Surname	Centre Number	Candidate Number
Other Names		0 .

wjec cbac

GCSE – NEW

3310U60-1

S17-3310U60-1

SOLUTIONS

MATHEMATICS – NUMERACY
UNIT 2: CALCULATOR-ALLOWED
HIGHER TIER

THURSDAY, 8 JUNE 2017 – MORNING

1 hour 45 minutes

ADDITIONAL MATERIALS

A calculator will be required for this paper.

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 or use the π button on your calculator.

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 **6**, 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.	3	
2.	2	
3.	4	
4.	4	
5.	8	
6.	6	
7.	8	
8.	6	
9.	3	
10.	5	
11.	8	
12.	7	
13.	7	
14.	9	
Total	80	

3310U601
01

JUN173310U60101

© WJEC CBAC Ltd.

Examiner only

1. Mali's scooter depreciated (decreased) in value by 24% in the **first** year.
In all further years, her scooter depreciated by 13% of its previous year's value.
She originally paid £850 for her scooter.
Calculate the value of Mali's scooter after 7 years. [3]

$850 \times 0.76 \times 0.87^6$

$= £280.12$

After 7 years, the value of Mali's scooter was £ 280.12

2. Sanjay stacks three boxes in a pile.
The heights of the boxes are 25 cm, 36 cm and 47 cm.
They are all measured correct to the nearest centimetre.
What is the greatest possible height of the stack of the three boxes? [2]

MAX Height = 25.5
36.5
+ 47.5
109.5 cm

Greatest possible height of the stack of three boxes is 109.5 cm

© WJEC CBAC Ltd.

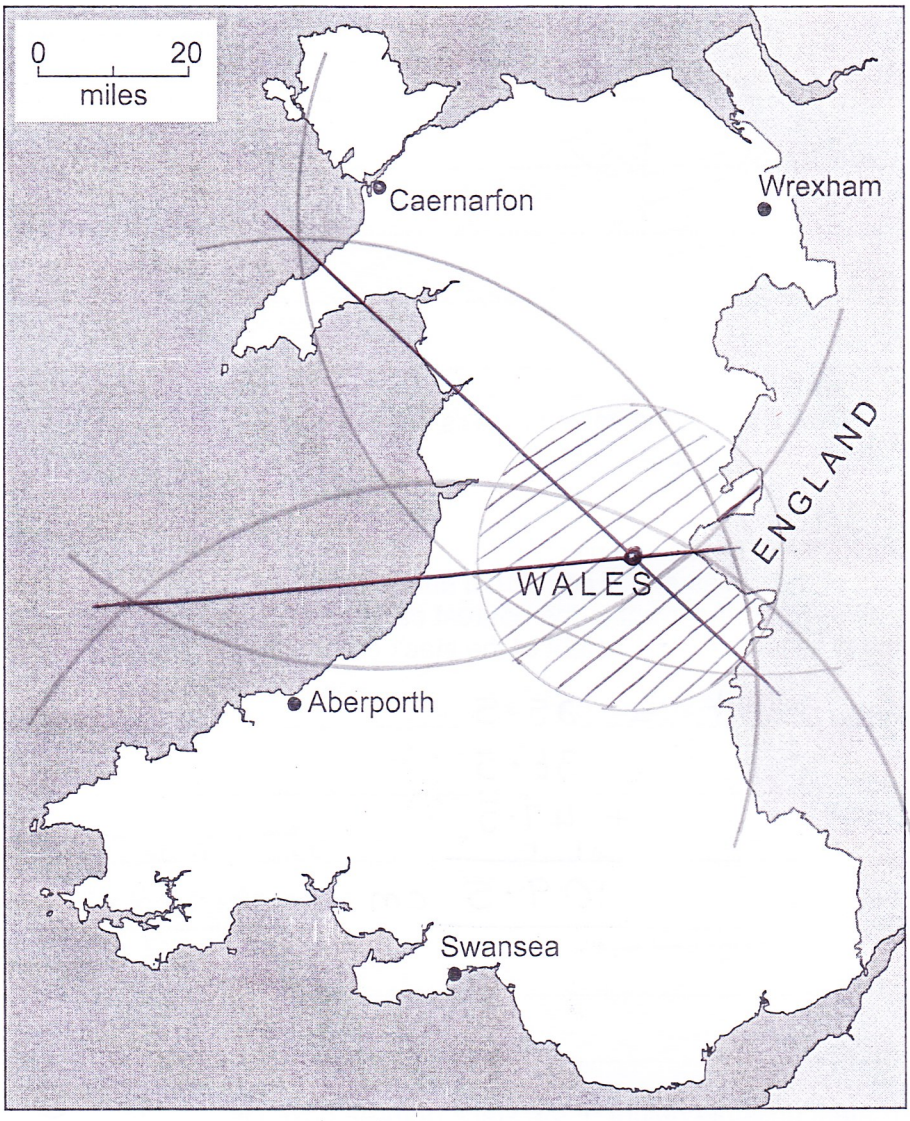
Examiner only

3. *Organics4U* is planning to have its headquarters in Wales.
The manager has instructed Ffion to look for a site for the headquarters.

Here are the instructions that Ffion has been given by her manager.

'Find the point that is
- an equal distance between Wrexham and Aberporth, and ← perpendicular bisectors
- an equal distance between Caernarfon and Swansea. ←
The new headquarters needs to be within 20 miles of this point.' ← set compass to 20 miles from scale

On the map below, shade the region, **in Wales**, that Ffion should identify for her manager. [4]

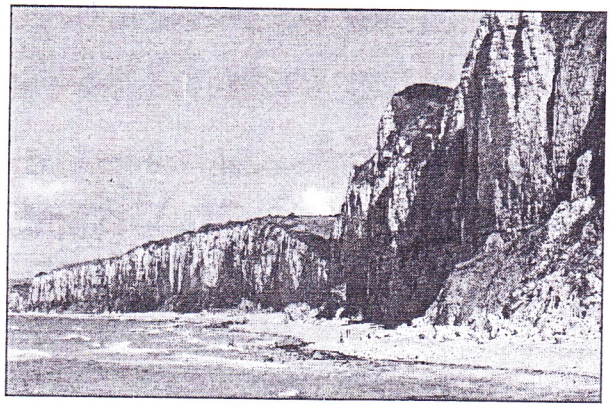


Do not shade in England.

© WJEC CBAC Ltd.

Examiner only

4.



Ursula is lying on her surfboard 180 metres away from the foot of a vertical cliff.
The height of the cliff is 146 metres.

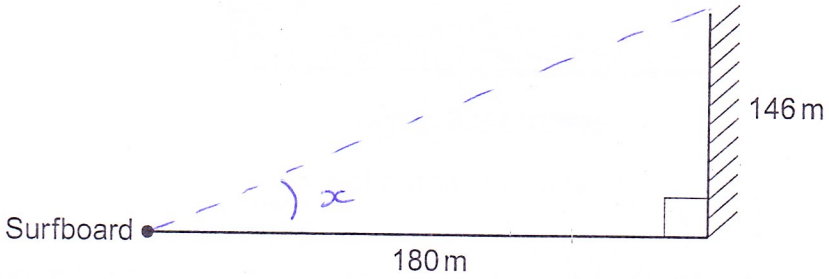


Diagram not drawn to scale

Ursula was told that if the angle of elevation of the top of the cliff from her lying position is between 42° and 45°, it is safe for her to attempt to stand on her surfboard.

Calculate the angle of elevation of the top of the cliff from Ursula's position lying on her surfboard.

State whether it is

- safe for Ursula to attempt to stand, or
- not safe as she is too near the cliff, or
- not safe as she is too far out at sea.

[4]

$\tan x = \frac{O}{a}$

$\tan x = \frac{146}{180}$

$x = 39.0°$

not safe as she is too far out to sea.

(To get angle x to between 42° and 45° she needs to make 180 m a smaller value)

© WJEC CBAC Ltd.

Examiner only

5. Marta buys a new television.

(a) Marta wants to fit the television in a bookcase on the wall.
In the shop she forgot to write down the length of the television.
She did write down the height and the diagonal of the screen.

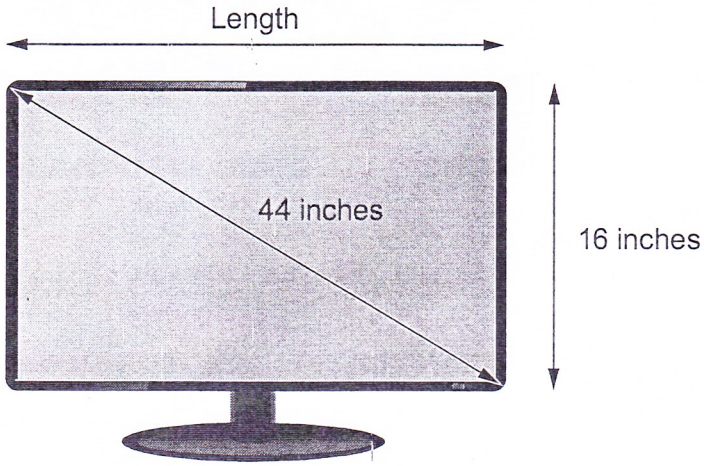


Diagram not drawn to scale

Marta needs to know the length of the screen before she opens the box, in case she wants to return the television.
Calculate the length of the screen.
Give your answer correct to 2 significant figures. [4]

$h^2 = a^2 + b^2$

$44^2 = 16^2 + b^2$

$1936 = 256 + b^2$

$1936 - 256 = b^2$

$1680 = b^2$

$40.99 \text{ inches} = b$

≈ 41 inches to 2 sig fig

Length is 41 inches, correct to 2 significant figures.

© WJEC CBAC Ltd.

Examiner only

(b) The television was reduced in the sale by 26% of its original price.
It cost Marta £710.40 in the sale.
What was the original price of the television? [2]

26% reduction.

∴ 74% = £710·40

1% = $\frac{710·40}{74}$

100% = $\frac{710·40}{74} \times 100$ = £960

Original price £ 960

(c) A television uses 1 unit of electricity every 10 hours.
A unit of electricity costs 9.8 p.

(i) Calculate the cost of having a television turned on for 24 hours.
Circle your answer. [1]

£23.52 £2.35 40.83 p (23.52 p) 2.45 p

$\frac{24}{10} \times 9·8$ p

= 23·52 p

(ii) On average, Marta watches 4 hours of television each day.
On average, how much **a week** does it cost her to watch television?
Circle your answer. [1]

(27.44 p) £27.44 £39.20 39.2 p 10.78 p

4 hrs × 7 = 28 hrs.

∴ $\frac{28}{10} \times 9·8$

= 27·44 p

© WJEC CBAC Ltd.

3310U601

Examiner only

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

Elin's old fish tank is leaking.

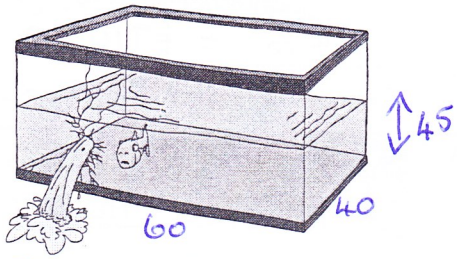


Diagram not drawn to scale

This old fish tank is in the shape of a cuboid.
The base of this tank measures 60 cm by 40 cm.
Before the leak, the height of the water level in Elin's old fish tank was 45 cm.

Elin decides to replace her fish tank with a cylindrical one.

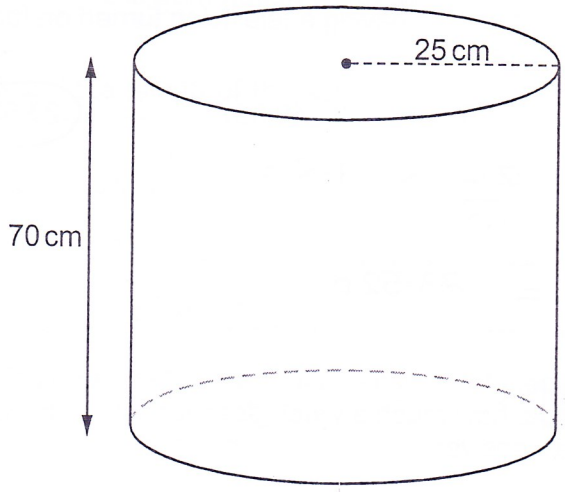


Diagram not drawn to scale

She selects a new cylindrical fish tank that has a radius of 25 cm and a height of 70 cm.

Will all the original contents, including the water and the fish, fit into this cylindrical tank?
You must show all your working. [4 + 2 OCW]

Volume water = lbh
= 60 x 40 x 45
= 108000 cm^3
= 108 litres

New Tank = $\pi r^2 h$
= $3.14 \times 25^2 \times 70$
= 137 375 cm^3
≈ 137.4 litres

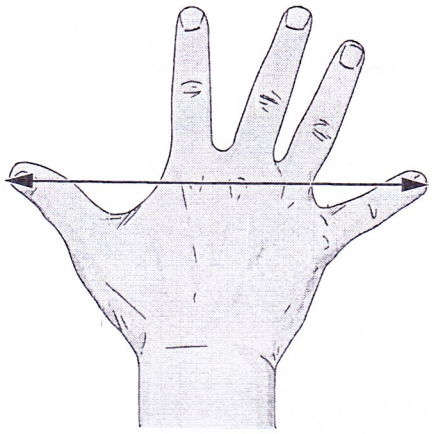
So YES all will fit comfortably

© WJEC CBAC Ltd.

Examiner only

7. Simon plans to make gloves.

(a) One morning, Simon decided to carry out a survey to find the mean hand span of people in Wales.



He decided to sample systematically.
He decided to sample from the first 240 people who pass him in the street during the morning.

He wanted to take 20 people's hand span measurements.
Explain how Simon could use systematic sampling to obtain 20 measurements. [1]

$\frac{240}{20} = 12$

∴ Simply ask every 12'th person from the 1st 240 people that pass by.

© WJEC CBAC Ltd.

Examiner only

(b) Yesterday morning, Simon only managed to sample 10 people.
He calculated the mean hand span of these 10 people to be 22·8 cm.

Yesterday afternoon, Simon recorded the hand spans of a **further** 20 people.

The results for these 20 people are shown in the frequency table below.

Hand span, to the nearest mm	Frequency	Mid Point
20·0 cm to 20·8 cm	2	20·4
20·9 cm to 21·7 cm	3	21·3
21·8 cm to 22·6 cm	10	22·2
22·7 cm to 23·5 cm	5	23·1

Calculate an estimate of the mean of all **30 hand spans** that Simon measured yesterday. [6]

For the 30 people

Estimated mean $= \frac{(2\times20.4)+(3\times21.3)+(10\times22.2)+(5\times23.1)+(10\times22.8)}{30}$

$= \frac{40.8+63.9+222+115.5+228}{30}$

$= \frac{670.2}{30}$

$= 22.34$ cm

(c) What could Simon do to improve his estimate of the mean hand span of people in Wales? [1]

He could use stratified sampling to ensure all ages and gender are accounted for.

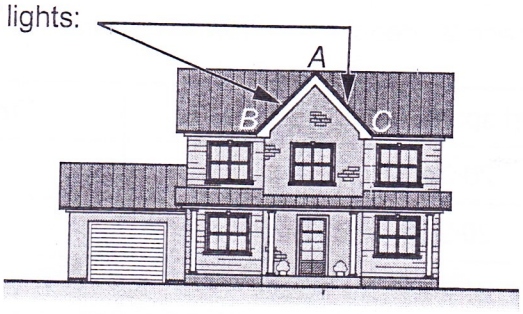
3310U601 11

© WJEC CBAC Ltd.

Examiner only

8. The diagram below shows where Levi wants to attach a string of lights to his house.

String of lights:



Levi wants to attach a single string of lights from *B* to *A* and then from *A* to *C*.
The diagram below shows the measurements Levi has taken.

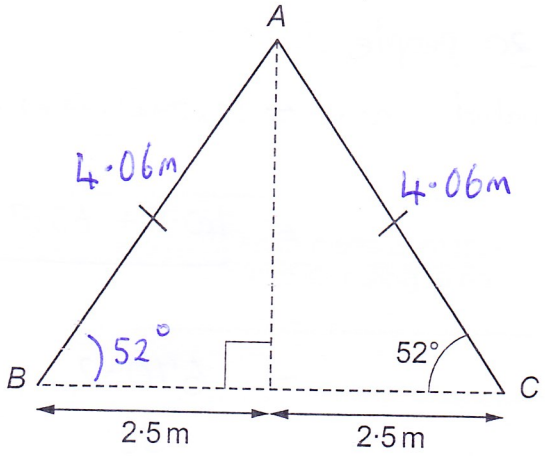


Diagram not drawn to scale

He spends £410 at the electrical store buying a string of lights.
After putting up the lights, Levi finds he has 6 metres of the string of lights left over at one end.

How much did the electrical store charge Levi, per metre, for the string of lights? [6]

Find AB = AC

$\cos 52° = \frac{2·5}{AB}$

$AB = \frac{2·5}{\cos 52°}$

$AB = 4·06\text{m} = AC$

∴ Total length of lights bought
$= 4·06 + 4·06 + 6$
$= 14·12\text{m}$

∴ Charge per metre $= \frac{410}{14·12} = £29·04$

© WJEC CBAC Ltd.

Examiner only

9. The table shows the number of Year 11 pupils attending schools in Cwmifan.

School	Cwrt Haf	Cwmifan High	Henclwyd
Number of Year 11 pupils	307	239	144

In total there are 690 Year 11 pupils attending these three schools.

A new youth theatre has been set up in Cwmifan.
On the opening night, a total of 80 Year 11 pupils from these three schools are going to be invited to attend.

Use a stratified sampling method to calculate the number of Year 11 pupils from each school who should be invited.
You must show all your working. [3]

CWRT HAF $\frac{307}{690} \times 80 = 35{\cdot}59 \approx 36$

CWMIFAN HIGH $\frac{239}{690} \times 80 = 27{\cdot}7 \approx 28$

HENCLWYD $\frac{144}{690} \times 80 = 16{\cdot}7 \approx 17$

TOTAL 81

Adjust CWRT HAF down by 1, to 35.

School	Cwrt Haf	Cwmifan High	Henclwyd
Number that should be invited	35	28	17

© WJEC CBAC Ltd.

Examine only

10. Fatima wants to invest some money in a savings account.
She has picked up leaflets from two building societies advertising their high-interest savings accounts.

'Bannau' account	'Eryri' account
Nominal annual rate of 3·85%	Nominal annual rate of 3·86%
Interest paid monthly	Interest paid every 6 months

By comparing AERs, which account will offer Fatima the better interest rate on her investment? You must show all your working. [5]

BANNAU

$$AER = \left(1 + \frac{i}{n}\right)^n - 1$$

$$= \left(1 + \frac{0.0385}{12}\right)^{12} - 1$$

$$= (1.003208333)^{12} - 1$$

$$= 1.03918 - 1$$

$$= 0.03918$$

$$= 3.92\%$$

ERYRI $AER = \left(1 + \frac{0.0386}{2}\right)^2 - 1$

$$= (1.0193)^2 - 1$$

$$= 1.03897 - 1$$

$$= 0.03897$$

$$= 3.90\%$$

∴ Bannau offers better rate of investment.

© WJEC CBAC Ltd.

Exam onl

11. A company produces metal badges to be worn by its employees.
The badge is made up of two parts.
One part is in the shape of a sector of a circle as shown in the diagram.

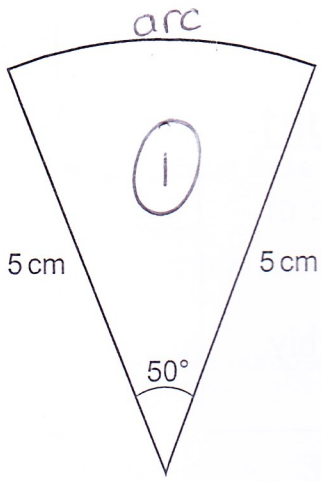


Diagram not drawn to scale

(a) The perimeter of the sector is decorated with a coloured edging strip.
Calculate the length of edging strip needed to decorate the sector. [3]

$P = 5 + 5 + \text{arc}$

$P = 10 + \frac{50}{360}\pi D$ $\quad D = 10\text{cm}$ here

$P = 10 + \left(\frac{50}{360} \times 3.14 \times 10\right)$

$P = 10 + 4.36$

$P = 14.36\text{ cm}$

(b) The other part is in the shape of a quarter-circle of radius 3 cm.

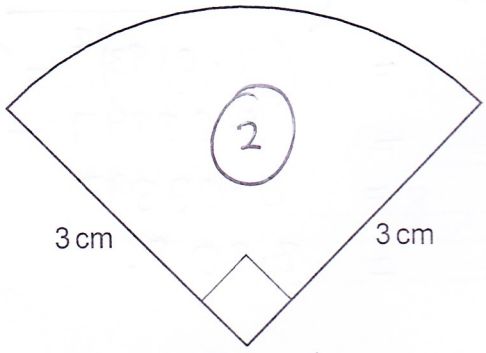


Diagram not drawn to scale

© WJEC CBAC Ltd.

Examiner only

To make the badge, the two pieces are joined together with the sector in front of the quarter-circle, as shown in the diagram.
The badge has a vertical line of symmetry.

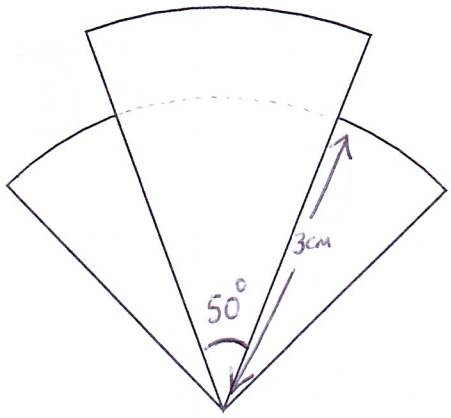


Diagram not drawn to scale

The visible surface of the front of the badge is painted.
Calculate the area that is painted. [5]

Area painted = (1) + (2) − (hidden $\frac{50 \times \pi r^2}{360}$)

$= \frac{50}{360}\pi \times 5^2 + \left(\frac{90}{360}\pi \times 3^2 - \frac{50}{360}\pi \times 3^2\right)$

These go together as $\frac{40}{360}\pi \times 3^2$

$= \left(\frac{50}{360} \times 3.14 \times 25\right) + \left(\frac{40}{360} \times 3.14 \times 9\right)$ (3^2)

$= 10.90 + 3.14$

$= 14.04\ cm^2$

© WJEC CBAC Ltd.

12. A plan view of Lowri's garden is shown below.

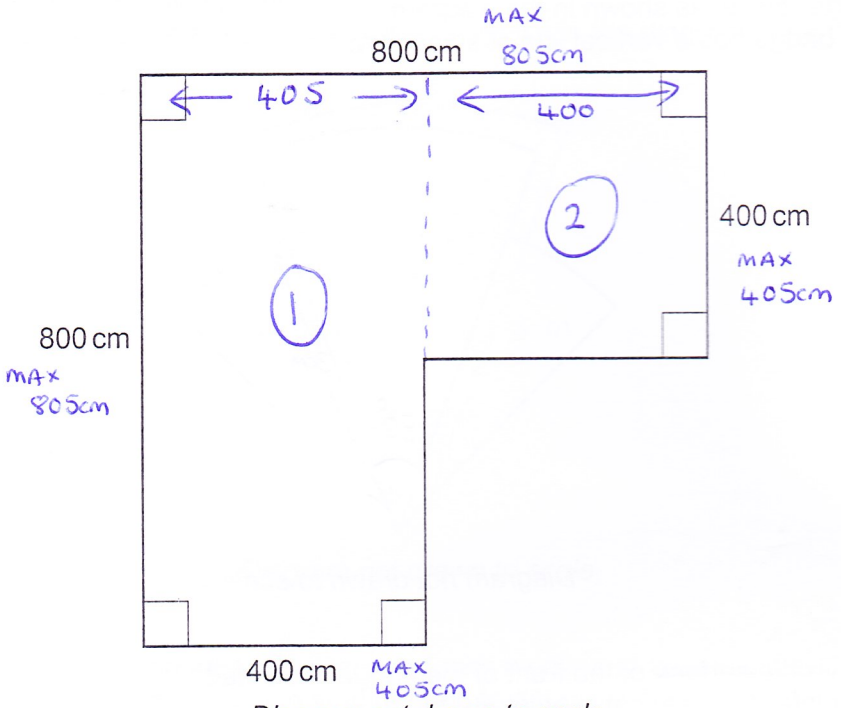


Diagram not drawn to scale

All the measurements are correct to the nearest 10 cm.

(a) Calculate the greatest possible area of Lowri's garden. [4]

MAX Area = MAX (1) + MAX (2)

= (805 × 405) + (400 × 405)

= 326025 + 162000

= 488025 cm^2

= $\frac{488025}{10000}$ m^2

= 48·8025 m^2

© WJEC CBAC Ltd.

Exami only

(b) Lowri plans to spread grass seed over her garden using a spreading tool.
Over **each square metre**, the spreading tool spreads 30 g of grass seed, correct to the nearest 5 g.

Lowri has exactly 1·5 kg of grass seed.
Can she be **certain** that she has enough grass seed?
You must show all your calculations. [3]

Each m^2 Max g used = 32.5g

∴ See how many 32.5g amounts there are in 1.5kg.

$\frac{1500}{32.5} = 46.1538$

∴ She can definitely cover 46.15 m^2

But the max area ≈ 48.8 m^2

∴ No she cannot be certain she has enough seed.

© WJEC CBAC Ltd.

13. The front views of two mathematically similar milk cartons are shown below.

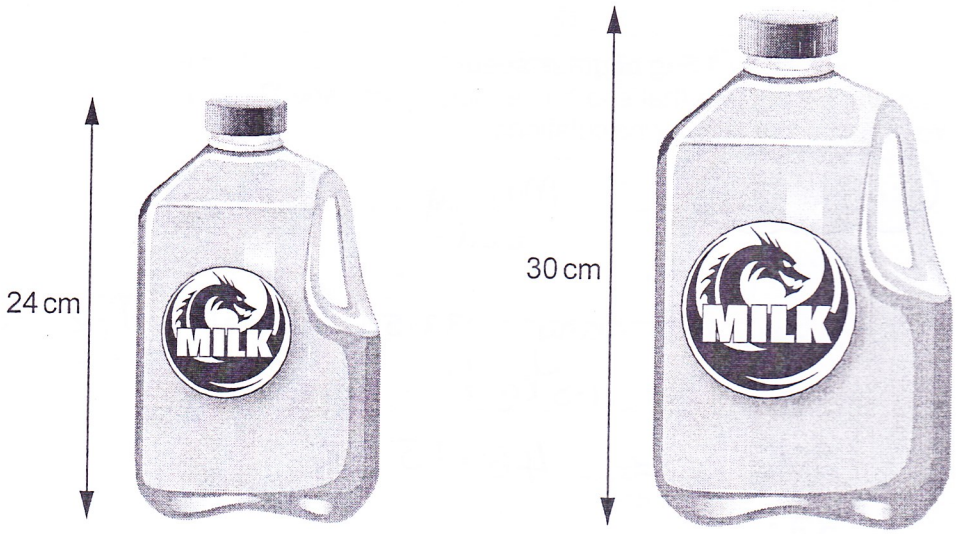


Diagram not drawn to scale

(a) Circle either TRUE or FALSE for each statement given below. [1]

STATEMENT		
The ratio of the lengths of the cartons is the same as the ratio of the heights of the cartons.	TRUE	FALSE
The ratio of the volumes of the cartons is the same as the ratio of the heights of the cartons.	TRUE	FALSE

(b) It is claimed that the larger carton contains double the amount of milk contained in the smaller carton.
Show that this claim is not true.
Explain your answer. [3]

Scale factor ratio $= \frac{30}{24} = \frac{5}{4} = 1.25$

$\therefore$ Scale factor volume (capacity) $= 1.25^3 = 1.953125$

$\therefore$ Larger carton does not have double the milk.

© WJEC CBAC Ltd.

Examiner only

(c) Another similar milk carton has a label with an area that is one quarter of the area of the label on the carton of height 24 cm.

Diagram not drawn to scale

Calculate the height of this new carton. [3]

SF factor area $= \frac{1}{4}$

$\therefore$ SF factor lengths $= \frac{1}{2}$ because $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

$\therefore$ Height of new carton $= \frac{1}{2}$ of 24

$= 12\text{cm}$.

© WJEC CBAC Ltd.

14. The diagram shows a 5 m wide section of road that has a uniform gradient.
The shaded area represents level ground.
Two cyclists, Delyth and Ioan, approach this section of road.

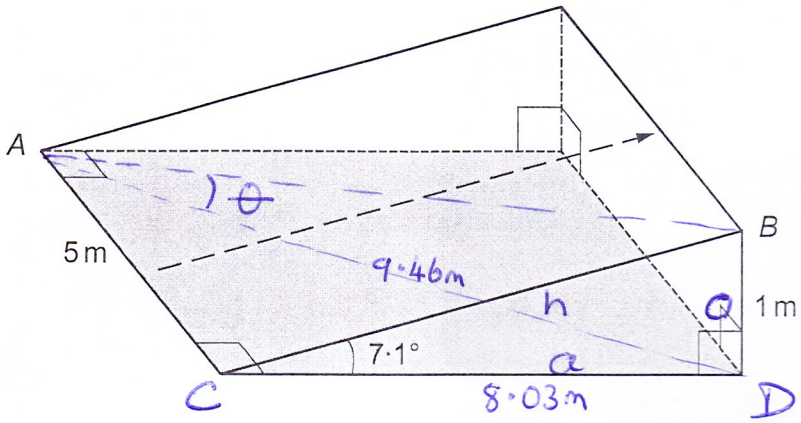


Diagram not drawn to scale

Delyth cycles straight up the middle of the road as shown by the arrow.
Ioan thinks this section of road is too steep to cycle straight up, so he decides to cycle from *A* to *B* in a straight line.

(a) How far does Ioan cycle in going from *A* to *B*? [6]

First use $\triangle BCD$ to find BC

$\sin 7.1^\circ = \frac{1}{BC}$

$BC = \frac{1}{\sin 7.1^\circ}$ $\quad BC = 8.09\ m$

Now use ~~triangle~~ triangle ABC and Pythag.

$h^2 = a^2 + b^2$

$AB^2 = 5^2 + 8.09^2$

$AB^2 = 25 + 64.46$

$AB^2 = 89.46$

$AB = 9.46\ m$.

© WJEC CBAC Ltd.

Examiner only

(b) Show that Ioan's route up this section of road is less steep than Delyth's route. You must show all your working. [3]

Use $\triangle ABD$ through the solid

First find CD from $\triangle BCD$

$\cos 7.1^\circ = \frac{CD}{8.09}$

$8.09 \cos 7.1^\circ = CD$

$8.03\text{ m} = CD$

$\therefore$ $h^2 = a^2 + b^2$ to find AD using $\triangle ACD$

$AD^2 = AC^2 + CD^2$

$AD^2 = 5^2 + 8.03^2$

$AD^2 = 25 + 64.48$

$AD^2 = 89.48$

$AD = 9.46\text{ m}$

END OF PAPER

Now use $\triangle ABD$

$\tan\theta = \frac{1}{9.46}$

$\theta = 6.03^\circ$

This is less than 7.1° for Delyth's route.

© WJEC CBAC Ltd.