OCR
Oxford Cambridge and RSA

H

Thursday 8 June 2017 – Morning

GCSE APPLICATIONS OF MATHEMATICS

A382/02 Applications of Mathematics 2 (Higher Tier)

Candidates answer on the Question Paper.

OCR supplied materials:
None

Other materials required:
- Scientific or graphical calculator
- Geometrical instruments
- Tracing paper (optional)

Duration: 2 hours

A382/02

7343626022

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Your answers should be supported with appropriate working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

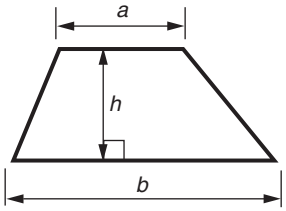
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- Your quality of written communication is assessed in questions marked with an asterisk (*).
- The total number of marks for this paper is **90**.
- This document consists of **24** pages. Any blank pages are indicated.

You are permitted to use a calculator for this paper

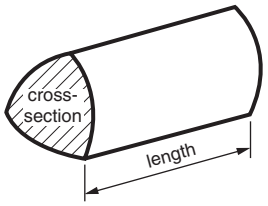
DC (RW/SW) 141717/5

Formulae Sheet: Higher Tier

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



Volume of prism = (area of cross-section) × length

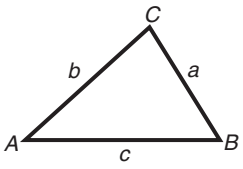


In any triangle *ABC*

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

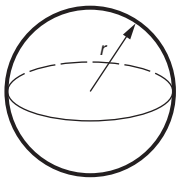
Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$

Area of triangle $= \frac{1}{2}ab\sin C$



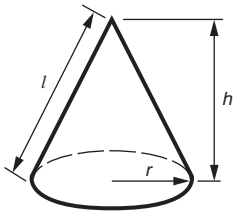
Volume of sphere $= \frac{4}{3}\pi r^3$

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



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

Curved surface area of cone $= \pi rl$



The Quadratic Equation

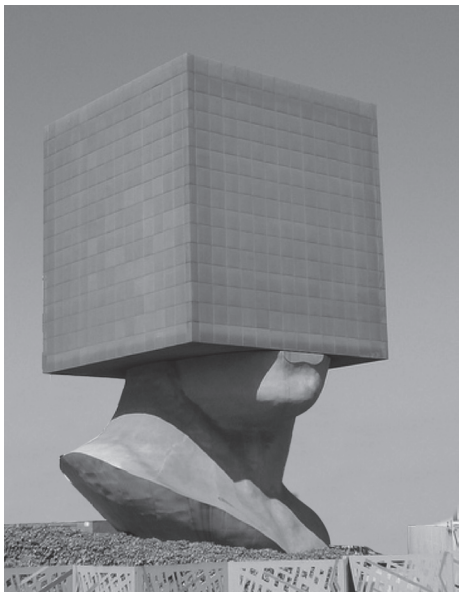
The solutions of $ax^2 + bx + c = 0$,
where $a \neq 0$, are given by

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

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

1 This is a photo of a building in France.



The whole building is 30 m high.

The building is divided into two sections.
The upper section is a cube.

The ratio

cube height : building height = 1 : 2.

(a) Work out the **volume** of the cube section.

(a) ..... m^3 **[3]**

(b) There are 4 floors in the cube section. These are used for offices.
There is office space for 40 people altogether.

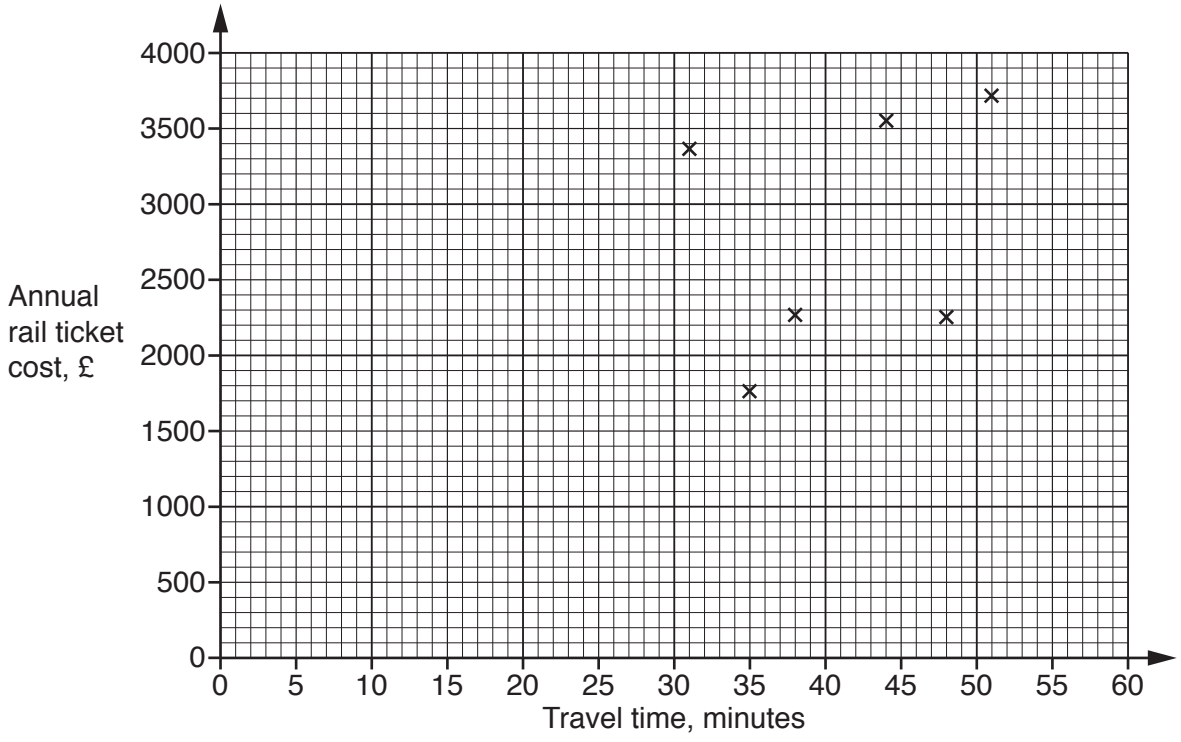
How much floor area is there for each person in the cube section?

(b) ..... m^2 **[3]**

2 Many people who work in London do not live in London. They travel to work by train each day. Here is information about the train travel time and annual train ticket costs in 2012 for some towns where people who work in London live.

Town	Travel time, minutes	Annual train ticket to London, £
Berkhamsted	31	3368
Cobham	38	2272
Epsom	35	1764
Henley	44	3540
Hertford	48	2228
Hove	51	3708
Marlow	48	3012
Reigate	39	2460
Sevenoaks	33	2980
St Albans	19	2988

This scatter graph shows the travel time and cost of an annual train ticket for the first six towns given in the table.



(a) (i) Complete the scatter graph. **[2]**

(ii) There is no correlation shown by this graph.

Explain fully what no correlation means for this graph.

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..... **[1]**

(b)* Sundip recorded the time taken for her train journey to work over 220 days.
She correctly summarised the information with these two statements:

Most journey times were 45 minutes or less.
The mean journey time was over 45 minutes.

Complete the table to show **possible** frequencies for Sundip's journey times.
Show that for **these** frequencies the mean journey time is over 45 minutes.

Journey time, *t* minutes	**Frequency**
$40 < t \leqslant 45$	
$45 < t \leqslant 50$	
$50 < t \leqslant 55$	
$55 < t \leqslant 60$	

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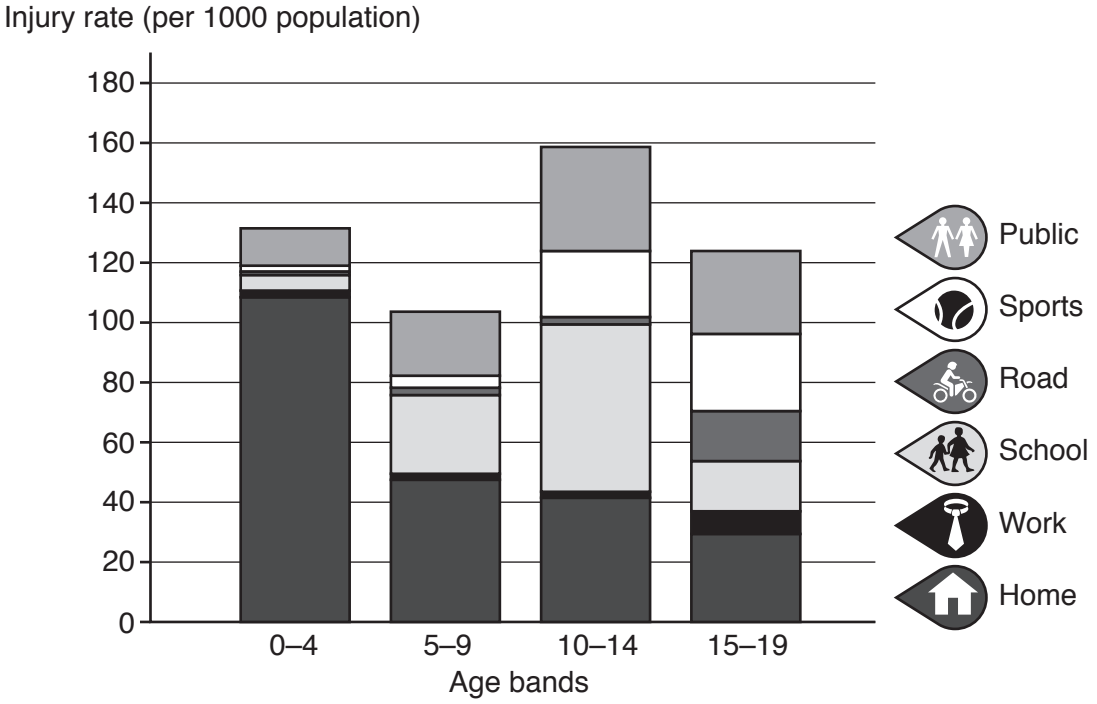
..... **[6]**

3 The bar chart is from 2008. It shows survey results for injury rate in a typical week for children and young people aged up to 19 years.



(a)* Emily says

'The bar chart shows that children aged 10–14 years are more likely to be injured at school than anywhere else.'

Hareen says

'Schools are not more risky places for 10–14 year olds to be injured as they spend more time at school than anywhere else.'

Using some results from the bar chart, explain if these statements are correct.
You must write down all assumptions you make, for example, about time awake and time at school.

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..... **[5]**

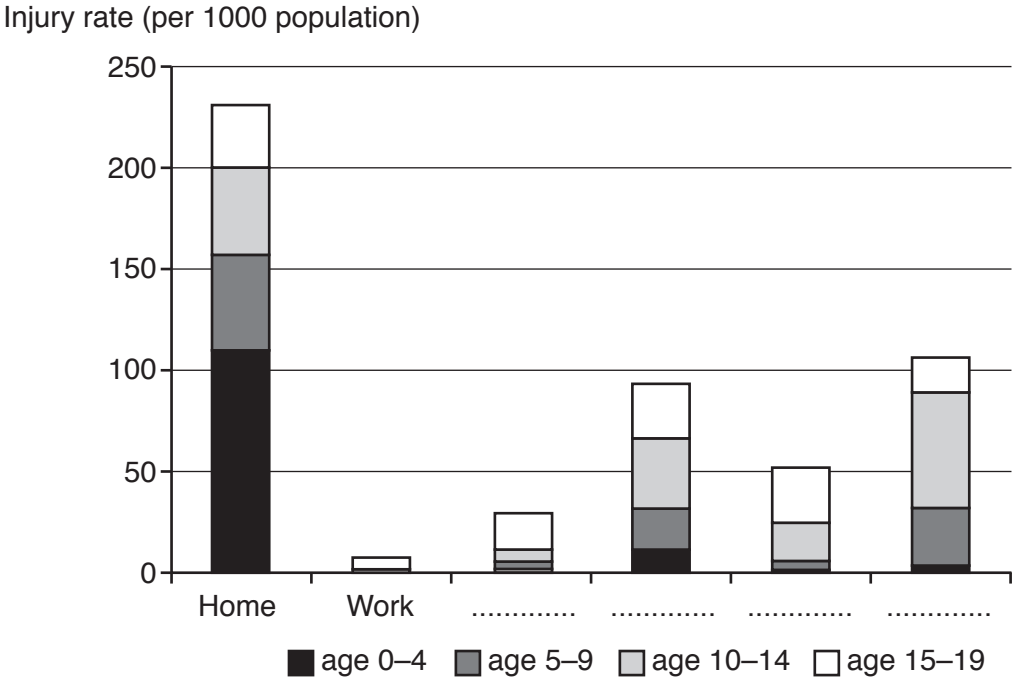
(b) Emily decides to conduct her own survey about where children get injured.
She wants to use the same age groups and the same place categories as the bar chart.

(i) Design a two way table for Emily to use to record the results of her survey. **[3]**

(ii) In her survey Emily found that 8 children aged 5–9 years were injured playing sports.

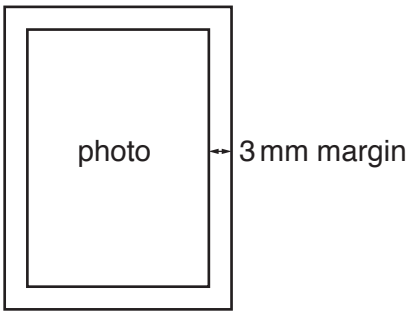
Enter this information in your table above. **[1]**

(c) Hareen used the information from the original survey and drew this bar chart.



Complete the missing labels on the horizontal axis. **[3]**

4 School photos of individual children are offered as various sizes of the same photograph on a single photographic sheet.
All of the photos must have a 3 mm margin around them after they have been cut from the single sheet.



A single sheet of photographic paper is 21.2 cm by 26.4 cm.

(a) Passport size photos measure 3.5 cm by 4.5 cm.

What is the maximum number of passport size photos can fit on a single sheet of photographic paper?
Describe how these photos will be arranged to fit on the paper.
You may assume all passport photos will be printed with the same orientation.

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..... **[4]**

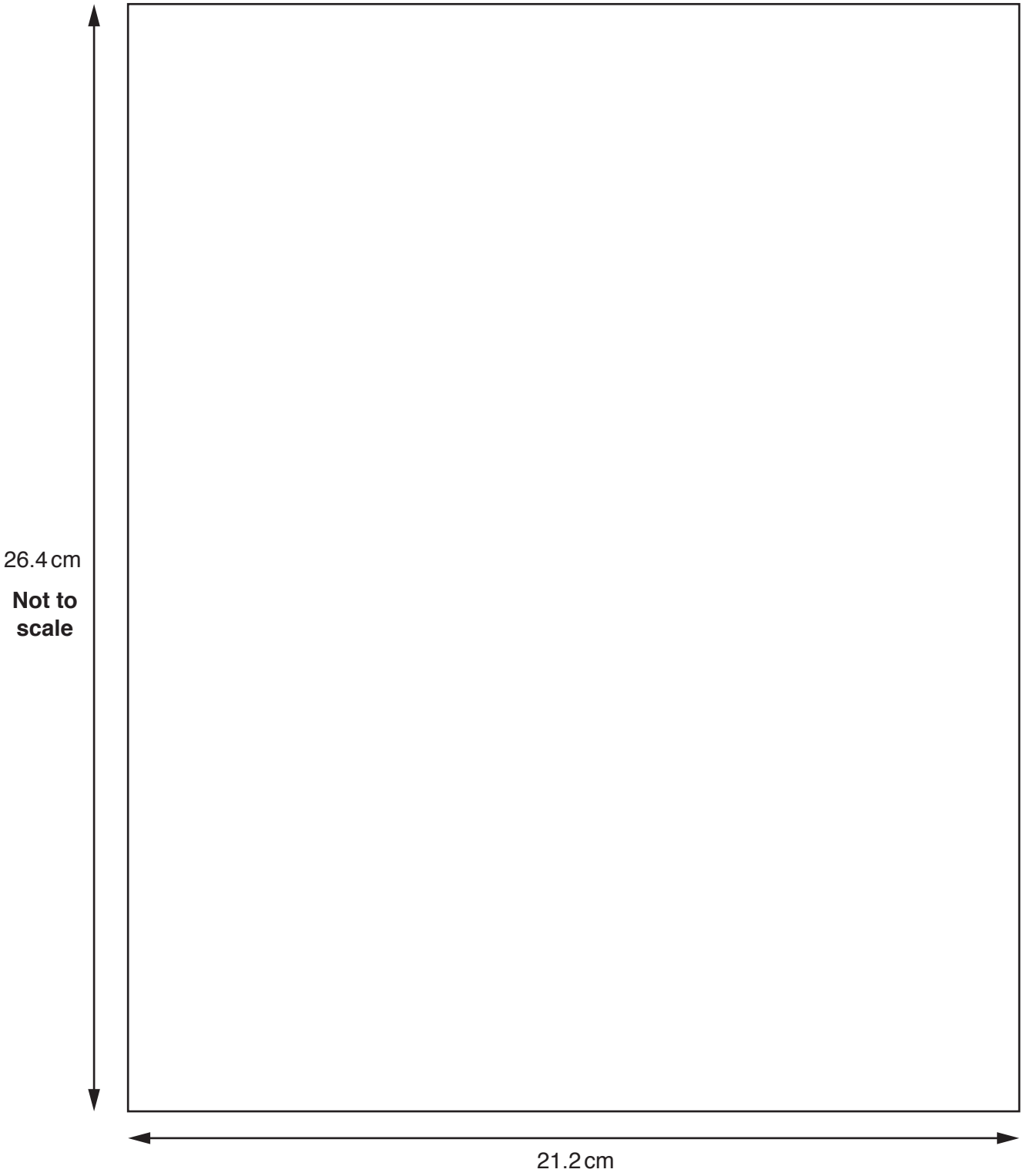
(b) Other school photo sizes offered are:

Small	5 cm by 7.5 cm
Medium	7.5 cm by 12.5 cm
Large	12.5 cm by 17.5 cm

Create a possible design on a single sheet of photographic paper for small, medium and large photos.

In your design include
- a total of four photos
- at least one small, one medium and one large photo.

State **all** measurements on your design.
You do not need to have all photos with the same orientation.



[4]

5 Reuben's local library is open on Tuesday, Friday and Saturday.
The table shows the number of people, rounded to the nearest 5, who visited the library during a four-week period and some three-point moving averages for the data.

Week	Day	Number of people	Three-point moving average
1	Tuesday	200	
	Friday	155	250
	Saturday	395	245
2	Tuesday	185	245
	Friday	155	255
	Saturday	425	245
3	Tuesday	155	245
	Friday	155	250
	Saturday	440	265
4	Tuesday	200	
	Friday	170	260
	Saturday	410	

(a) Explain why a three-point moving average would be appropriate to analyse the data.

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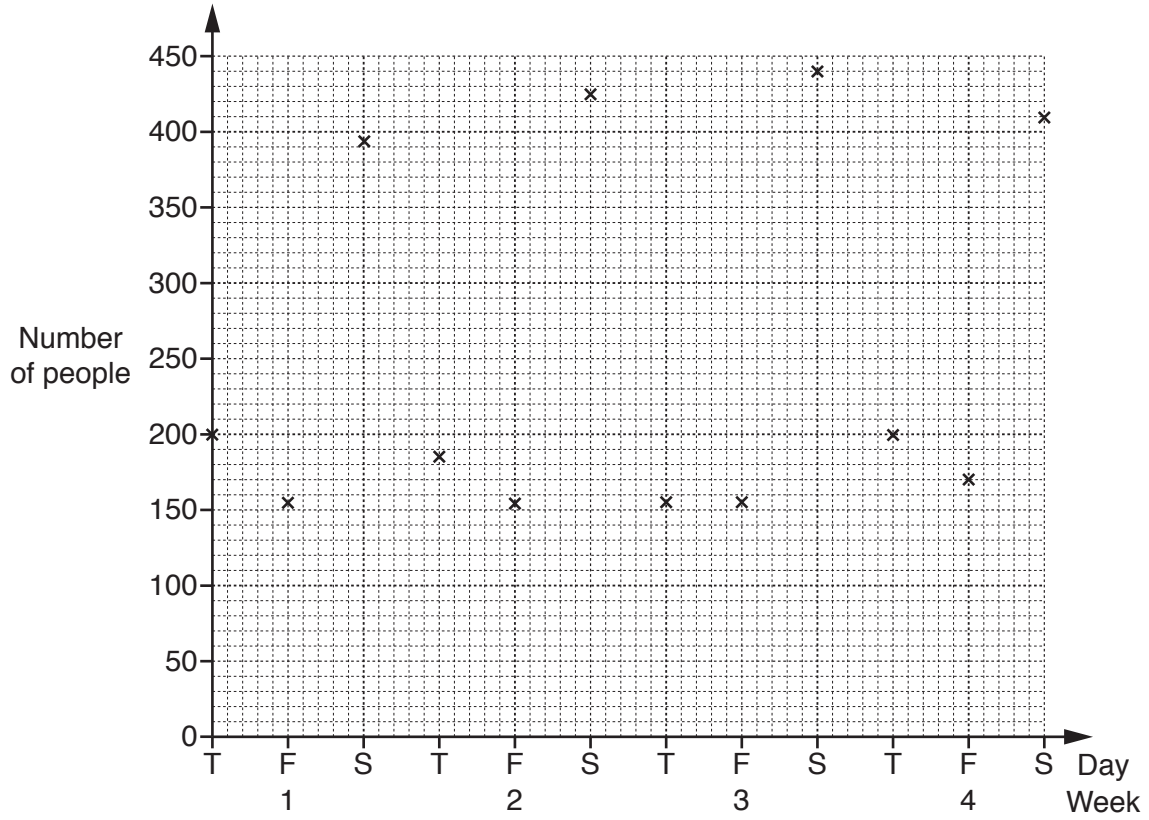
..... **[1]**

The graph shows the number of people visiting the library on each day.



(b) (i) Calculate the missing three-point moving average in the table on the previous page.

(b)(i) ..... **[2]**

(ii) Plot all the three-point moving averages on the graph and draw the trend line. **[3]**

(iii) Write one comment on what is shown by the trend line.

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..... **[1]**

6 Ollie went to university in 2011. His total student loan was £28 200.
Ollie started work and began paying back his student loan in April 2015.
The amount Ollie pays back each year depends on how much he earns above a set amount.

He earned an annual salary of £29 000 in his first year at work.
That year Ollie was charged interest of 1.5% on the whole student loan.
That year Ollie had to pay back 9% of the amount he earned above a set amount of £17 335.

(a) How much of Ollie's loan was still remaining at the end of that year?

(a) £ ..... **[5]**

(b) Ollie does not have to pay back any of his student loan after 25 years.

Show that Ollie will never pay all his student loan if the difference between his annual salary and the set amount remains the same each year.

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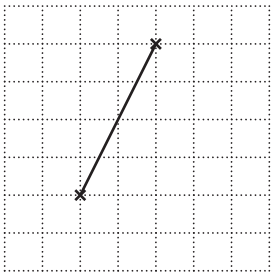
..... **[3]**

7 Ciro wanted to find out the value of $\sqrt{20}$. He did not have a calculator.

Ciro drew a line on the grid.



Each square on the grid measures 0.5 cm by 0.5 cm.

(a) Explain why the length, in cm, of the line is $\sqrt{5}$.

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..... **[2]**

Ciro measured the length of the line. It is 2.3 cm.
He then used his measurement in a calculation.
Ciro then wrote $\sqrt{20} = 4.6$.

(b) Explain why Ciro's answer is correct.

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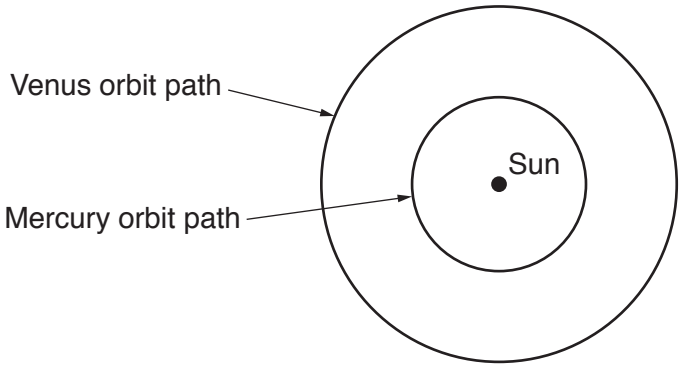
..... **[2]**

8 Marcus investigated the orbital radius of the planets as part of a school science project.
The orbital radius is the distance of the planet from the Sun.
Here is the information Marcus found.

Planet	Distance from Sun, km	Time for one orbit, days
Mercury	5.79×10^7	88
Venus	1.08×10^8	225
Earth	1.50×10^8	365
Mars	2.28×10^8	687
Jupiter	7.78×10^8	4332
Saturn	1.43×10^9	10 760
Uranus	2.87×10^9	30 700
Neptune	4.50×10^9	60 200
Pluto	5.91×10^9	90 600

The orbit of each planet is very close to a circle.
The diagram shows the orbits of Venus and Mercury around the Sun.



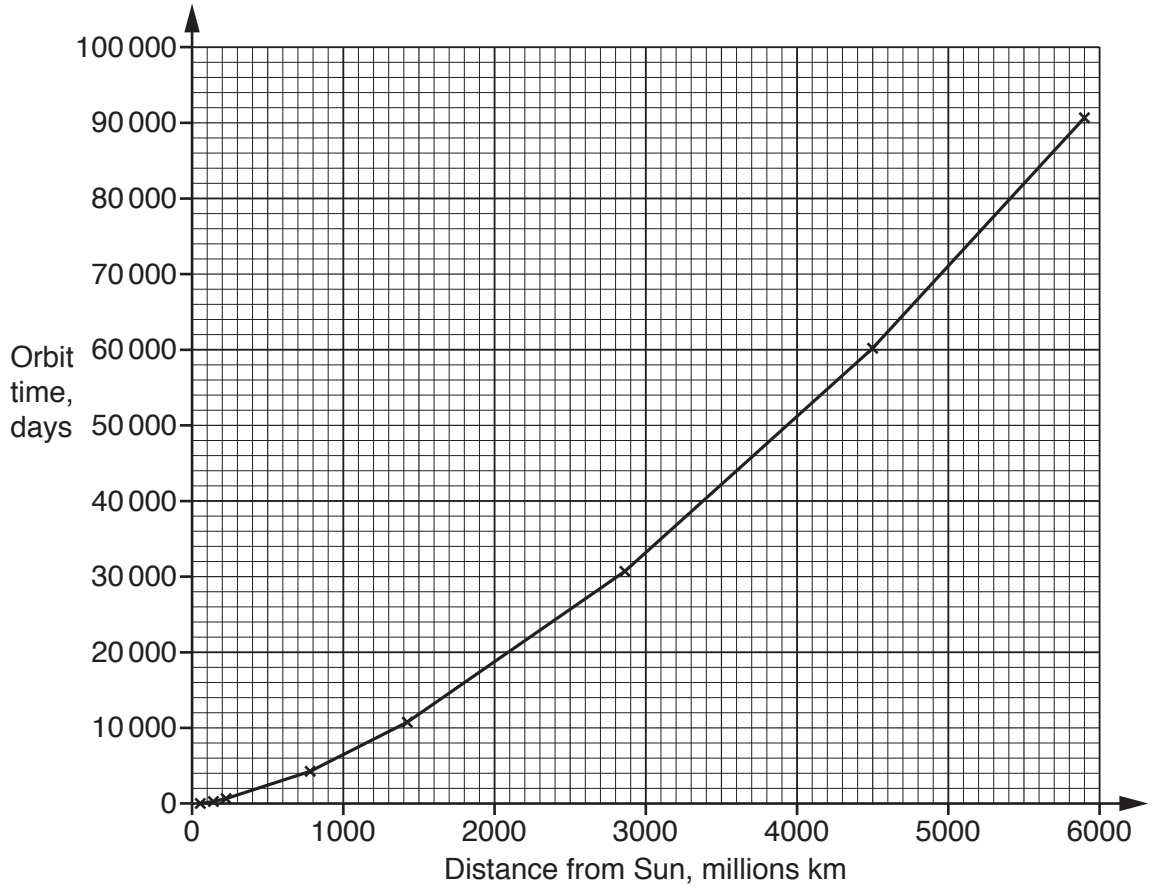
Not to scale

(a) Work out the smallest and largest distance apart between Venus and Mercury.
Give your answers in standard form.

(a) Smallest distance ..... km

Largest distance ..... km **[4]**

(b) Marcus drew this graph of distance from the Sun and time to orbit the Sun.



(i) Describe fully the relationship shown by the graph.

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.....

..... **[1]**

(ii) Some people thought there should be a tenth planet 420 million km from the Sun.

Use the graph to predict the time this planet would take to orbit the Sun.

(b)(ii) ..... days **[1]**

9 Jonah, a student, has two part-time jobs to support his studies.
He works in a supermarket and is a football coach.

(a) In one week Jonah works f hours coaching football and s hours at the supermarket.

Write down an inequality for each of the following three statements.

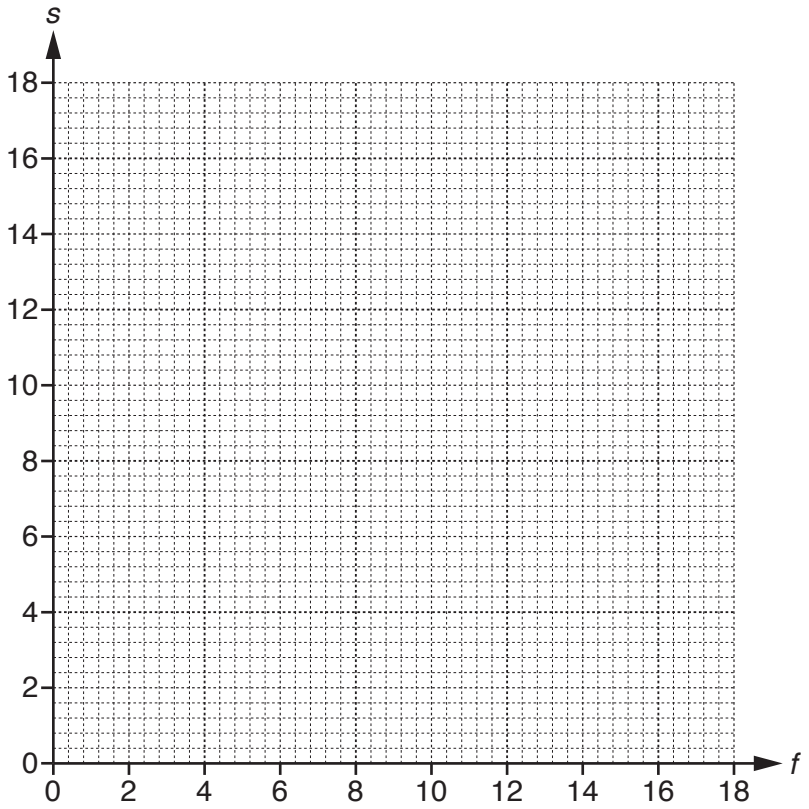
Jonah must work at least 5 hours each week in the supermarket. .....

He coaches football for 2 hours one evening every week and up to 6 hours at the weekend. .....

Jonah can work 18 hours each week at most. .....

[4]

(b) Represent these inequalities on the graph. Shade out the unwanted regions.



[4]

(c) Jonah is paid £9 per hour to coach football and £7.50 per hour to work in the supermarket.

What is the most that Jonah can earn in one week?
How many hours must he work at each job to earn this amount?

(c) £ .....

..... hours coaching, ... hours at the supermarket **[3]**

10 The edge of a kite is caught in a tree.
Jemima is standing under the kite. She decides to throw a ball vertically upwards at the kite.

The height, h metres, the ball can reach is given by the formula $h = \frac{v^2}{2g}$

where $g = 9.81$ correct to two decimal places and
v is the speed of the ball in m/s when it leaves Jemima's hand.

The kite is 29 m correct to the nearest metre above Jemima's hand when the ball leaves her hand.

What is the minimum speed Jemima should throw the ball to be sure it reaches the kite?
Show how you reached your answer.

..... m/s **[5]**

11 The diagram shows a bow top railing design.
It is made by fixing hoops in a horizontal bar.
The horizontal bar in the railing has holes spaced 10 cm apart for the hoops to pass through.
At each end of the railing is a vertical bar.

A hoop consists of a semi-circle and two vertical sections.

The distance between the vertical sections of each hoop is 30 cm.

(a) What is the number of **complete** hoops and number of **part** hoops needed to make a length of railing 150 cm long?

(a) Complete hoops .....

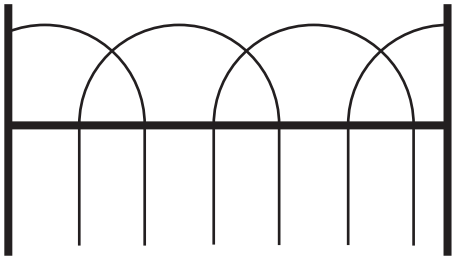
Part hoops ..... **[2]**

(b) The length of the vertical sections of each hoop is 60 cm.

Calculate the total length of each hoop.

(b) ..... cm **[3]**

(c) Only part hoops are needed at each end of the railing.



Not to scale

What are the possible lengths of the curved section of the part hoops?

(c) ..... **[5]**

12 One litre of fern green paint is made by mixing blue and yellow paint in the ratio 2 : 3.
Tom mixes the blue and yellow paint and makes a total of 2.5 litres of green paint.
Tom makes a mistake. He reverses the ratio and mixes blue and yellow paint in the ratio 3 : 2.

How much yellow paint must now be added to Tom's mixture to get the correct colour of fern green paint?

..... litres **[4]**

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).