OCR
RECOGNISING ACHIEVEMENT

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Tuesday 11 June 2013 – Morning

GCSE APPLICATIONS OF MATHEMATICS

A381/01 Applications of Mathematics 1 (Foundation Tier)

A317030613

Candidates answer on the Question Paper.

OCR supplied materials:
None

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

Duration: 1 hour

A381101

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. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

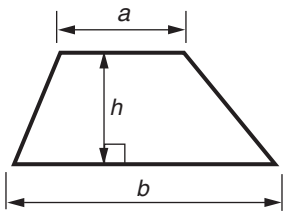
INFORMATION FOR CANDIDATES

- 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 **60**.
- This document consists of **20** pages. Any blank pages are indicated.

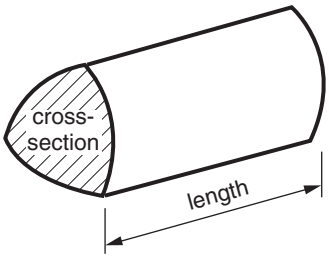
You are permitted to use a calculator for this paper

Formulae Sheet: Foundation Tier

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

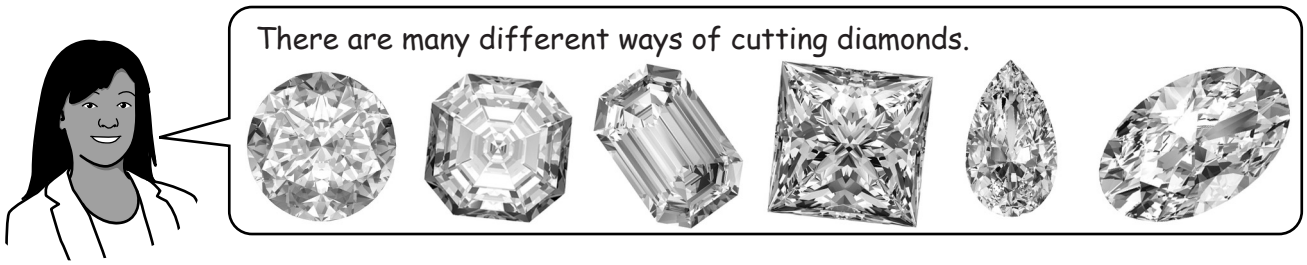


Volume of prism = (area of cross-section) × length

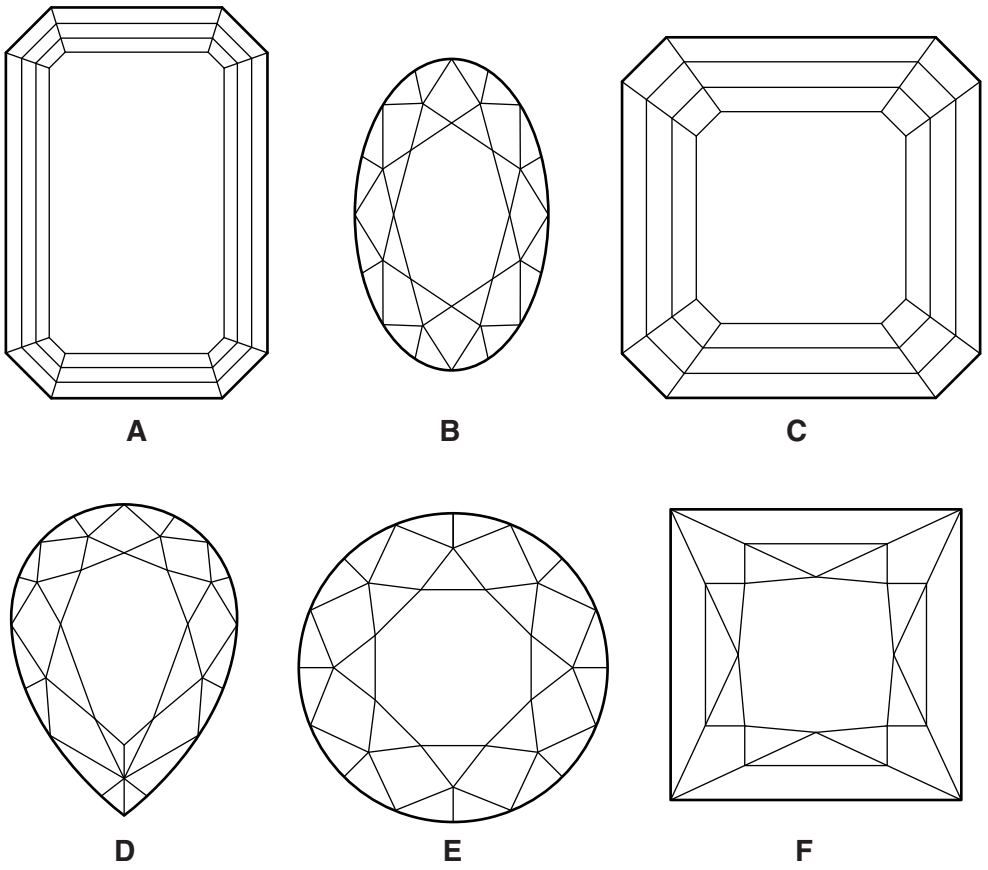


PLEASE DO NOT WRITE ON THIS PAGE

1 Josh starts a work experience placement at the local jewellers.
The manager, Lucy, tells him some facts about diamonds.



(a) The diagrams below show the top views of six ways of cutting diamonds.



(i) Which of the diagrams has reflection symmetry **but not** rotation symmetry?

(a)(i) _____ **[1]**

(ii) How many lines of symmetry does **B** have?

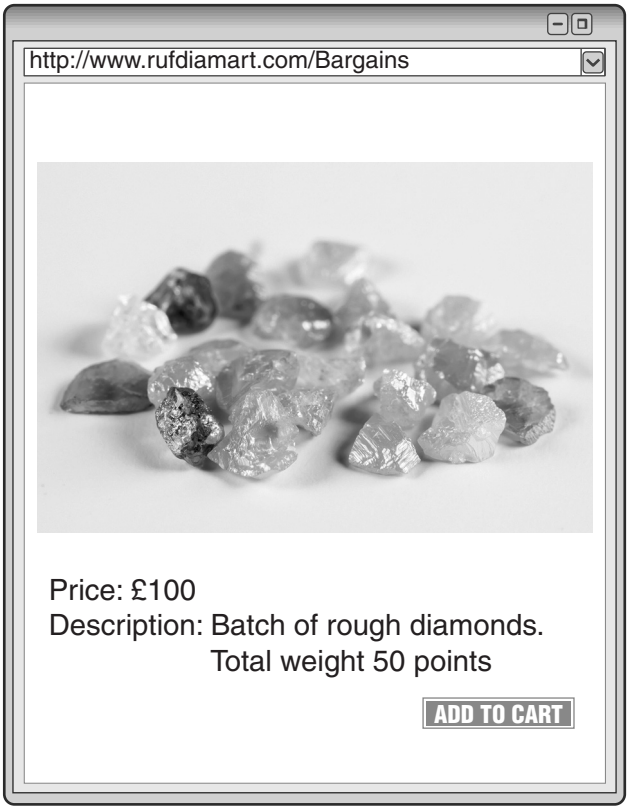
(ii) _____ **[1]**

(b)*

Diamonds are weighed in carats or points. We use points in this shop.

Each diamond that we sell in a ring or in earrings weighs between 10 points and 150 points.

Josh finds this advert for rough diamonds.



Would this batch of rough diamonds be suitable for cutting into diamonds for rings and earrings?

Support your answer with some calculations.

_____

_____

_____

_____

_____

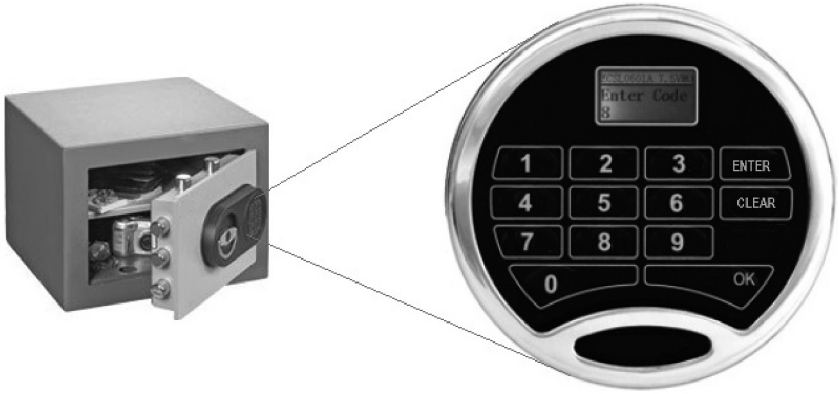
_____ **[3]**

(c) Josh helps in the jeweller's workshop.

Image has been removed due to third party copyright restrictions.

Details: Two persons in a jewellery workshop.

The code on the diamond safe is changed each week.
Josh is asked to suggest the last six digits of the code for the next week.



(i) Josh's birth date is 20/5/96.
He uses his birth date to help him remember the last six digits of the code.

- The first pair of digits of Josh's code is the next prime number after the day of his birth.
- The middle pair of digits is the square of his birth month.
- The last pair of digits is the square root of four more than his year of birth.

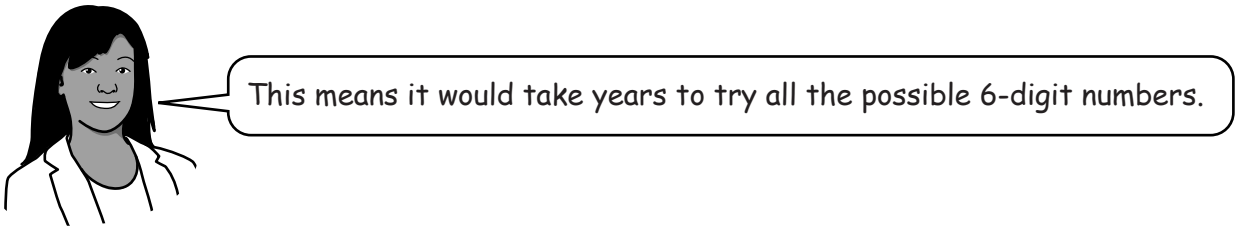
What are the last 6-digits of the safe's code number?

(c)(i)_____ _____ _____ **[3]**

(ii)* With a 6-digit code number there are one million possible codes!

For added security, if the wrong 6-digit number is entered, the safe does not allow another number to be keyed in for 10 minutes.

Lucy says:



Is Lucy right?

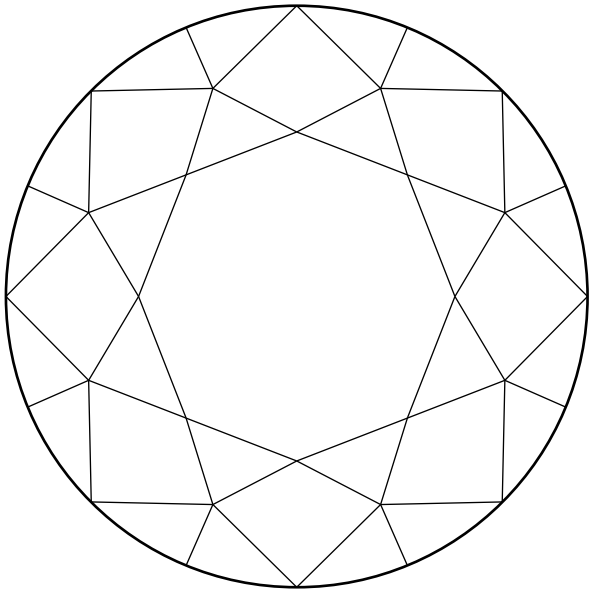
_____

_____

_____

_____ **[4]**

(d) This is the top view of a Round Brilliant Cut diamond.



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On the diagram clearly mark

(i) an acute angle, label it A, **[1]**

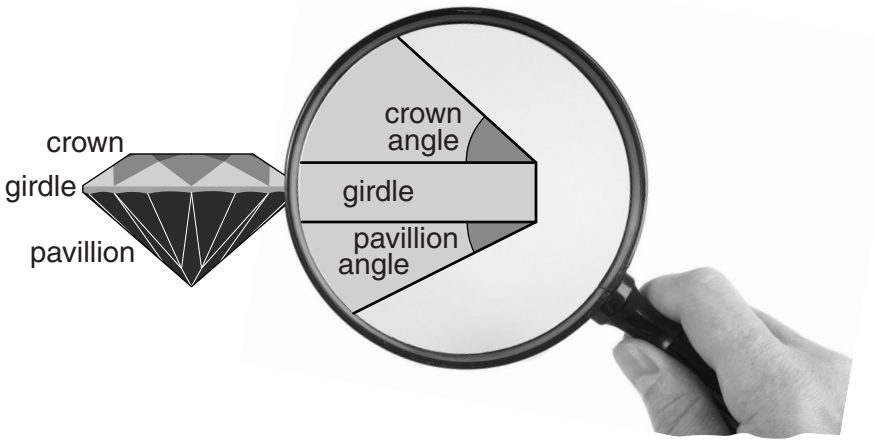
(ii) a kite, label it K, **[1]**

(iii) an octagon, label it O, **[1]**

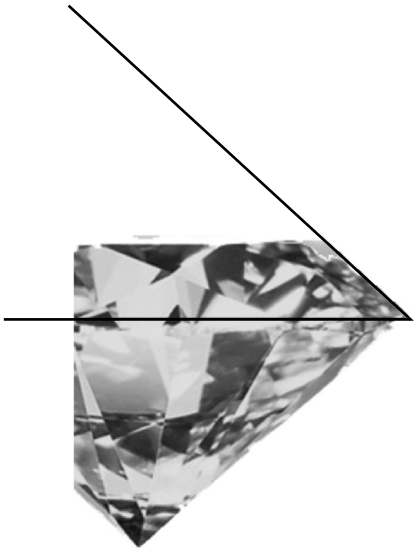
(iv) a pair of congruent shapes, label both shapes C. **[1]**

(e)

These are the important parts of the most popular cut of diamond.
It is called the Round Brilliant Cut.

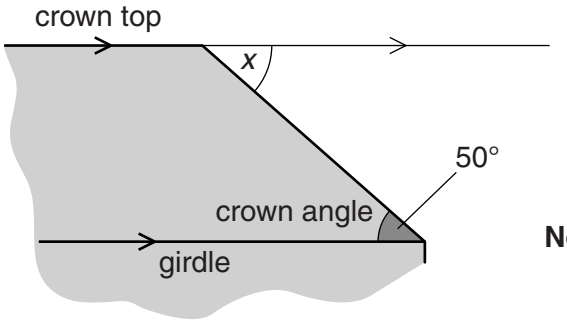


(i) Measure the crown angle of this diamond viewed under a microscope.



(e)(i) _____ ° **[1]**

(ii) The crown angle for a different diamond is 50°.
The crown top is parallel to the girdle

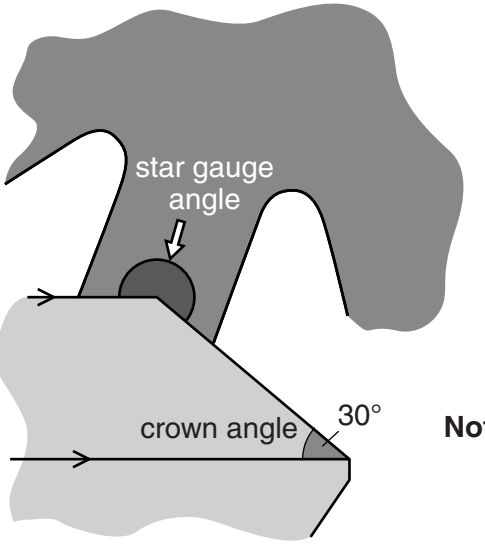


Not to scale

Find the size of the angle marked *x*.

(ii) _____ ° **[1]**

(iii) Jewellers use a star gauge like this one to find crown angles.

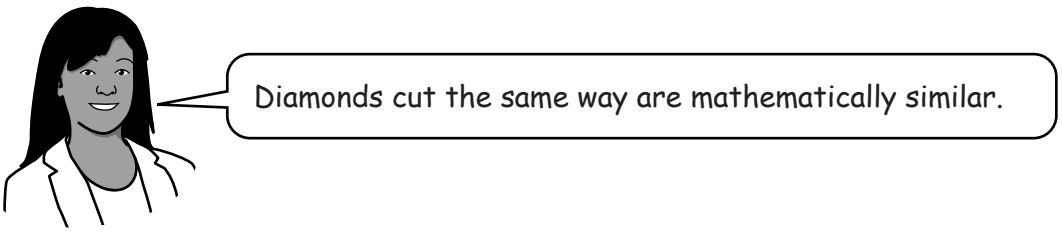


Not to scale

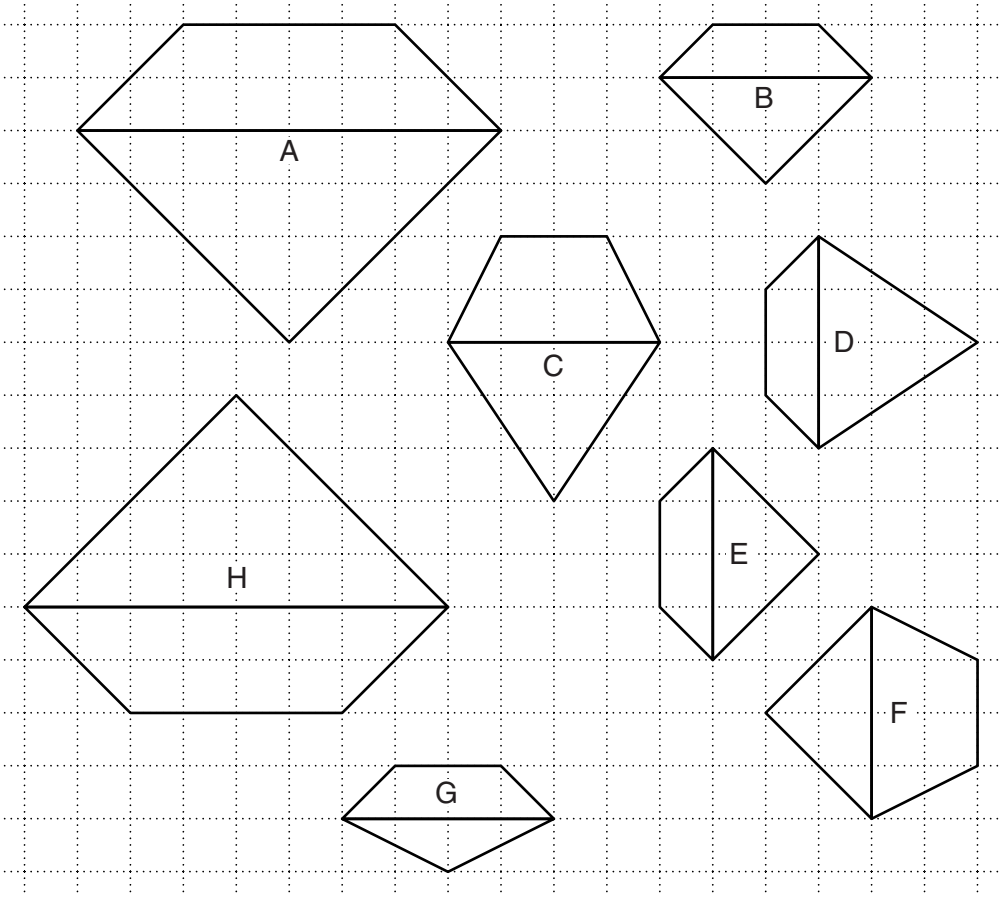
Work out the star gauge angle for a crown angle of 30°.

(iii) _____ ° **[2]**

(f)



Here are the outlines of some diamonds, enlarged and seen from the side.

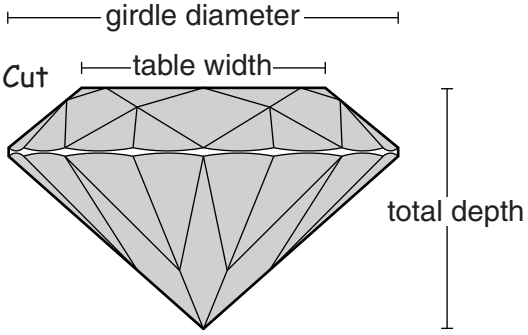


Which of the diamonds are similar to diamond A?
Put a tick (✓) inside the outline if it is similar or a cross (✗) if it is not similar to A. **[3]**

(g)

How much a diamond sparkles depends on how it is cut.

A good quality Round Brilliant Cut diamond should have:



- a crown angle of 34.5°
- a table width 55% of the girdle diameter
- a total depth 0.6 (or $\frac{3}{5}$) of the total girdle diameter

A large Round Brilliant Cut diamond has a girdle diameter of 8 mm.

(i) What should the total depth be?

(g)(i) _____ mm **[1]**

(ii) What should the table width be?

(ii) _____ mm **[2]**

(h) One of Josh's jobs is to help with people's ring size.

Each UK ring size is given a letter, A, B, C, etc. A is number 1, B is number 2, C is number 3 and so on. The inside diameter of a ring in millimetres = (UK size number × 0.4) + 11.5 So a UK size B ring has an inside diameter of (2 × 0.4) + 11.5 = 12.3 mm

(i) To help, Josh draws up a table converting ring size letters into inside ring diameters.

Use the formula to complete this part of his table.

UK ring size	Number	Inside ring diameter (mm)
A	1	11.9
B	2	12.3
C	3	
D	4	13.1
E	5	13.5
F	6	13.9

[1]

(ii) European ring sizes are worked out differently.

To work out the European ring size
• Calculate (inside diameter of ring in millimetres) × 3.142 • Round your answer correct to two decimal places

A customer's UK ring size is E.

What is this as a European ring size?

(h)(ii) _____ mm **[2]**

2 Plastic cards have many uses.
These include credit, library, identity and gift cards.

(a) A man in California uses 1497 plastic credit cards.

(i) How many grams do all these cards weigh?

(a)(i) _____ g **[1]**

(ii) How many credit cards would be needed to make a stack 1 metre tall?
Remember that 1 metre is 1000 millimetres.

(ii) _____ **[2]**

There are over 100 000 000 plastic cards in the UK.

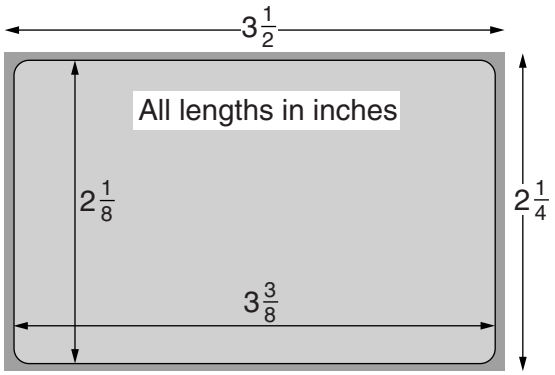
(b) Complete this statement to write 100 000 000 as a power of 10.

(b) $100\,000\,000 = 10^{\square}$ **[1]**

(c) Plastic cards have round corners.

The cards are cut from a plastic rectangle measuring

$3\frac{1}{2}$ inches by $2\frac{1}{4}$ inches.



Not to scale

(i) Calculate the difference in length between the height of the plastic rectangle ($2\frac{1}{4}$ inches) and the height of the plastic card ($2\frac{1}{8}$ inches).

(c)(i) _____ inches **[1]**

(ii) The straight border (the dark grey region) between the plastic rectangle and the card is the same width all the way round.

Calculate the width of the straight border.

(ii) _____ inches **[2]**

(d) Millions of plastic cards are thrown away each year.
However they can be used to make things.

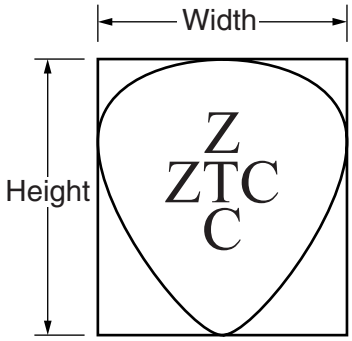
Guitar picks can be made from old plastic cards.

The picks are cut out
using a special punch.

Amy wonders if it might be worthwhile making and selling guitar picks made from old plastic cards.
The plastic cards will cost her nothing!

(i) The 351 is the most popular shape of pick.
This is an accurate drawing of a 351 pick.

Measure its width and height.



(d)(i) Width _____ mm

Height _____ mm **[1]**

Amy looks on the internet to see what guitar picks cost.

(ii) Amy thinks about selling her guitar picks at half the price of the internet ones.

What does she plan to sell **one** of her guitar picks for?

(ii) _____ p **[2]**

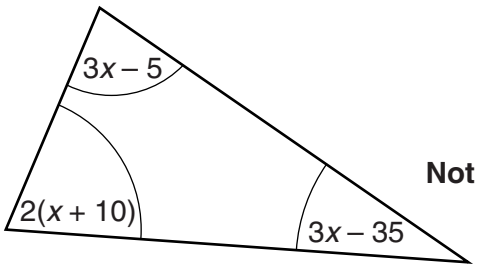
(iii) A guitar pick punch will cost Amy £14.
Remember the plastic cards cost her nothing.

How many picks will she have to sell to break even?

(iii) _____ **[2]**

3 Solve this puzzle that Tim found in an old maths workbook.

The diagram shows a sketch of a triangle.
Expressions for each of the three angles are given.



Not to scale

(a) Find an expression, in terms of x, for the sum of the three angles.
Simplify your answer.

(a) _____ **[2]**

(b) Form an equation in x and solve it.

(b) _____ **[2]**

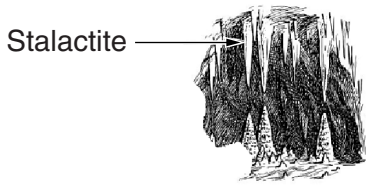
(c) Use your value of x to find the size of each of the angles.

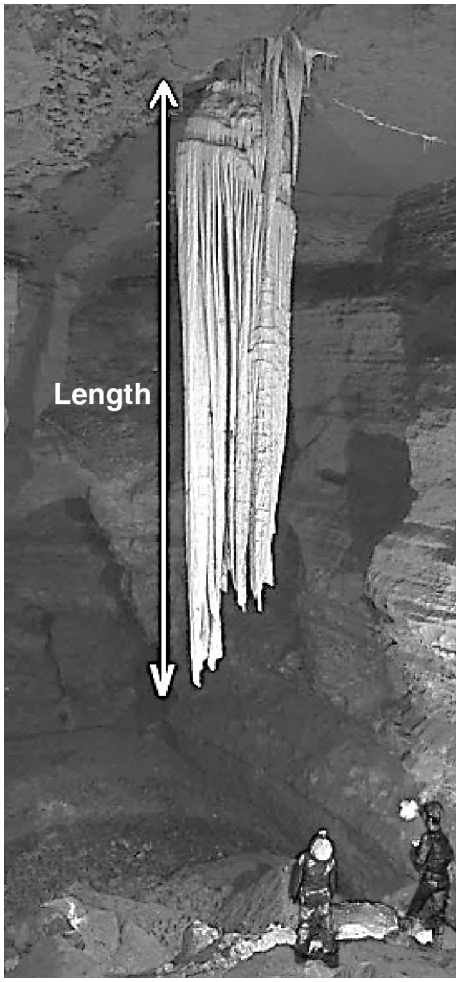
(c) _____° _____° _____° **[3]**

(d) Write down the correct mathematical name for this type of triangle.

(d) _____ **[1]**

4 Stalactites are formed on cave roofs by slowly dripping water.





This is a photo of two people standing beneath one of the largest stalactites in the world.
It is in Doolan, Ireland.

(a) Estimate the length of the stalactite.
Remember to include the units of your estimate.

(a) _____ _____ **[2]**

(b) Geologists are able to predict how the lengths of some stalactites grow over time.

For some caves in France the rule is

$$L = 0.5 \times t + 300$$

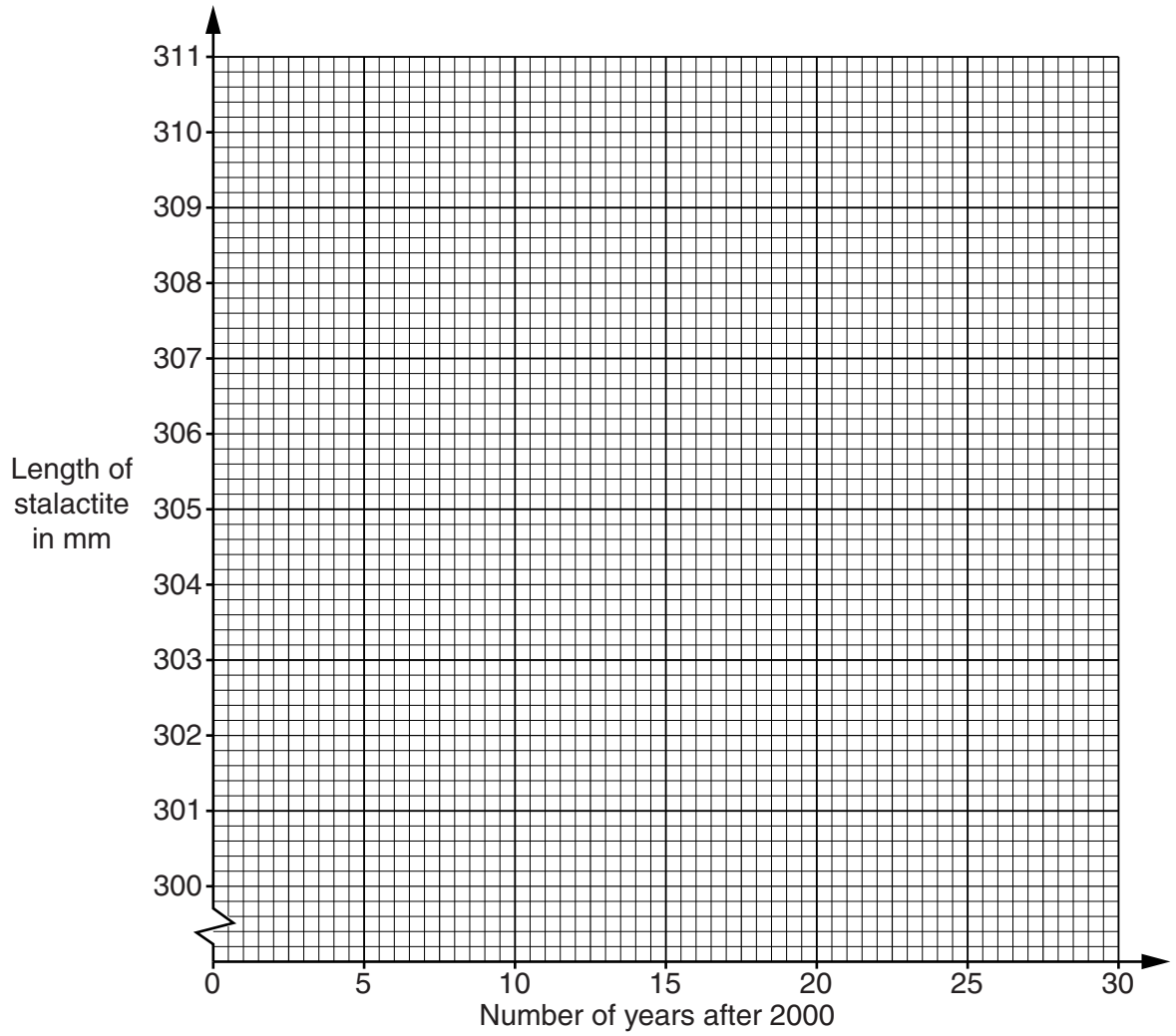
L is the length, in mm, of the stalactite,
t is the number of years after the year 2000.

(i) Complete this table showing the length of the stalactite for some years after 2000.

Years after 2000 (t)	0	5	10	20
Length of stalactite (L mm)		302.5		310

[2]

(ii) Plot the four points in the table on the grid below.
Join the four points, making a straight line graph.



[2]

(iii) In what year would the stalactite be 304 mm long?

(b)(iii) _____ **[1]**

(iv) How much does the stalactite grow each year?

(iv) _____ mm **[1]**

TURN OVER FOR part (v)

(v) Use your answer to part **(a)** to estimate the age of the Doolan stalactite.
Assume that the Doolan stalactite grows at the same rate as the ones in France.

(v) _____years **[2]**

(c) Most caves keep an almost constant temperature all year round.

This is the temperature reading on a digital thermometer which is accurate to the nearest degree. It shows the temperature in a cave.

Circle the four temperatures in the box below which would fit the temperature given by the digital thermometer.

11.7	12.01	12.45	12.7	12.07	11.07

[1]

END OF QUESTION PAPER