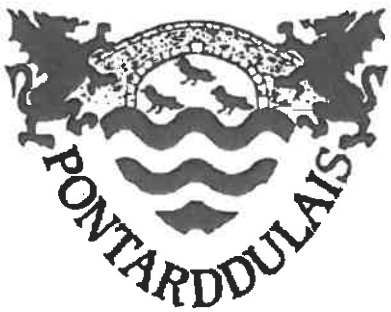
# HIGHER NUMERACY REVISION BOOKLET

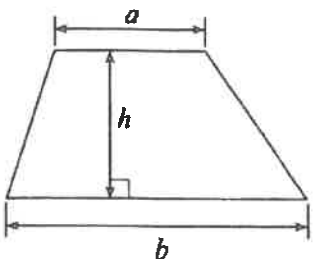
NAME: .....

TEACHER: .....

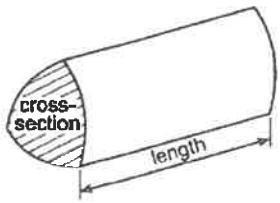


## Formula List - Higher Tier

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

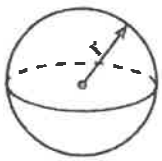



**Volume of prism** = area of cross-section × length



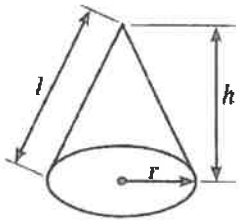

**Volume of sphere** = $\frac{4}{3}\pi r^3$

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




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

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

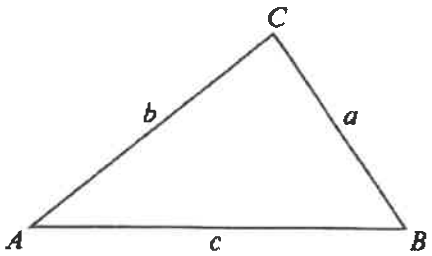



**In any triangle** $ABC$

**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.

H NUM JUNE 2015 U1

Examiner only

**10.** Astronomers use astronomical units (AU) to describe distances in our solar system.
The distance between the Sun and the Earth is 1 AU.
1 AU is $1{\cdot}496 \times 10^8$ km, correct to 4 significant figures.

*(a)* The distance of Pluto from the Sun is $5{\cdot}913 \times 10^9$ km, correct to 4 significant figures.

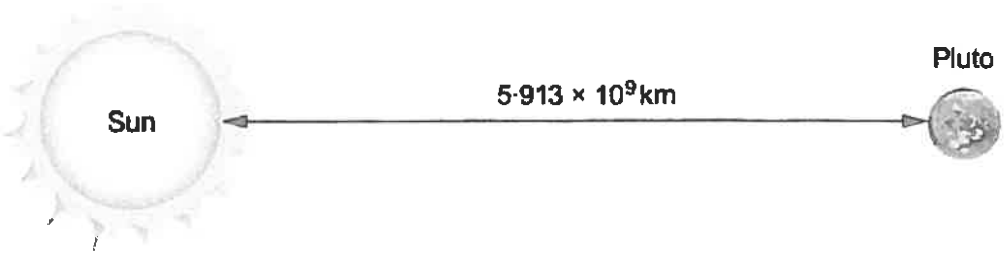



*Diagram not drawn to scale*

Siôn says that the distance of Pluto from the Sun is less than 50 AU.

Using **suitable** approximations, estimate the distance of Pluto from the Sun, in AU, to show that Siôn is correct.
You must show all your working. [2]

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*(b)* A light year is the distance light travels in one year.

1 light year is approximately 63 000 AU.

Estimate the length of a light year in km.
Give your answer in standard form. [3]

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4 NUM JUNE 2C 18 L1

Examiner only

H Num June 2018 4.1

Examiner only

**11.** During a chemistry experiment, it was found that a particle **lost** $\frac{3}{4}$ of its mass every second.

The initial mass of the particle was 160 mg.

*(a)* Calculate the mass of the particle after 4 seconds.
Circle your answer. [1]

2·5 mg  0·15625 mg  40 mg  0·625 mg  0·875 mg

*(b)* Write down a formula for the mass $m$, in milligrams, of the particle after $t$ seconds. [3]

Examiner only

**9.** Matas knows the following information about the amount of fuel his car uses.

| Speed | Miles per gallon |
|---|---|
| 30 mph | 54 |
| 50 mph | 60 |
| 70 mph | 50 |

During one journey, Matas drove at 50 mph for part of the time and at 70 mph for the rest of the time.

He drove for 3 hours at a speed of 50 mph.
For the whole journey, Matas used 4·6 gallons of fuel.

For how long did Matas travel at 70 mph?
You must show all your working. [6]

H Maths Num U1 18 June 2017

Examiner only

**8.** On a new housing estate, teams of painters paint the walls and ceilings of houses once they are built.

*(a)* It takes a team of 5 painters 10 hours to paint a house that has a total wall and ceiling area of 500 $m^2$.

A new house on the estate has a total wall and ceiling area of 600 $m^2$.
This house has to be painted in 8 hours.

Calculate the least number of painters needed.
You must show all your working. **[4]**

*(b)* What assumption have you made in answering part *(a)*? **[1]**

Examiner only

**7.** Here is some information from a 2014 geographical journal:

- Population of the UK: $6{\cdot}5 \times 10^7$, correct to the nearest 1 000 000
- Area of the UK: 244 000 km$^2$, correct to the nearest 1000 km$^2$

Using these figures, calculate the greatest possible value for the population density of the UK, in population per km$^2$. **[4]**

H U2 Num June 2019

Examiner only

**10.** Holly wants to buy a new house in Cardiff.
She knows that Land Transaction Tax will be added to the price of the house.

Land Transaction Tax rates are shown below:

- pay nothing on the first £180 000 of the price of the house,
- pay 3·5% on the part of the price of the house that is above £180 000 and up to and including £250 000,
- pay 5% on the part of the price of the house that is above £250 000 and up to and including £400 000.

*(a)* Show that the Land Transaction Tax payable on a house costing £255 000 is £2700. [2]

*(b)* The most Holly can afford to spend, including Land Transaction Tax, is £327 000.

Let $x$ be the highest price of house that Holly can afford.
Write an equation in $x$ and solve it to calculate the highest price of house that Holly can afford. [5]

**END OF PAPER**

Examiner only

**9.** *Alpha*, *Beta* and *Gamma* are three boats.
They receive a weather warning and need to go to the port of Aberwyn.

The following diagram shows the positions of the three boats when the weather warning is received.

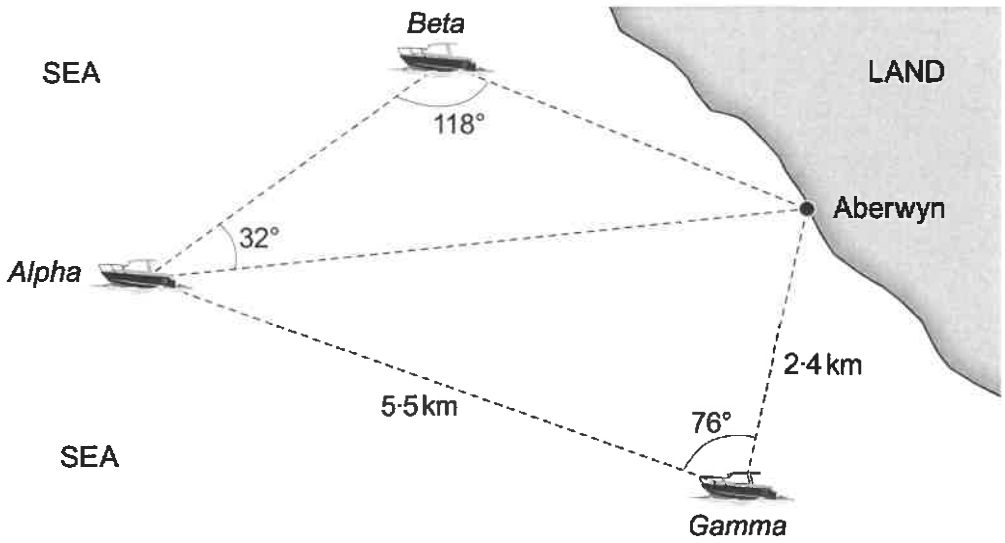


*Diagram not drawn to scale*

The captains of *Alpha* and *Beta* need to know their distances from Aberwyn in order to find how long it will take them to get to the port.

Calculate the distance of each of the boats *Alpha* and *Beta* from Aberwyn. [7]

Sampling

H Maths Num Nov 12 2016

Examiner only

**6.** Porth Ifan Hospital has made some changes to improve patient care.
A survey is to be used to find out the views of the hospital staff.

*(a)* The table shows the total number of staff in each job type.

| Job type | Doctor | Nurse | Management | Clerical |
|---|---|---|---|---|
| Number of staff | 120 | 320 | 56 | 144 |

The survey is to be given to a sample of 75 staff.

Use a stratified sampling method to calculate the number of staff from each job type that should be asked to complete the survey.
You must show your working. [4]

| Job type | Doctor | Nurse | Management | Clerical |
|---|---|---|---|---|
| Number in sample | | | | |

H Maths Num W2 Nov 2016

Examiner only

*(b)* The hospital decides to take a random sample of its 120 doctors to select those needed for the survey.
Use the following list of random numbers to select the first **5 doctors**.
You must start with the first number in the list. Explain clearly how you are using the numbers to select the sample. **[3]**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 032 | 520 | 021 | 924 | 152 | 627 | 351 | 295 | 081 | 495 |
| 542 | 708 | 339 | 557 | 396 | 949 | 417 | 235 | 962 | 261 |
| 837 | 783 | 983 | 493 | 876 | 924 | 032 | 421 | 205 | 740 |
| 055 | 491 | 806 | 415 | 158 | 392 | 441 | 521 | 105 | 342 |
| 782 | 398 | 923 | 729 | 968 | 244 | 119 | 480 | 451 | 780 |

H. Num Nov 2017 18 C12

Examiner only

**9.** An engineering company employs 85 staff.
The company plans to carry out a survey on staff health.
It will conduct the survey using a sample of 15 of its staff, stratified by job type.

*(a)* Circle either TRUE or FALSE for each statement given below. [2]

| STATEMENT | | |
|---|---|---|
| Choosing every 4th person on an alphabetical list of office staff is a suitable method of randomly choosing the office staff required for the sample. | TRUE | FALSE |
| Numbering the cleaning staff, placing the numbers in a hat and drawing out numbers at random is a suitable method of choosing the cleaners required for the sample. | TRUE | FALSE |
| There are 9 managers employed by the company. The calculation to find the number of managers in the sample is $\frac{9}{85} \times 15 = 1{\cdot}59$. This answer means there will **definitely** be 2 managers in the sample. | TRUE | FALSE |
| The proportion of the staff in each job type in the sample will be **exactly** the same as the proportion of the staff in each job type in the company as a whole. | TRUE | FALSE |

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Examiner only

*(b)* 50 engineers are employed by the company.
Use the following extract from a table of random digits to choose 9 engineers for the sample.
You must start with the first number in the list.
Describe clearly how you are using the numbers to select the sample. [3]

29974 55479 07248 33999 17038 02475 49979 01218

H Maths Numu2 14 June 2017

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]

| School | Cwrt Haf | Cwmifan High | Henclwyd |
|---|---|---|---|
| Number that should be invited | | | |

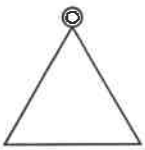
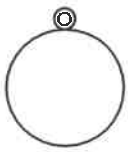
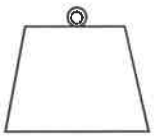
Examiner only

**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.<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 |

Examiner only

*(b)* Alun makes pendants that are mathematical shapes.
The following table shows the pendants and the number of these pendants that Alun made last month.

| | Triangle | Circle | Rectangle | Trapezium |
|---|---|---|---|---|
| Pendant |  |  |  |  |
| Number made last month | 52 | 96 | 30 | 62 |

At the end of last month, Alun took a stratified sample of 30 of these 240 pendants to check their quality.

Calculate how many pendants of each shape were in Alun's sample.
You must show all your working. [4]

| Pendant | Triangle | Circle | Rectangle | Trapezium |
|---|---|---|---|---|
| Number in sample | | | | |

Pythag + Trig (+ 3D)

H Num Nov 2017 14 4.2



Examiner only

**6.** The diagram below shows the locations of the ports of Lindat, Molk and Nuir.
Lindat is due south of Nuir, and Nuir is due west of Molk.

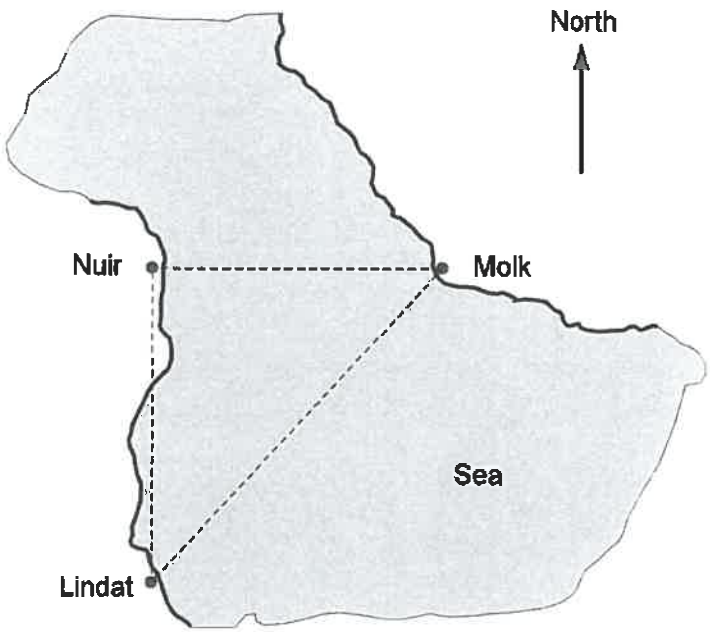



*Diagram not drawn to scale*

Agnetha lives in Molk.
She travels from Molk to Lindat by ship.

- Lindat is 24 km due south of Nuir.
- The ship sails directly to Lindat on a bearing of 211°.
- The ship has an average speed of 20 km/h.
- The ship leaves at 11:45 a.m.

Calculate Agnetha's arrival time in Lindat. [7]

H Num Nov 2017 42

Examiner only

Examiner only

**11.** A sensor can detect any movement up to a distance of 6·5 m.

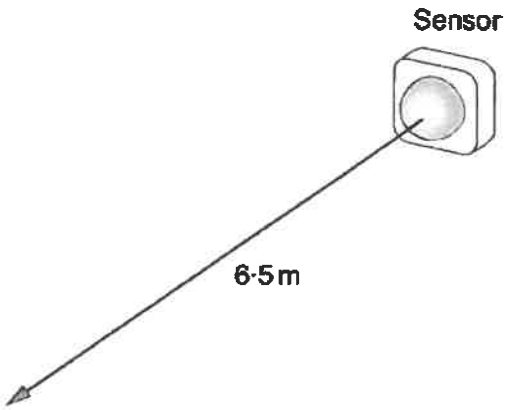



*Diagram not drawn to scale*

*(a)* A storeroom is in the shape of a cuboid, as shown below.
The sensor is placed at *A*, so that

- it is aimed directly at *B*, where *BD* = 2 m,
- the front of the sensor is 20 cm from *A* along the line *AB*.

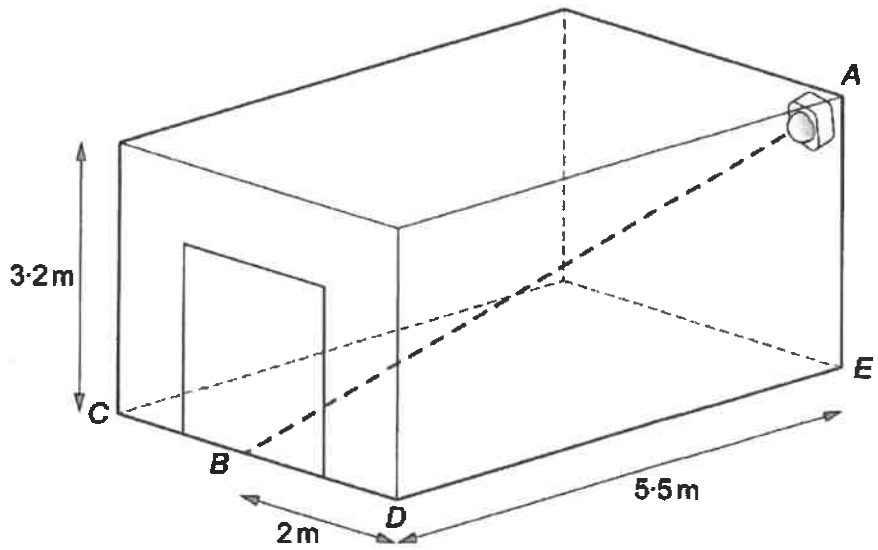



*Diagram not drawn to scale*

Will the sensor be able to detect movement at *B*?
You must show all your working. [5]

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Examiner only

(b) Show that $B\hat{A}E = 61{\cdot}3°$, correct to 1 decimal place. [3]

**END OF PAPER**

Examiner only

**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.

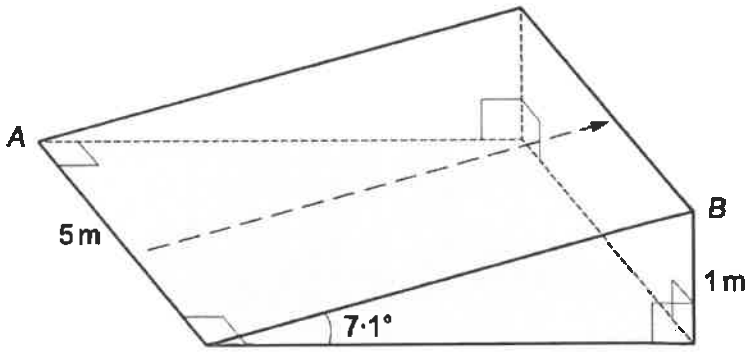


*Diagram not drawn to scale*

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]

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]

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**END OF PAPER**

Examiner only

**8.** A company is designing a new chocolate-covered biscuit in the shape of a square-based pyramid.
The centre of the square base is labelled *O*.
Each biscuit will have base sides of length 3·4 cm, and a vertical height of 2·1 cm.

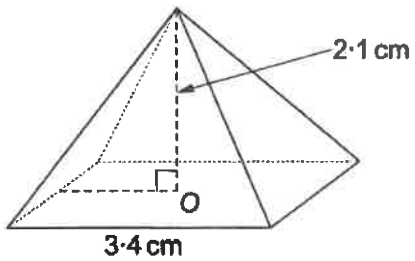


*Diagram not drawn to scale*

*(a)* **Calculate the angle that one of the triangular faces makes with the base of the pyramid.** **[4]**

*(b)* **The company knows that it costs 0·08p per $cm^2$ to apply a chocolate covering. Calculate the cost of applying a chocolate covering to all 5 faces of a biscuit.** **[6]**

H U1 Num June 2019

Examiner only

**10.** A tent company is designing a new 2-person tent.
The base of the tent is in the shape of a kite, as shown below.
The width of the kite is 160 cm, and the two shorter sides are of length 100 cm.
The point where the diagonals of the kite intersect has been marked *O* on the diagram below.

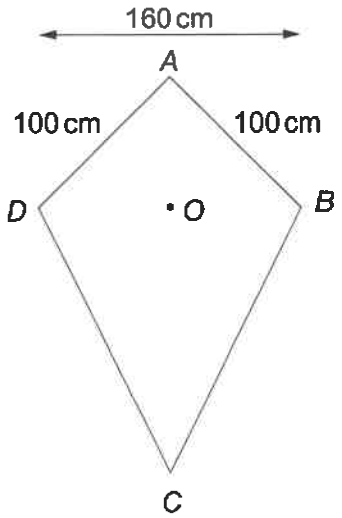


*Diagram not drawn to scale*

*E* is the highest point of the tent, and is 110 cm vertically above *O*.
Part of the frame that supports the tent cover is a straight pole that goes from *A* to *E*.

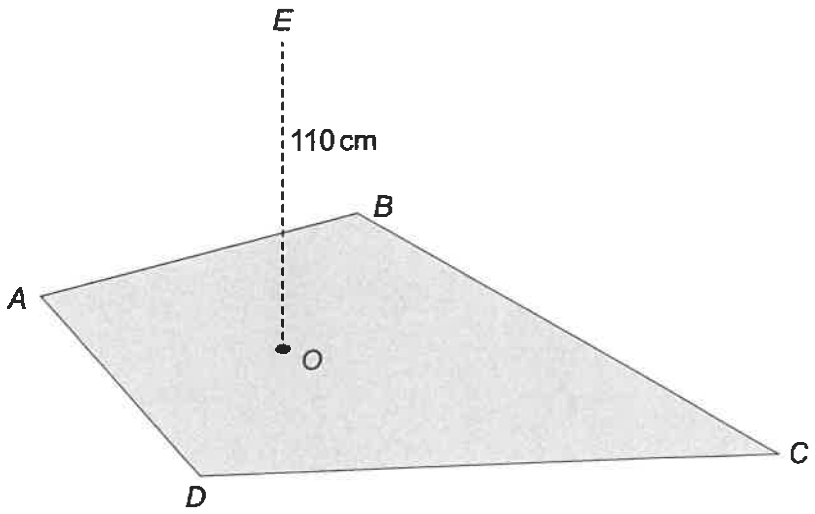


*Diagram not drawn to scale*

Calculate the length of pole *AE*.
Give your answer as a surd.
You do not need to simplify your answer. [4]

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H U1 Num June 2019

Examiner only

P, A, V, – Higher



Examiner only

**9.** A metal round-headed nail can be thought of as a cone sitting on top of a cylinder, which sits on top of a hemisphere.
A company produces round-headed nails of different sizes, but made of the same metal.
Each nail has the following dimensions:

- height of cone = $9r$,
- height of cylinder = $15r$,
- radius of the hemisphere = $12r$,

where $r$ is the radius of the cylinder and the base radius of the cone.

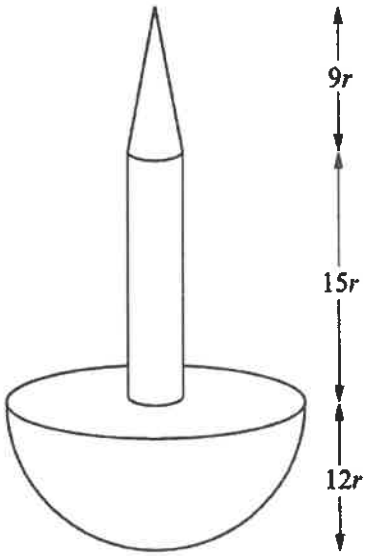


*Diagram not drawn to scale*

A metal cuboid of volume 18000 mm$^3$ is melted down, and re-cast to form round-headed nails of size A, where $r$ = 0·4 mm.

*(a)* Calculate the greatest number of round-headed nails of size A that can be produced. [6]

Examiner only

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*(b)* Circle either TRUE or FALSE for each statement given below. [2]

| STATEMENT | | |
|---|---|---|
| A nail double the height of a size A nail will have a total height of 28·8 mm. | TRUE | FALSE |
| A nail double the height of a size A nail will be 8 times the weight of a size A nail. | TRUE | FALSE |
| A nail 3 times the height of a size A nail will have a total surface area 6 times that of a size A nail. | TRUE | FALSE |
| When $r$ = 0·8 mm, the number of nails that could be produced from the same metal cuboid will be double the number of size A nails. | TRUE | FALSE |

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H Num June 2018 21 U2

Examiner only

**10.** *(a)* A company makes plastic shelf supports for use in kitchen cupboards.
A shelf support is made by attaching a cylinder to a right-angled triangular prism.

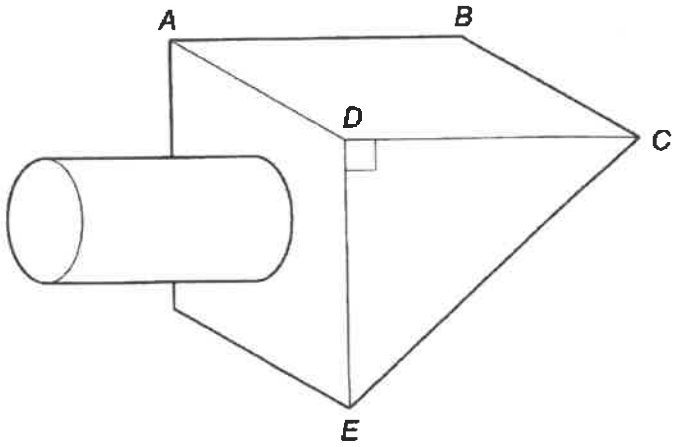



*Diagram not drawn to scale*

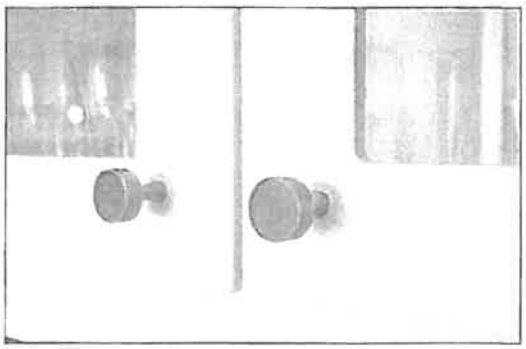
The cylinder has a diameter of 6 mm and a length of 9 mm.
The prism has dimensions $CD$ = 8 mm, $DE$ = 8 mm, $CE$ = 11·3 mm and $BC$ = 10 mm.

The company sells the shelf supports in packs of 500.
It needs to know the volume of plastic in 500 shelf supports.
Calculate the volume of 500 shelf supports. [4]

Volume of 500 shelf supports = .....

Examiner only

*(b)*



The company also makes metal door handles for kitchen cupboards.
One of the door handles it makes is shown below.
It is formed by joining two cylinders.
One of the cylinders has a diameter of 4 cm and a length of 1·2 cm.
The other cylinder has a diameter of 1·8 cm and a length of 3 cm.

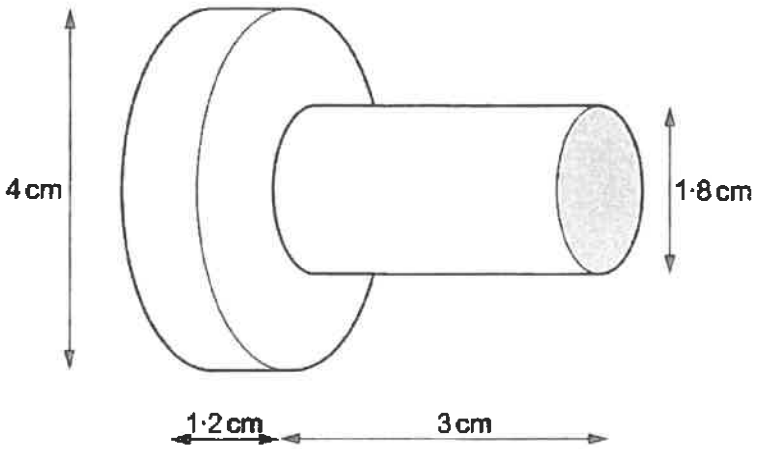



*Diagram not drawn to scale*

At present, the company paints **all** the surfaces of the handle with a protective finish **after** the two cylinders have been joined together.

The shaded circular face is pressed against a cupboard door when fitted.
In future, the company is not going to paint this shaded circular face. This is to reduce costs.

Calculate the percentage reduction in the area that is painted. [6]

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H Num - June 2015 U2

Examiner only

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**11.** The diagram below shows a wooden end-piece for a curtain pole.
It is in the shape of a cone with measurements as shown in the diagram.

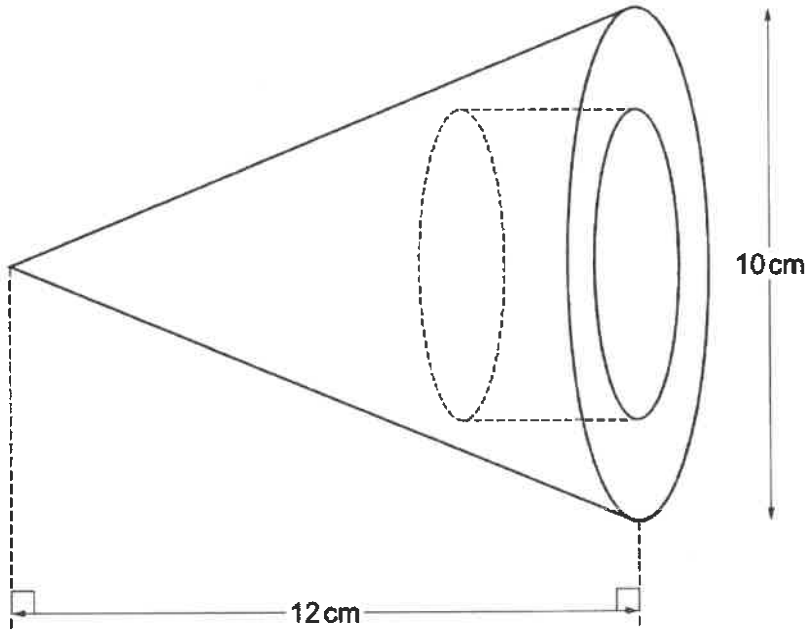


*Diagram not drawn to scale*

The curtain pole sits in a cylindrical hole that has been drilled into the end-piece.
The hole is of radius 3 cm and depth 4 cm.

*(a)* Show that the volume of wood that remains is $64\pi\,\text{cm}^3$. [4]

Examiner only

*(b)* The surface area of the end-piece is to be painted, except for the area inside the hole. Calculate the surface area that is to be painted. Give your answer in terms of $\pi$. [6]

**END OF PAPER**

H Nilim June 2015 U1

Examiner only

**14.** The diagram shows the simplified model of part of an engine.
It shows a belt which runs around three circular cogs.
The engine rotates Cog 1.
Cog 1 rotates the belt, which then makes Cogs 2 and 3 rotate.

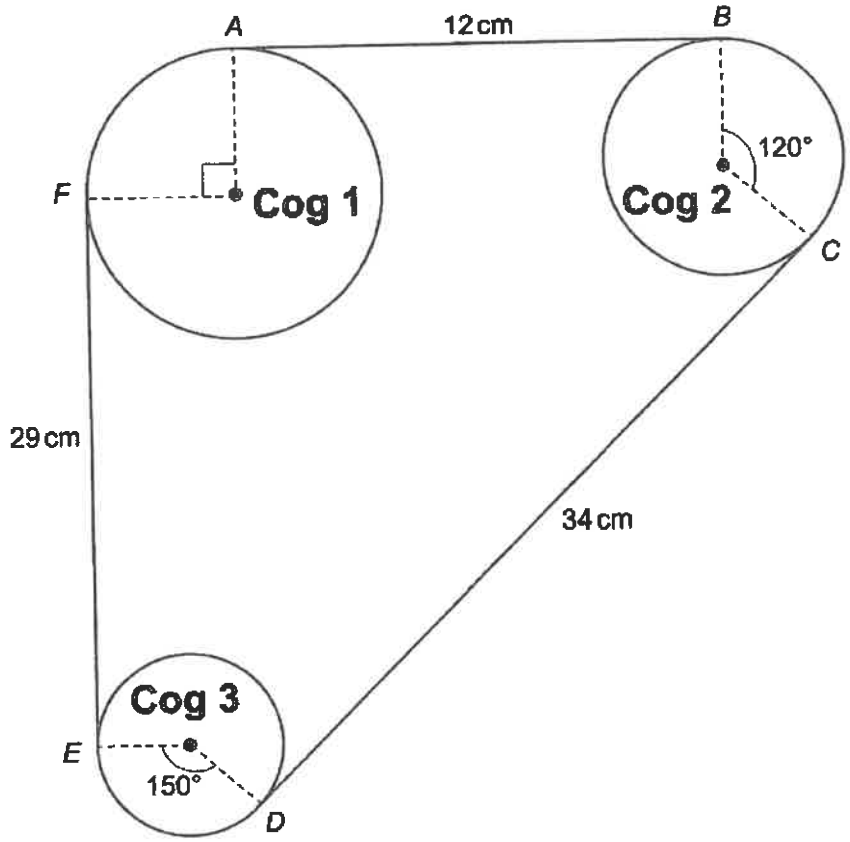


*Diagram not drawn to scale*

*AB*, *CD* and *EF* are straight sections of the belt.
*AB* = 12 cm, *CD* = 34 cm and *EF* = 29 cm.
The belt bends around the outer edges of the circular cogs, represented by the arcs *BC*, *DE* and *AF*.
The dimensions of the cogs are:

- radius of Cog 1 = 6 cm
- radius of Cog 2 = 4·5 cm
- radius of Cog 3 = 3 cm

*(a)* What is the length of arc *AF* in terms of $\pi$?
Circle your answer. [1]

$2\pi$ $3\pi$ $6\pi$ $4\pi$ $\frac{3\pi}{2}$

H Num June 2018 4(1

Examiner only

*(b)* Calculate the total length of the belt.
Give your answer in terms of $\pi$ in its simplest form. [4]

Total length of the belt = ..... cm

*(c)* Elen notices that when Cog 3 makes two revolutions, Cog 1 makes only one revolution, because the radius of Cog 3 is half the radius of Cog 1.

In one minute, Cog 3 makes 2400 revolutions.
Calculate the number of revolutions **Cog 2** will make in one minute. [3]

**END OF PAPER**

Examiner only

**11.** A company is building a new headquarters.
The diagram below shows the ground plan of the new headquarters.

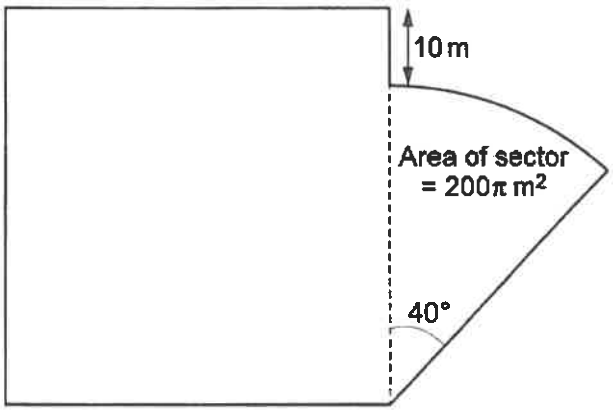


*Diagram not drawn to scale*

The plan consists of a square and a sector of a circle.

*(a)* Using the information given in the diagram, calculate the radius of the sector of the circle.

Give your answer in the form $a\sqrt{b}$, where $a$ is an integer and $b$ is a prime number. [5]

Examiner only

*(b)* The square is to be covered in concrete.

Calculate the area of the square.
Expand any brackets, and simplify your answer. [3]

**END OF PAPER**

Examiner only

**8.** A baker makes cake slices to sell in her shop.
All of the cake slices are identical. They have been cut from a cylindrical cake of radius 10 cm and depth 4 cm.

Piped icing is placed on the curved surface of each cake slice, as shown in the diagram.
It connects opposite vertices of this curved surface, and follows the shortest path between these vertices.

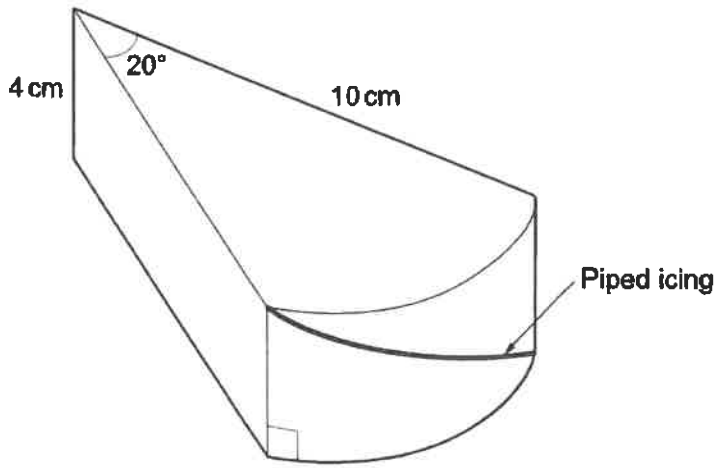


*Diagram not drawn to scale*

What length of piped icing will be needed to decorate all the slices that make up a whole cylindrical cake? [7]

Length of piped icing needed for a whole cake = ..... cm

Examiner only

**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.

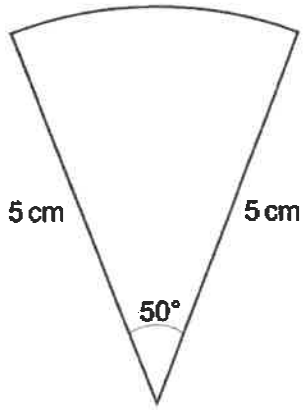


*Diagram not drawn to scale*

*(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]

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

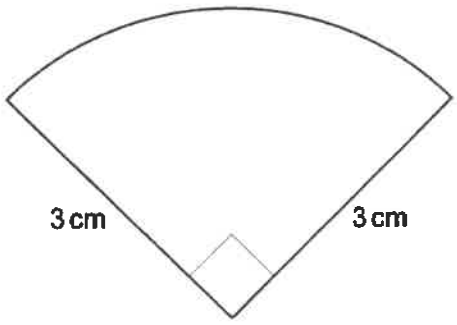



*Diagram not drawn to scale*

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.

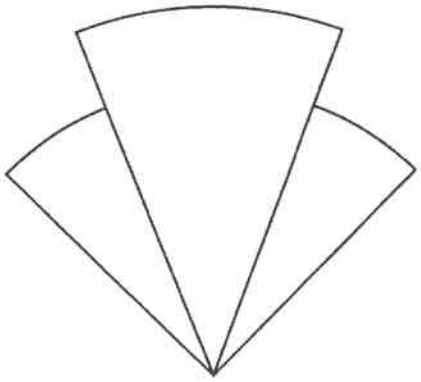


*Diagram not drawn to scale*

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

Examiner only

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

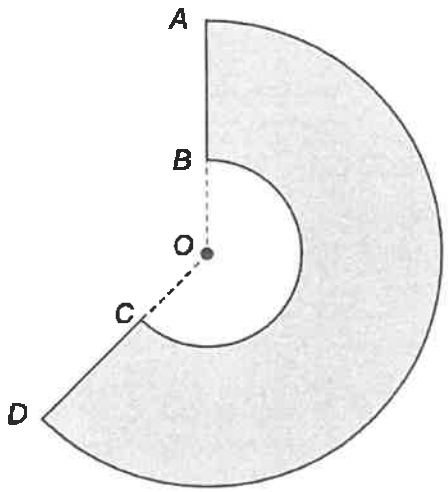



*Diagram not drawn to scale*

The measurements taken by a motor engineer are:

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

*(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

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 $\pi$, in its simplest form. [4]

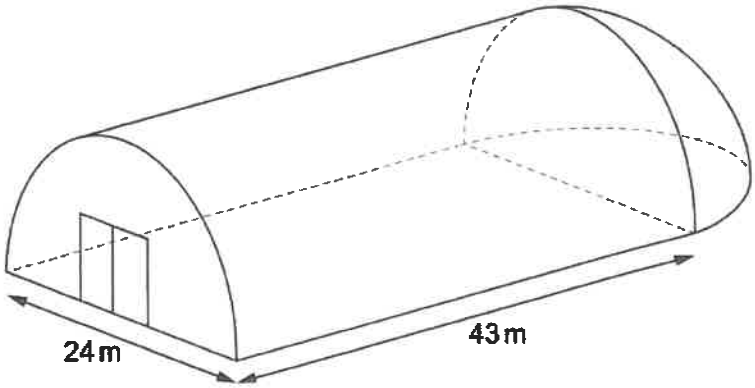
(ii) Using $\pi = 3$, calculate how much it costs to paint the top surface of 20 engine parts.
Give your answer in pounds. [1]

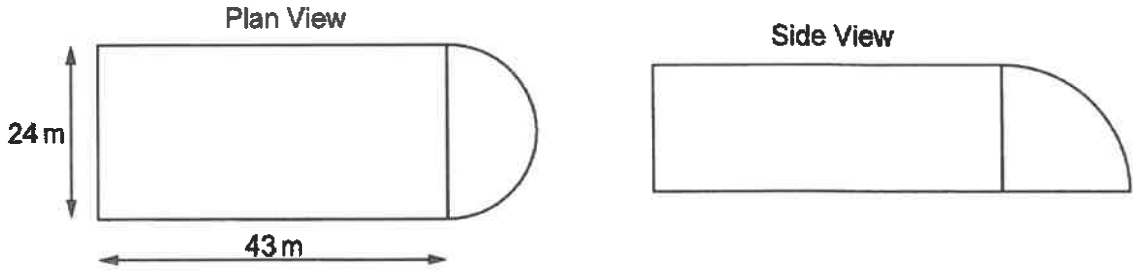
Paint cost is £ .....

**END OF PAPER**

Examiner only

(c) The engineering company has a storage building, as shown below.
The building is in the form of half a cylinder, with half a hemisphere attached at one end.




*Diagrams not drawn to scale*

The company needs to paint all the exterior surfaces of the building, including the doors.

The measurements on the diagram are given **correct to the nearest metre.**
The paint comes in tins that cover an area of 40 $m^2$, **correct to the nearest** $m^2$.

Calculate the smallest number of tins that would guarantee having enough paint to cover these exterior surfaces. **[8]**

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Examiner only

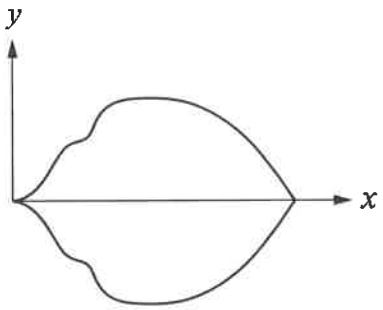
**END OF PAPER**

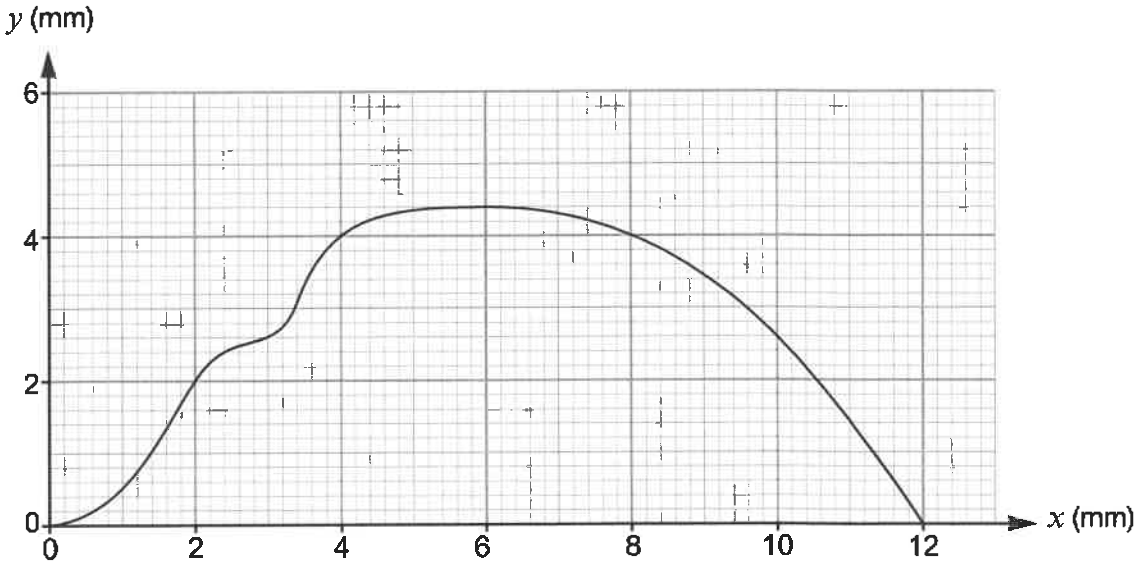
Examiner only

**11.** *(a)* Alun is a jeweller.
He is designing a symmetrical pendant, as shown below.

*Diagram not drawn to scale*

The pendant will be made from solid silver, with a uniform thickness of 3 mm.
In order to calculate the cost of making the pendant, Alun wants to calculate an estimate of the volume of the pendant.
He has accurately drawn one of the symmetrical halves of the shape on graph paper.



H H Num June 2019

Examiner only

Calculate an estimate of the volume of the whole pendant.
Use the graph opposite, with 6 strips of equal width. [5]

Examiner only

(c) Alun has 5 identical metal cylinders, each of length 40 mm.

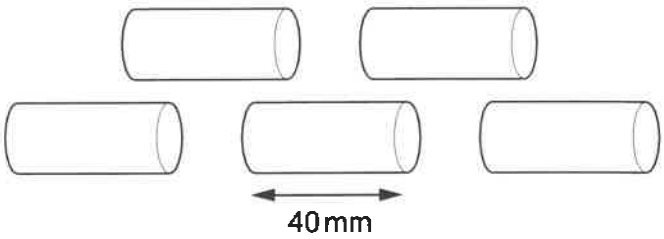



*Diagram not drawn to scale*

He has been asked to make a solid sphere of radius 30 mm.

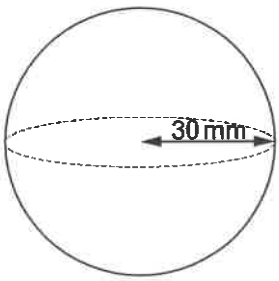



*Diagram not drawn to scale*

He melts the 5 cylinders and recasts all the metal to make the sphere.

Calculate the radius of each of the cylinders.

Give your answer in mm, in the form $a\sqrt{b}$, where $a$ and $b$ are integers, and $b$ is as small as possible. [6]

Examiner only

**12.** A new athletics stadium is to be built in Alltycapel.

*(a)* A throwing circle is to be built for the shot put and discus events.
There are lines drawn from the centre of the circle. They show the athletes where the boundaries are for their throws.
The lines form a sector of the circle.
This sector is to be painted, as shown in the diagram.

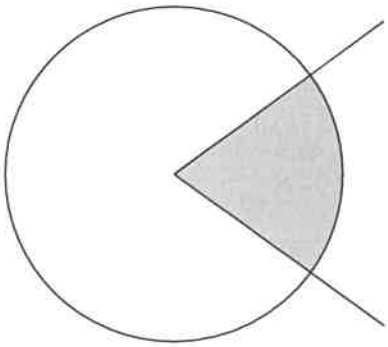


*Diagram not drawn to scale*

The radius of the throwing circle is 120 cm.

The area of the sector is $0{\cdot}08\dot{3}$ of the area of the circle.

(i) Write $0{\cdot}08\dot{3}$ as a fraction in its simplest form. [3]

Examiner only

(ii) Use your answer to (i) to calculate the area to be painted.
Give your answer in terms of $\pi$ in its simplest form. [2]

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Examiner only

*(b)* A new running track is to be built at the stadium.

Athletes in a 200-metre race run in lanes.
The inside line of one of the lanes is shown below.

The inside line consists of:

- a straight section of length 90 m,
- an arc of a circle with radius 36 m.

The length of this inside line is 200 m.

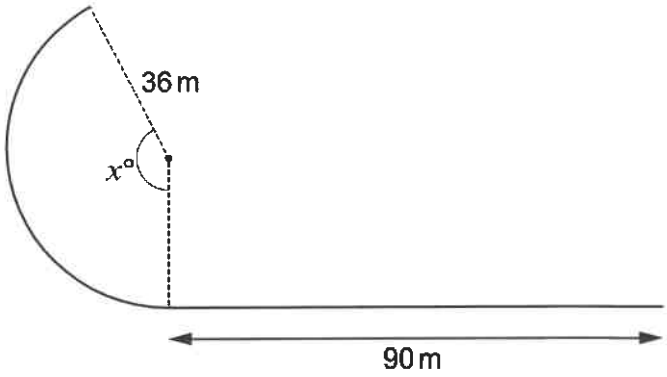


*Diagram not drawn to scale*

Show that the value of $x$ is $\frac{550}{\pi}$. [5]

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Examiner only

**8.** A company makes buckets in two sizes. Both sizes are in the shape of a frustum of a cone. Bucket A has the dimensions shown in the diagram below.

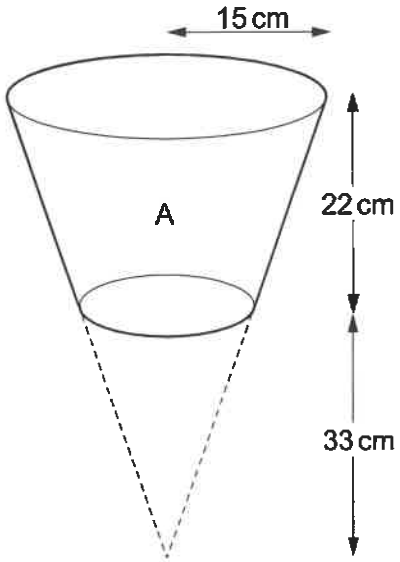


*Diagram not drawn to scale*

*(a)* Show that:

- the radius of the base of the bucket is 9 cm,
- the volume of the bucket is $3234\pi\,\text{cm}^3$. [5]

Examiner only

*(b)* Bucket B is shown below. It is mathematically similar to Bucket A.

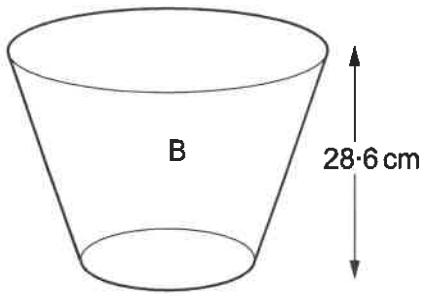


*Diagram not drawn to scale*

Calculate the number of **gallons** Bucket B can hold when full. [6]

| Remember: |
| --- |
| 1 gallon = 8 pints |

Upper + Lower Bounds

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Examiner only

8. The Headteacher of Ysgol Castell Gwyn wants to display pictures, drawn by pupils, along one side of a corridor.
The pictures are to be in one row with no gaps between them, as shown in the diagram below.

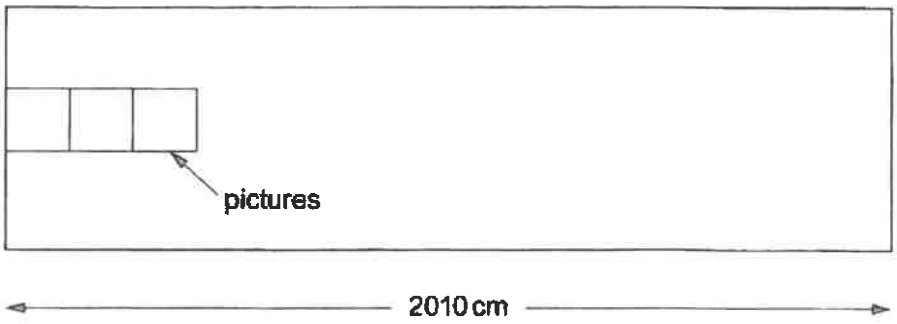



*Diagram not drawn to scale*

The pictures are all square, with sides of length 15 cm, correct to the **nearest 0·5 cm**.
The length of the corridor wall is 2010 cm, correct to the **nearest 10 cm**.

Calculate the smallest number of pictures and the greatest number of pictures that can be fitted in the row. **[5]**

| Smallest number of pictures | Greatest number of pictures |
|---|---|
| ..... | ..... |

Examiner only

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

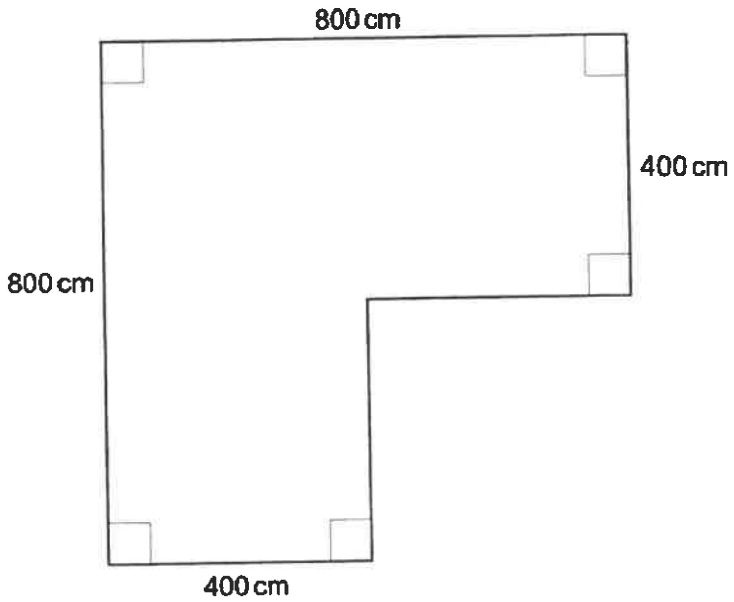



*Diagram not drawn to scale*

All the measurements are correct to the nearest 10 cm.

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

Examiner 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]

H U1 Num Sure 2019

Examiner only

**9.** The voltage, $V$ volts, of an electric circuit is given by the formula

$$V = IR,$$

where $I$ is the current measured in amps, and $R$ is the resistance measured in ohms.

During an experiment,

- $V$ was measured at 280 volts, correct to the nearest 10 volts,
- $I$ was measured at 0·2 amps, correct to the nearest 0·1 amps.

Calculate the least possible value and greatest possible value of the resistance $R$. [6]

Least possible value of $R$ = ..... ohms

Greatest possible value of $R$ = ..... ohms

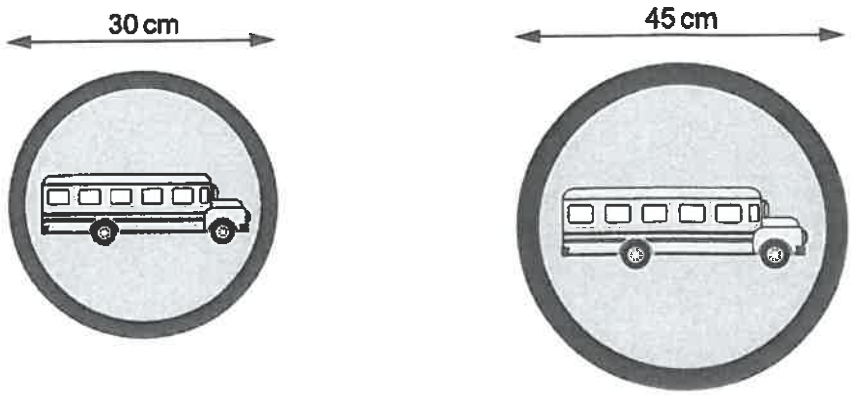
Similar Shapes

H Num Nov 2017 u1



Examiner only

**8.** A company produces two **similar** road signs.




*Diagrams not drawn to scale*

*(a)* The cost of the paint needed for the smaller road sign is £1.60.
Calculate the cost of the paint needed for the larger sign. [4]

H Num Nov 2017 U1

Examiner only

*(b)* The selling price of the smaller road sign is £12.00.
This selling price was calculated from the cost price by:

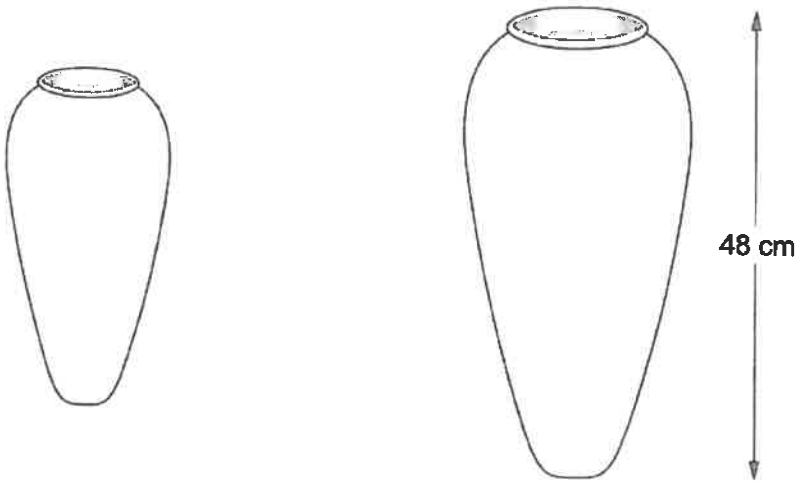
- adding a profit of 25%,
- then adding VAT at 20%.

Calculate the cost price of the smaller road sign.
You must show all your working. [4]

H Numm June 2015 (11)

Examiner only

**12.** *Ffiol-Aur* is a company that makes vases.
They make one of their vases in two mathematically similar sizes.




*Diagrams not drawn to scale*

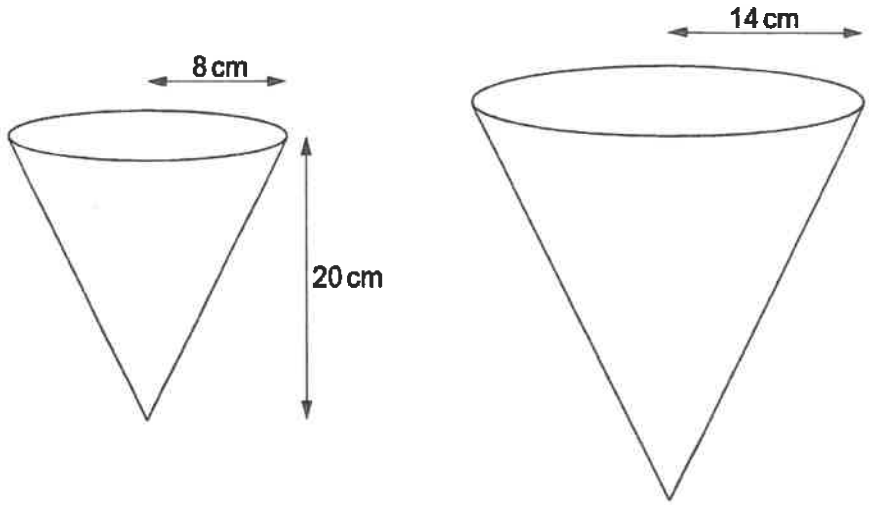
A decorative glaze covers the surfaces of each vase.
The glaze covers an area of:

- $400\,cm^2$ on the smaller vase,
- $3600\,cm^2$ on the larger vase.

The height of the larger vase is 48 cm.
Calculate the height of the smaller vase. [3]

Examiner only

**10.** The diagram below shows two **similar** flasks for measuring liquid.




*Diagrams not drawn to scale*

The flasks are in the shape of cones.
The smaller flask has a base radius of 8 cm and a vertical height of 20 cm.
The larger flask has a base radius of 14 cm.

*(a)* Calculate the vertical height of the larger flask. [2]

Examiner only

*(b)* The larger flask is now partly filled with liquid up to a vertical height of 15 cm.

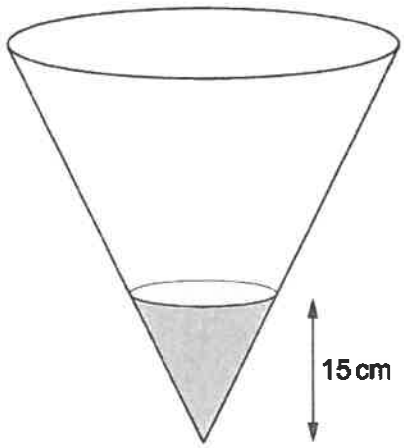



*Diagram not drawn to scale*

Calculate the volume of liquid in the flask.
Give your answer in terms of $\pi$. **[4]**

Examiner only

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

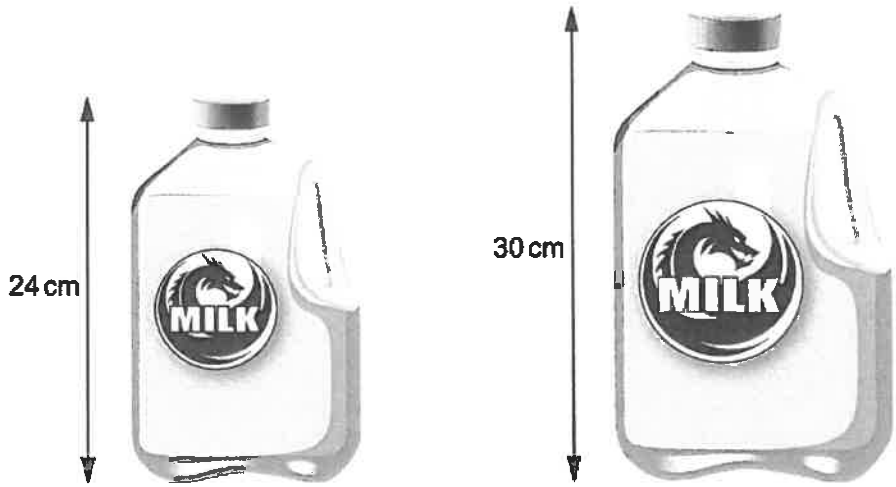



*Diagram not drawn to scale*

*(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]

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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]

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Recurring to fraction



Examiner only

**8.** Eirlys works for an accountancy firm.
She receives an annual salary, which is paid in equal instalments.

Eirlys has calculated that, so far this financial year, she has been paid $0{\cdot}41\dot{6}$ of her annual salary.

*(a)* Express $0{\cdot}41\dot{6}$ as a fraction in its lowest terms. [3]

*(b)* Use your answer from part *(a)* to find the number of months' pay Eirlys has received. [1]

Examiner only

6. Daniel has made a pizza to share with some friends.

After he has taken his share, he calculates that he has $0{\cdot}8\dot{3}$ of the pizza left.
Daniel shares what he has left equally between 3 of his friends.
Calculate the fraction of the whole pizza that each of these 3 friends will have.
Give your answer as a fraction in its lowest terms. [4]

AER

H Num Nov 2017 16 L12

Examiner only

7. Iestyn opened a savings account on 1 August 2017, investing £2800.
On 1 October 2017, he viewed his savings account online.
The table below shows all the transactions that had taken place since he opened the account.

| Date | Details | Paid in (£) | Paid out (£) | Balance (£) |
|---|---|---|---|---|
| 01/08/17 | Account opened | 2800.00 | | 2800.00 |
| 31/08/17 | Interest | 14.00 | | 2814.00 |
| 30/09/17 | Interest | 14.07 | | 2828.07 |

*(a)* Calculate the nominal interest rate per annum. [3]

*(b)* Calculate the AER the account was paying.
Give your answer as a percentage, correct to 2 decimal places. [3]

H Num Nov 2017 12 Q2

Examiner only

**5.** Teleri needs £8000 to pay a deposit for a new house.
She already has £7500.

Teleri decides to invest the £7500 in a bank account that pays interest at a rate of 0·31% every month.
She does not plan to make any further payments into this account.

Calculate the number of months Teleri will need to wait until she has enough money in the account to pay the deposit of £8000. **[3]**

H Num. June 2015 20 Q2

Examiner only

**9.** *(a)* Circle either TRUE or FALSE for each statement given below. [2]

| STATEMENT | | |
|---|---|---|
| A nominal annual interest rate is **not** the same as an AER. | TRUE | FALSE |
| A savings account offers a nominal annual interest rate of 2%, with interest paid monthly.<br>After a year, any investment will have increased in value by exactly 2%. | TRUE | FALSE |
| A savings account offers an AER of 2·4%, with interest paid monthly.<br>The monthly interest rate the account offers will be exactly 0·2%. | TRUE | FALSE |
| £100 is invested in a savings account that pays monthly interest at a rate of 1%.<br>There are no further transactions into or out of the account.<br>The amount in the account after a year will be £112. | TRUE | FALSE |

*(b)* Benjamin invests £1000 into an account that pays interest every 6 months.
He does not make any further payments into the account, and does not withdraw any money either.
After a year, there is £1036 in the account.

Calculate how much was in the account after 6 months.
Give your answer correct to the nearest penny.
You must show all your working. [4]

H Maths Num 42 15 June 2017

Examiner 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]**

Examiner only

**10.** Huw wants to open a savings account.
Here are the details of savings accounts advertised by two local Welsh banks.

| **Banc Padarn** | **Banc Teilo** |
|---|---|
| Nominal interest rate of 1·98% per annum<br><br>Interest paid monthly | AER 1·99% |

*(a)* (i) What is 1·98% as a decimal?
Circle your answer. [1]

0·0198 0·198 1·098 1·98 98·0

(ii) Which of these two banks should Huw choose in order to gain the most interest per annum?
You must show your working. [4]

Examiner only

*(b)* Interest earned from savings is taxable, according to the table below.

| Tax rates for savings | |
|---|---|
| Basic rate taxpayer | 20% on annual interest earned above £1000 |
| Higher rate taxpayer | 40% on annual interest earned above £500 |

Matthew is a higher rate taxpayer.
Any savings interest he earns over £500 within a year is taxed at 40%.

On 1st May 2016, he invested £150 000 in a savings account that pays interest at a rate of 1·98% **per annum**.

(i) What is this interest rate **per month**, written as a decimal?
Circle your answer. [1]

0·0033 0·00495 0·00165 0·0099 0·0066

Savings interest is added at the end of every month.

(ii) Calculate the date when the interest that Matthew earned went above his annual tax-free limit. Calculate the amount of tax he would have to pay on this interest if he had closed the account on this date. [5]

Examiner only

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Date ..... Tax Matthew would have to pay .....

**END OF PAPER**

Examiner only

**6.** Simon has some money to invest in a savings account.
Two banks have sent him details of their *Special 1-Year Saver* accounts.
He plans to make only one payment into the account and not withdraw any money during the year.

**Morgannwg Bank**

0·41% interest paid every month

**Banc Gwynedd**

Nominal annual rate of 4·92 %
Interest paid every 3 months

What is the difference between the AERs that the two accounts are offering?
Give your answer as a percentage correct to 2 decimal places. [5]

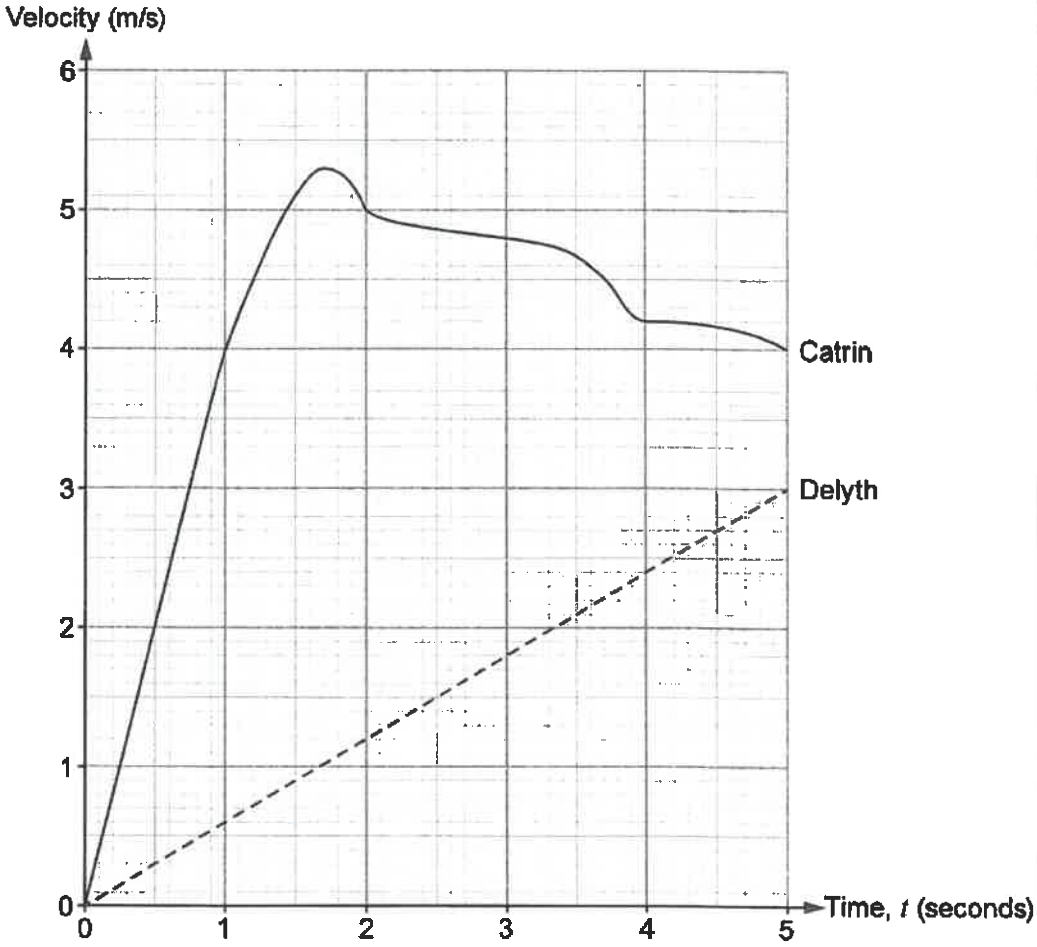
Difference in AERs = ..... %

Rates of Change

H Num Nov 2017 20 (11)

Examiner only

**9.** Two runners, Catrin and Delyth, start a race at the same time.
The velocity-time graph shows their velocities over the first 5 seconds of the race.




*(a)* After the start of the race, what was the earliest time that Catrin's acceleration was $0\,m/s^2$?
[1]

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Examiner only

*(b)* Use the trapezium rule to calculate an estimate of the distance Catrin travelled in the first 5 seconds of the race.
Use Catrin's velocities at times $t = 0$, $t = 1$, $t = 2$, $t = 3$, $t = 4$ and $t = 5$.
You must show all your working. [3]

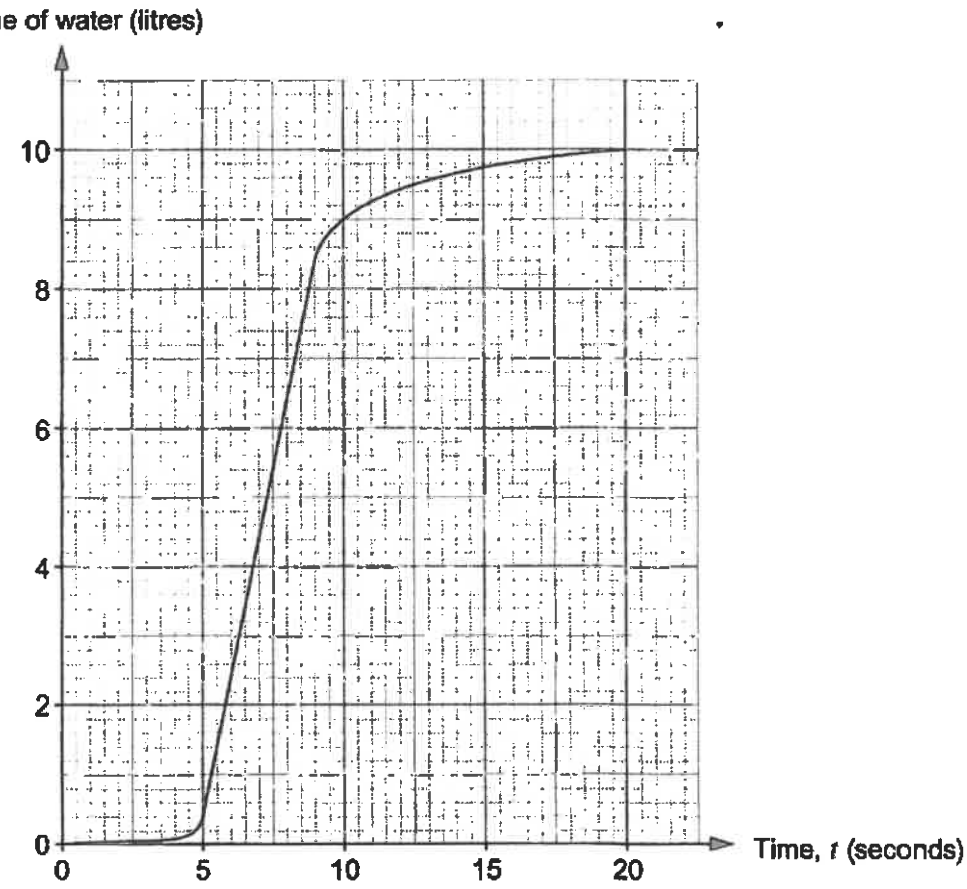
*(c)* (i) Calculate an estimate of how far Catrin was ahead of Delyth after 5 seconds. [2]

(ii) Explain why your answer to *(c)* (i) is an underestimate. [1]

Examiner only

**7.** Gwen fills a 10-litre bucket with water from a tap.
She turns the tap until it is fully open. The bucket fills up with water, and when Gwen thinks it is close to being full, she slowly closes the tap.
The bucket is full after 20 seconds.

The graph below shows the volume of water in the bucket during the 20 seconds.




*(a)* After how many seconds did Gwen start to close the tap? [1]

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*(b)* Estimate at what rate water is entering the bucket at time $t$ = 10 seconds.
Give your answer in litres per second. [3]

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Examiner only

(c) When the tap is fully open, water flows out at 2 litres per second.

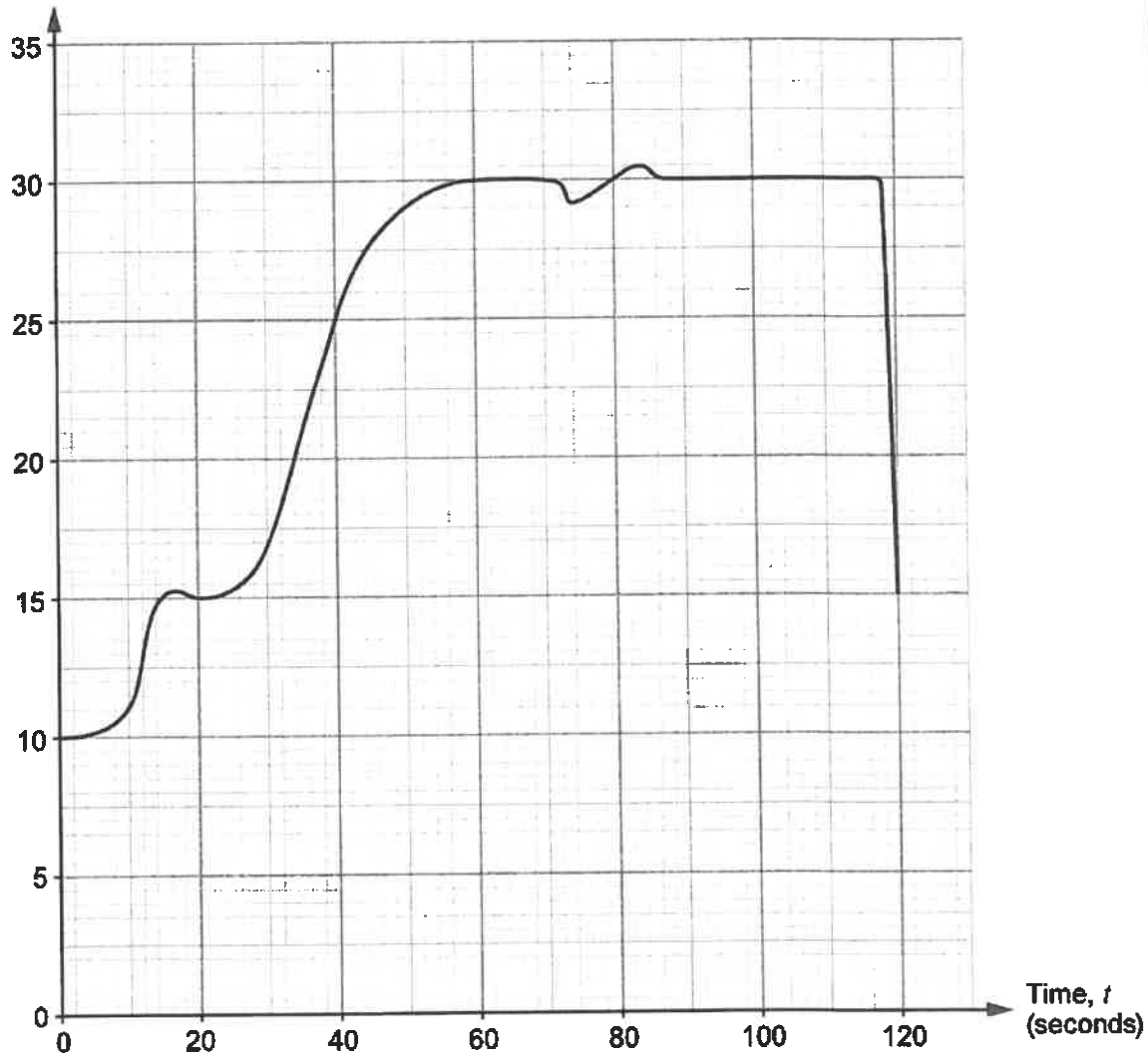
(i) Express 2 litres per second in **gallons per minute**.
You must show all your working. [3]

Remember
1 gallon = 8 pints

(ii) Can a fully open tap fill a 90-gallon tank in under $3\frac{1}{2}$ minutes?
You must show all your working. [2]

Examiner only

**10.** The graph below shows a 120-second section of Iestyn's car journey to work this morning.




*(a)* (i) At $t = 50$ seconds, estimate the acceleration of Iestyn's car in m/s$^2$. Leave your answer as a fraction. [3]

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H Maths Num u1 June 2317

Examiner only

(ii) At another time, Iestyn calculated the acceleration of the car to be $0.2\dot{4}$ m/s$^2$.
Write this recurring decimal as a fraction. [2]

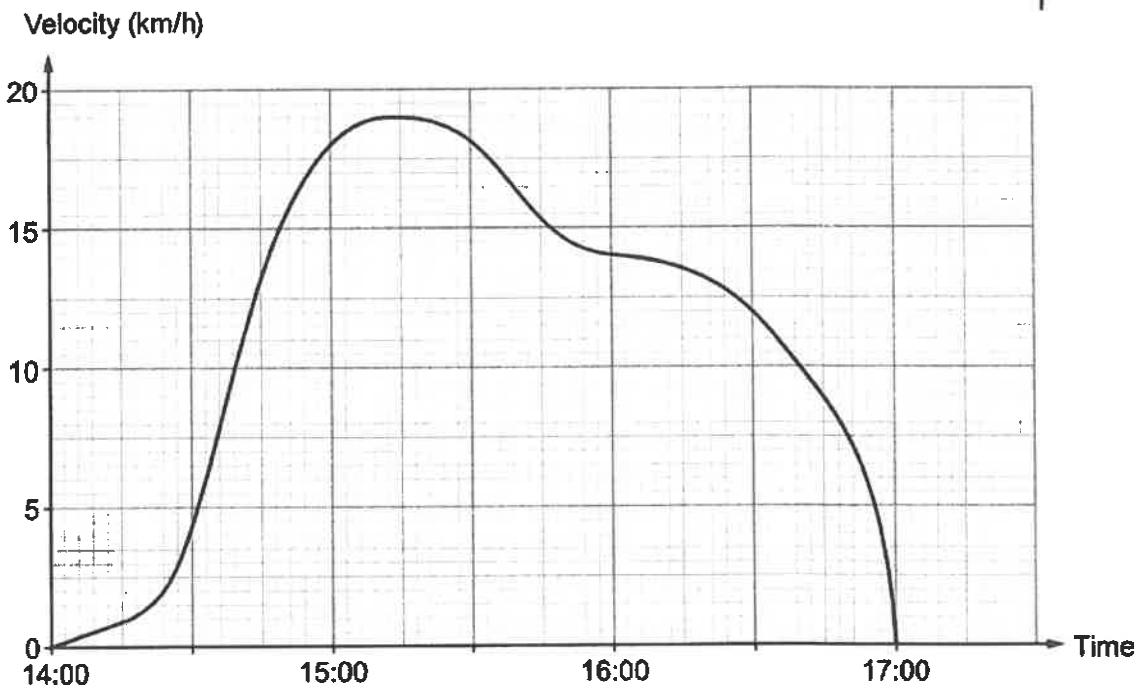
(b) (i) Calculate an estimate of the distance travelled by Iestyn's car in the first 80 seconds of his journey.
You must consider the speed of the car when $t$ = 0, 20, 40, 60 and 80 seconds. [4]

(ii) Hence, calculate an estimate of the average speed of Iestyn's car for this entire 120-second section of his car journey.
Give your answer in m/s. [4]

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]

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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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Examiner only

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

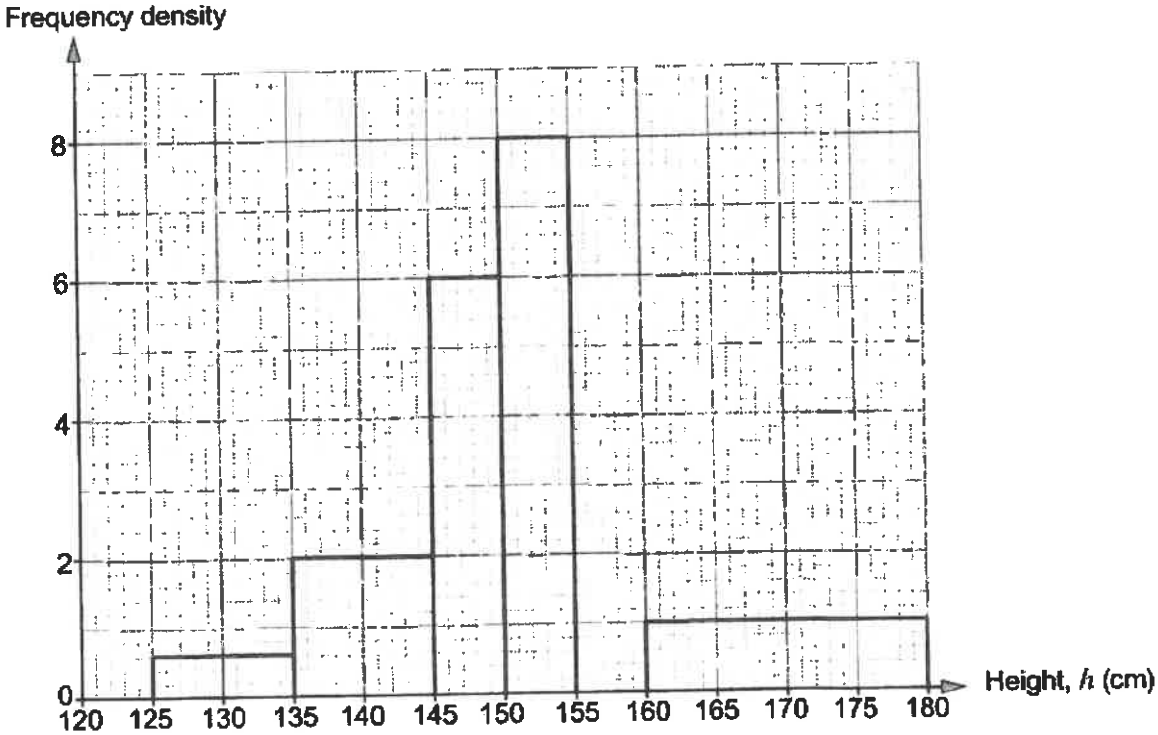
# Histograms

H Num June 2015 U1



Examiner only

**13.** The heights of all the Year 11 girls at a school were measured.
Nia has started to draw a histogram of the results.




*(a)* There were 24 girls in Year 11 whose heights were in the group $155 < h \leqslant 160$ cm.
Use this information to complete Nia's histogram. [2]

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Examiner only

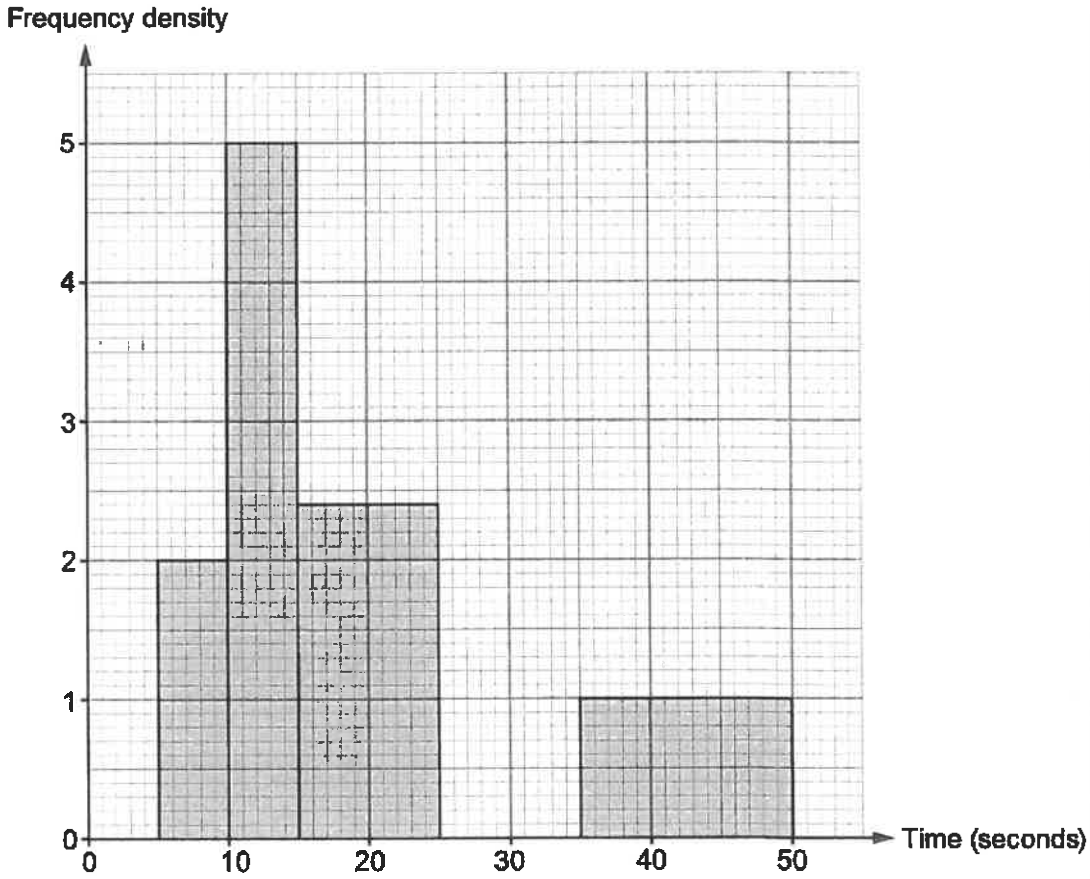
*(b)* Nia has started to do some data analysis on the heights of the Year 11 girls.
She has estimated the median and the upper quartile, as shown in the table below.

| Lower quartile | Median | Upper quartile |
|---|---|---|
| ..... | 151·75 cm | 156·875 cm |

Use the histogram to calculate an estimate of the lower quartile of the heights of the Year 11 girls. [6]

Examiner only

**7.** The times taken by a group of pupils to answer a numeracy question were recorded. The histogram below shows some of the results.




*(a)* The remaining 16 pupils took between 25 and 35 seconds to answer the question. Complete the histogram. [1]

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*(b)* What is the greatest possible range of times taken by the pupils to answer the question? Circle your answer. [1]

50 seconds  4 seconds  40 seconds  45 seconds  35 seconds

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H Num Nov 2017 Q1

Examiner only

(c) Calculate the total number of pupils that were in the group. [2]

(d) Gareth was one of the pupils in the group.
He says,

"The time I took to answer the question was 18 seconds. This means I was in the fastest 50% of the pupils."

(i) Explain how Gareth's statement could be true.
You must use calculations to justify your answer. [3]

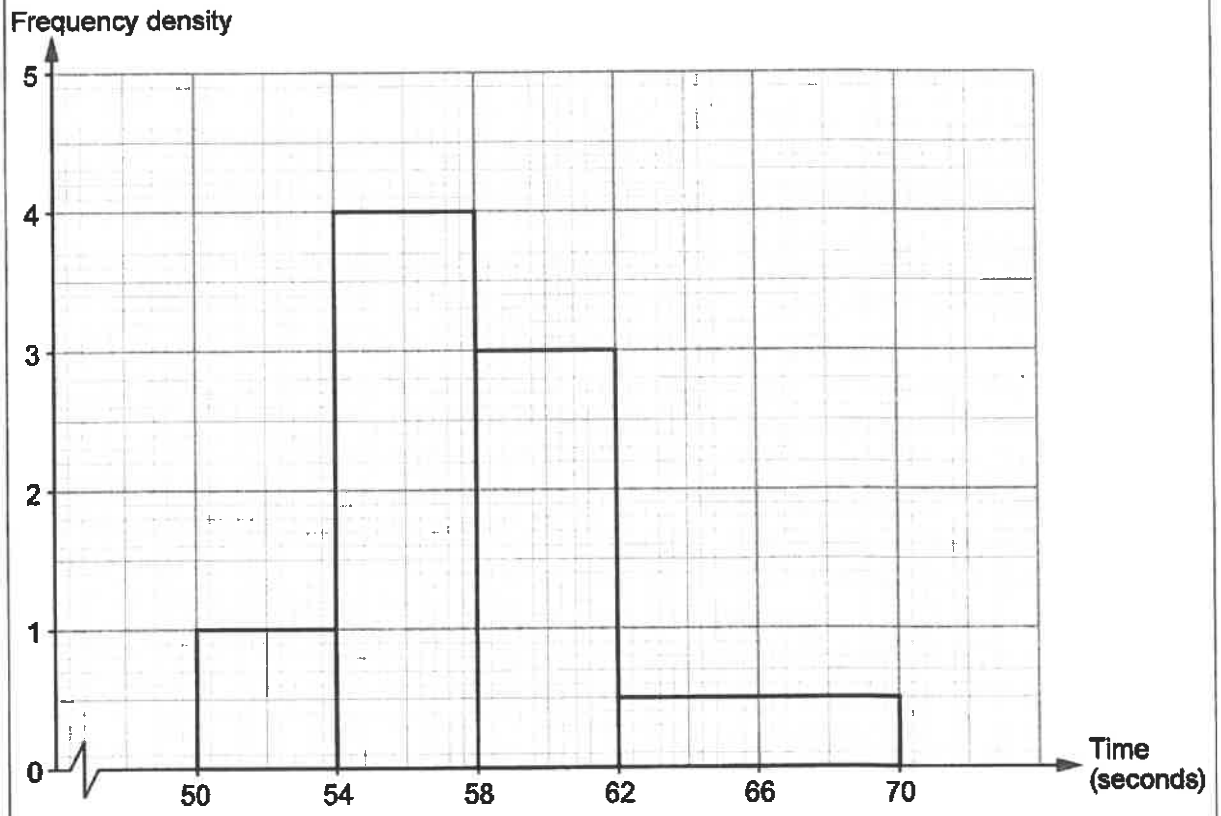
(ii) Explain how Gareth's statement could be false. [1]

H Maths Num 4 June 2017

Examiner only

**9.** The time taken to run 400 m was recorded for each member of a running club.

*(a)* A histogram of the results for the members who are under 30 years of age is shown below.




(i) Calculate how many members of the running club are under 30 years of age. [2]

(ii) Calculate an estimate of the median time taken by the under-30s to run 400 m. [4]

Examiner only

(b) The frequency table below shows the results for the members who are 30 years of age or over.

| Time, $t$ (seconds) | $50 < t \leqslant 54$ | $54 < t \leqslant 58$ | $58 < t \leqslant 60$ | $60 < t \leqslant 62$ | $62 < t \leqslant 70$ |
|---|---|---|---|---|---|
| Number of people | 4 | 10 | 16 | 18 | 12 |
| Frequency density | | | | | |

Complete the table, and draw a histogram to illustrate this data on the graph paper below. [4]

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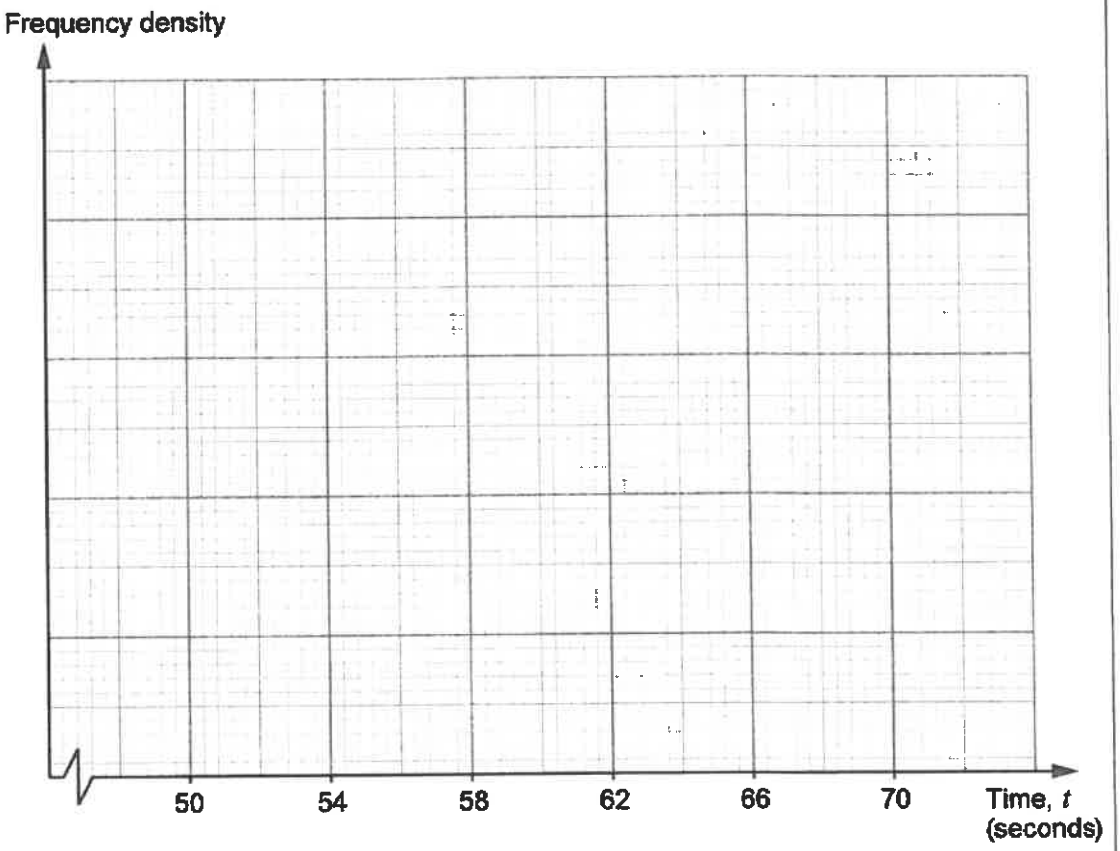


(c) On average, which of the two groups was faster at running 400 m?
Give a reason for your answer.
Your reason must be based on your interpretation of the histograms. [1]

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H Maths Num U1 Nov 2019 20

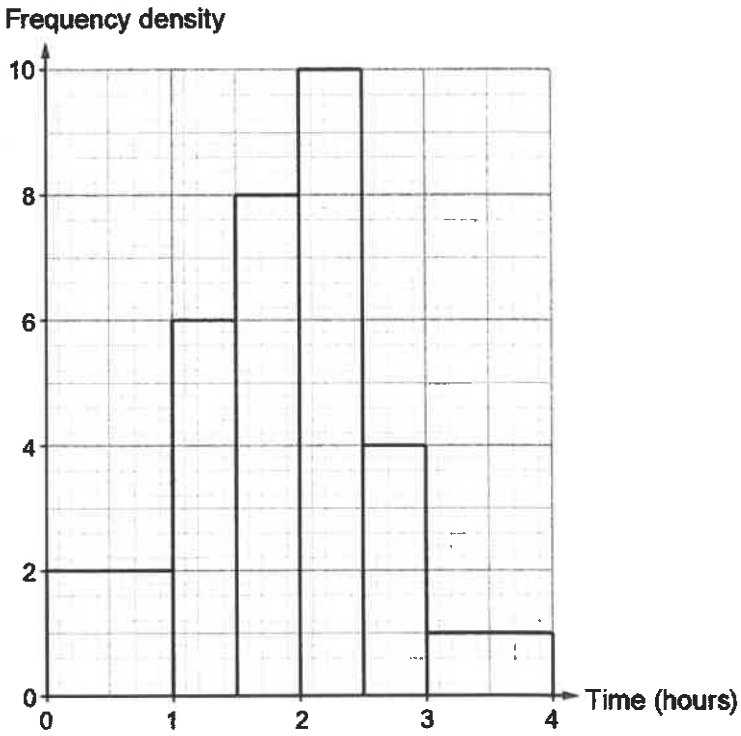
Examiner only

**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. (An angler is someone who goes fishing).

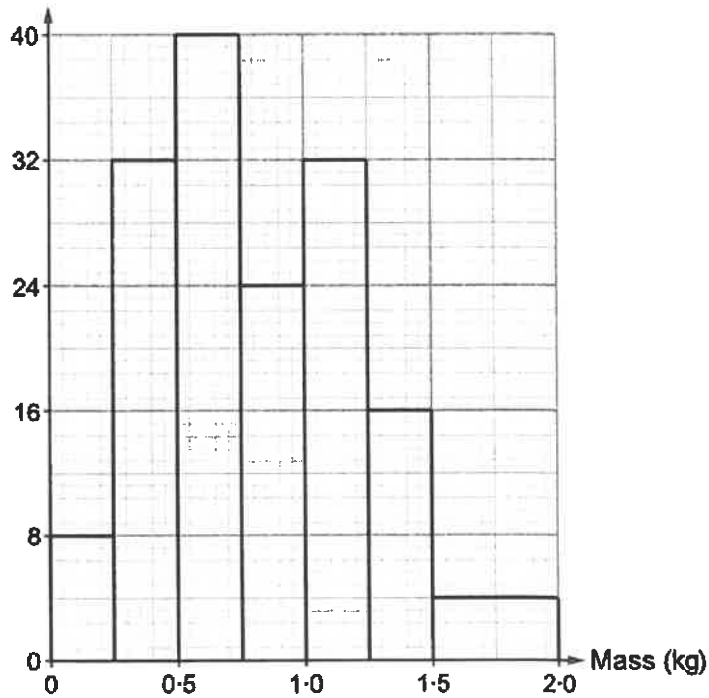
The competition organisers recorded the time taken for **each** angler to catch their **first** fish.

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.



Higher Maths Num (i) Nov 2016

Examiner only

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

.....

(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

H Maths Num U1 Nov 2016

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]

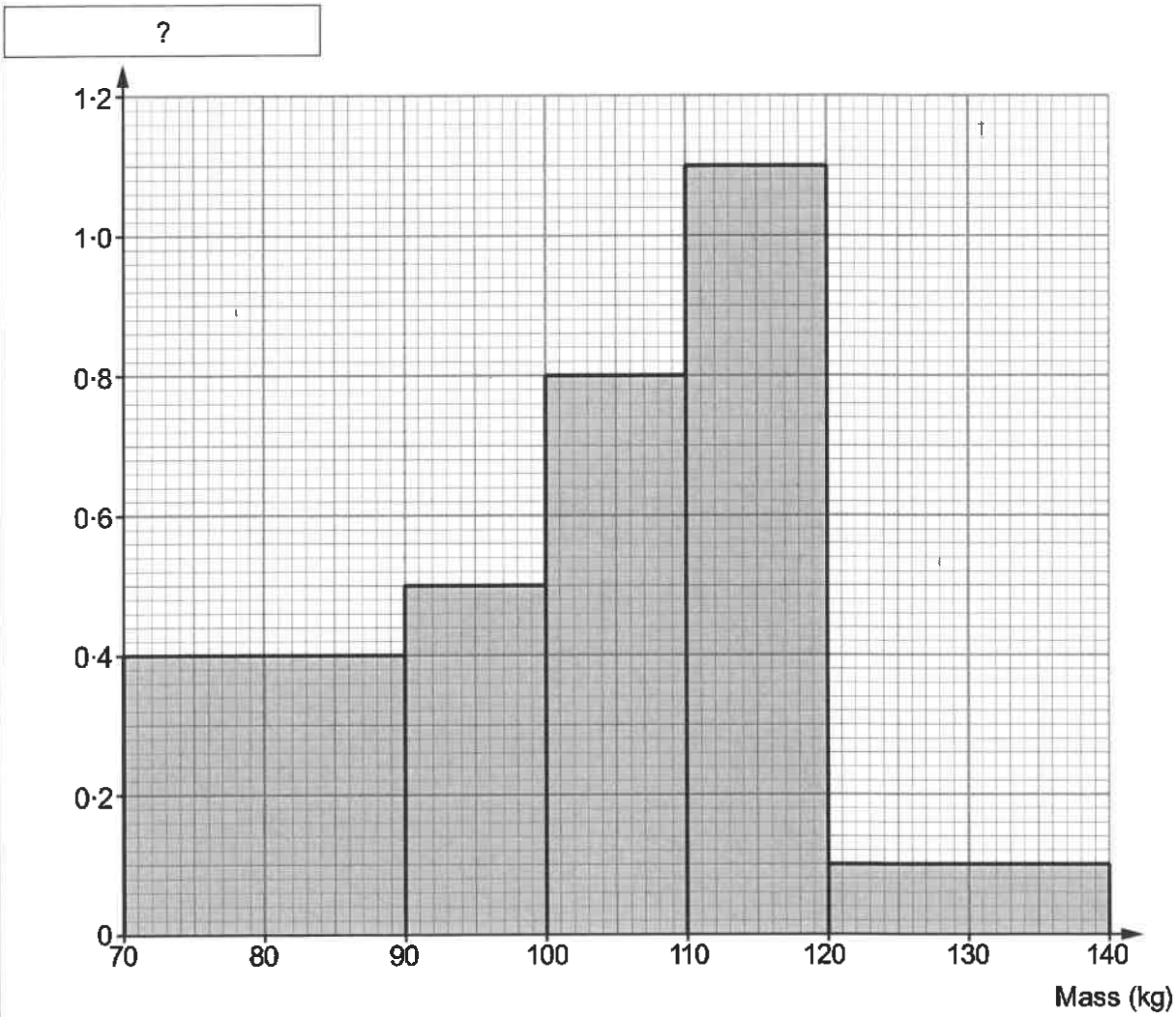
(ii) Do you think it is fair to compare last year's competition results with this year's competition results?
You must give a reason for your answer. [1]

H H2 Num June 2019



Examiner only

**7.** The masses of the players in the men's 2017-2018 Wales rugby squad are shown in the histogram below.
The squad consisted of 34 players.




*(a)* The label is missing on the vertical axis. What should the label be?
Circle your answer. [1]

Frequency  Number of players  Density

Cumulative frequency  Frequency density

Examiner only

(b) Ben says,

"The histogram shows that the mass of the heaviest member of the squad was double the mass of the lightest member of the squad."

Is Ben correct?

Yes ☐ No ☐ You cannot tell ☐

You must give a reason for your choice. [1]

Reason: .....

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(c) The *Forwards* were the heaviest players in the squad.
The lightest *Forward* had a mass of 104 kg.
Calculate the **maximum** possible number of *Forwards* there could have been in the squad.
You must show all your working. [3]

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(d) To make a comparison with other teams, the coach wanted to know the mean mass of all the players in the squad.
Use the histogram to calculate an estimate of the mean mass of all the players in the squad. [5]

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