

CANDIDATE  
NAME

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CENTRE  
NUMBER

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CANDIDATE  
NUMBER

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**STATISTICS**

**4040/13**

Paper 1

**October/November 2017**

**2 hours 15 minutes**

Candidates answer on the Question Paper.

Additional Materials:      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 an HB pencil for any diagrams or graphs.  
Do not use staples, paper clips, glue or correction fluid.  
**DO NOT WRITE IN ANY BARCODES.**

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.

At the end of the examination, fasten all your work securely together.  
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **17** printed pages and **3** blank pages.

**Section A** [36 marks]

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

1 (a) State, for each of the following, the name of a method of sampling in which

(i) a sampling frame is never required,

.....[1]

(ii) every item in the population is numbered, and a random number table or generator is used to select every item in the sample,

.....[1]

(iii) every item in the population is numbered, and a random number table or generator is used to select only the first item in the sample.

.....[1]

(b) Consider the following statement, from which two statistical terms have been omitted.

‘When selecting a sample from a population, a researcher should, wherever possible, ensure that the sampling method is free from ....., and that the sample is ..... of the population.’

Insert the appropriate terms into the spaces to complete the statement. [1]

2 The maximum temperature each week in a town was recorded over a ten-week period.

(i) The following values, in °C, rounded to the nearest integer, were obtained.

23 24 22 26 28 23 28 32 29 28

For these values, find

(a) the median,

.....[2]

(b) the mode,

.....[1]

(c) the mean.

.....[2]

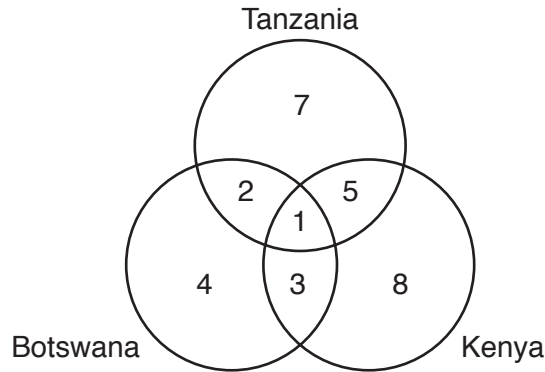
The temperatures in the town were originally recorded correct to one decimal place.

(ii) Using the original values, it might have been impossible to find one of the measures named in part (i).

State which measure, explaining the reason for your choice.

.....  
.....[1]

- 3 A holiday company organises safari tours to African countries. The diagram below shows the number of the company’s guides who have taken tours to one or more of the countries Tanzania, Botswana and Kenya.



Use this information to find the number of guides who have taken tours to

- (i) Botswana,

.....[1]

- (ii) Tanzania and Kenya but not Botswana,

.....[1]

- (iii) Tanzania or Kenya or both.

.....[2]

All the guides who have taken tours to Botswana, but only these guides, have also taken tours to Zimbabwe.

Of the four countries Tanzania, Botswana, Kenya and Zimbabwe, find the number of guides who have taken tours to

- (iv) exactly two countries,

.....[1]

- (v) at least three countries.

.....[1]

- 4 A dental surgery is open for six days each week, and holds appointments each day in three sessions: morning, afternoon, and evening.  
The table below shows measures for the number of appointments held in each session during one particular week.

<i>Session</i>	<i>Mean</i>	<i>Standard deviation</i>
Morning	6.33	0.745
Afternoon	5.33	2.810
Evening	2.50	1.260

- (i) State, for which one of the sessions morning, afternoon or evening, the number of appointments was generally

(a) largest,

.....[1]

(b) most varied.

.....[1]

- (ii) Find the total number of appointments held in the surgery during this week.

.....[2]

Each afternoon session lasts 4 hours.

- (iii) Assuming that appointments are held continuously throughout the session, estimate the length of time of an afternoon appointment, on average, during this particular week. Give your answer in minutes.

.....[2]

- 5 The table below summarises the performance of a hockey team for every match played in one season. For each match there are two pieces of information: the number of goals scored and the number of goals conceded.

		<i>Number of goals scored</i>					
		<i>0</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5 or more</i>
<i>Number of goals conceded</i>	<i>0</i>	0	0	0	0	0	0
	<i>1</i>	1	1	0	1	0	2
	<i>2</i>	0	0	1	0	3	0
	<i>3</i>	0	1	1	4	2	2
	<i>4</i>	0	0	2	1	0	0
	<i>5 or more</i>	0	0	0	0	0	0

For example, there were three matches in which the team scored 4 goals and conceded 2 goals.

- (i) Find the number of matches in which the team

(a) conceded exactly 3 goals,

.....[1]

(b) scored 4 goals or more,

.....[1]

(c) scored the same number of goals as it conceded.

.....[1]

- (ii) Calculate the total number of goals conceded by the team in the season.

.....[2]

- (iii) Explain why it is not possible to calculate, from the table above, the total number of goals scored by the team in the season.

.....  
 .....[1]

6 Candidates who enter for a proficiency certificate with an examining board must submit a long essay, with specified minimum and maximum word limits, in their subject of study. From its records, the board knows that, for any subject, 3% of the essays submitted are underlength, 5% are overlength, and the remainder are of the specified length.

(i) A manager at the board selects at random an essay submitted in History and an essay submitted in Sociology.

Find the probability that

(a) both essays are of the specified length,

.....[2]

(b) the essay in History is of the specified length, but the essay in Sociology is not,

.....[2]

(c) one of the essays is underlength and the other essay is overlength.

.....[2]

(ii) In one particular year, 134 candidates submitted an essay that was not of the specified length.

Find the total number of essays submitted in that year.

.....[2]

**Section B** [64 marks]

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

Each question in this section carries 16 marks.

- 7** In this question all pass rates, whether given or to be found, are expressed, or are to be expressed, as percentages.

At Lernalott School the academic ability of all enrolled A Level pupils, based on O Level performance, is recorded as one of outstanding, very good, good or modest.

The table below gives information on the number of enrolments and the pass rate in A Level Biology at the school, together with the standard population of enrolments for all A Level subjects at the school.

<i>Academic ability group</i>	<i>Number of enrolments</i>	<i>Ability group pass rate (%)</i>	<i>Standard population of enrolments (%)</i>
Outstanding	6	100.0	20
Very good	8	87.5	40
Good	5	80.0	30
Modest	4	50.0	10

For A Level Biology, calculate

- (i) the standardised pass rate,

.....[4]

- (ii) the crude pass rate.

.....[5]



The table below gives information on pass rates, over the same period of time, for pupils in other A Level subjects at Lernalott School.

<i>Subject</i>	<i>Number of enrolments</i>	<i>Standardised pass rate (%)</i>	<i>Crude pass rate (%)</i>
Chemistry	28	84.7	85.7
Physics	18	75.0	72.2
Chinese	25	73.3	80.0
Japanese	12	88.0	66.7
English	17	65.0	76.5

**(iii)** State, with a reason, in which of these five subjects the highest quality of teaching appears to have been provided.

.....  
 ..... [2]

**(iv)** State in which of these five subjects the highest number of passes was obtained. Explain how this can be known without further calculation.

.....  
 ..... [2]

In publicity material the school gives crude pass rates for Arts, Sciences, Languages etc. (rather than for individual subjects).

**(v)** Calculate the crude pass rate for the languages Chinese, Japanese and English combined.

..... [3]

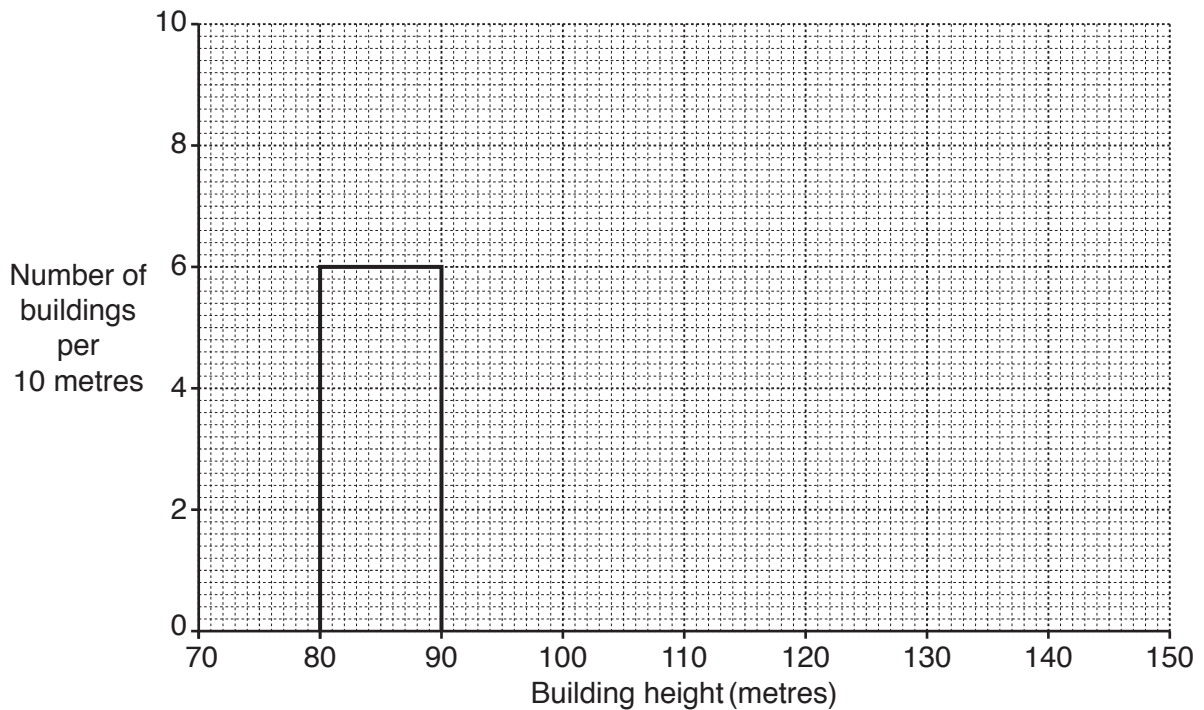
8 The following table summarises the heights of the 25 tallest buildings in a city.

<i>Building height (metres)</i>	<i>Number of buildings</i>	
80 – under 90	6	
90 – under 95	3	
95 – under 100	4	
100 – under 120	7	
120 – under 145	5	

(i) Estimate the mean height of these buildings.

.....[3]

(ii) On the following grid, draw a histogram to illustrate the data in the table above. The rectangle representing the 80 – under 90 class has already been drawn for you.



[4]

In the city a new building is being constructed which will have a height of 165 metres after completion.

- (iii) Estimate the new mean height of the 25 tallest buildings in the city after the completion of this building.

..... [2]

One of the buildings has 20 floors (levels) of three different types: 4 floors have only shops, 9 floors have only offices, and the remainder have only apartments.

Three of the 20 floors are selected at random for routine safety checks.

Find the probability that

- (iv) all three floors have apartments,

..... [2]

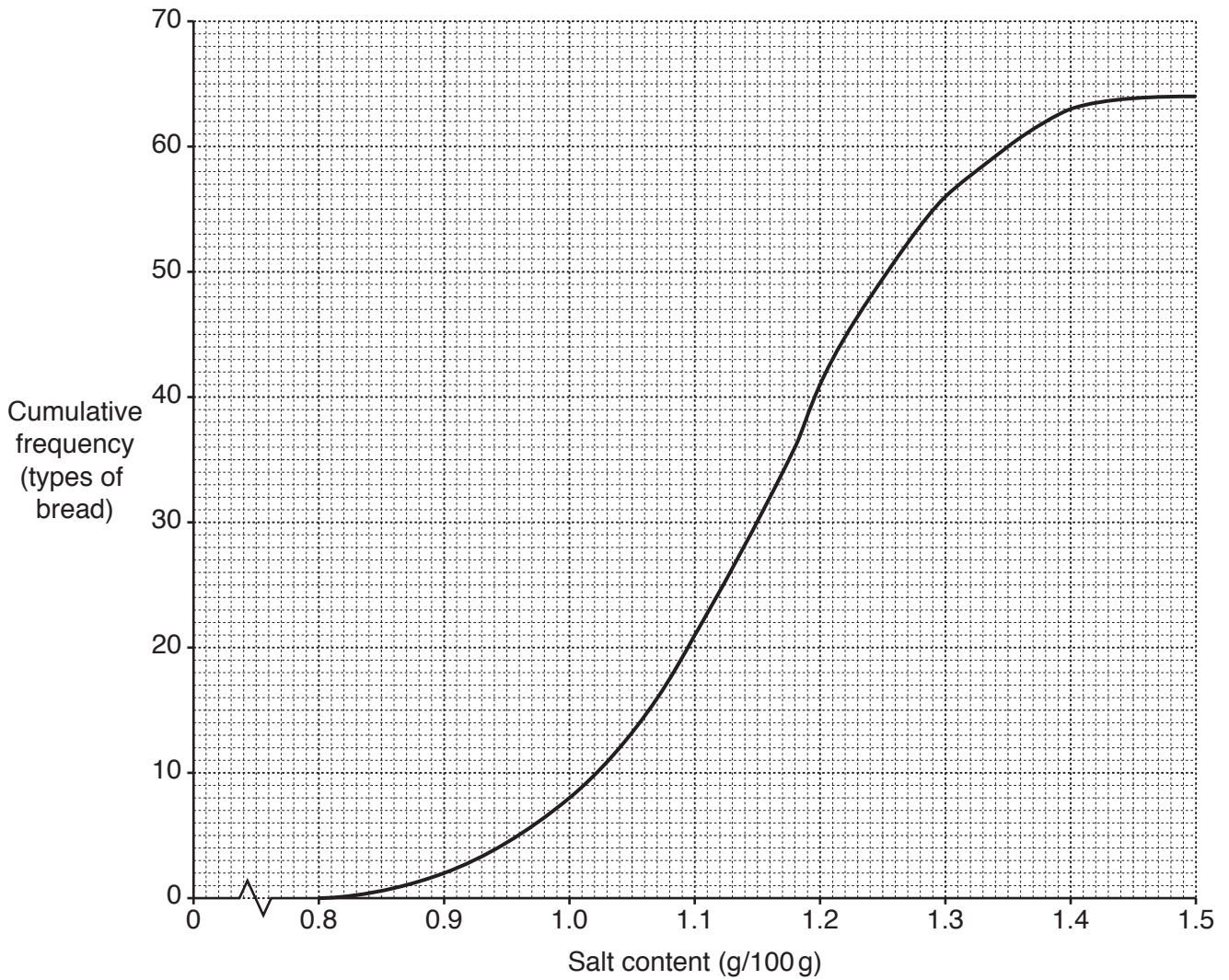
- (v) two floors have shops and one floor has offices,

..... [3]

- (vi) the floors are of different types.

..... [2]

- 9 A particular supermarket sells 64 different types of bread. The salt content of these types, in grams per 100 grams of bread (g/100g), is illustrated in the cumulative frequency curve below.



(i) Use the graph to estimate, for these types of bread,

(a) the median salt content,

..... g/100g [1]

(b) the interquartile range of the salt content,

..... g/100g [4]

(c) the value of  $p$ , if the  $p$ th percentile of the salt content is 1.35g/100g.

..... [2]

For a healthy diet, the government recommends a maximum salt content for bread of 1.0g/100g.

(ii) Use the graph to estimate, for these types of bread,

(a) the number which meet the government's recommendation,

.....[1]

(b) the median salt content of those which do not meet the government's recommendation.

..... g/100g [2]

A government food inspector, visiting this supermarket, selects four different types of bread at random.

Find the probability that she finds

(iii) none which meet the government's recommendation,

.....[3]

(iv) at least one which meets the government's recommendation.

.....[2]

Later, the supermarket reduces the salt content of all types of bread by 0.05g/100g.

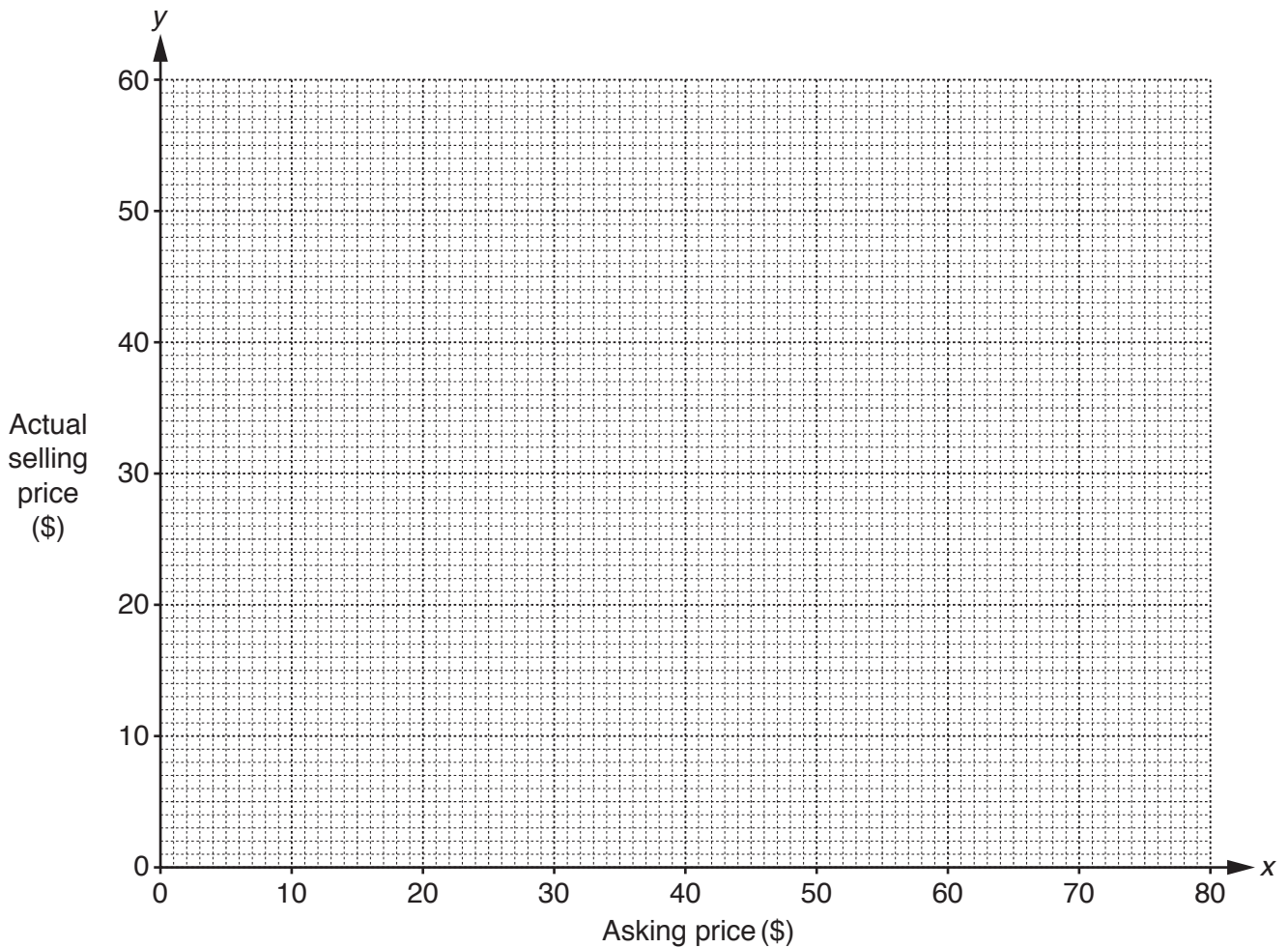
(v) State, explaining your answer, which of the measures found in part (i) will be unchanged. **You are not required to recalculate the measures.**

.....  
.....[1]

- 10 Pedro is a market trader who displays no prices on the items he offers for sale. When a potential customer shows interest in an item, Pedro states his asking price. Usually, following bargaining, if he sells the item it will be for a different price. His daughter Manuela (a statistics student) observes eight transactions her father makes, and in each case records the asking price and the actual selling price. Her results are shown in the following table.

Item	A	B	C	D	E	F	G	H
Asking price, $x$ (\$)	15	35	40	75	10	65	60	25
Actual selling price, $y$ (\$)	12	20	40	55	8	45	35	20

- (i) Plot these data on the grid below.



[2]

The data have an overall mean of (40.625, 29.375) and an upper semi-average of (60, 43.75).

(ii) Find the lower semi-average, and plot this and the two given averages on your graph.

[3]

(iii) Use your plotted averages to draw a line of best fit, and find its equation in the form  $y = mx + c$ .

.....[4]

(iv) Use your line to estimate, to the nearest \$5, for other transactions,

(a) the actual selling price of an item with an asking price of \$55,

.....[2]

(b) the asking price for an item which Pedro wishes to sell for \$50.

.....[2]

Manuela observes from her line of best fit that, overall, Pedro's actual selling price is approximately  $k\%$  less than the asking price.

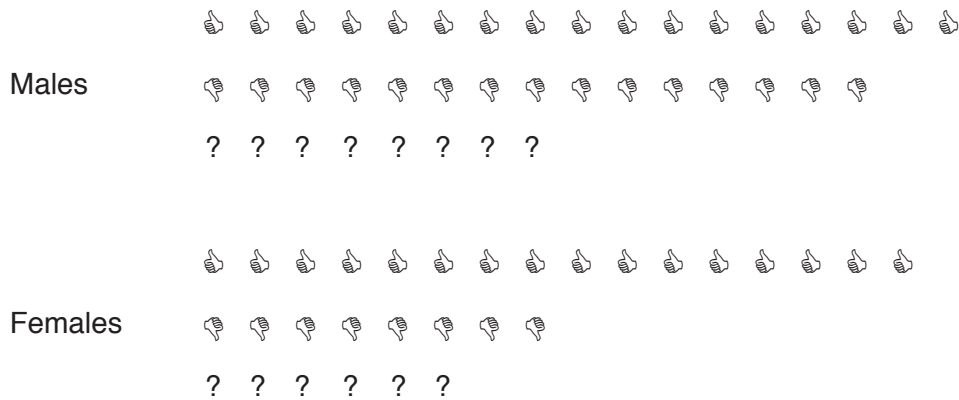
(v) Use your answer to part (iii) to estimate the value of  $k$ .

.....[2]

(vi) State, with a reason, for which of the items A – H Pedro will be most satisfied with the business transacted.

.....  
.....[1]

11 A restaurant manager surveys a sample of customers to find their opinions on a proposed ban on the use of mobile phones in her restaurant. Results are shown in the pictogram below.



 = 1 person in favour of a ban     = 1 person against a ban    ? = 1 person undecided

For this sample,

(i) state the total number of customers who were in favour of a ban,  
 .....[1]

(ii) state how many fewer females were against a ban than in favour of it,  
 .....[1]

(iii) calculate the percentage of all the customers who had a decided opinion on the ban.  
 .....[3]

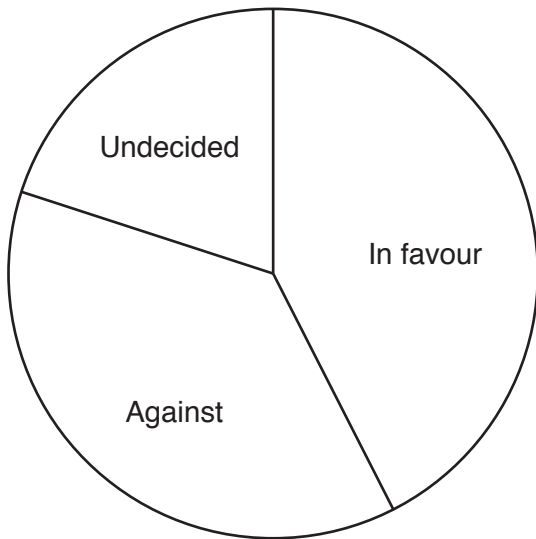
The results shown in the pictogram are to be represented in comparative pie charts drawn to scale; one for males and one for females. The chart for males has already been drawn for you on the opposite page.

(iv) Draw, on the opposite page, the chart for females.



**Opinions of Males on Proposed Ban**

**Opinions of Females on Proposed Ban**



[5]

**(v)** By comparing the pie charts, write down three conclusions that may be drawn from the survey.

- 1 .....
- 2 .....
- 3 ..... [3]

**(vi)** For survey results, give one advantage of

**(a)** a pictogram presentation over a pie chart presentation,  
 ..... [1]

**(b)** a pie chart presentation over a pictogram presentation.  
 ..... [1]

In conducting a survey, open or closed questions may be used.

**(vii)** State, for the restaurant manager’s survey, which of these types of question she seems to have used. Explain your answer.

.....  
 ..... [1]





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