**GCSE – NEW**

wjec cbac

3310U50-1

A16-3310U50-1

# MATHEMATICS – NUMERACY
## UNIT 1: NON-CALCULATOR
## HIGHER TIER

WEDNESDAY, 2 NOVEMBER 2016 – MORNING

1 hour 45 minutes

## ADDITIONAL MATERIALS

The use of a calculator is not permitted in this examination.
A ruler, a protractor and a pair of compasses may be required.

## INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** the questions in the spaces provided.

If you run out of space, use the continuation page at the back of the booklet, taking care to number the question(s) correctly.

Take $\pi$ as 3·14.

## INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

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

In question **7**(e), the assessment will take into account the quality of your linguistic and mathematical organisation, communication and accuracy in writing.

| For Examiner's use only | | |
|---|---|---|
| Question | Maximum Mark | Mark Awarded |
| 1. | 5 | |
| 2. | 9 | |
| 3. | 7 | |
| 4. | 8 | |
| 5. | 9 | |
| 6. | 5 | |
| 7. | 12 | |
| 8. | 15 | |
| 9. | 2 | |
| 10. | 8 | |
| Total | 80 | |

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**Formula List - Higher Tier**

**Area of trapezium** $= \frac{1}{2}(a + b)h$
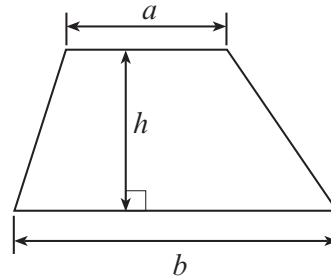
**Volume of prism** = area of cross-section × length
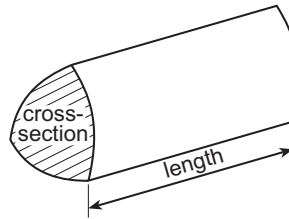
**Volume of sphere** $= \frac{4}{3}\pi r^3$

**Surface area of sphere** $= 4\pi r^2$
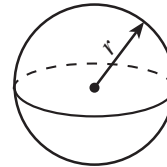
**Volume of cone** $= \frac{1}{3}\pi r^2 h$

**Curved surface area of cone** $= \pi r l$
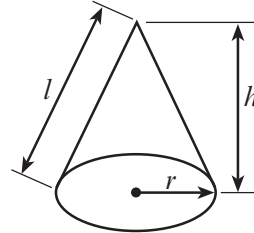
**In any triangle** $ABC$

    **Sine rule** $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

    **Cosine rule** $a^2 = b^2 + c^2 - 2bc\cos A$

    **Area of triangle** $= \frac{1}{2}ab\sin C$
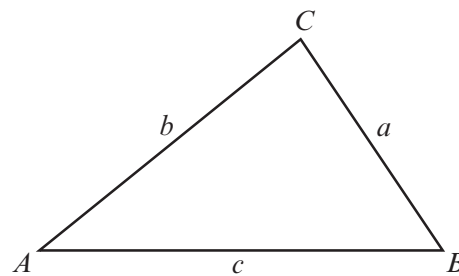
**The Quadratic Equation**

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by $\qquad x = \dfrac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

**Annual Equivalent Rate (AER)**

AER, as a decimal, is calculated using the formula $\left(1 + \dfrac{i}{n}\right)^n - 1$ , where $i$ is the nominal interest rate

per annum as a decimal and $n$ is the number of compounding periods per annum.

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**Turn over.**

**1.** The scale diagram opposite shows an Eisteddfod camping field.

The camping field is 100 metres long and 80 metres wide.

> A river runs along the side *AB*.
> There is a hedge along *AD*.
> There is a fence along *BC*.
> *DC* is an opening with access to the Eisteddfod camping field.

The scale used is **1 cm represents 10 metres**.

A barbecue area is to be built on the camping field.

The barbecue area must be
- nearer to the river than to the opening to the Eisteddfod camping field,
- nearer to the river than to the hedge,
- more than 30 metres from the corner of the field where the hedge meets the river.

Draw suitable lines on the diagram and shade the region where the barbecue area could be built. [5]

(3310U50-1)

**1 cm represents 10 metres**

Opening to the Eisteddfod camping field

D ------------------------------------------------- C

Hedge                                              Fence

A _____ B

River

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**2.** *(a)*

Lotty and Rafael decide to enter a prize draw.
They agree to share any money they win in the ratio 2 : 3 respectively.
After winning a total of £2000, they think again and decide that Lotty's share should be increased by 30%.

(i) Rafael thinks that his share will be reduced by 30%.
Without any calculation, explain why Rafael's thinking is incorrect. [1]

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(ii) Calculate the amount of money Lotty wins after the decision is made to increase her share. [4]

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(iii)    Find the ratio that is now used to share the money between Lotty and Rafael. Express your answer in its simplest form. [3]

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Lotty's winnings : Rafael's winnings = ............................. : .............................

*(b)*    In another prize draw, it was planned to give £5000 as the first prize.
To make it more popular, the organisers decide to increase this first prize by 26%.

The most efficient method of calculating the amount of the increased first prize is

$$1 \cdot 26 \times 5000.$$

The second prize was planned to be £3000, but it is now decided to decrease this prize by 6%.

Write down the most efficient method of calculating the amount of the decreased second prize.
You are not expected to work out the answer. [1]

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**3.**

Stylish computer desk

Made of laminate wood.
Non-scratch top.

**Length is exactly 2000mm**

Luc wants this new desk for his bedroom.

The desk is to fit on the straight wall between his wardrobe and his bookcase.

WALL
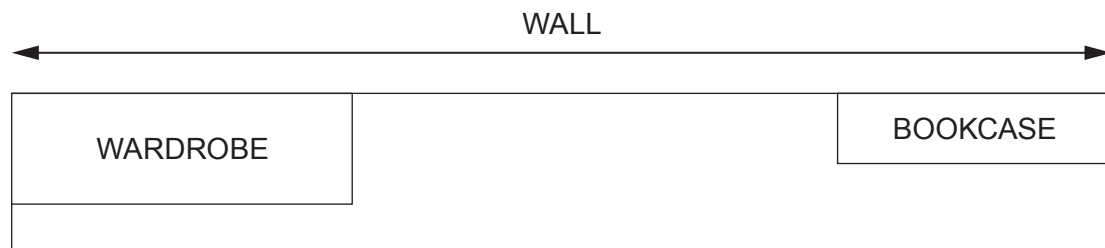
WARDROBE

BOOKCASE

*Diagram not drawn to scale*

Luc has measured the length of
- the wall, which is 600 cm, correct to the nearest 10 cm,
- the bookcase, which is 147 cm, correct to the nearest 1 cm,
- the wardrobe, which is 250 cm, correct to the nearest 1 cm.

*(a)* What is the greatest possible length of the wall?
Circle your answer. [1]

600 cm          605 cm          645 cm          610 cm          650 cm

*(b)* What is the least possible length of the wardrobe?
Circle your answer. [1]

249 cm          249·45 cm          249·49 cm          249·5 cm          250 cm

(3310U50-1)

*(c)* Can Luc be certain that this desk will fit in the space available?

You must
  • show all your calculations,
  • give the greatest or least bounds of any measurements used in calculations or comparisons,
  • give a reason for your answer.                                                                    [5]

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**Turn over.**

**4.** *(a)* 140 girls were asked how long they spent revising for their GCSE examinations. The cumulative frequency diagram shows the results.

Cumulative frequency
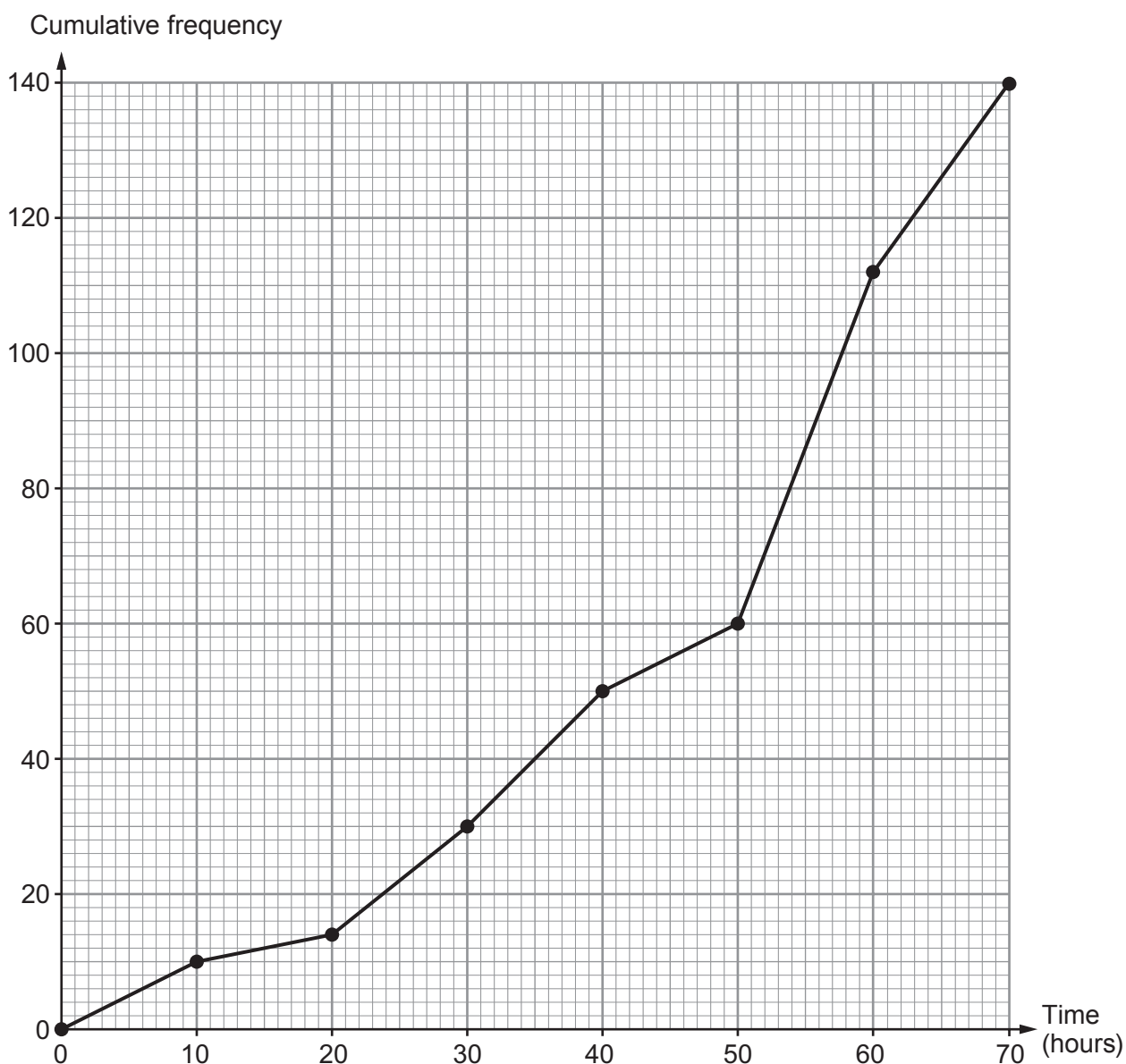


(i) Estimate the median time the girls spent revising.
Circle your answer. [1]

35 hours          40 hours          48 hours          52 hours          70 hours

(ii) Calculate the number of girls who spent between 40 and 50 hours revising.
Circle your answer. [1]

0 girls          5 girls          10 girls          15 girls          20 girls

(3310U50-1)

(iii)   Circle either TRUE or FALSE for each of the following statements.   [2]

| | | |
|---|---|---|
| 25 girls spent between 30 and 50 hours revising. | TRUE | FALSE |
| No girls spent more than 80 hours revising. | TRUE | FALSE |
| The modal group is between 50 and 60 hours spent revising. | TRUE | FALSE |
| 20 girls spent more than 60 hours revising. | TRUE | FALSE |

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*(b)*    140 boys were asked how long they spent revising for their GCSE examinations.
The cumulative frequency diagram below shows the results.

Cumulative frequency

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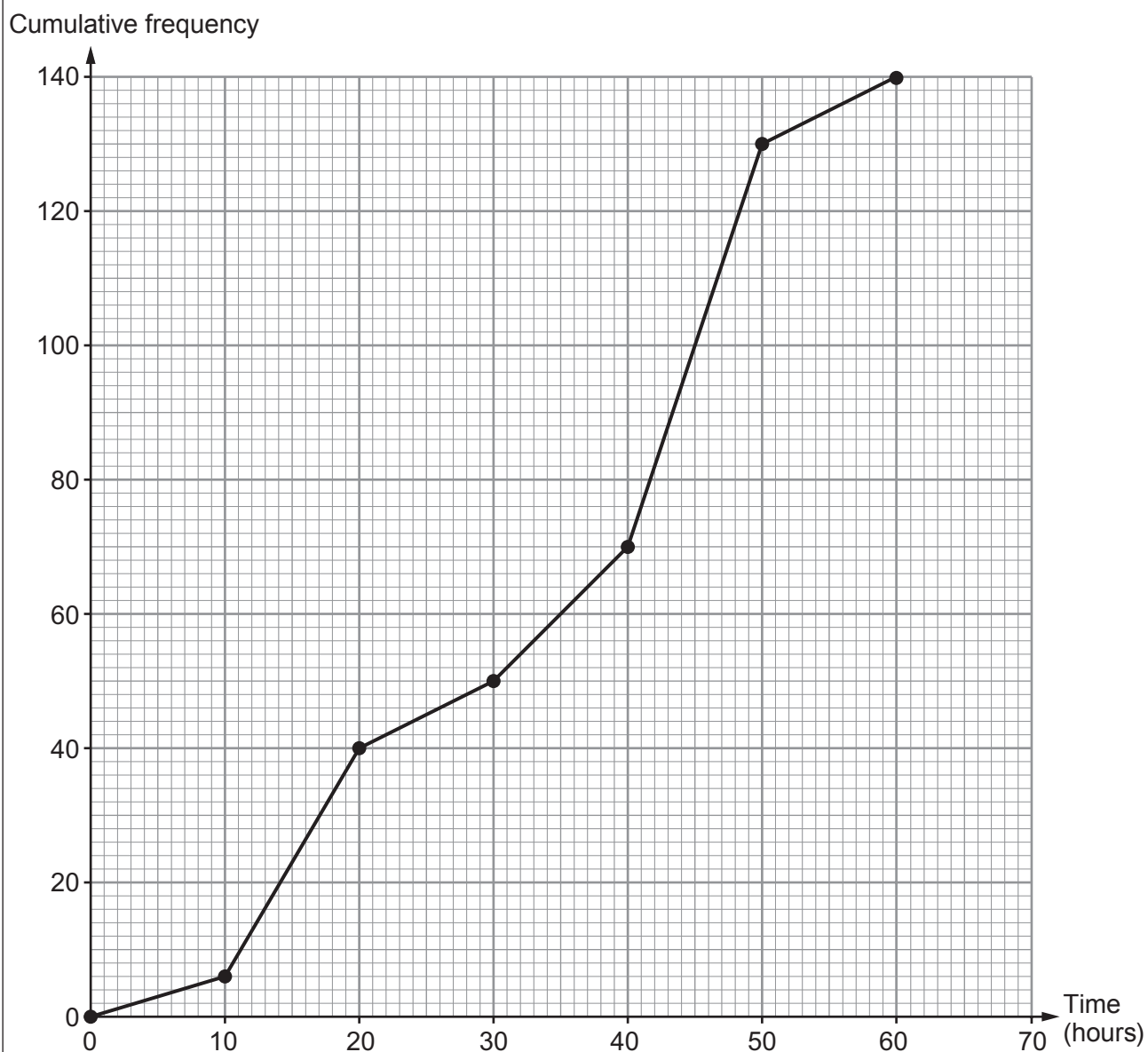
Trefor makes two statements.

1. The boys' interquartile range is greater than the girls' interquartile range.

2. On average, boys spent more time revising.

Are both Trefor's statements correct?
Show calculations and give reasons to support your answers. [4]

Statement 1: ......................................................................................................................................

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Statement 2: ......................................................................................................................................

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**5.** Petra is organising a prom for her year group.
The number of people attending the prom is likely to be between 20 and 80.

The cost of holding the prom at *Hotel Afonwen* would be as follows.
- Hire of the room: £100
- Food: £15 per person
- Welcome drink on arrival: £3 per person
- Decorations: £2 per person

*(a)* Draw a graph to illustrate the total cost of holding the prom for between 20 and 80 people. Use the graph paper below. [4]

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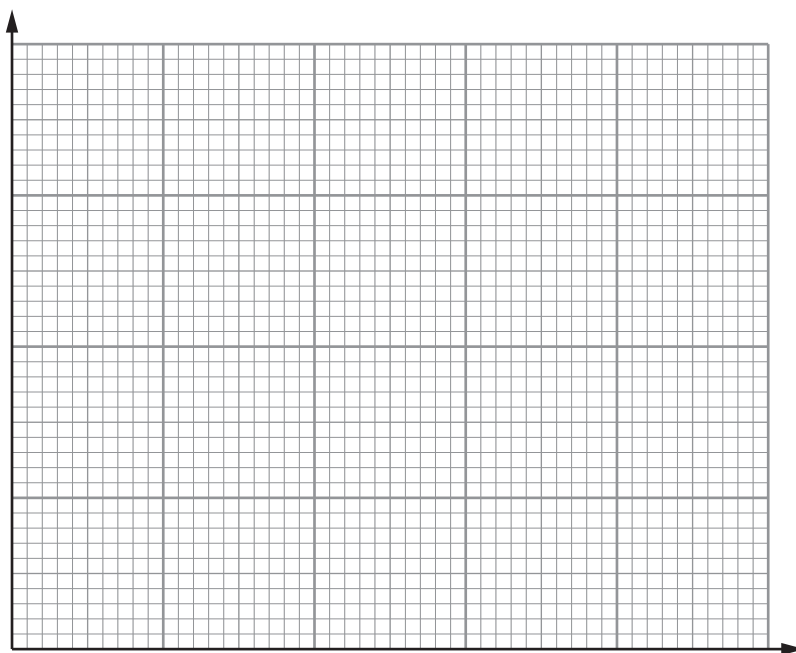
*(b)* Petra decides to share all the costs equally between the people attending.

- Let £*P* be the price paid per person.
- Let *N* be the number of people attending the prom.

Write a formula for *P*, in terms of *N*. [3]

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*(c)* Hiring a larger room at *Hotel Afonwen* costs £200.
The cost per person for food, welcome drinks and decorations remains the same.
If the total cost is £2240, how many people attend? [2]

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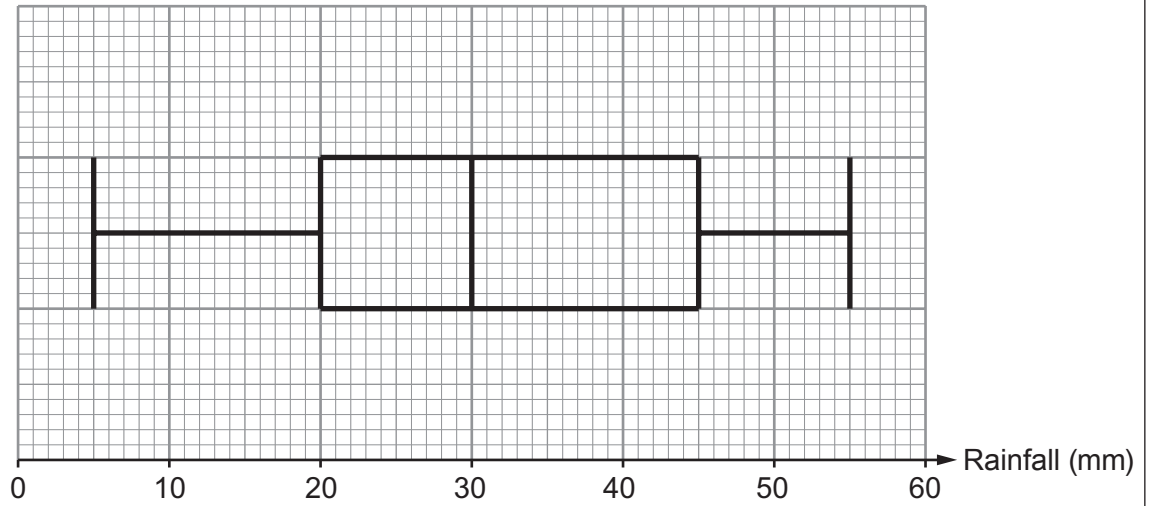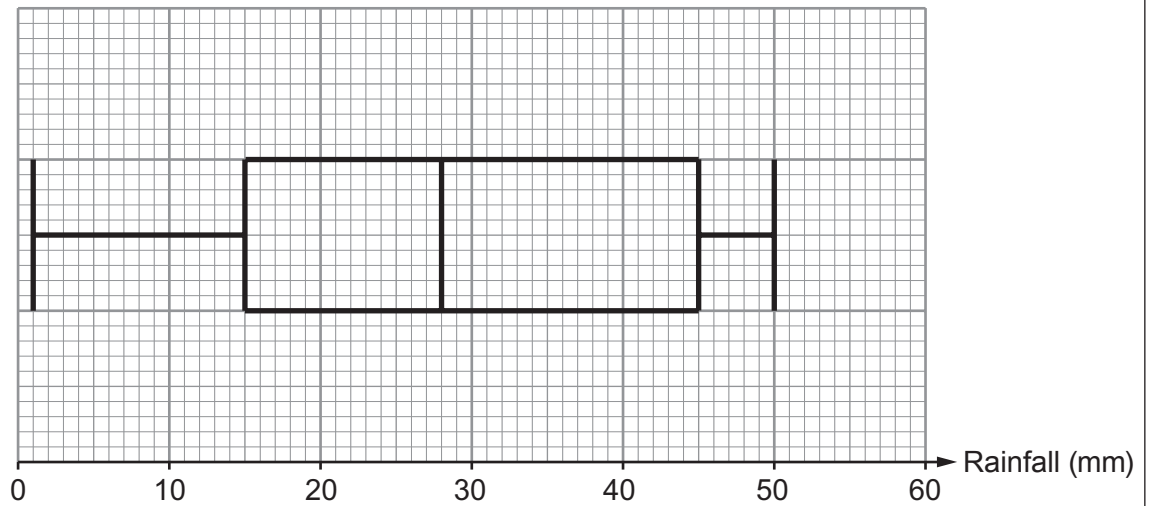
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**6.** The following box-and-whisker plots illustrate the daily rainfall for April 2016 in Trefwen and in Nawrby.

April rainfall in Trefwen



April rainfall in Nawrby

(3310U50-1)

*(a)* Complete the following table. [4]

| | Range | Median | Interquartile range |
|---|---|---|---|
| Trefwen | ..................... mm | ..................... mm | ..................... mm |
| Nawrby | ..................... mm | ..................... mm | ..................... mm |

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*(b)* Iona is going on holiday next April.
She is hoping for good weather, with hardly any rain.
She decides to go to Nawrby.
Give a reason to support Iona's decision.
Include values for both Trefwen and Nawrby. [1]

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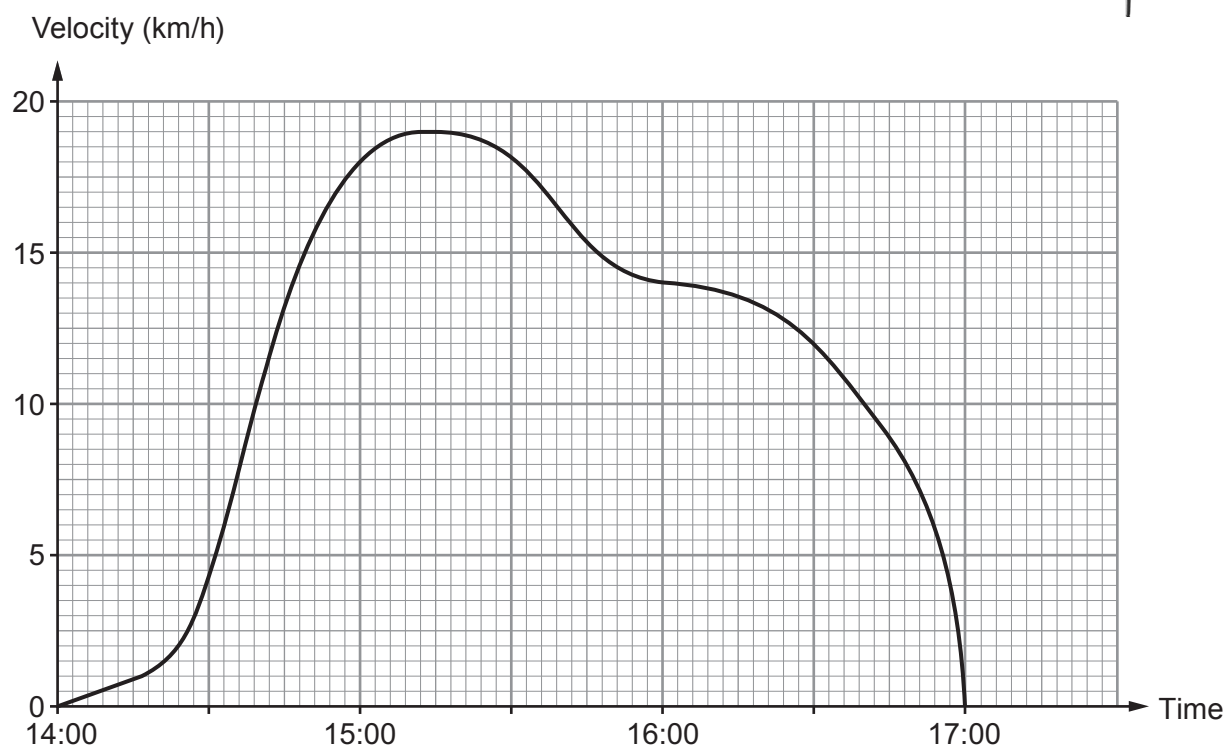
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**Turn over.**

**7.** Siân went for a ride on her bike.

She started her ride at 14:00.
The graph below shows information about her bike ride.



(a) During which quarter-hour period was Siân's acceleration the greatest? [1]

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(b) At about what time did Siân stop accelerating? [1]

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(c) Siân usually finds cycling at a velocity of 18 km/h very comfortable.
Express 18 km/h in metres per second. [2]

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*(d)* Using her velocities at 14:00, 15:00 and 16:00, calculate an estimate for the total distance Siân travelled **between 14:00 and 16:00**. [3]

Distance travelled ........................................ km

*(e)* *In this part of the question, you will be assessed on the quality of your organisation, communication and accuracy in writing.*

Siân estimated the distance she travelled between 16:00 and 17:00 as **5 miles**.
Is Siân's estimate reasonable?
You must justify your answer and show your working. [3 + 2 OCW]

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**8.** The *Big Fish Cymru* annual fishing competition is held on the west coast of Wales.

Information about **last year's** competition is displayed in the *Big Fish Cymru* booklet. A section of this booklet is shown below.
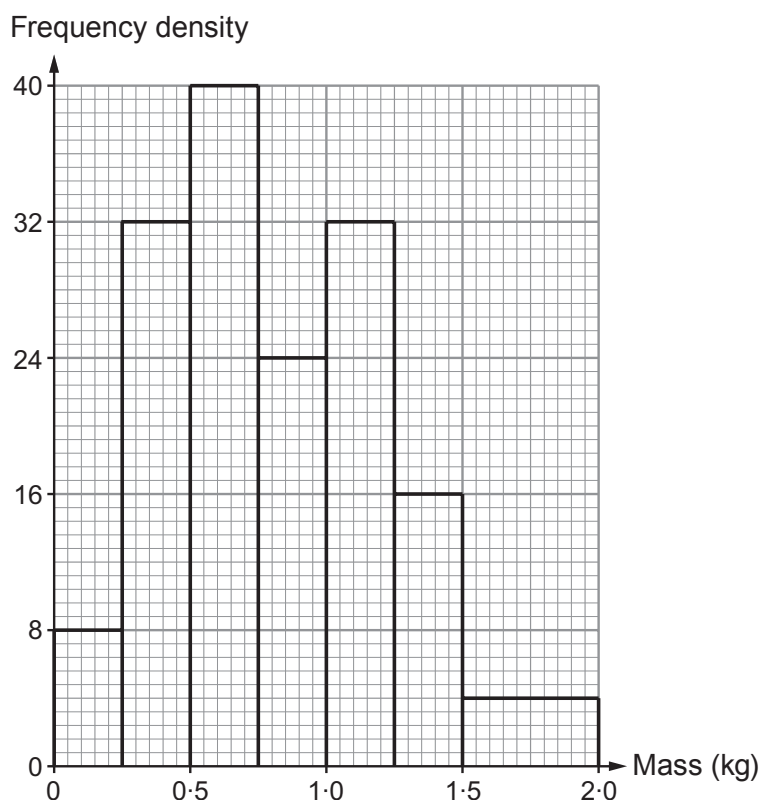
The competition organisers recorded the time taken for **each** angler to catch their **first** fish.

This is shown in the histogram on the right.

Frequency density
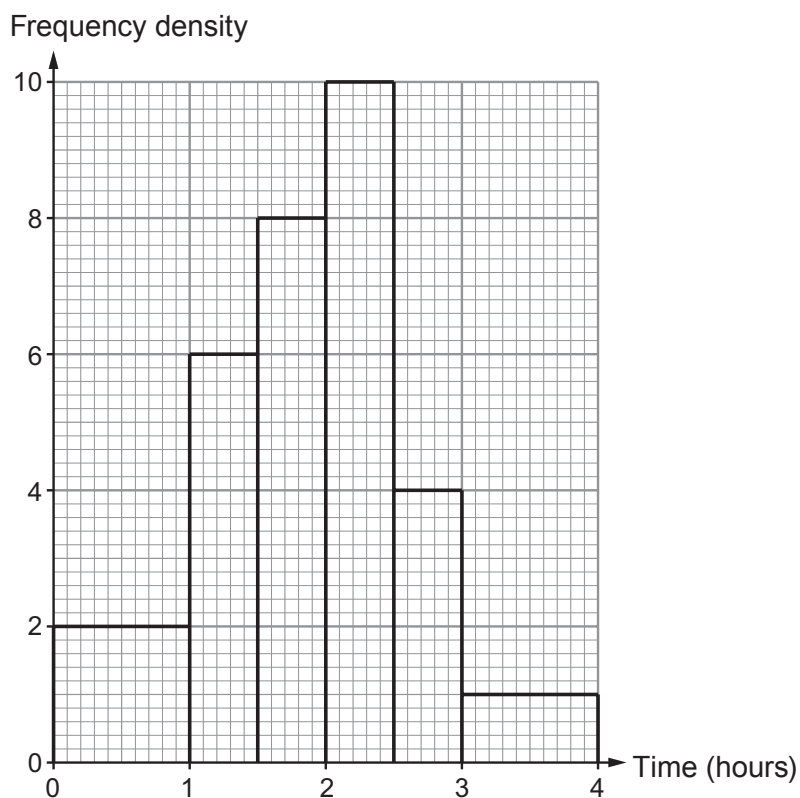


The competition organisers also recorded the mass of every fish caught.

This is shown in the histogram on the right.

Frequency density

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(a)  Last year, how many of the fish caught had a mass of less than 250 g?  [1]

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(b)  Last year, the final angler to catch their first fish did so after $3\frac{1}{2}$ hours.

How many **other** anglers took more than 3 hours to catch their first fish?  [1]

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(c)  The number of anglers taking part this year was three times as many as took part last year.
How many anglers took part in the competition this year?  [4]

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Number of anglers this year was ...........................................

(d)  The median mass of the fish caught this year was 0·9 kg.

What is the difference, in kg, between the median mass of the fish caught this year and the median mass of the fish caught last year?  [5]

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Difference in mass is ........................................... kg

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*(e)* Approximately 10% of the anglers this year caught their first fish within 1 hour.

    (i)    How does this percentage compare with last year's percentage?
You must show all your working. [3]

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    (ii)    Do you think it is fair to compare last year's competition results with this year's competition results?
You must give a reason for your answer. [1]

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**9.** Circle TRUE or FALSE for each of the following statements. [2]

| | | |
|---|---|---|
| Selecting the first name on each class register will give a random sample. | TRUE | FALSE |
| The ratio of boys to girls in a school is 2 : 3.<br>The pupil committee of 30 pupils is selected using a gender stratified sample.<br>There are 10 boys and 20 girls on the school committee. | TRUE | FALSE |
| A telephone survey is carried out to find which political party people support.<br>The sample of people surveyed is **not** a random sample of the whole population. | TRUE | FALSE |
| A stratified sample always considers proportions according to given criteria. | TRUE | FALSE |
| A random sample of people means everyone has an equal chance of being selected. | TRUE | FALSE |

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**10.** The shaded part of the diagram below shows the top surface of an engine part.

*A*

*B*

*O*

*C*

*D*

*Diagram not drawn to scale*

The measurements taken by a motor engineer are:

- reflex angle $B\hat{O}C$ = 240°,
- $AO = OD = 6\,cm$,
- $BO = OC = 3\,cm$.

(a) The length of the major arc *AD* is to be sealed by attaching a flexible anti-rust strip.
Each flexible anti-rust strip is of length 35 cm.
What length of the anti-rust strip will be left over after sealing the length of the major arc *AD*?
Give your answer in terms of $\pi$, in its simplest form. [3]

Length of anti-rust strip left over = ............................................ cm

(3310U50-1)

*(b)* The top surface of the engine part is to be painted.
The paint costs 15p per cm$^2$.

    (i)    Calculate the cost of the paint to be used.
          Give your answer in terms of $\pi$, in its simplest form.     [4]

    (ii)   Using $\pi = 3$, calculate how much it costs to paint the top surface of 20 engine parts.
          Give your answer in pounds.     [1]

Paint cost is £ .........................................

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| Question number | Additional page, if required. Write the question number(s) in the left-hand margin. |
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