1]

8 A large number of seeds of the same variety of flower were sown on the same day. Six months later, the heights, h mm, of the 80 surviving flowers were measured accurately. The histogram below illustrates the data obtained.

For Examiner's Use



(i) Use the histogram to complete the following grouped frequency table.

Height (h mm)	*Frequency*
$42 \leqslant h < 44$	
$44 \leqslant h < 45$	
$45 \leqslant h < 46$	
$46 \leqslant h < 46.5$	
$46.5 \leqslant h < 47$	
$47 \leqslant h < 48$	
$48 \leqslant h < 50$	
TOTAL	80

[6]

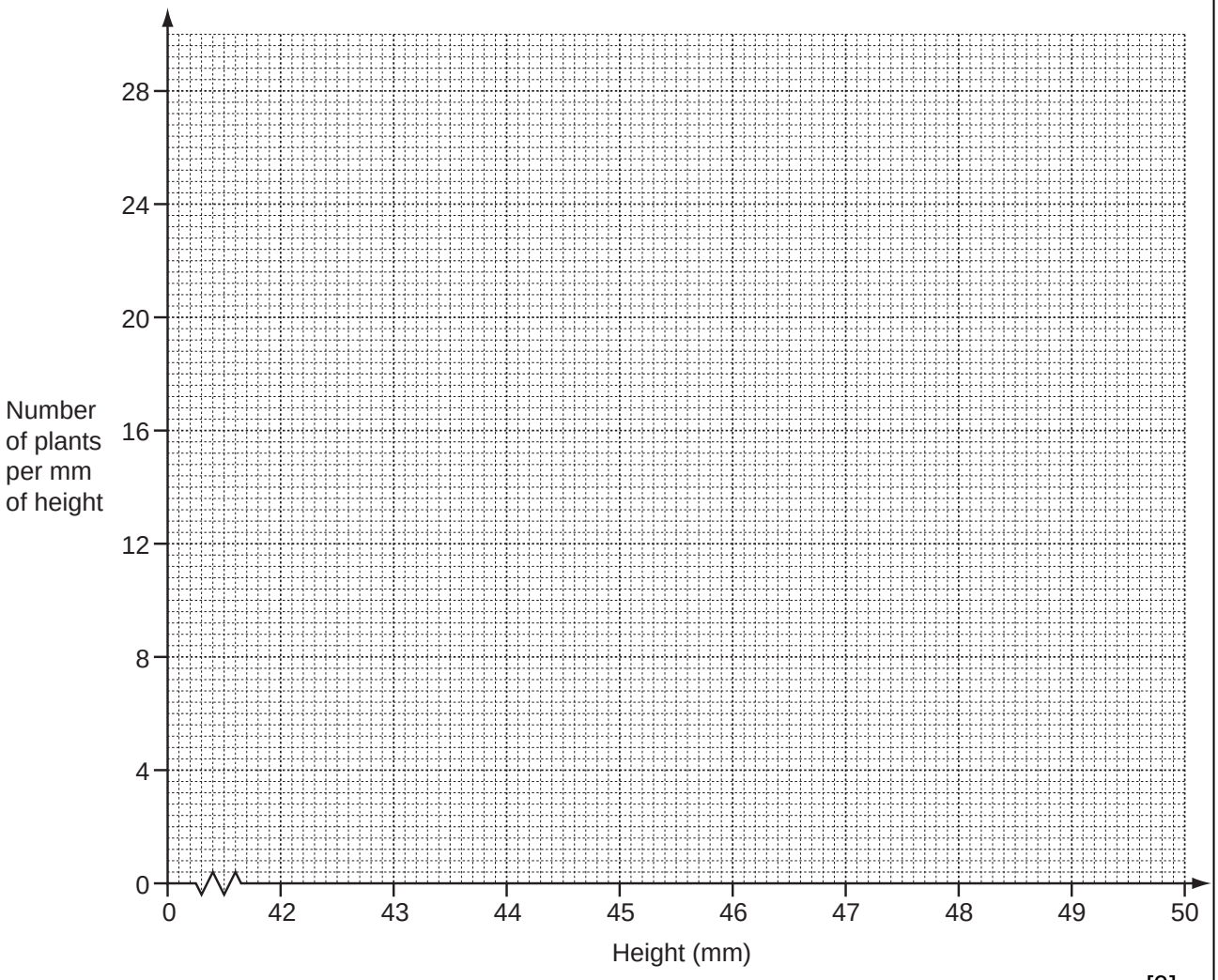
(ii) Hence complete the simpler grouped frequency table, using the class intervals

$42 \leqslant h < 44$, $44 \leqslant h < 46$, $46 \leqslant h < 48$, $48 \leqslant h < 50$.

Height (h mm)	*Frequency*
$42 \leqslant h < 44$	
$44 \leqslant h < 46$	
$46 \leqslant h < 48$	
$48 \leqslant h < 50$	

[5]

(iii) Draw, on the grid below, a histogram to illustrate the data in your table in **(ii)**.



[3]

(iv) **Use the histogram you have drawn in (iii)** to estimate the modal length to the nearest 0.1 mm.

..... [2]

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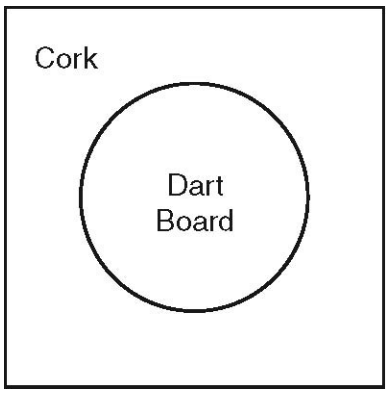
9 **(a)** A circular dart board, of radius 15 cm, is mounted centrally on a square piece of cork of side 50 cm. A dart is thrown at random and sticks in either the dart board or the cork surrounding the dart board.



Calculate, to 3 significant figures, the probability that the dart sticks in the cork. (Take the value of π to be 3.14.)

..... [6]

(b) A hospital monitored the number of patients admitted during the course of one year and suffering from a variety of illnesses. For 3 of these illnesses the records are summarised in the following table.

Illness	*Male*	*Female*
Thrombosis	10	20
Pneumonia	21	27
Appendicitis	18	14

One of these patients is selected at random. Find the probability that the patient

(i) is female and suffers from thrombosis,

..... [1]

(ii) suffers from pneumonia,

..... [2]

(iii) suffers from appendicitis, given that he is male.

..... [2]

Two of the patients are chosen at random.

(iv) Find the probability that both of them are male and suffering from thrombosis.

..... [3]

(c) A biased coin is such that when it is tossed, the probability of a head being obtained is $\frac{2}{3}$. Calculate the probability that exactly one head is obtained when the coin is tossed twice.

..... [2]

For Examiner's Use

10 In this question calculate all death rates per thousand and to 2 decimal places.

The table below gives information about the population and deaths in the town of Brownville for the year 2005, together with the standard population of the area in which Brownville is situated.

Age group	*Deaths*	*Population in age group*	*Standard population* (%)
Under 15	2	750	30
15 – 40	10	2000	30
41 – 65	53	5000	25
Over 65	85	1500	15

(i) For Brownville in the year 2005,

(a) calculate the crude death rate,

.....per thousand [4]

(b) calculate the death rate for each age group,

.....per thousand [2]

(c) use your results in **(i) (b)** to calculate the standardised death rate.

.....per thousand [4]

The table below gives information about Greentown, another town in the same area, also for the year 2005.

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Age group	*Death rate per thousand*	*Population in age group* (%)
Under 15	4	18.75
15 – 40	5.5	43.75
41 – 65	11.2	31.25
Over 65	80	6.25

(ii) Calculate the **crude** death rate for Greentown in the year 2005.

.....per thousand [3]

(iii) Use your results in **(i) (b)** and the information in the table for Greentown to compare the age group death rates for the two towns.

.....

..... [1]

(iv) State, giving a reason, an age group for which one of the towns appears to have a far less healthy environment.

.....

.....

..... [2]

11 The cumulative frequency graph below illustrates the journey times to work, t minutes, of the 100 workers in a factory.

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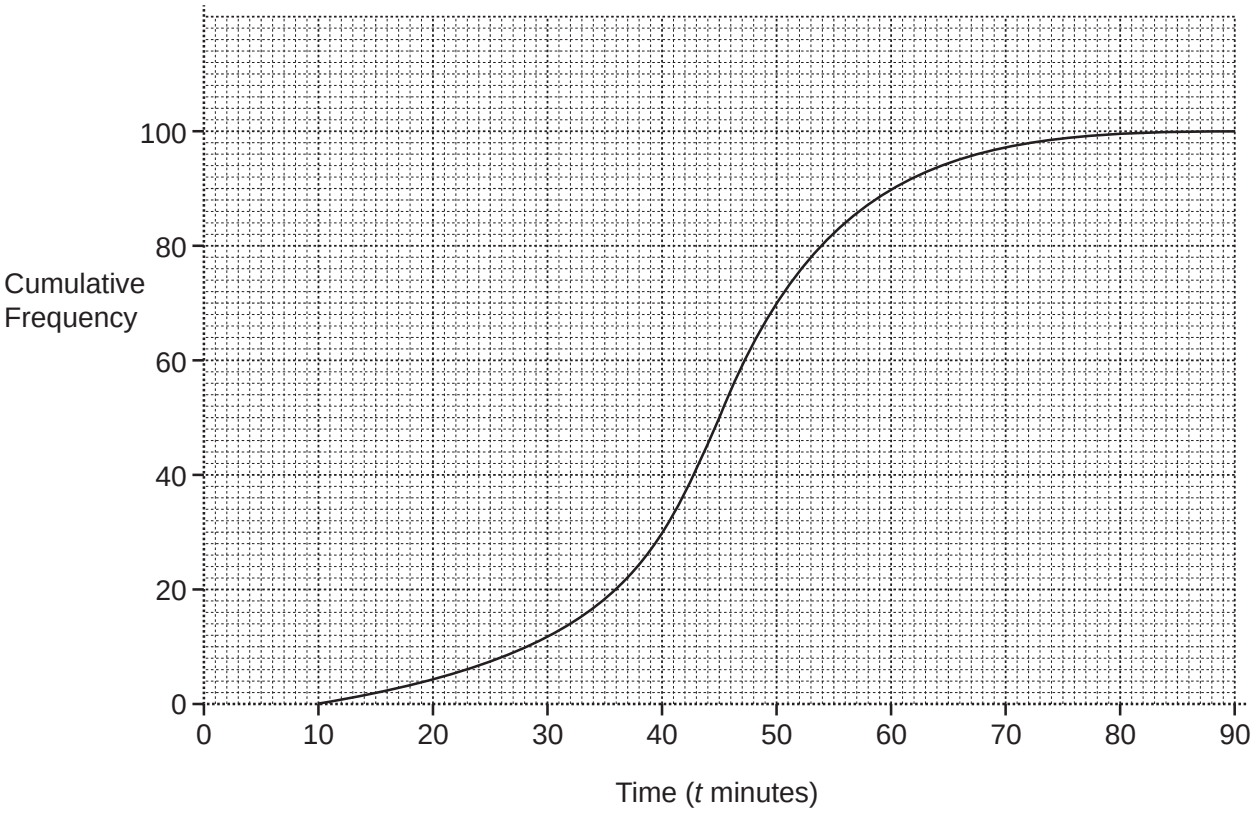

(i) Use the graph to estimate

(a) the median of the journey times,

..... [1]

(b) the interquartile range of the journey times.

..... [4]

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(ii) Use the graph to complete the following table.

Journey time (t minutes)	*Cumulative frequency*	*Frequency*
$10 \leqslant t < 30$		
$30 \leqslant t < 40$		
$40 \leqslant t < 50$		
$50 \leqslant t < 60$		
$60 \leqslant t < 90$		
TOTAL		100

[3]

(iii) Use the frequencies you have obtained to estimate

(a) the mean of the journey times, giving your answer to 1 decimal place,

..... [4]

(b) the standard deviation of the journey times, giving your answer to 1 decimal place.

..... [2]

(iv) Compare the values of the median and the mean, giving an explanation for your answer.

.....

..... [2]

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