Cambridge Assessment
International Education

# Cambridge O Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

## STATISTICS

**4040/12**

Paper 1

**October/November 2024**

**2 hours 15 minutes**

You must answer on the question paper.

You will need: Calculator
Pair of compasses
Protractor

## INSTRUCTIONS
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You must show all necessary working clearly.

## INFORMATION
- The total mark for this paper is 100.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages.

**[Turn over**

**1** A store manager surveys a sample of customers to find their opinions on the quality of clothing sold in the store. The results are shown in the pictogram.

Men   ☺ ☺ ☺ ☺ ☺ ☺ ☺
      ☹ ☹ ☹ ☹ ☹

Women   ☺ ☺ ☺
        ☹ ☹ ☹ ☹ ☹ ☹ ☹ ☹ ☹ ☹

☺ = 3 satisfied customers     ☹ = 3 dissatisfied customers

**(a)** State the number of men who were dissatisfied.

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

**(b)** State how many fewer women were satisfied than were dissatisfied.

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

**(c)** Calculate the percentage of customers who were satisfied.

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

**2** A supermarket sells rice in bags labelled as containing 200 grams of rice.
A sample of eight of these bags was selected and the mass of the contents was measured.
The following values, in grams, were obtained.

197     208     197     194     211     202     199     204

**(a)** For these values find

**(i)** the mean,

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

**(ii)** the median.

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

**(b)** Find the range of the values for the bags whose contents had masses less than 200 grams.

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

**3** The table gives information on the number of teachers at an international school. For each teacher there are two pieces of information: the seniority of the teacher, and the region of the world from which they come.

| Seniority | Region | | |
|---|---|---|---|
| | Africa | Asia | Europe |
| Senior teacher | 3 | 5 | 2 |
| Junior teacher | 9 | 8 | 6 |
| Assistant teacher | 2 | 4 | 1 |

For example, there are 3 Senior teachers who come from Africa.

Find

**(a)** the number of Assistant teachers,

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

**(b)** the number of teachers from Asia or Europe,

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

**(c)** the percentage of teachers who are Junior teachers.

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

A teacher is selected at random to be interviewed.

Find the probability that the teacher

**(d)** is a Senior teacher or an Assistant teacher,

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

**(e)** is a Junior teacher, given that the teacher comes from Africa.

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

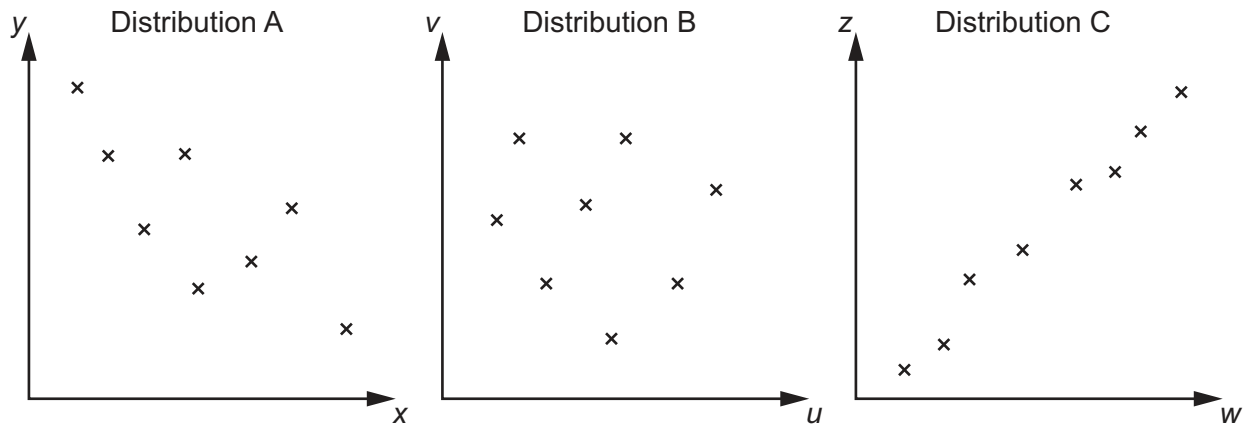**4** **(a)** Explain what is meant by the statement that there is positive correlation between the variables in a bivariate distribution.

.......................................................................................................................................................

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

The variables in three bivariate distributions were measured and plotted. The following scatter diagrams were obtained.



**(b)** Describe fully the correlation shown by the variables in each of these distributions.

Distribution A .....................................................................................................................................

Distribution B .....................................................................................................................................

Distribution C .....................................................................................................................................
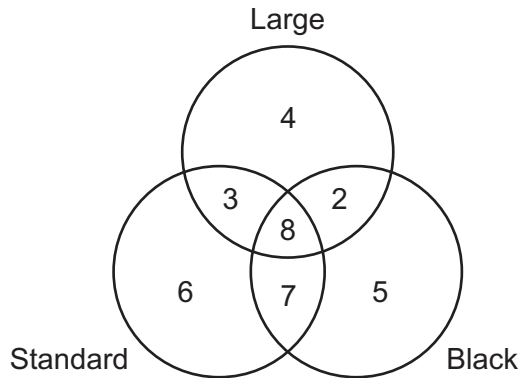
[4]

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**5** A café sells teas which are either large or small, are either standard or special, and are either black or green.

The diagram shows the number of these teas sold one morning which were one or more of large, standard, and black.



**(a)** Find the number of teas sold which were

**(i)** large,

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

**(ii)** standard and black,

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

**(iii)** large and green,

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

**(iv)** small, special and black.

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

**(b)** Explain why it is not possible from this information to find the total number of teas sold.

....................................................................................................................................

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

**6** At an 'Eat Simply' conference, plates of 9 sandwiches are provided for participants, of which 4 are cheese and 5 are tomato.
A participant chooses three sandwiches at random, without replacement, from such a plate.

**(a)** Show that the probability of choosing exactly one cheese sandwich is $\frac{10}{21}$.

[3]

**(b)** If $X$ is the number of cheese sandwiches chosen, find, as fractions, the probabilities of all other possible values of $X$.
Present your answers in a probability distribution table.

[5]

**7** Nandi is a music journalist. At a music festival, she surveys the amount of time musicians plan to spend each week practising. The following histogram summarises her results.
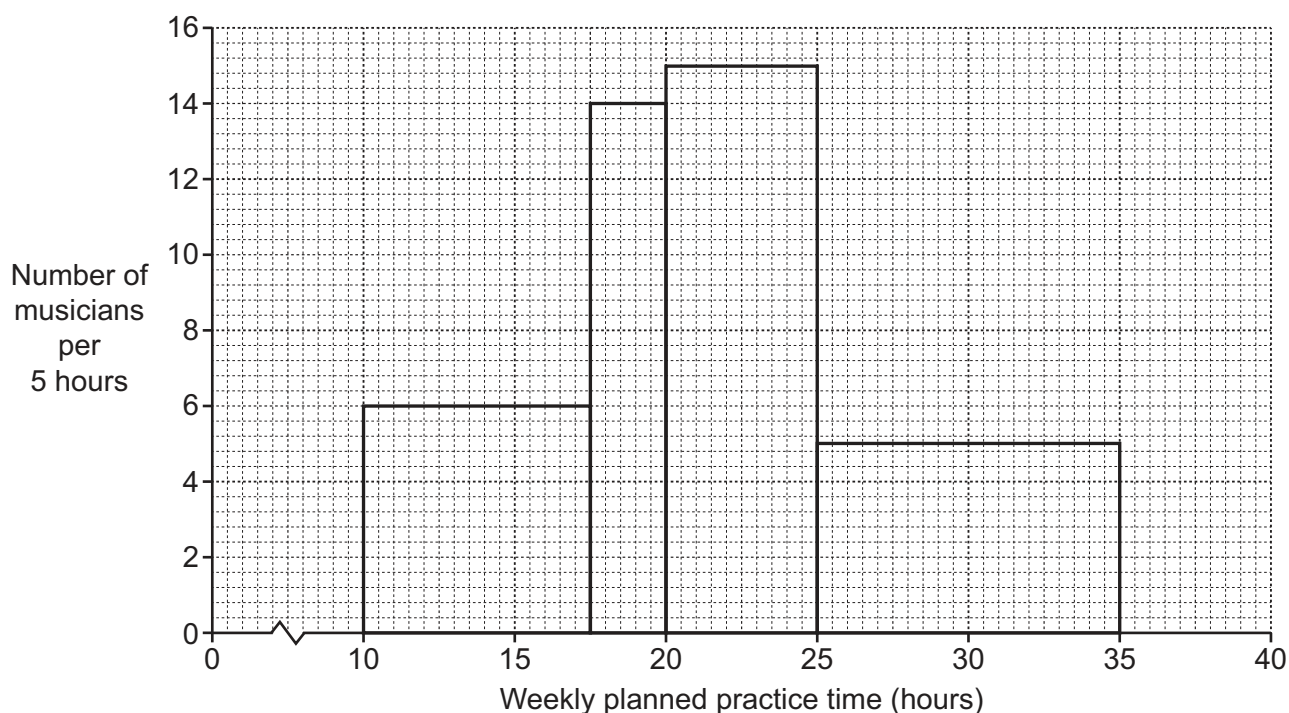


**(a)** Use the histogram to find the number of musicians whose weekly planned practice time is

  **(i)** from 25 hours up to 35 hours,

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

  **(ii)** from 10 hours up to 17.5 hours,

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

  **(iii)** from 17.5 hours up to 20 hours.

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

**(b)** Use the histogram to estimate the number of musicians whose weekly planned practice time is from 21 hours up to 28 hours.

  ...................................................... [3]

**(c)** Explain why the number of musicians can be found accurately in part **(a)**, but only estimated in part **(b)**.

  ...................................................................................................................................

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

**8** **In this question the fertility rate of a population is defined as the number of births per 1000 females.**

The table below gives information about the female population and births in a particular town for the year 2023, together with the standard population of the area in which the town is situated.

| Age group of females | Births | Population of females in age group | Age group fertility rate | Standard population of females (%) |
|---|---|---|---|---|
| Under 20 | 238 | 6800 | | 30 |
| 20–29 | 369 | 4100 | | 20 |
| 30–39 | 407 | 5500 | | 15 |
| Over 39 | 143 | 11 000 | | 35 |

**(a)** Calculate the crude fertility rate for the town.

.......................................................... [3]

**(b)** Calculate the fertility rate for each age group and insert the values in the table above.

[3]

**(c)** Use your results from part **(b)** to calculate the standardised fertility rate for the town.

.......................................................... [4]

**(d)** Explain the purpose of calculating a standardised fertility rate.

...................................................................................................................................

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

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The table below gives information on three other towns in the same region for 2023.

| Town | Population | Crude fertility rate, per thousand | Standardised fertility rate, per thousand |
|------|-----------|-----------------------------------|-------------------------------------------|
| A | 26 000 | 39.5 | 38.1 |
| B | 28 000 | 47.0 | 48.3 |
| C | 24 000 | 52.5 | 52.4 |

**(e)** Find the number of births in the town in which there were most births.

.......................................................... [3]

**9** **(a)** Give one advantage and one disadvantage of forming a large set of data into a grouped frequency distribution.

Advantage ................................................................................................................................

................................................................................................................................

Disadvantage ................................................................................................................................

................................................................................................................................

[2]

The following table summarises the daily electricity consumption, in kilowatt hours (kWh), of a family over a period of 50 days.

| Daily electricity consumption, $x$ (kWh) | Number of days, $f$ | |
|---|---|---|
| 2–under 4 | 4 | |
| 4–under 6 | 8 | |
| 6–under 8 | 17 | |
| 8–under 10 | 12 | |
| 10–under 12 | 7 | |
| 12–under 14 | 2 | |

For these daily electricity consumption values

**(b)** state the modal class,

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

**(c)** estimate the mean and standard deviation.

Mean ...................................................... kWh

Standard deviation ...................................................... kWh

[6]

The electricity supply company charges $0.18 per kWh of electricity consumed, plus an additional service charge of $0.25 per day.

**(d)** Estimate the total amount owed by the family to the electricity supply company for these 50 days.

.......................................................... [4]

Another electricity supply company charges $0.22 per kWh of electricity consumed, but has no additional service charge.
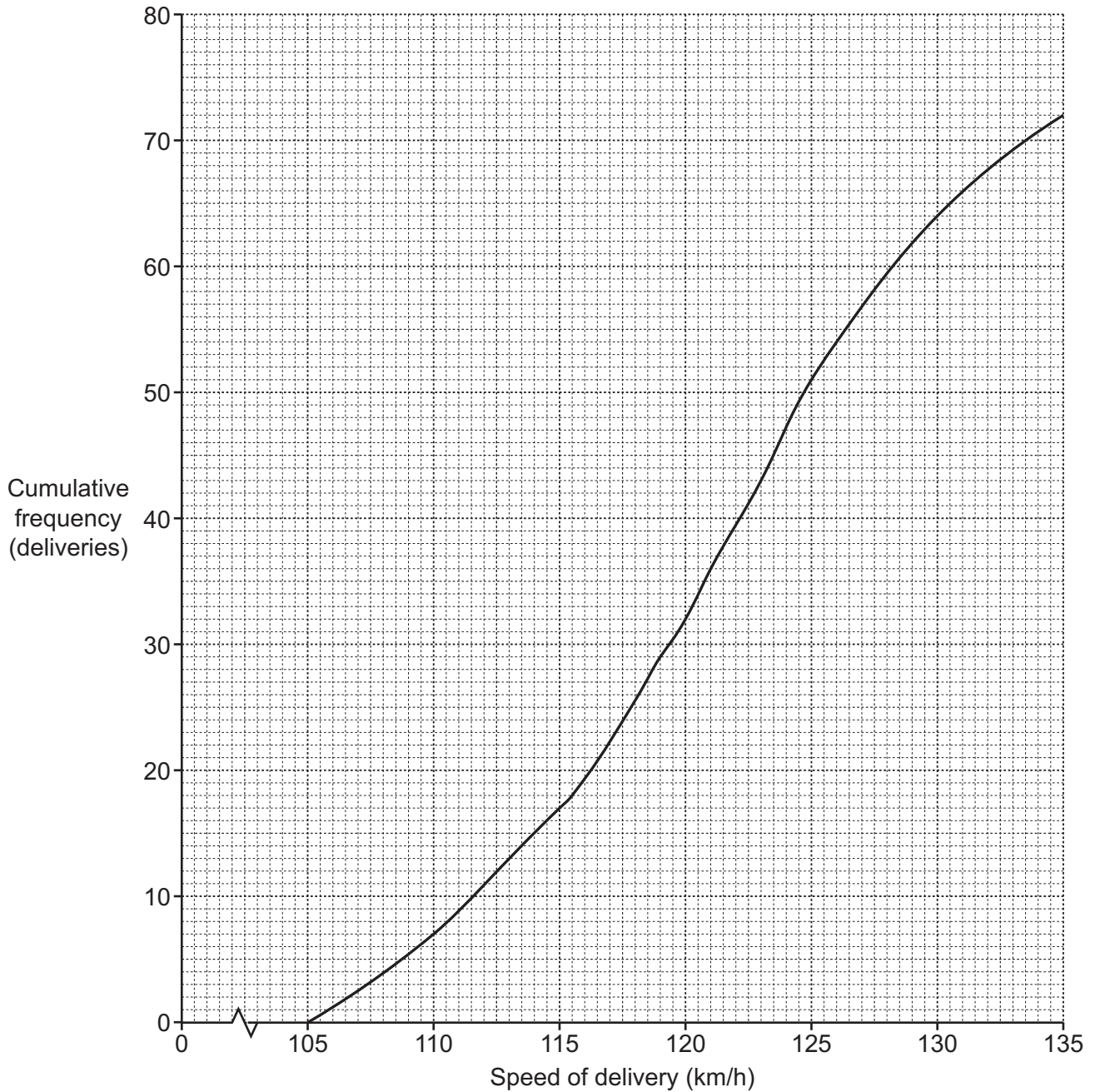
**(e)** Would it have been cheaper for this family to have used this other supplier for these 50 days? Show your working.

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

**10** Azlan is the coach of a cricket team. He measured the speed, in kilometres per hour (km/h), of 72 deliveries (balls bowled) by Buraid, one of his players. His results are summarised in the cumulative frequency curve below.



**(a)** Use the graph to estimate, for these delivery speeds,

    **(i)** the median,

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

    **(ii)** the interquartile range, given that the lower quartile is 115.5 km/h,

.................................................... [3]

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**(iii)** the 40th percentile,

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

**(iv)** the value of $p$ if the $p$th percentile is 123 km/h.

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

Azlan classifies deliveries with speeds of 125 km/h or more as 'fast' and deliveries with speeds of less than 125 km/h as 'medium-paced'.

**(b)** Use the graph to estimate, for these deliveries by Buraid,

**(i)** the percentage which Azlan classified as 'fast',

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

**(ii)** the median speed of those which Azlan classified as 'medium-paced'.

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

On Azlan's advice, Buraid reduces the speed of his deliveries by 5 km/h, in order to obtain greater accuracy.

**(c)** Estimate the percentage of Buraid's deliveries which Azlan will now classify as 'fast'.

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

**(d)** **(i)** State which one of the measures calculated in part **(a)** will remain unchanged.

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

**(ii)** Explain why this measure will remain unchanged.

.................................................................................................................................

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

**11** The osprey is a bird of prey which eats fish. After the eggs hatch, the male catches fish and brings them back to the nest to feed the chicks.

An osprey nest was observed over a ten-week period. The table shows the data collected.

| Week number after hatching, $x$ | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Number of fish caught, $y$ | 4 | 8 | 6 | 9 | 11 | 10 | 15 | 13 | 19 | 21 |

**(a)** Plot the data on the grid below.



Week number after hatching
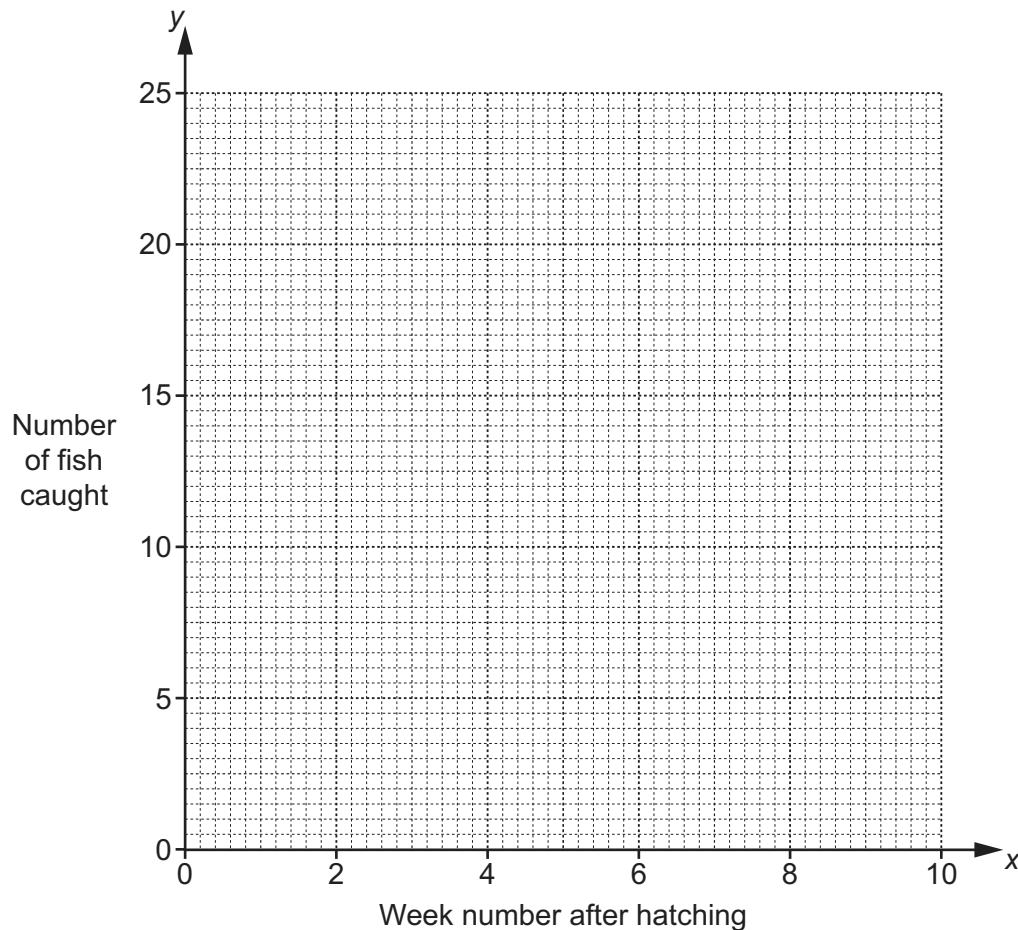
[2]

The data have an overall mean of (5.5, 11.6) and an upper semi-average of (8, 15.6).

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

........................................................ [3]

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

..................................................... [4]

The species of fish that the male osprey brought back to the nest over this period were categorised as Trout, Mullet, Flounder or Other. The pie chart represents the proportion of the total in each category.
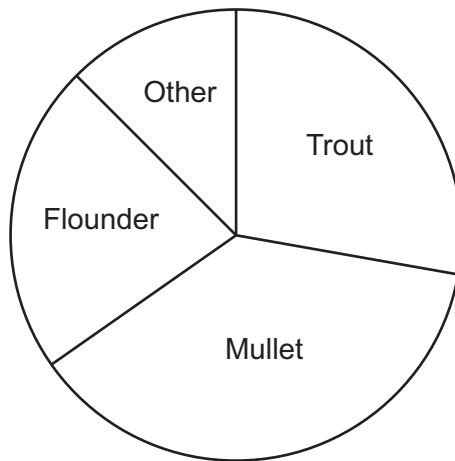


The chicks will not leave the nest for many more weeks.

**(d)** Use the pie chart and your answer from part **(c)** to estimate, for Week 16 after hatching,

    **(i)** the number of trout that will be caught,

..................................................... [3]

    **(ii)** the number of fish caught that will **not** be mullet.

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

**[Question 11 continues on the next page]**

**(e)** Give two assumptions made in obtaining your answers to part **(d)**.

1 ..............................................................................................................................................

..............................................................................................................................................

2 ..............................................................................................................................................

..............................................................................................................................................

[2]