Surname	Centre Number	Candidate Number
Other Names		0

GCSE – NEW

3310U50-1

S17-3310U50-1

MATHEMATICS – NUMERACY
UNIT 1: NON-CALCULATOR
HIGHER TIER

THURSDAY, 25 MAY 2017 – MORNING

1 hour 45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**9**	
2.	**3**	
3.	**5**	
4.	**4**	
5.	**6**	
6.	**6**	
7.	**8**	
8.	**5**	
9.	**11**	
10.	**13**	
11.	**10**	
Total	**80**	

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 **1**(*b*), the assessment will take into account the quality of your linguistic and mathematical organisation, communication and accuracy in writing.

3310U501 01

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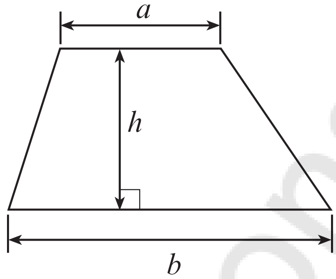
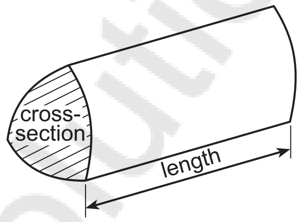
Formula List - Higher Tier

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

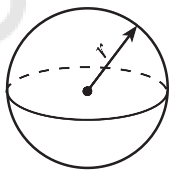


Volume of prism = area of cross-section × length



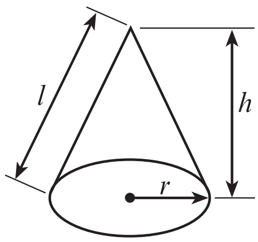
Volume of sphere $= \frac{4}{3}\pi r^3$

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



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

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

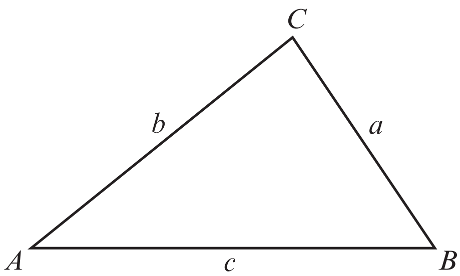


In any triangle ABC

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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TURN OVER

Examiner only

1.

(a) Jasmine entered herself, Sophie and Bryn as a group in a talent contest. Bryn only had a minor part.

Bryn, Sophie and Jasmine won the contest.
They shared the prize money in the ratio 2 : 6 : 7, with Bryn getting the smallest share.
Jasmine won £560, the largest share.

$560/7 = 80$

How much money did Bryn and Sophie each win? [4]

Ratio of sharing = 2 : 6 : 7
Bryn : Sophie : Jasmine

Jasmine's share = $\frac{7}{15} \times$ Total money shared

Let the total money shared be x.

$560 = \frac{7}{15} \times x$

$2 : 6 : 7 \times 80$
$160 : 480 : 560$

80
15 4
40 0
80
1200

$7 \overline{)560}$ = 80
56
00

Bryn receives £ 160

Sophie receives £ 480

$\frac{560}{1} = \frac{7x}{15}$

$\frac{\cancel{560}^{80} \times 15}{\cancel{7}_1} = \frac{1 \times \cancel{7}x}{\cancel{7}}$

$x = 80 \times 15 = £1200$

Bryn's share $= \frac{2}{\cancel{15}} \times 80 \times \cancel{15}$

Bryn's share = £160

Sophie's share $= \frac{6}{\cancel{15}} \times 80 \times \cancel{15}$

Sophie's share = £480

 (3310U50-1)

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

The talent contest is held once a year.
Every year, the cost of putting on the talent contest increases by 10% of the previous year's cost.
In summer 2014 the cost was £6600.

Calculate the cost of putting on the summer 2017 talent contest.
You must show all your working. [3 + 2 OCW]

Cost = 10% increase of previous year

In 2014, Cost = £6600

Now, in 2015

New cost = $\frac{110}{100} \times 6600 = £7260$

Now, in 2016

New Cost = $\frac{110}{100} \times 7260 = £7986$

So, in 2017

Cost of putting on summer 2017 talent contest

New Cost = $\frac{110}{100} \times 7986 = \frac{87846}{10}$

New Cost in 2017 = £8784.6

110, 66, 660, 660, 7260

726, 11, 726, 726, 7986

7986, 11, 7986, 7986, 87846

 (3310U50-1)

Turn over.

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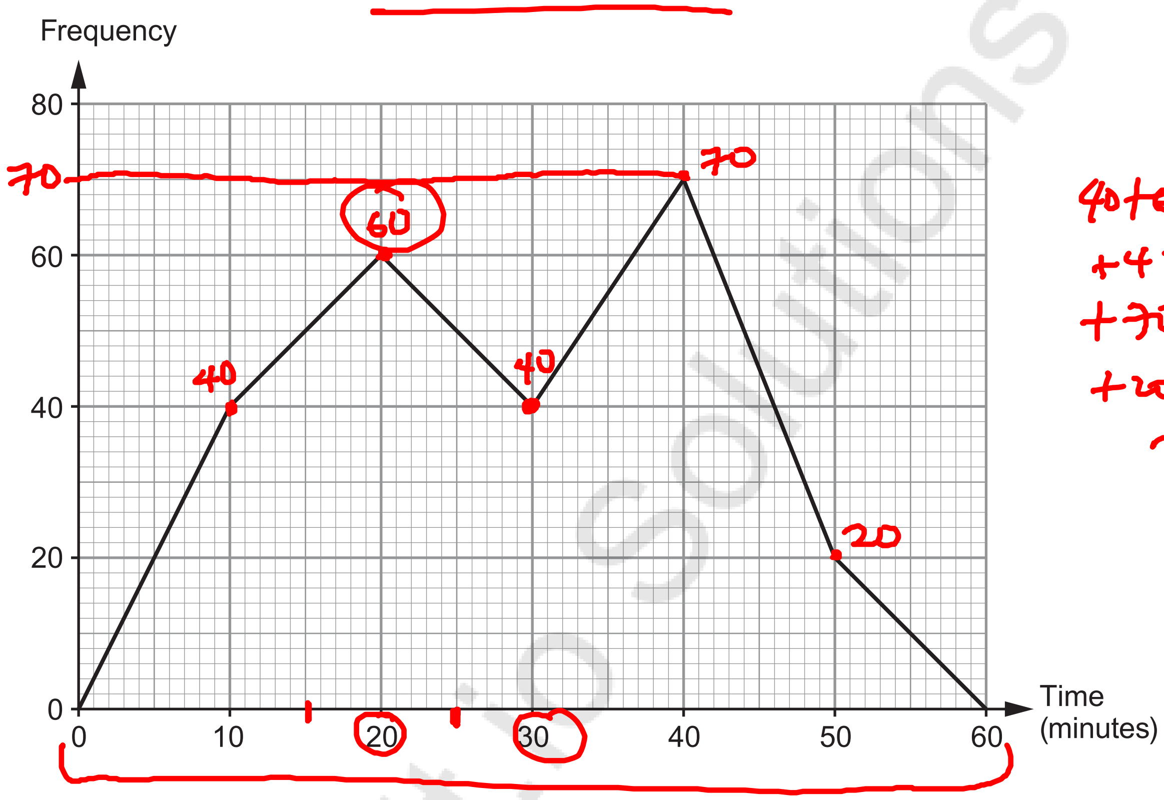
2. A survey was carried out to find how much time a group of 16-year-old students and a group of 18-year-old students spent using social media.
The frequency polygons below, which use equal time intervals, illustrate the results.

16-year-old students



40+60 100
+40 140
+70 210
+20
230

18-year-old students

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(a) How many 16-year-old students took part in the survey?
Circle your answer. [1]

60 70 210 230 2300

(b) How many more 16-year-old students than 18-year-old students spent between 15 minutes and 25 minutes using social media?
Circle your answer. [1]

20 40 60 100 250

16 years [15 - 25 mins] = 60
18 years [15 - 25 mins] = 20
60 - 20 = 40

(c) Wesley says,

'The 16-year-old students generally spent about the same time using social media as the 18-year-old students.'

Using the frequency polygons, how would you explain to Wesley that his statement is not true? [1]

Using median
median [16 years] = 40
median [18 years] = 60
Since the median of 16 years is less than the median of 18 years student
Then, 18 years student spent more time on social media.

 (3310U50-1) Turn over.

3310U501 07

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3. Bethan builds a rectangular sheep pen.

(a) The perimeter fence of the sheep pen is 18 m long.
The length of Bethan's sheep pen is two times its width.
Find the length and width of this sheep pen.
You must show your working. [2]

Let width $= x$

L

W

$L = 2 \times W = 2x$

Perimeter $= 2[L + W)$

$\frac{18}{2} = \frac{\cancel{2}[2x + x]}{\cancel{2}}$

$\frac{9}{3} = \frac{3x}{3}$

$3 = x$

width $= 3$ m

length $= 6$ m

Length is 6 metres

Width is 3 metres

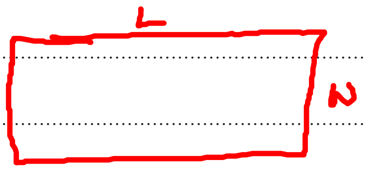
Examiner only

(b) Bethan decides to build a new sheep pen.
The perimeter fence of the new sheep pen is 16 m long.
The length of the new sheep pen is 3 metres longer than the width.

Form an equation and solve it to find the dimensions of this new sheep pen. [3]

$P = 16m$ Let $w = x$

$L = x + 3$



$P = 2(L + W)$

$16 = 2[x + 3 + x]$

$16 = 2(2x + 3)$ — Equation

$\frac{16}{2} = \frac{\cancel{2}(2x+3)}{\cancel{2}}$

$8 = 2x + 3$

$-3 \quad -3$

Length is 5·5 metres

Width is 2·5 metres

$\frac{5}{2} = \frac{2x}{\cancel{2}}$

$2 \cdot 5 = x$

$x = 2 \cdot 5m$

Width $= 2 \cdot 5m$

Lenght $= 2 \cdot 5 + 3 = 5 \cdot 5m$

Turn over.

Examiner only

4. Josef has a job in a workshop that makes decorations.

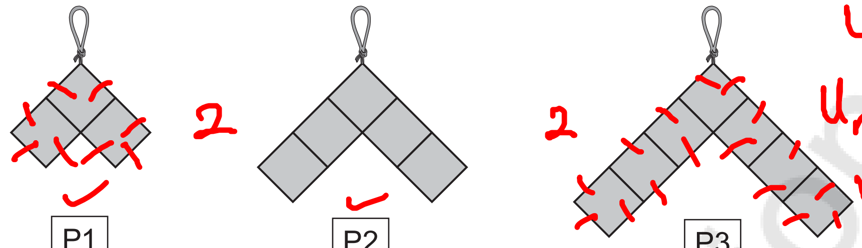
He has made the following three decorations using small squares of stained glass.

Using AP

$U_n = a+(n-1)d$

$U_n = 3+(n-1)2$

$U_n = 3+2n-2$



P1

P18 P19 (2)

P20 (2)

P21 (2)

P22 (2)

Josef labels these patterns P1, P2 and P3 in order.

3, 5, 7, 9, 11, ... $U_n = 1+2n$

Josef continues to make decorations following the pattern he has started.

(a) How many **more** squares would he need to make pattern P22 than to make pattern P18? [1]

(8)

$P22 = U_{22} = 1+2\times 22 = 1+44 = 45$

$P18 = U_{18} = 1+2\times 18 = 1+36 = 37$

He needs $= 45-37 = 8$ more squares

(b) Josef has 22 squares.

Josef states,

'I think I can make one complete decoration using **all** 22 squares, with none left over.'

21 or 23

Is Josef correct?

Yes ☐ No ☒

Give a reason for your answer. [1]

3, 5, 7, 9, 11,

He can't make a complete decoration with 22 squares because 22 is an even number. The sequence is a set of odd numbers.

P4

Examiner only

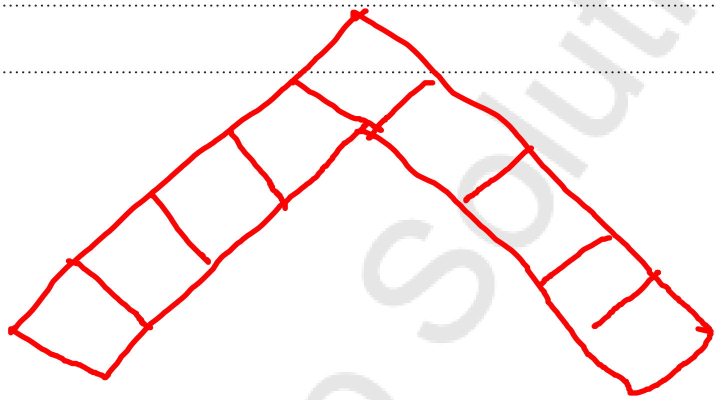
(c) Each small square of stained glass measures 0·5 cm by 0·5 cm.
The perimeter of one of Josef's decorations is 10 cm.
Complete the label that Josef would use for this decoration. [2]

P 4

each of the square is 0·5 cm by 0·5 cm

Perimeter = 10 cm

Number of square edges = 10 ÷ 0·5 = 20 edges

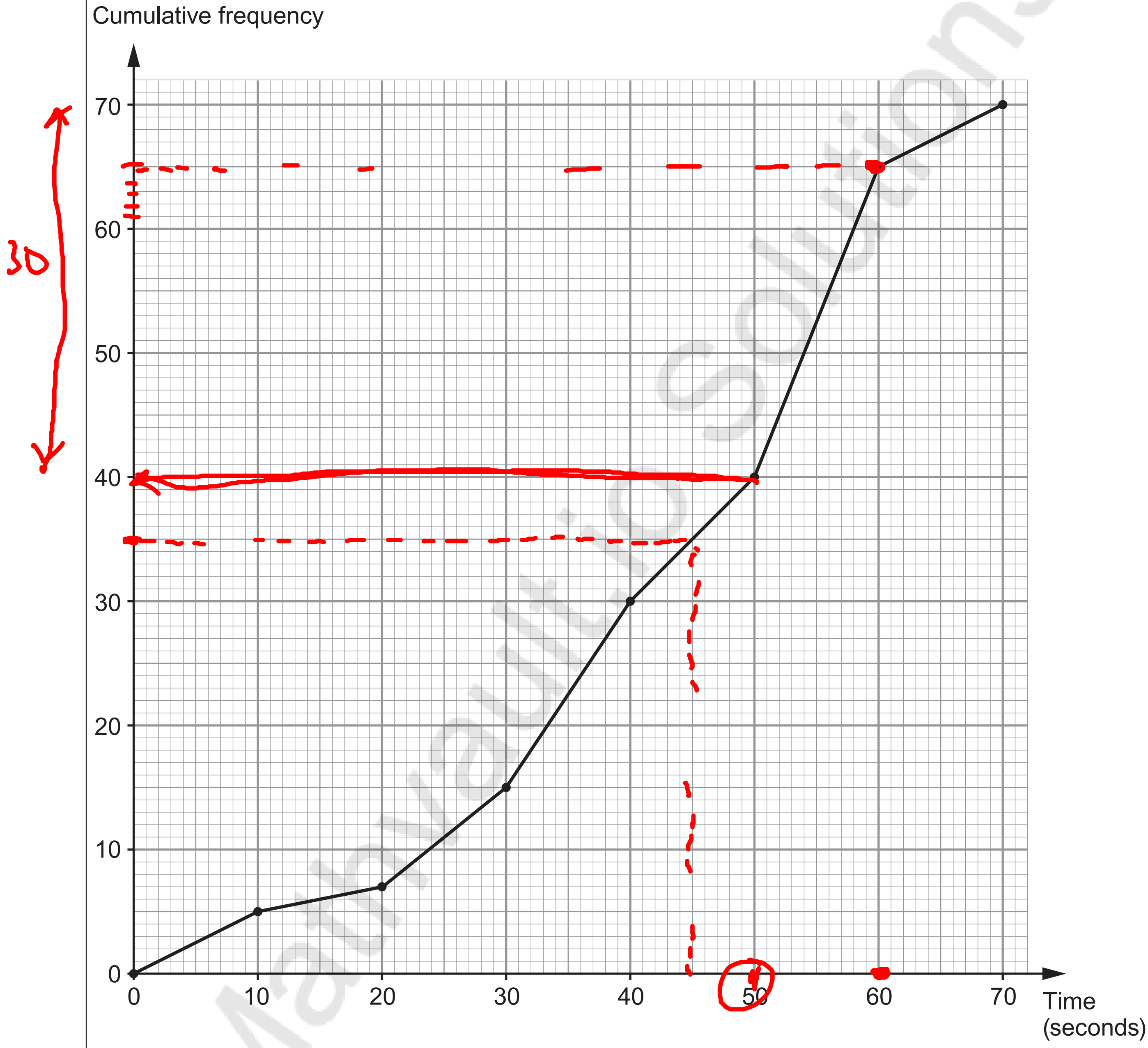


20 edges

P4

Examiner only

5. *Cambria Airlines* has planes that can carry up to 70 passengers.
For safety, the crew practise the emergency exit procedures with a group of 70 passengers.
Every 10 seconds the safety officer records the total number of passengers who have left the plane.
He has displayed the results in the cumulative frequency diagram shown below.



(a) Estimate the median time taken by the passengers to leave the plane. [1]

45 seconds

 (3310U50-1)

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(b) How many passengers took more than 50 seconds to leave the plane?
Circle your answer. [1]

10 20 30 40 50

(c) *Cambria Airlines* has a policy that states the following.

'In the event of an emergency exit procedure, at least 90% of the 70 passengers must have left the plane within 1 minute.'

Did the practice emergency exit procedure meet the requirements of the airline's policy?
You must show all your working. [4]

What is 90% of total passengers

$\frac{90}{100} \times 70 = 63$

So, expected 63 passengers should have exit within 1 minute

So, Real practical, 65 passengers have exited within 1 minute

Yes, the practice emergency exit procedure meet the requirement since 65 passenges exited within 1 minute compare to 63 passenges expected to exit.

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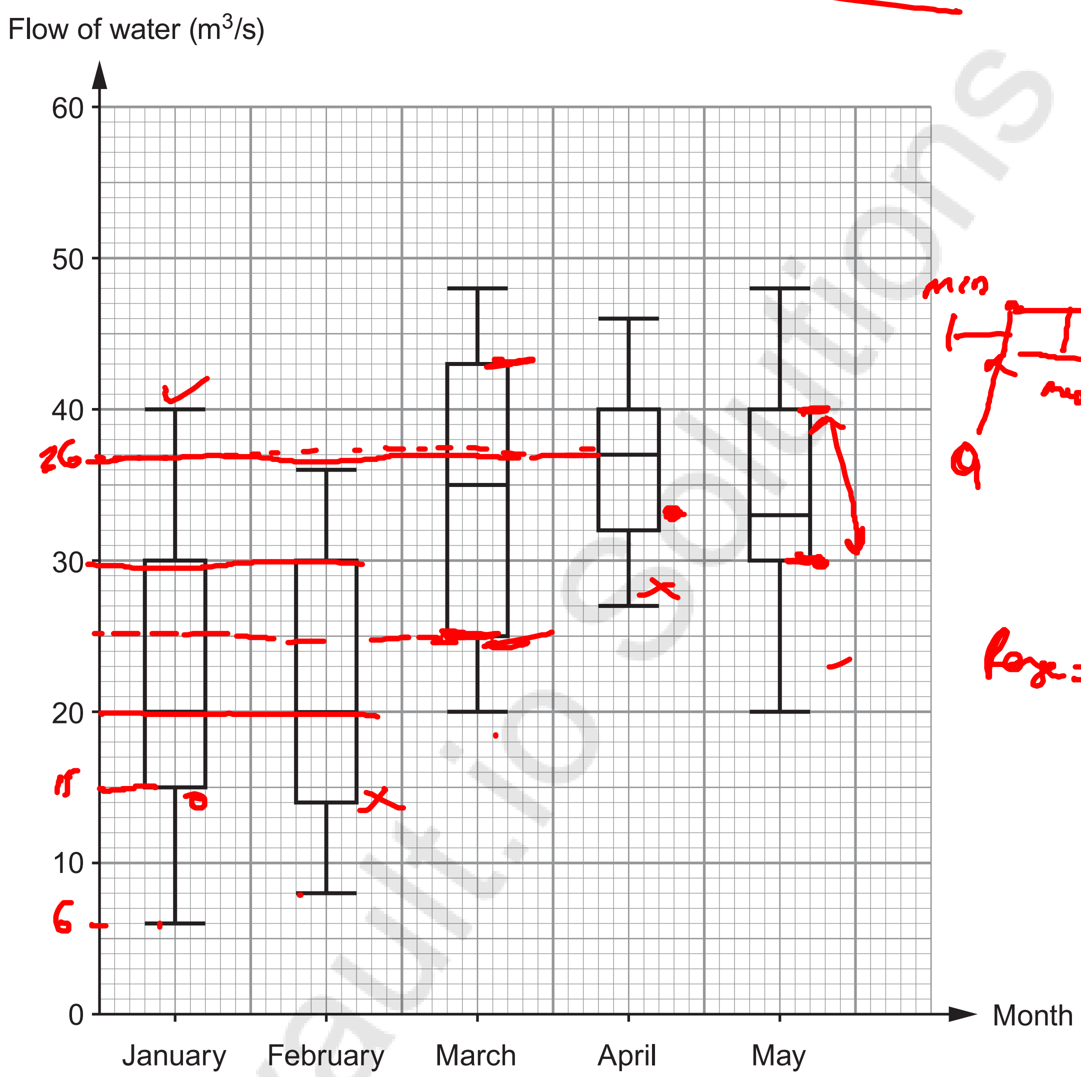
 (3310U50-1) Turn over.

Examiner only

6. The following box and whisker plots show the flow of water through a drain, measured in m^3/s.
The flow of water was measured at 11 a.m. each day for the first 5 months of the year.



(a) In which of the five months was the median flow of water the greatest? [1]

April with a median of 37

 (3310U50-1)

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(b) In which of the five months was the range of the flow of water the greatest? [1]

Range = Highest value - lowest value

January with a range of 37

(c) Iona is writing some statements for a report on the flow of water through the drain. Complete each of the statements given below.

(i) 'Both the upper quartiles and medians in the months of January

and February were the same.' [1]

(ii) '25% of the results in March show the flow of water was greater than

25 m^3/s.' Q1 for mach = 25 [1]

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

25% of the results in January show the flow of water was less than 6 m^3/s.	TRUE	FALSE
The units, m^3/s, measure the volume of water passing through the drain each second.	TRUE	FALSE
The mean flow of water in April was **certainly** greater than 36 m^3/s. median = 36	TRUE	FALSE
The month with the greatest difference between the lower quartile and the median was May.	TRUE	FALSE

IQR = $Q_3 - Q_1$

Examiner only

7. *(a)* A standard piece of A4 paper is usually 0·08 mm thick.
What is 0.08 mm written in **metres** in standard form?
Circle your answer. [1]

1mm = 10^{-3} m

8×10^{4} 8×10^{-4} 8×10^{-3} 8×10^{3} 8×10^{-5}

Thickness 0·08mm

$0 \cdot 08\,mm = 0 \cdot 08 \times 10^{-3}\,m$

$= 8 \times 10^{-2} \times 10^{-3}\,m = 8 \times 10^{-5}\,m$

(b) A piece of card is 1 mm thick.
A stack of these pieces of card is 3×10^{-2} metres high.

(i) Calculate how many pieces of card there are in the stack. [2]

A piece = 1mm = 1×10^{-3} m

Stack = 3×10^{-2} m.

pieces of card = $\frac{\text{stack height}}{\text{piece height}}$

$= \frac{3 \times 10^{-2}}{1 \times 10^{-3}}$

$\frac{10^{-2}}{10^{-3}} = 10^{-2+3}$

$= 3 \times 10^{-2+3}$

$= 3 \times 10 = 30$

30

(ii) What assumption have you made in answering *(b)*(i)? [1]

So, assumption is

No space or gap between the pieces of papers.

 (3310U50-1)

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(c) In 2012 it was recorded that
- the total mass of the paper used for printing newspapers, in the world, was $2{\cdot}88 \times 10^7$ **tonnes**,
- the world population was approximately $7{\cdot}2 \times 10^9$ people.

Use this information to calculate the mass of paper per person used to print newspapers in 2012.
Give your answer in **kg per person**. [4]

Total mass $= 2.88 \times 10^7$ $\boxed{\text{tonnes}}$

Population $= 7.2 \times 10^9$ people

1 tonne $= 1000$ Kg

Total mass $= 2.88 \times 10^7 \times 1000$ Kg

Total mass $= 2.88 \times 10^7 \times 10^3$ Kg

Total mass $= 2.88 \times 10^{10}$ Kg

mass density per person $= \dfrac{\text{Total mass}}{\text{Total population}}$

mass Density $= \dfrac{2.88 \times 10^{10}}{7.2 \times 10^9} = \dfrac{2.88}{7.2} \times 10^{10-9}$

mass Density $= \dfrac{2.88 \times 10}{7.2} = \dfrac{28.8}{7.2} \times \dfrac{10}{10}$

$= \dfrac{288}{72} = 4$

72
$\times 4$
288

mass Density $= 4$ Kg/person,

Mass of paper: 4 kg per person

 (3310U50-1) Turn over.

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]

5 painters $\longrightarrow$ 10 hours $\longrightarrow$ $500m^2$

New house

x painters $\longrightarrow$ 8 hours $\longrightarrow$ $600m^2$

Total paint hours = 5 painter × 10 hours = 50 paint hr

This means that 1 painter paint = $\frac{500m^2}{50} = 10m^2/hr$

Total paint hours = x paint × 8 = $8x$ paint hr

This means that, 1 painter paint = $\frac{600}{8x}$ m^2/hr

$10 = \frac{600}{8x}$ ∴ $10 \times 8x = 600$ $x = \frac{\cancel{600}\ \cancel{30}\ 15}{\cancel{80}\ \cancel{4}\ 2} = 7.5$

So, we need 8 painters

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

We assumed that all the painters have the same efficiency.

 (3310U50-1)

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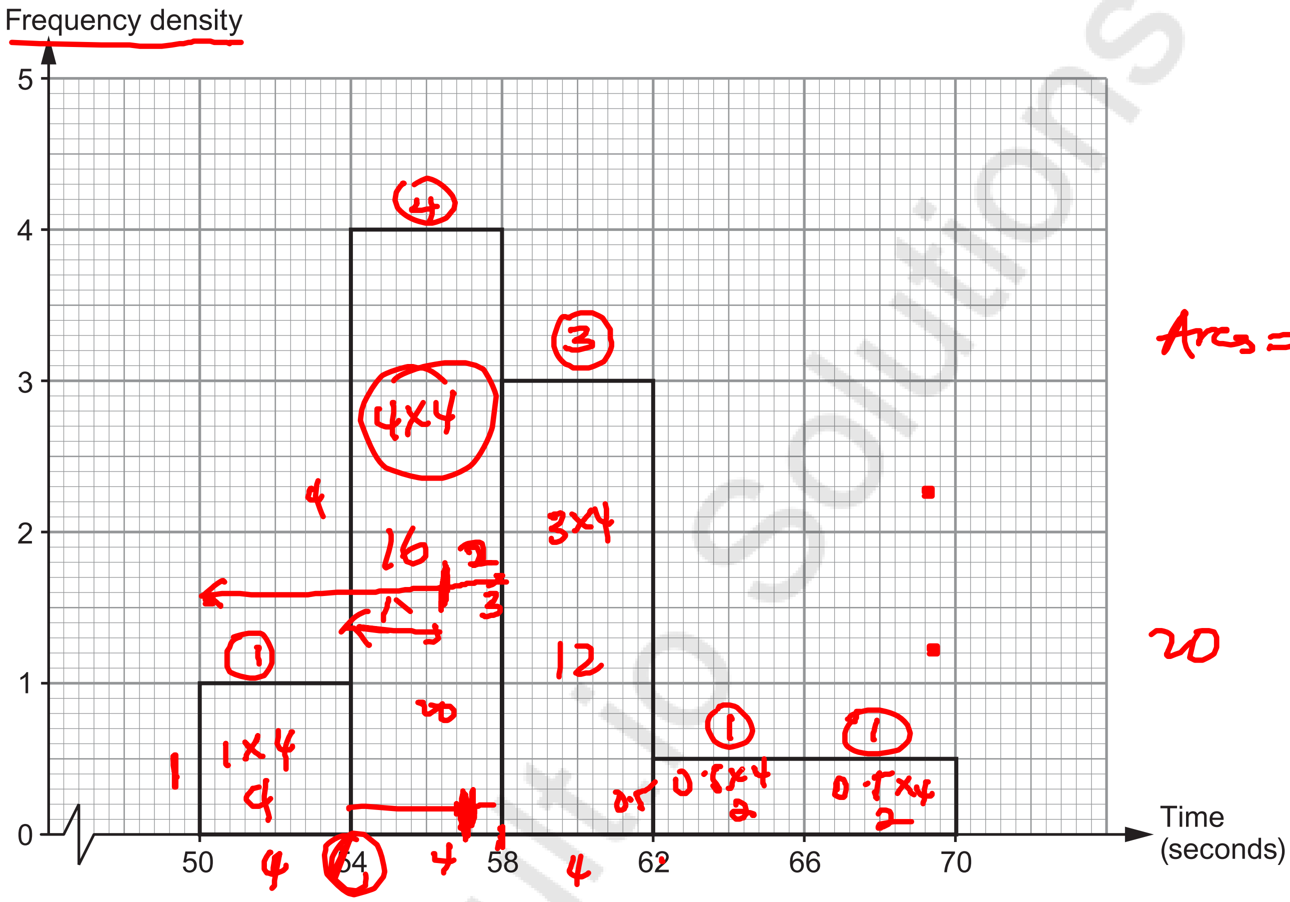
9. The time taken to run 400 m was recorded for each member of a running club.

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



Area = l×B

20 32

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

Total Members = 4 + 16 + 12 + 2 + 2

36//

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

median time.

Total members = 36

median will be at 36/2 = 18th position.

median falls between 54 – 58

So, $\frac{14}{16} \times 4$ or $\frac{2}{16} \times 4 = \frac{8}{16} = 0.5$

3.5 or 0.5

57.5 57.5//

median = 57.5

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30+ 16 12 30 3

(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 14	16 30	18	12
Frequency density	1	2.5	8	9	1.5

60

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

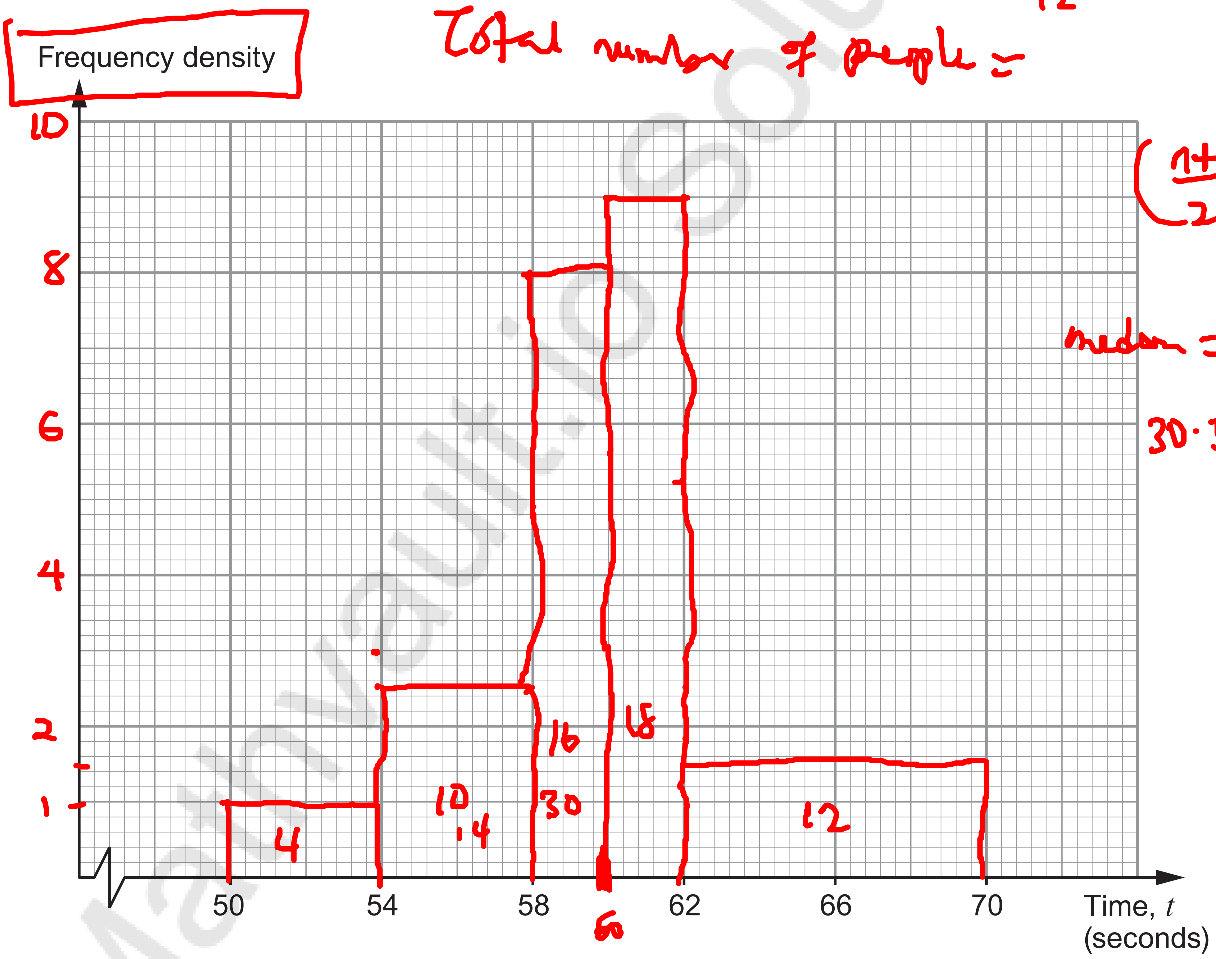
Frequency density = $\frac{\text{number of people}}{\text{time used}}$ 18 ÷ 2 = 9

Total number of people =

$\left(\frac{n+1}{2}\right)^{th}$

median = 30th

30.5th



(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]

median = 60

median (30 years +) = 60

median (30 years −) = 57.5

The 30 year and over group is faster at running 400m because it has a higher median.

 (3310U50-1) Turn over.

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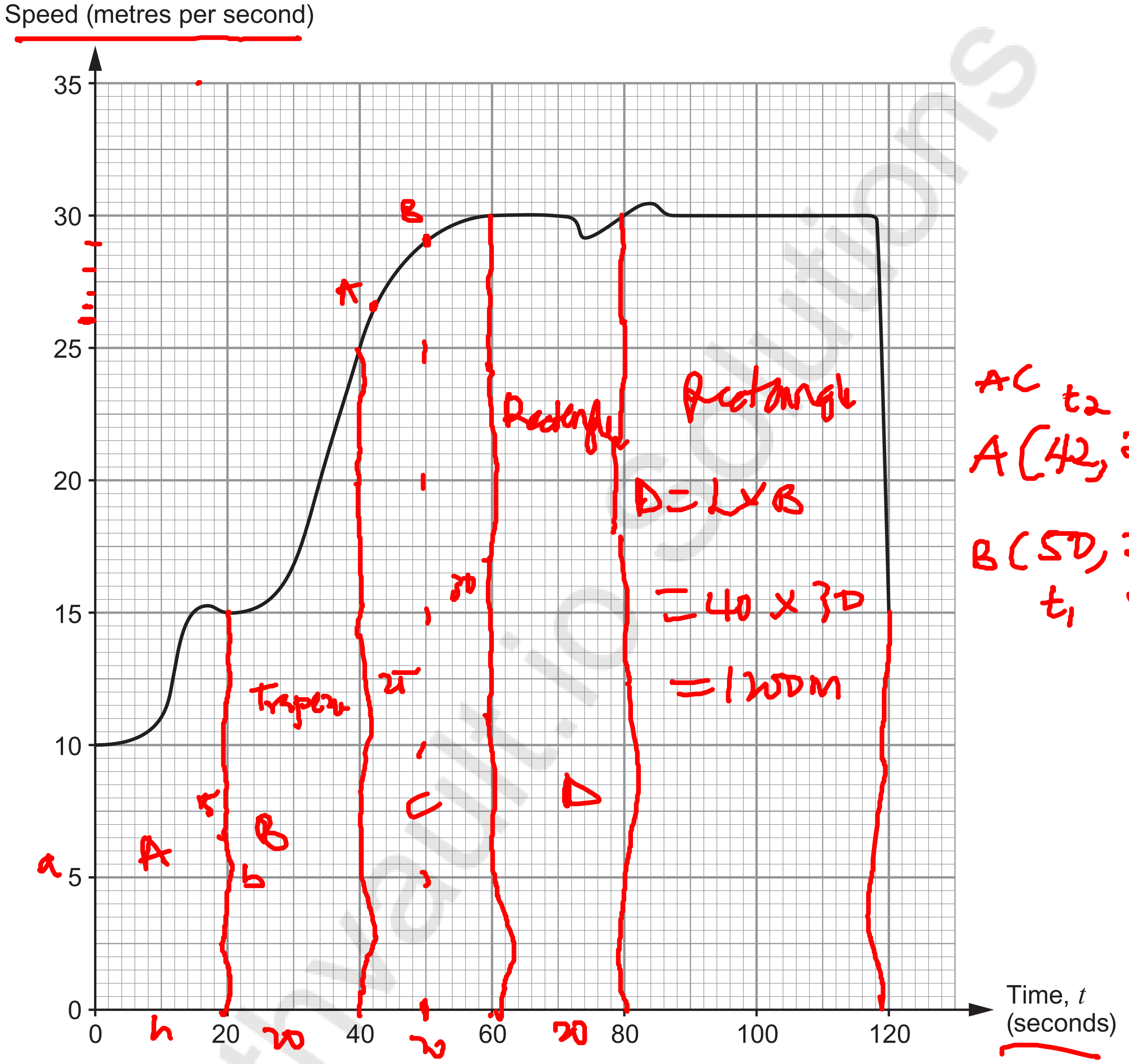
10. The graph below shows a 120-second section of Iestyn's car journey to work this morning.



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

$$\text{acceleration} = \frac{\Delta V}{\Delta t} = \frac{V_2 - V_1}{t_2 - t_1} = \text{slope}$$

$$= \frac{26.5 - 29}{42 - 50} = \frac{-2.5}{-8} = \frac{2.5 \times 10}{8 \times 10}$$

$$a = \frac{25}{80} = \frac{5}{16} \text{ m/s}^2$$

 (3310U50-1)

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(ii) At another time, Iestyn calculated the acceleration of the car to be $0{\cdot}2\dot{4}$ m/s^2.
Write this recurring decimal as a fraction. [2]

$a = 0.24444$ m/s^2

Let $x = 0.244444$ $\times 10$

$10x = 2.44444$ $\times 10$ — (1)

$100x = 24.44444$ — (2)

$90x = 22$

$x = \frac{22}{90} = \frac{11}{45}$

$a = \frac{11}{45}$ m/s^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]

$t = 0, 20, 40, 60, 80$

For shape A $= \frac{1}{2}(a+b)h = \frac{1}{2}(10+15) \times 20$
$= 250$ m

For shape B $= \frac{1}{2}(a+b)h = \frac{1}{2}(15+25) \times 20$
$= 400$ m

For shape C $= \frac{1}{2}(a+b)h = \frac{1}{2}(25+30) \times 20$
550 m

For shape C $= L \times B = 30 \times 20 = 600$ m

15
25
30

(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]

Total Distance $= 250$ m $+ 400$ m $+ 550$ m $+ 600$ m

Distance $= 1800$ m

(ii) Average Speed $= \dfrac{\text{Total Distance Travel}}{\text{Total Time taken}}$

Total Distance $= 1800 + 1200 = 3000$ m

Average Speed $= \frac{3000}{120} = 25$ m/s

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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.

$l^2 = 5^2 + 12^2$

$l^2 = 25 + 144$

$l^2 = 169$

$l = \sqrt{169}$

$l = \underline{\underline{13}}\text{cm}$

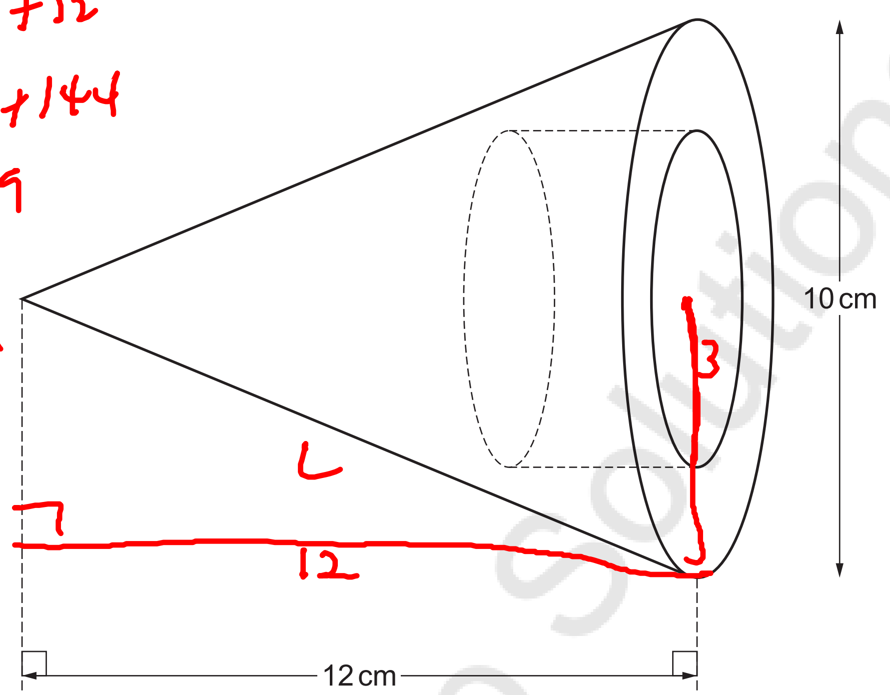

Diagram not drawn to scale

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]

$r = 3\text{cm}$ $h = 4\text{cm}$ [cylinder]

$r = 5\text{cm}$ $h = 12\text{cm}$ [cone]

Volume remain = [volume of cone − volume of cylinder]

$= \frac{1}{3}\pi r^2 h - \pi r^2 h$

$= \frac{1}{\cancel{3}_1}\pi \times 5^2 \times \cancel{12}^4 - \pi \times 3^2 \times 4$

$= 100\pi - 36\pi$

$= \underline{\underline{64\pi \text{ cm}^3}}$ proved

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 π. [6]

Area of the top part = Area of big circle − small circle
$= \pi R^2 - \pi r^2$
$= \pi 5^2 - \pi 3^2$
$= 25\pi - 9\pi = 16\pi \text{ cm}^2$

Surface area of a cone $= \pi r L$
L is the slant height
$l = 13$ cm

$\begin{array}{r} 13 \\ \times 5 \\ \hline 65 \end{array}$

CSA of the cone $= \pi r l = \pi \times 5 \times 13$
$= 65\pi \text{ cm}^2$

$\begin{array}{r} 65 \\ 16 \\ \hline 81 \end{array}$

Total Area to be painted = CSA + Top part
$= 65\pi + 16\pi$
$= 81\pi \text{ cm}^2$

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