Surname	Centre Number	Candidate Number
Other Names		0

GCSE – NEW

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 π 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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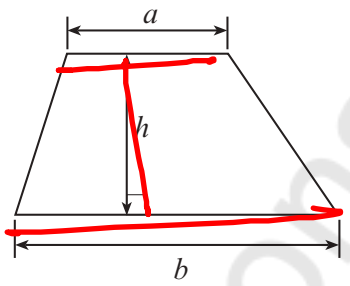
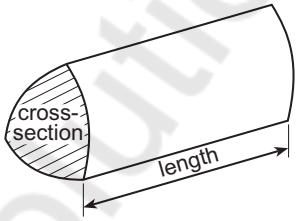
Formula List - Higher Tier

Area of trapezium $= \frac{1}{2}(a + b)h$



Volume of prism = area of cross-section × length

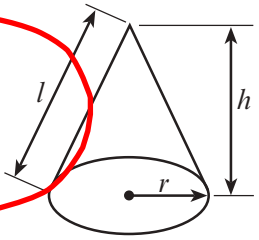


Volume of sphere $= \frac{4}{3}\pi r^3$

Surface area of sphere $= 4\pi r^2$

Volume of cone $= \frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi r l$

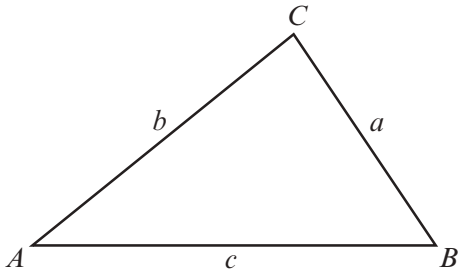


In any triangle ABC

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

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 $x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

Annual Equivalent Rate (AER)

AER, as a decimal, is calculated using the formula $\left(1 + \frac{i}{n}\right)^n - 1$, 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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Examiner only

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.

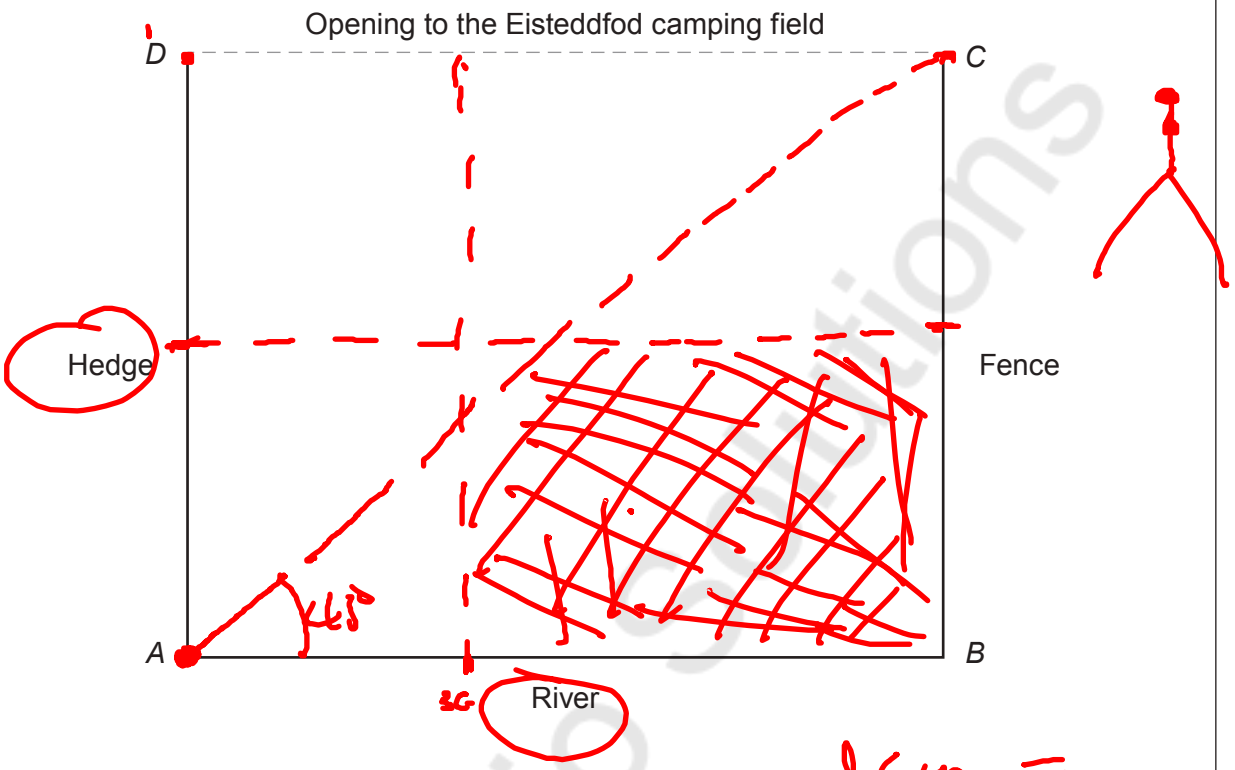
The barbecue area must be

- 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]

Examiner only

1 cm represents 10 metres



1cm =

30m =

1cm = 10m

3cm = 30m

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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]

(i) The total amount is not what was increased
It was Lotty share that increased by 30%

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

Firstly: Ratio for sharing 2:3
Lotty has 2 Rafael has 3
Lotty share will be = $\frac{2}{5} \times 400 = £800$
Now increase of 30% on Lotty's shared
Lotty New shared will be = 130% of 800
$= \frac{130}{100} \times 800$

130
×8 2
1040

$= £1040$

1 9 6 0 0
1 0 4 0
9 6 0

Examiner only

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

Lotty : Rafael
Lotty = £1040 Rafael = 2000 − 1040
Rafael = £960 ✓

Lotty : Rafael = 1040 : 960
$\frac{1040}{960} = \frac{26}{24} = \frac{13}{12}$

Lotty : Rafael = 13 : 12

Lotty's winnings : Rafael's winnings = 13 : 12

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(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

1·26 × 5000.

$\frac{126}{100}$ of 5000

$\frac{94}{100}$

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]

First Prize → £5000 % increase 26%
Second prize → £3000 % decrease 6%
% decrease of 6% will give 100 − 6 = 94%
Second prize (new) = 94% of 3000
= 0·94 × 3000 ✓

0·94 × 3000

Examiner only

3.

Stylish computer desk Made of laminate wood. Non-scratch top. **Length is exactly 2000 mm**	

Luc wants this new desk for his bedroom.

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

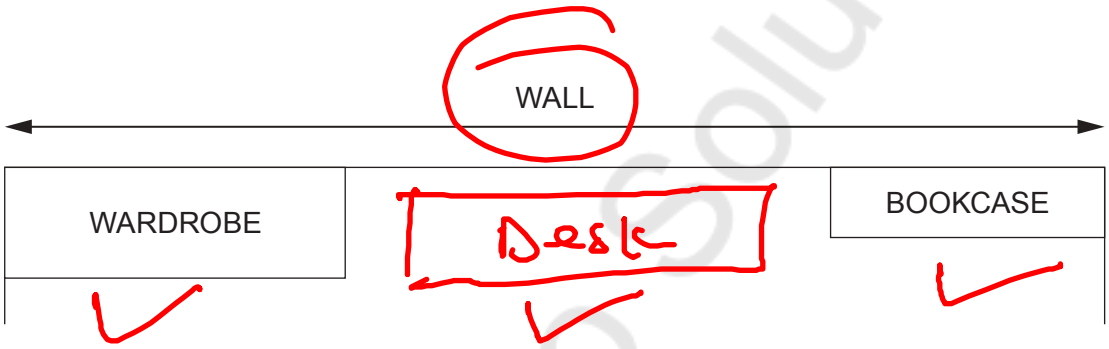

Diagram not drawn to scale

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

Examiner only

(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]

lenght of desk = 200cm

Worst case scenerior

lenght of wall minimum = 595cm

lenght of boot case = 147.5cm

Lenght of wardrope = 250.5cm

Lenght of desk = x

x + 250.5 + 147.5 = 595

x + 398 = 595

−398 −398

x = 197cm

250.5
147.5
398.0

595
−398
197

Space for desk 197cm

Desk lenght is 200cm

So, since space of desk available (197cm) is less than the length of the desk (200cm), then the the desk will not fit in.

197cm < 200cm

59
33
26

Q_3: 75% of CF = 105 $Q_3 = 59$ hours

Q_1: 25% of CF = 35 $Q_1 = 33$

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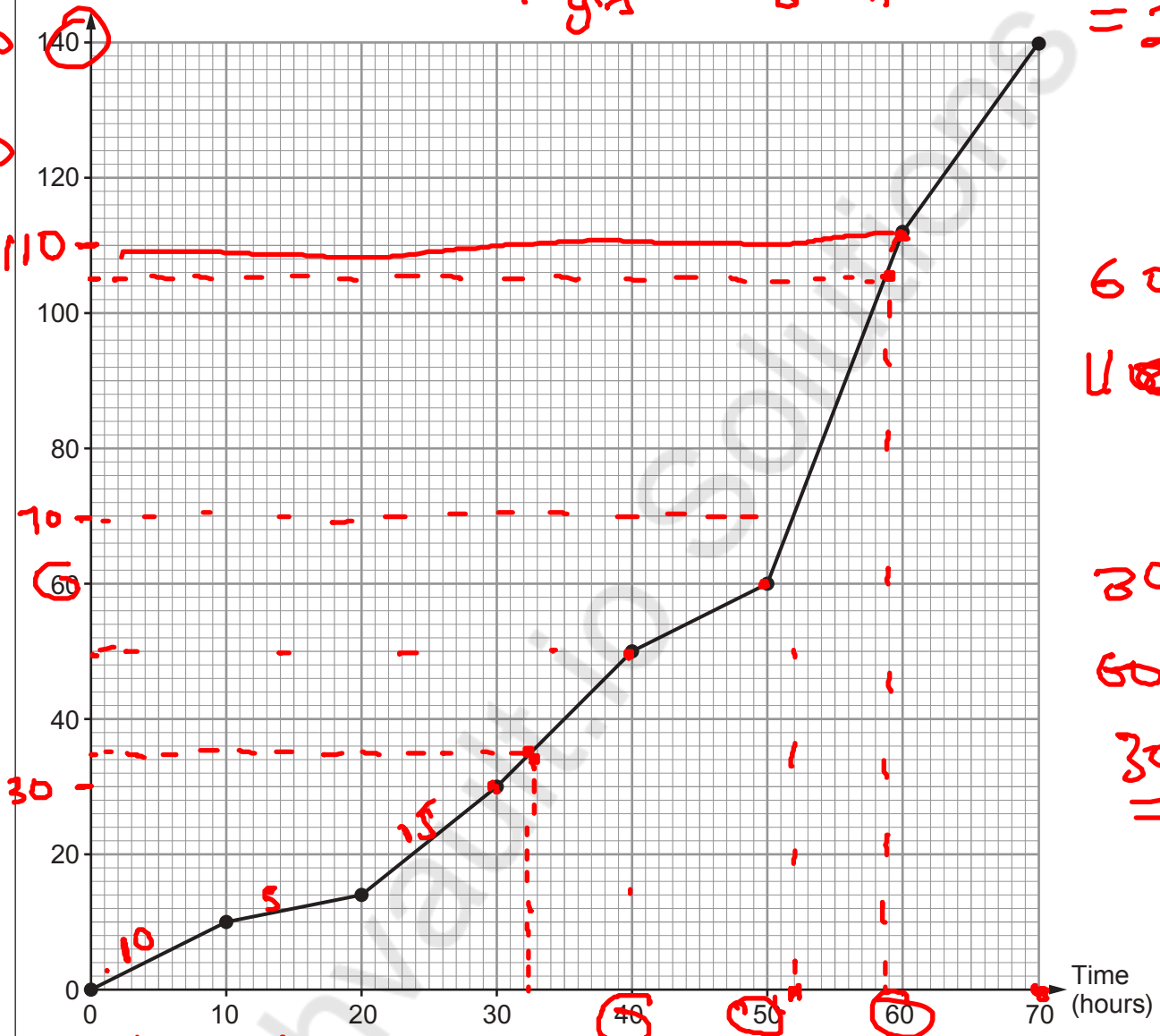
4. *(a)* 140 girls were asked how long they spent revising for their GCSE examinations. The cumulative frequency diagram shows the results.



IQR girls $= Q_3 - Q_1 = 59 - 33 = 26$

Median time will occur at $\frac{CF}{2} = \frac{140}{2} = 70$

(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

40 hrs CF = 50

50 hrs CF = 60

60 − 50 = 10 girls

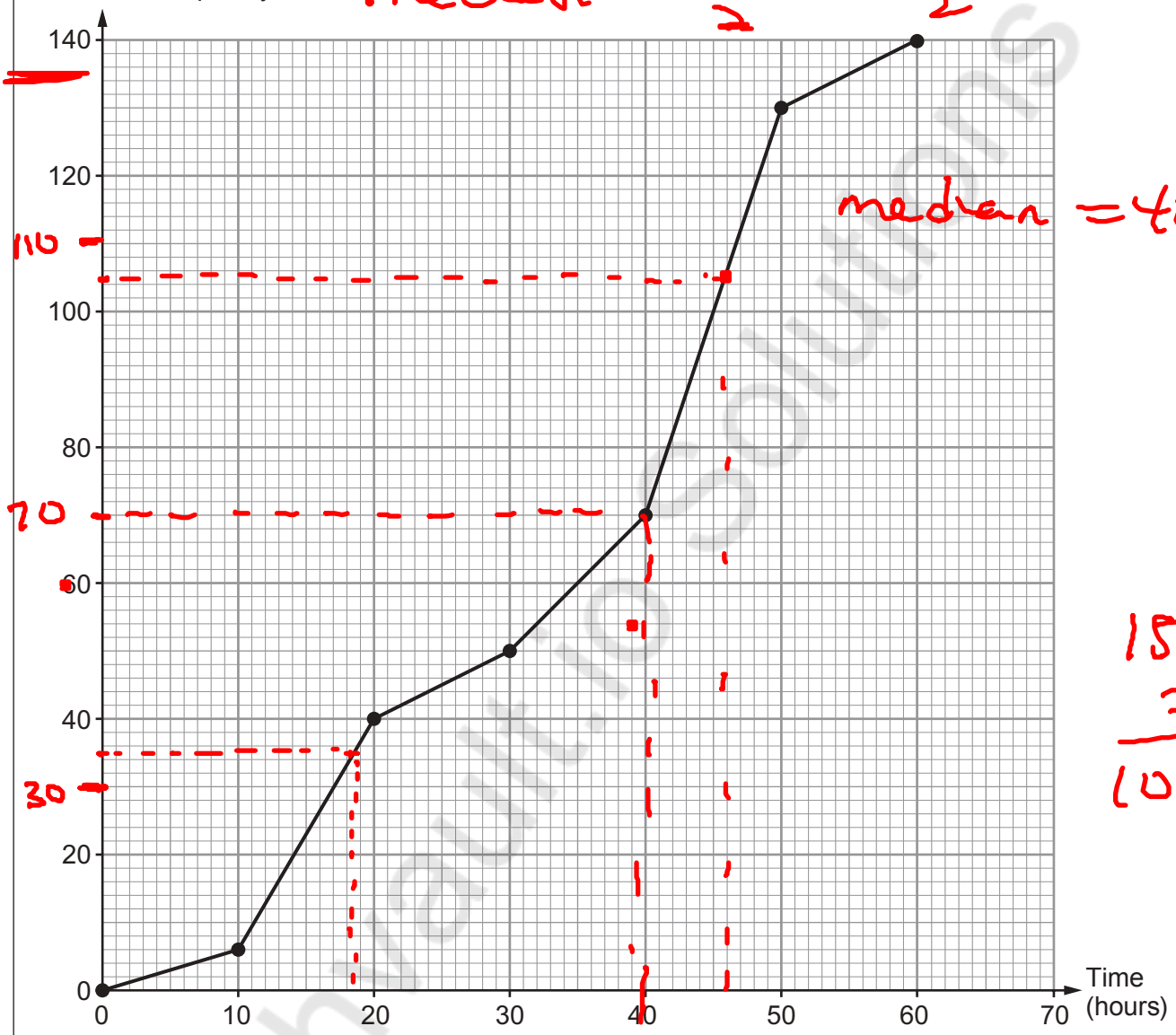
Examiner only

(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

Examiner only

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



median = $\frac{CF}{2} = \frac{140}{2} = 70$

median = 46

IQR = $Q_3 - Q_1$

Q_3 = 75% of CF = $\frac{75}{100} \times \frac{7}{140} = 105$

Q_1 = 25% of CF = $\frac{25}{100} \times \frac{7}{140} = 35$

Q_3 = 46 hrs

Q_1 = 19 hrs

IQR = $Q_3 - Q_1 = 46 - 19$

IQR$_{boys}$ = 27

Examiner only

Trefor makes two statements.

IQR IQR

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: $IQR_{boy} = 27$ $IQR_{girls} = 26$

The first statement is true because the boys IQR (27) is greater than the girls IQR (26).
IQR_{Boys} (27) > IQR_{girls} (26)

Statement 2:

Using median to discuss the average
medians of the girls is 52 hours
median of the boys is 40 hours
false, Boys spend less hours
studying than the girls because
the median of the boys is less
than the median of the girls

$Median_{Boys}$ (40) < median girls (52)

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Examiner only

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.

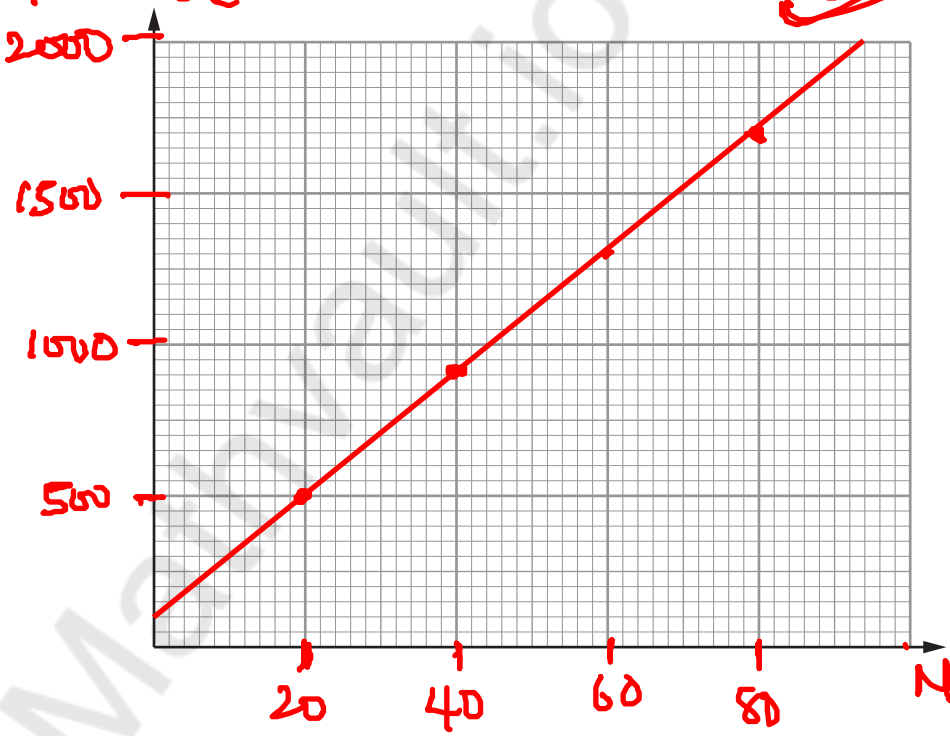
- Hire of the room: £100
- Food: £15 per person
- Welcome drink on arrival: £3 per person
- Decorations: £2 per person

(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]

No of people	20	40	60	80
Cost	500	900	1300	1700

Equation: Cost $= 100 + 2x + 15x + 3x$

$= 100 + 20x$



$x = 0$

$100 + 20 \times 0$

$100 + 0$

100

$P = \frac{100 + 20N}{N}$ $P = \frac{100}{N} + 20$ //

Examiner only

(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]

$\frac{1000}{20}$

Total Cost = $100 + 20x$

$TC = 100 + 20N$

$P = \frac{TC}{N} = \frac{100 + 20N}{N} = \frac{100}{N} + \frac{20N}{N}$

$P = \frac{100}{N} + 20$ //

(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]

New room cost → £200

TC = £2240

New Equation for total cost is

$TC = 200 + 20x$

$2240 = 200 + 20x$

$-200 \quad -200$

$2040 = 20x$

$x = \frac{2040}{20} = 102$

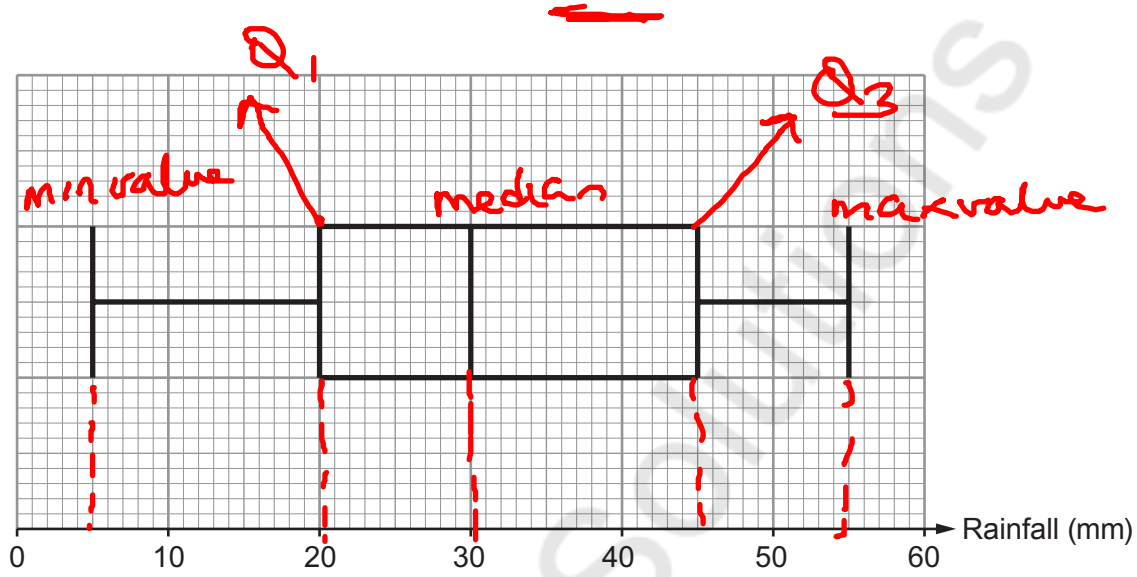
The number of attendees is 102 people //

Examiner only

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

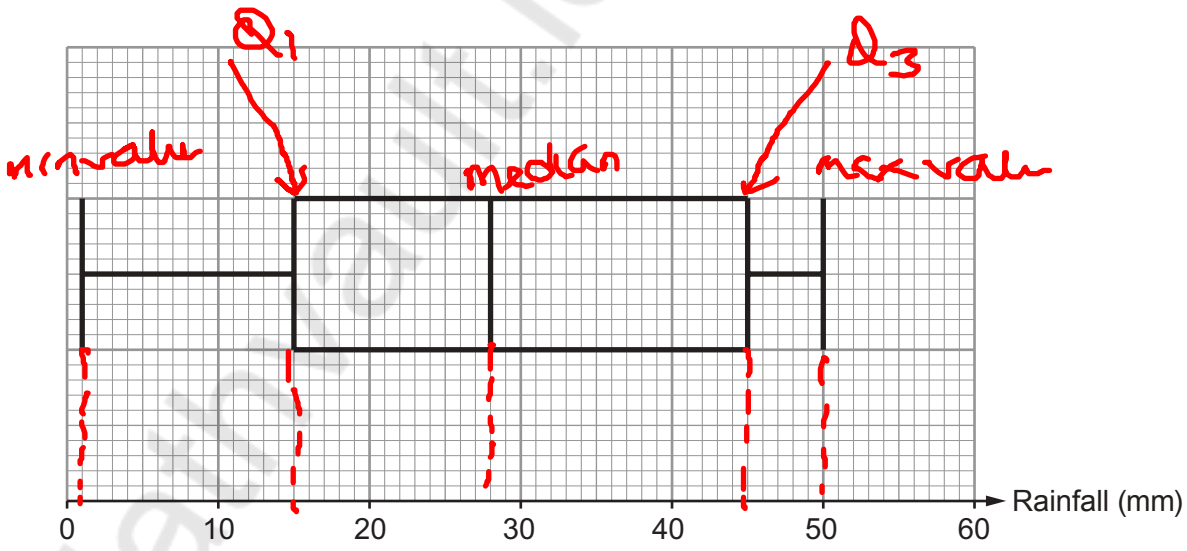
IQR = $Q_3 - Q_1$ = 45 − 20 = 25

April rainfall in Trefwen



Range = max value − min value = 55 − 5 = 50

April rainfall in Nawrby



Range = max value − min value = 50 − 1

= 49

IQR = $Q_3 - Q_1$ = 45 − 15 = 30

IQR = $Q_3 - Q_1$

Examiner only

(a) Complete the following table. [4]

	Range	Median	Interquartile range
Trefwen	50 mm	30 mm	25 mm
Nawrby	49 mm	28 mm	30 mm

(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]

She is going to Nawrby because the rainfall in Nawrby is less than the rainfall in Trefwen because the average rain fall in Nawrby (median = 28mm) is lower than the average rainfall in Trefwen (median = 30 mm)

median of Nawrby < median of Trefwen

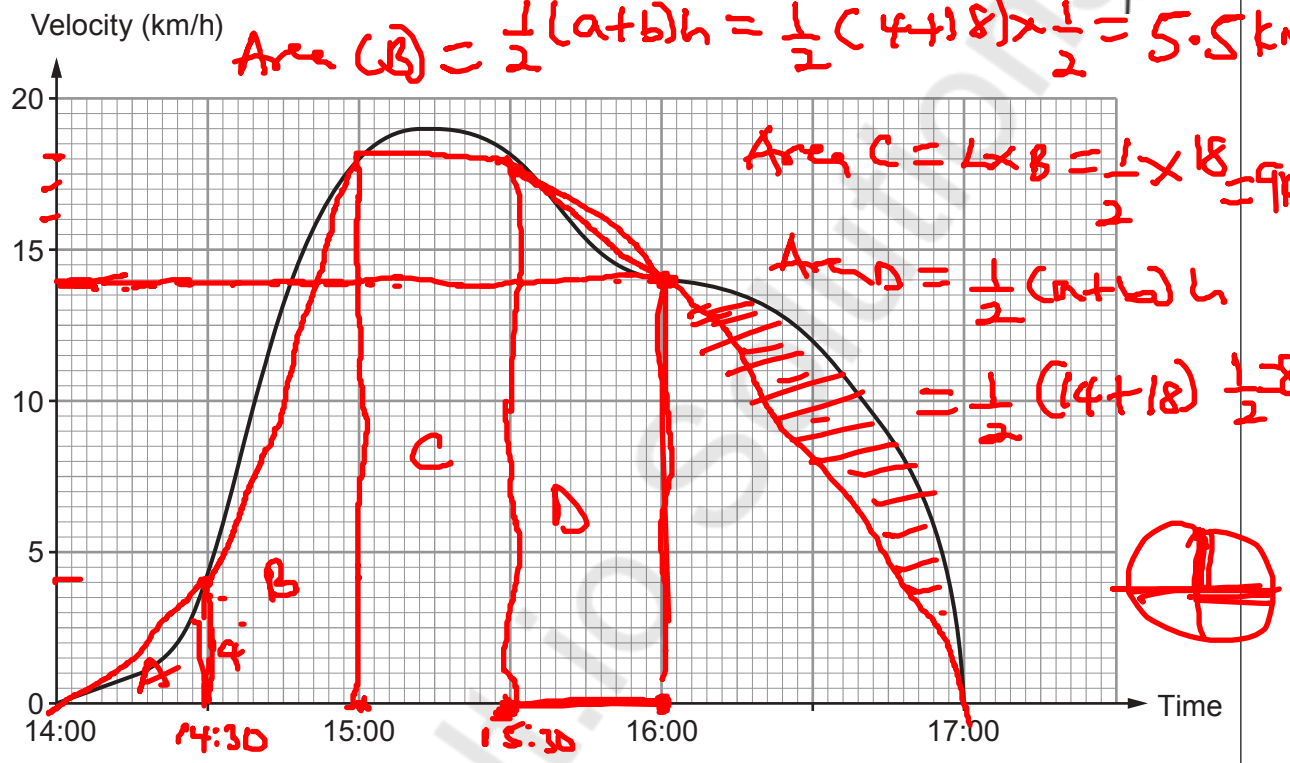
28mm < 30mm

3·1
3·5
15·5
9·3
10·85

Examiner only

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]

14:30 – 14:45

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

15:15

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

$V = \frac{18\text{ km}}{1\text{ hr}} = \frac{18 \times 1000\text{ m}}{3600\text{ s}}$

$V = 5\text{ m/s}$

10.0
13.5
23.5

Examiner only

(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]

Total Distance between 14:00 to 16:00
Total Distance Travell will be the
area under the curve 14:00 - 16:00
Total Distance = 1 + 5·5 + 9 + 8 = 23·5km
= 24km
½ hr

Distance travelled 24 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]

Estimated distance between 16:00 - 17:00
was 5miles
Graph of 16:00 - 17:00

42
14km/hr
0·62
7 4
4 - 3 4

Assume shape is a triangle
Distance = Area under the curve

Distance = Area = $\frac{1}{2}bxh = \frac{1}{2} \times 1 \times 14$

10
Distance = 7km
1km = 0·62miles

Distance = 7 × 0·62
= 4·34miles

So, she is right because 4·34miles

4 close to 5 miles and we lost some area because we assumed the shape is a triangle.

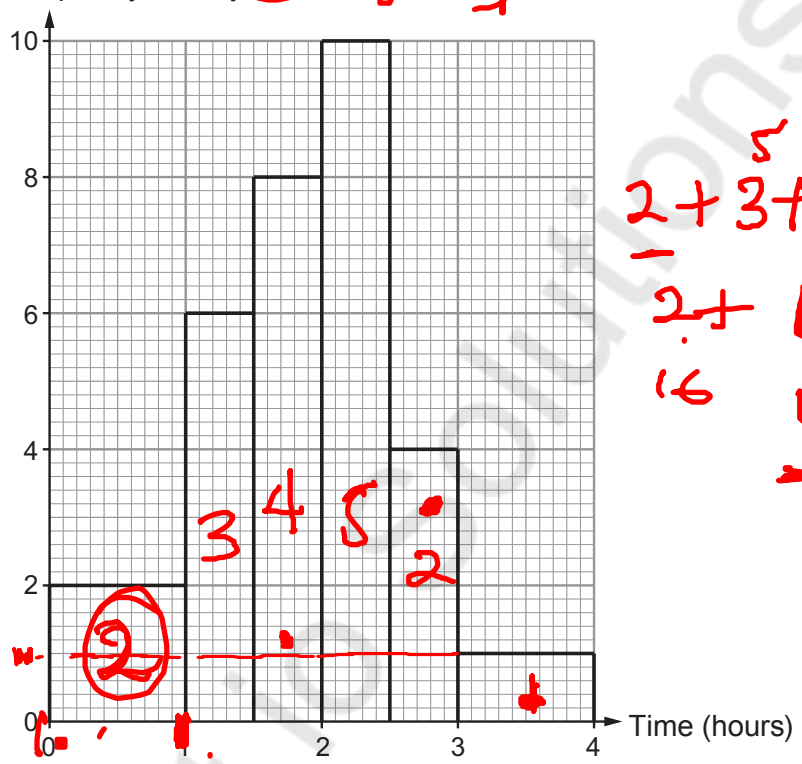
Examiner only

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.

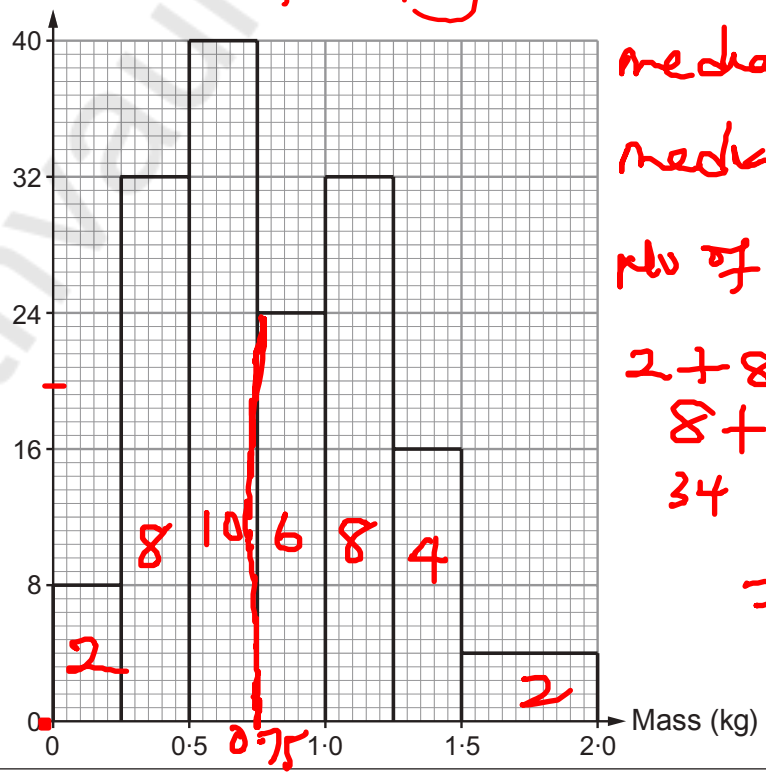
The competition organisers recorded the time taken for **each** angler to catch their **first** fish.

This is shown in the histogram on the right.



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

This is shown in the histogram on the right.



Number fish = mass × density = $\frac{1}{4}$ × 8 = 2 fish/kg

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(a) Last year, how many of the fish caught had a mass of less than 250 g? (0 - 25 kg) [1]

frequency density of 1 kg 250 g = 8 Fish / Kg

2 fish/kg

(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]

1 person took more than 3 hours

So, No other anglers take more than 3 hours **0**

(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]

This year anglers = 3 × Last year anglers

Last year anglers = 17

This year anglers = 3 × 17 = 51

Number of anglers this year was 51 angler

(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]

Median (This year) = 0·9 Kg

Median (Last year) = 0·75 Kg

Difference = 0·9 − 0·75

0·90 − 0·75 = 0·15

= 0·15 Kg

Difference in mass is 0·15 kg

Turn over.

Examiner only

(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]

10% of angler caught within 1hr this year

Last year = (no of fish caught within 1hr / Total fish caught) × 100

0.118
17 ⟌ 20

% last year within 1hr = 2/17 × 100

= 2/20 × 100

= 10%

It is approximately the same percentage

(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]

No, the event might have grown bigger, thereby drawing more participant. So, more people might involve this years. Then, it is not fair to compare last year's competition results with this year's competition.

Examiner only

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. The pupil committee of 30 pupils is selected using a gender stratified sample. 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. 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

2 : 3 x 5

10 : 15

10 : 20

1 : 2

Examiner only

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

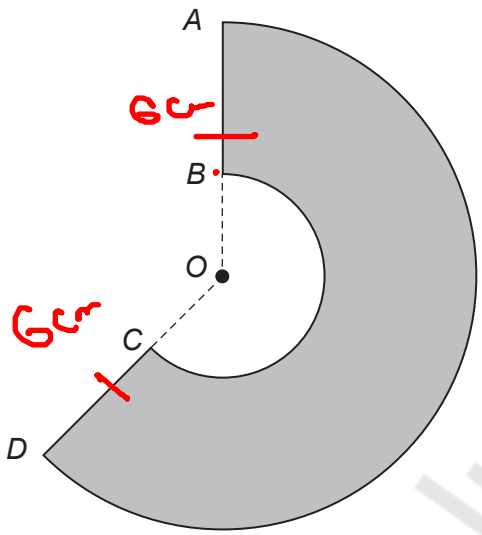

Diagram not drawn to scale

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 π, in its simplest form. [3]

Lenght of an arc $= \frac{\theta}{360} \times 2\pi r$

$= \frac{240}{360} \times 2 \times \pi \times 6$

Lenght of arc AD $= 8\pi$ cm

Extra length $= 35$ cm $\rightarrow 8\pi$ cm

Length of anti-rust strip left over = $35 - 8\pi$ cm

Shaded part = $24\pi cm^2 - 6\pi cm^2$

$= 18\pi\ cm^2$

Examiner only

(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 π, in its simplest form. [4]

Cost per area is 15p / cm^2

Area of Big Sector $= \frac{\theta}{360} \times \pi r^2$

$= \frac{240}{360} \times \pi \times 6 \times 6$

$= 24\pi\ cm^2$

Area of Small Sector $= \frac{\theta}{360} \times \pi r^2$

$= \frac{240}{360} \times \pi \times 3 \times 3$

$= 6\pi cm^2$

Cost $= 18\pi \times 15p$

$= 270\pi p$.

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

$\pi = 3$

1 engine part $= 270\pi p$

20 engine parts $= 270\pi p \times 20$

$= 5400\pi p$

$= 16200p$

Paint cost is £ 162

100p = £1

£162

$270 \times 20 = 5400$

$5400 \times 3 = 16200$

$16200p = £162$

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

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