Let's think about polygons

If you look at these raised flower beds from above, what kind of shapes do you see?







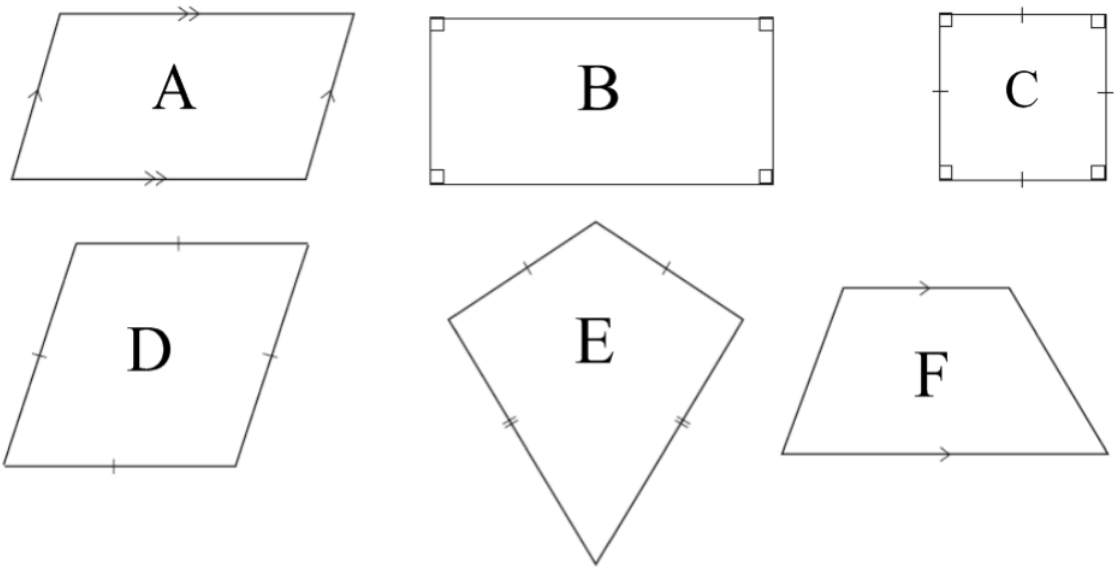






Let's think about quadrilaterals

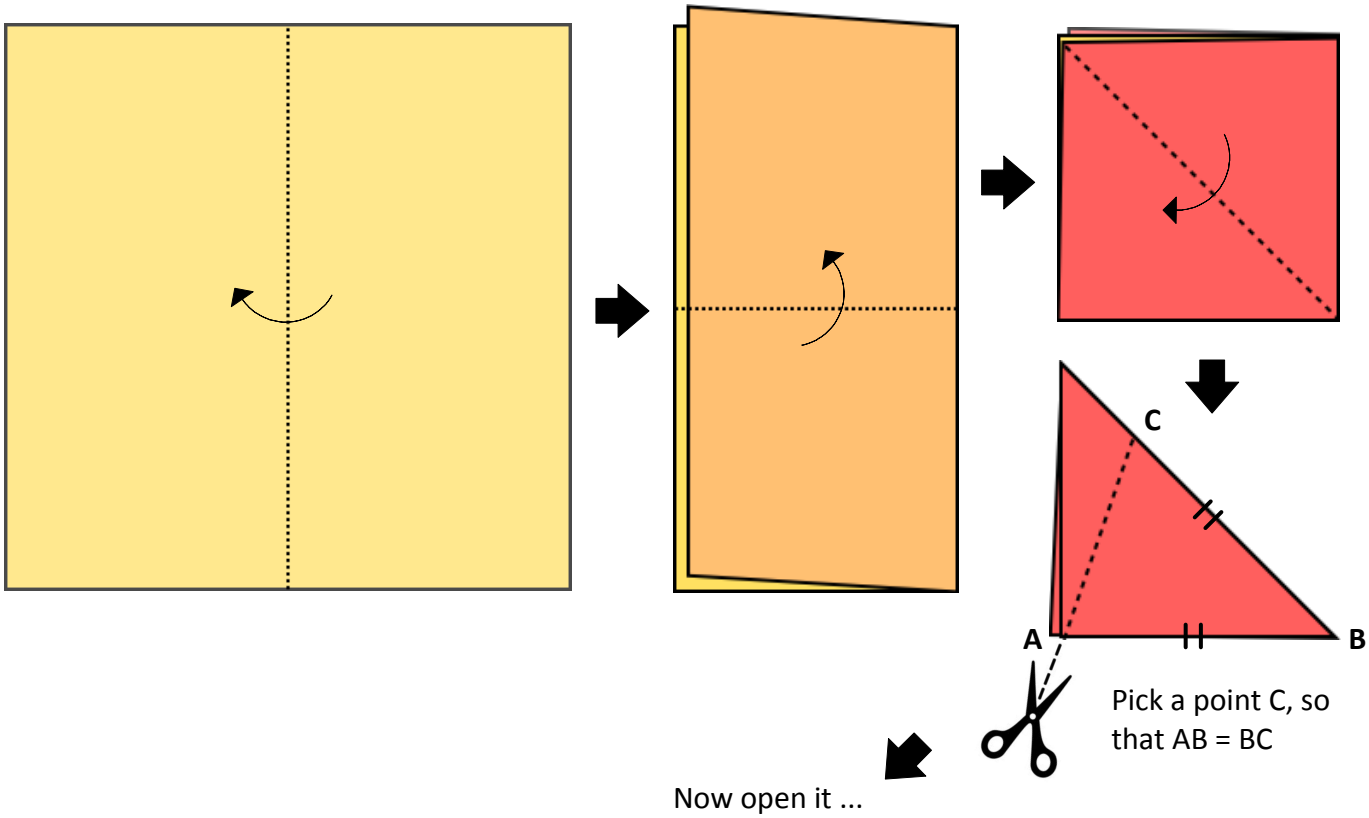
Several quadrilaterals are shown below. Choose the quadrilaterals that share characteristics with shape C and write down the characteristics.



Mathematical feature in common with C	**A**	**B**	**C**	**D**	**E**	**F**
4 sides	✓	✓	✓	✓	✓	✓

Let's think about polygons

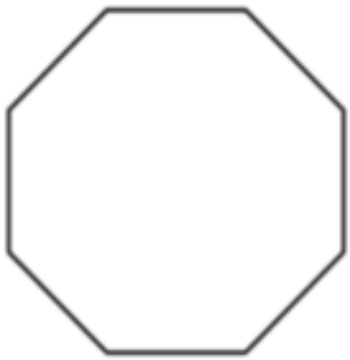
Cut a square piece of paper after folding it three time, as shown here.





Alice

It's an 8 sided figure.
So it's an octagon.

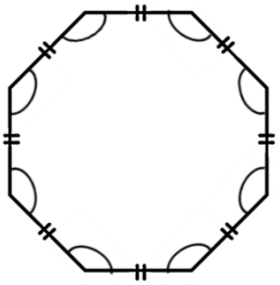


1 Investigate the properties of the octagon you created.

1. Measure the length of each side
2. Measure each angle
3. Find the centre of the octagon
4. Why is this shape called a regular octagon?

Polygons

All 8 sides you created on the previous page were all equal in length.
All of the angles were also the same. Polygons with these properties are called regular polygons.

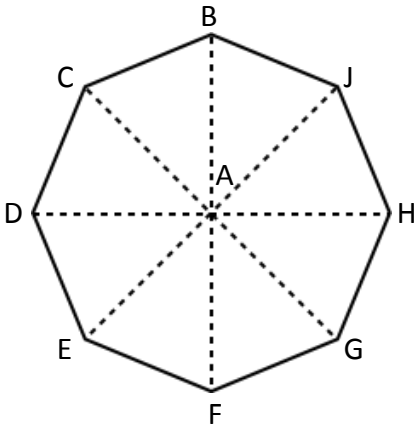


2 Think about how to draw a regular octagon



Evie

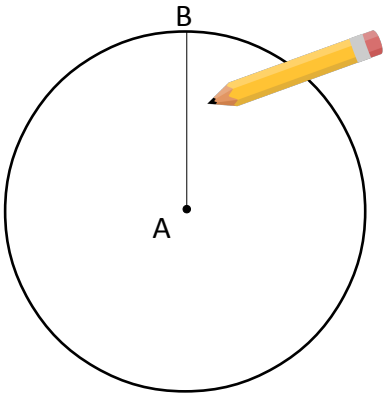
I labelled the vertices on my octagon and then found the centre by joining opposite vertices.
The distance from A to any of the vertices is always the same.





Amber

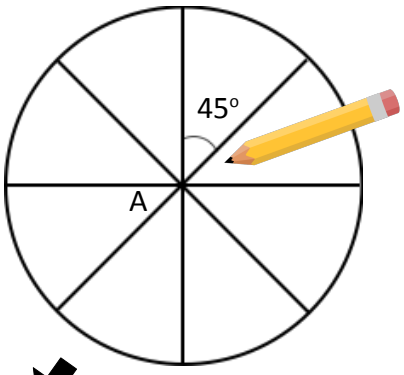
So maybe we should draw a circle, centre A and radius equal to the length AB.

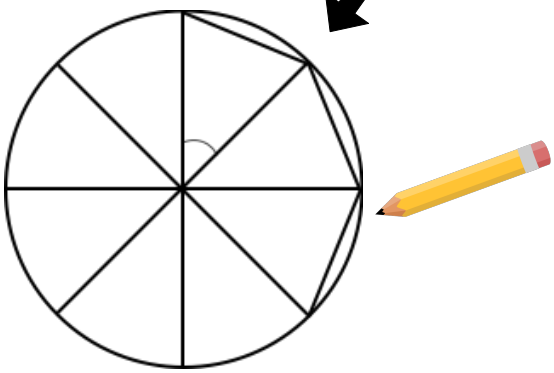




Jon

Then divide the angle at the centre into 8 equal parts. That's $360^o \div 8 = 45^o$







Alice

Now, join up the vertices to make 8 triangles.

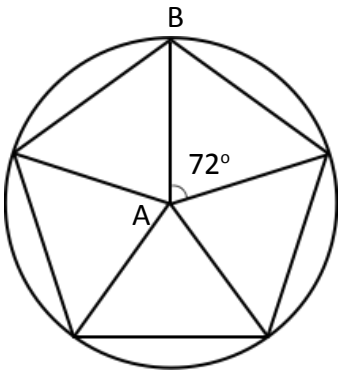
3 Draw a regular octagon of your own using this method.
Start with a circle of radius 4 cm.

4 Using this method of equally dividing the angle around the centre of a circle, can you draw a regular pentagon and a regular hexagon? Begin with a circle of radius 4 cm.



Evie

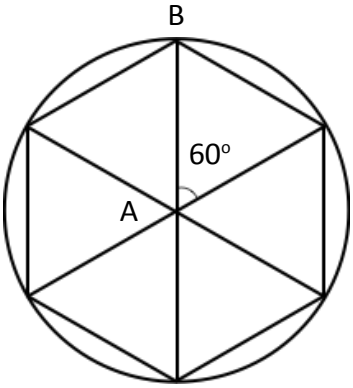
For a regular pentagon, the angle at the centre will be $360^o \div 5 = 72^o$





Amber

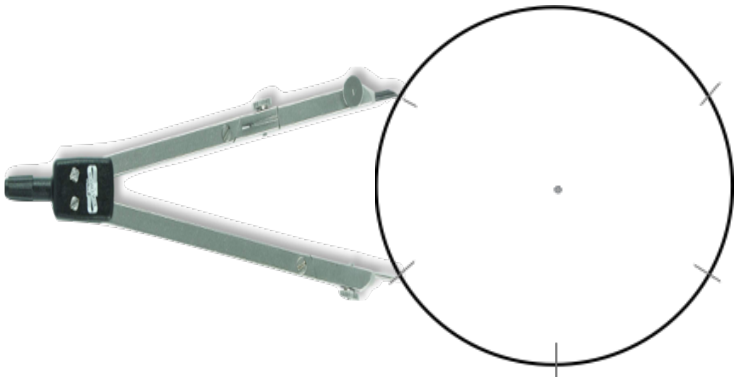
For a regular hexagon, the angle at the centre will be $360^o \div 6 = 60^o$

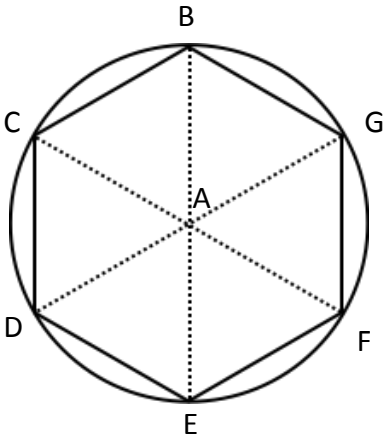




Matthew

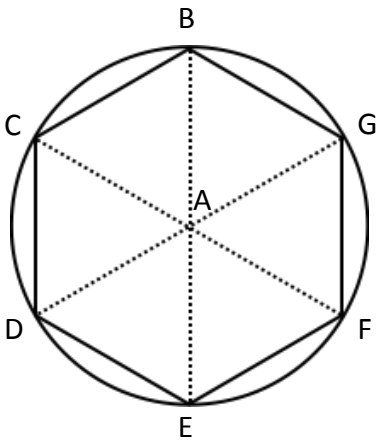
I've found a different way of drawing a regular hexagon. Just draw a circle and then use your compass to divide the circle into six equal parts without changing your compass setting.





5 Draw a regular hexagon using Matthew's method. Start with a circle with a radius of 4 cm.

6 Can you explain why Matthew's method works?





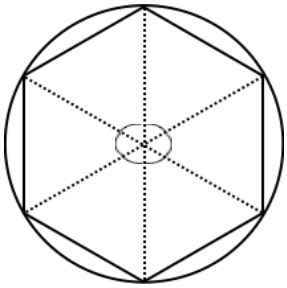
Jon

It might have something to do with the six triangles. For example, triangle ABC is an ...



Alice

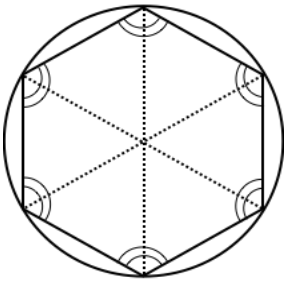
Since the 6 triangles are all congruent, the measures of the angles formed around the centre of the circle are ...





Sarah

Since the 6 triangles are all congruent equilateral triangles, the lengths of the sides of the hexagon are all equal to the radius, and the measures of the 6 angles are also...





Evie

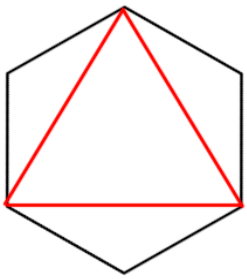
I've noticed something else. If you connect every other vertex of the hexagon, you get ...

7 What did Evie notice?



Matthew

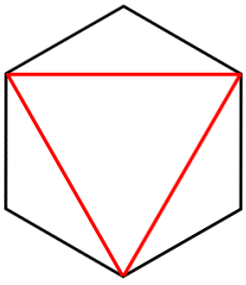
You get an equilateral triangle.



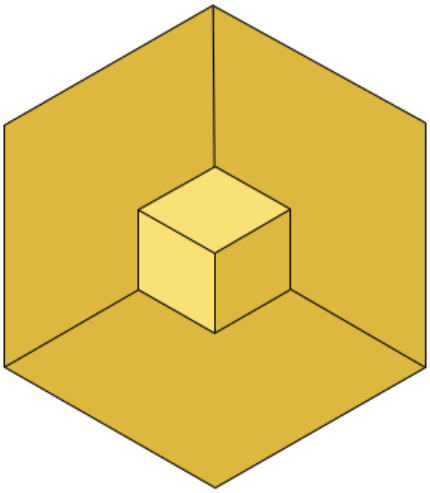


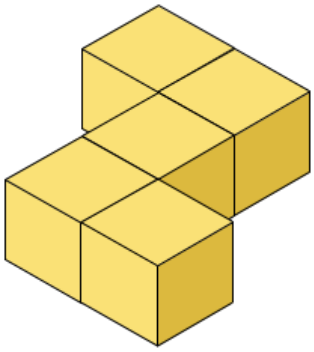
Amber

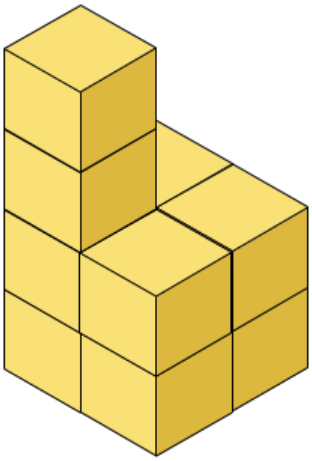
And it doesn't matter where you start!

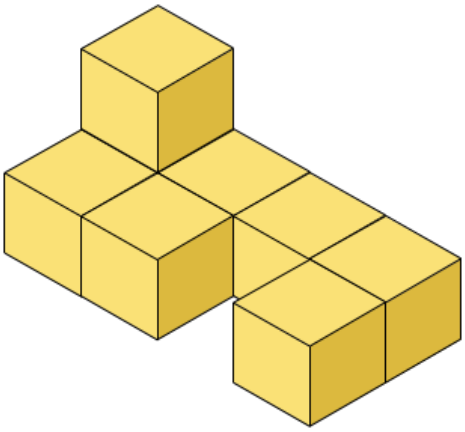


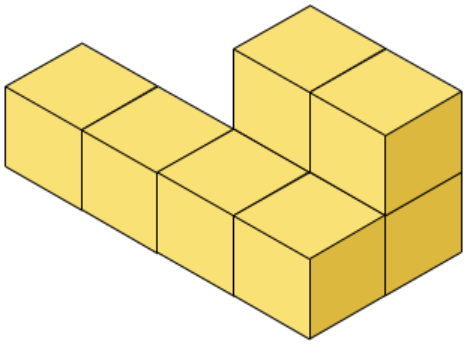
Describe what you see.

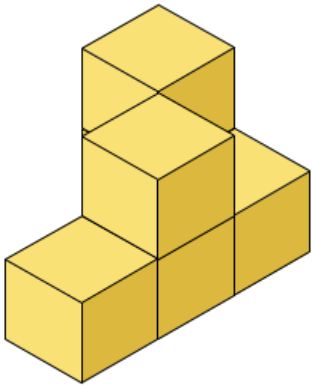








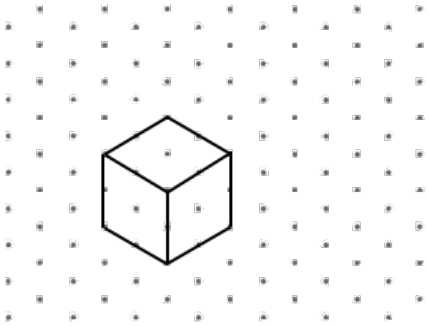




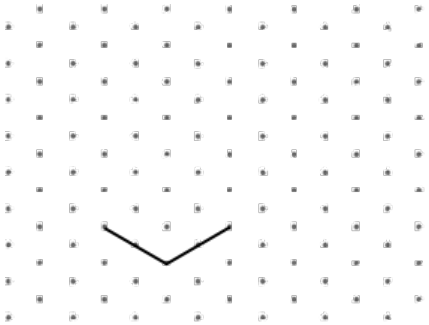
8 In each case, decide how many cubes you would need to build the model.

Isometric paper

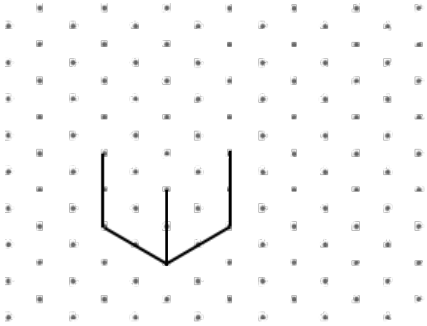
The dots on isometric paper are arranged at the corners of equilateral triangles.
Isometric paper is useful for representing 3D shapes with a 2D diagram.
For example, this diagram represents a cube.



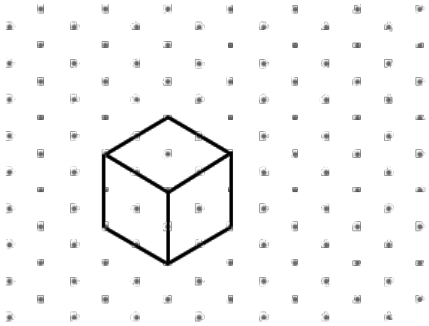
First draw the base



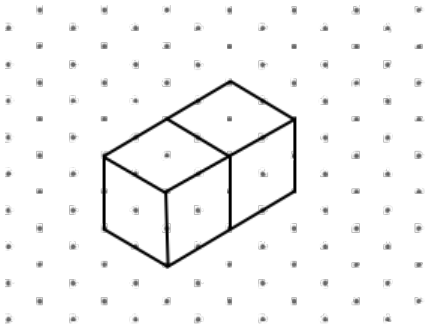
Now add the uprights



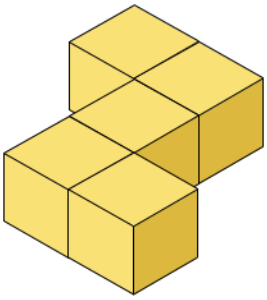
Now add the top

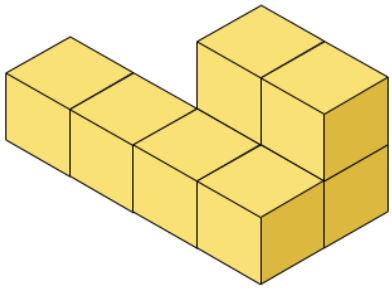


Try adding a second cube



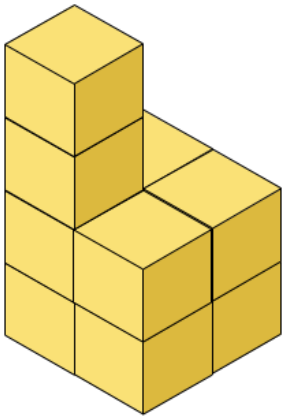
9 Using isometric paper, try to draw these two shapes.





Base designs

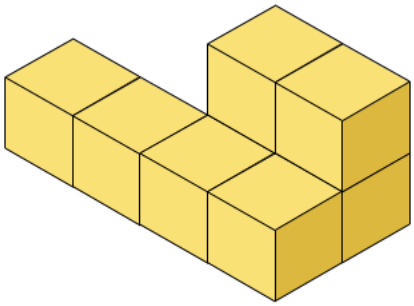
In the drawings below, the drawing on the left shows the shape. The drawing on the right tells you how many cubes are on each base square. The drawing on the right is called a base design.



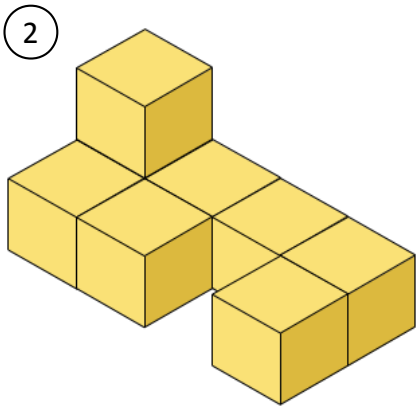
2	2
4	2

What would be the base designs for these two shapes?

1



2





Evie

Evie's solution

1

0	0	2	2
1	1	1	1

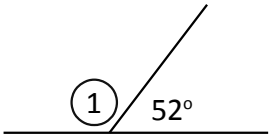
2

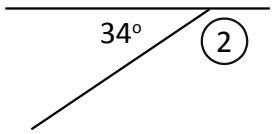
2	1	1	1
1	1	0	1

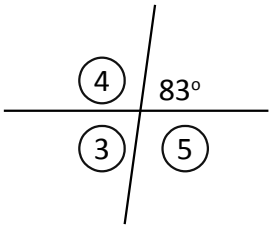
8 Would you be able to draw the shape if you are given the base design?

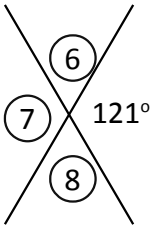
What do you remember about angles?

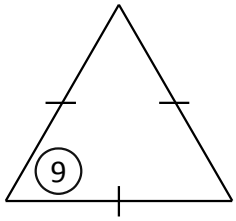
In each of these diagrams, find the missing angles.

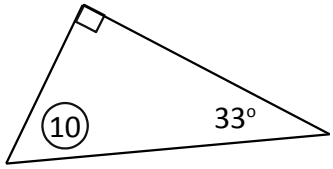


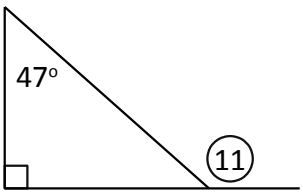


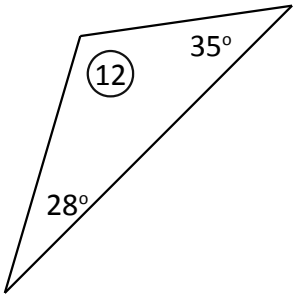


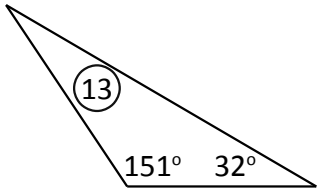


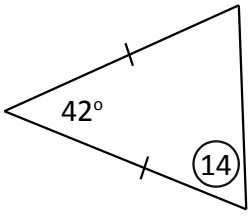


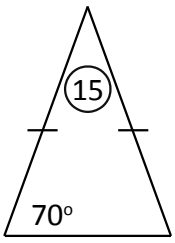


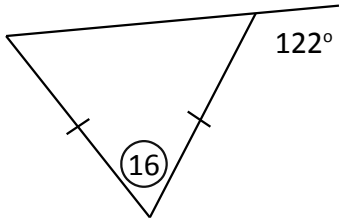






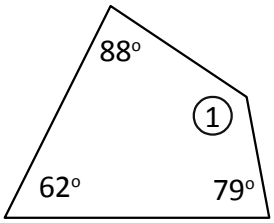


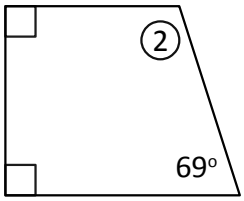


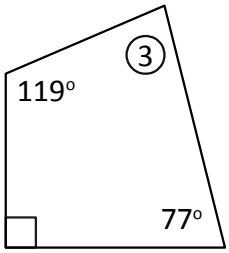


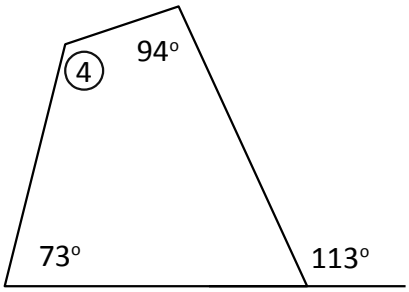
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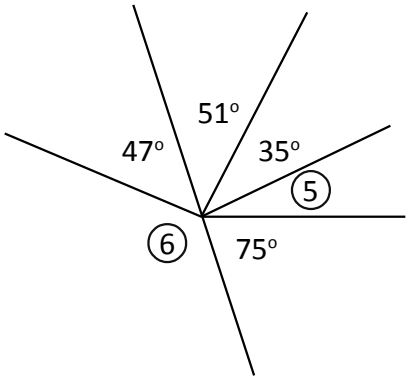
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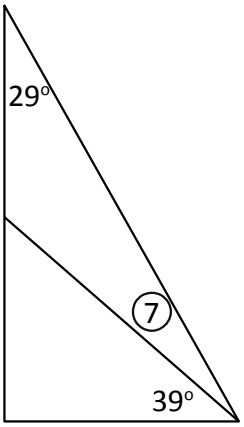


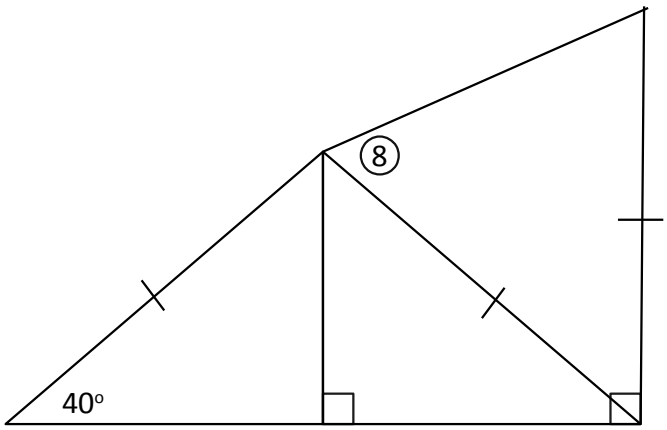


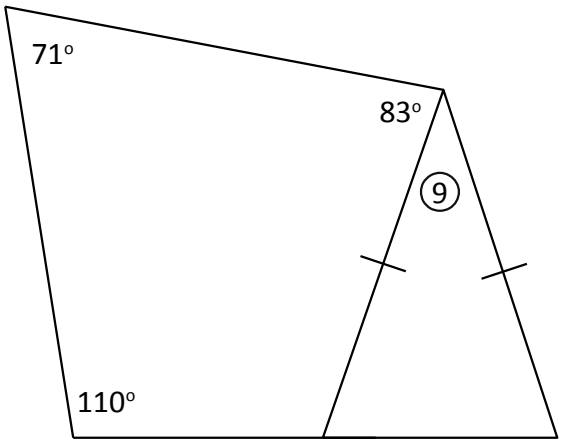






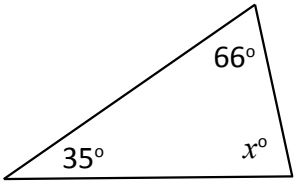






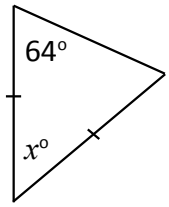
Geometry 3a: Mastery questions

1. What is the size of the missing angle?



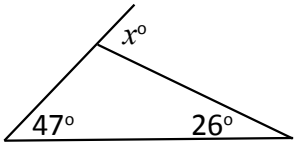
A	101°	B	79°	C	89°	D	91°

2. What is the size of the missing angle?



A	64°	B	180°	C	116°	D	52°

3. What is the size of the missing angle?



A	47°	B	107°	C	73°	D	26°

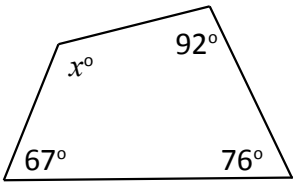
4. What is the greatest number of obtuse angles you can have in a triangle?

A	0	B	1	C	2	D	3

5. What is the greatest number of obtuse angles you can have in a quadrilateral?

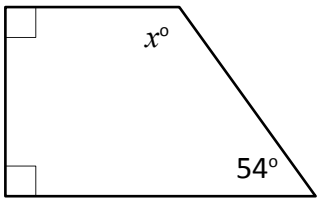
A	1	B	2	C	3	D	4

6. What is the size of the missing angle?



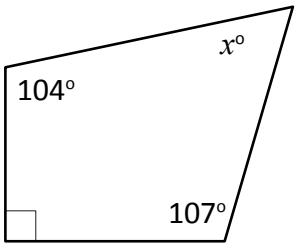
A	110°	B	125°	C	76°	D	67°

7. What is the size of the missing angle?



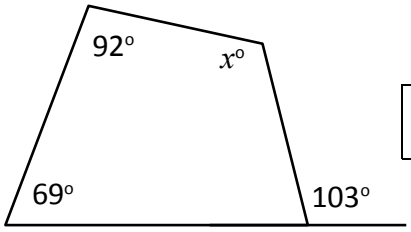
A	106°	B	116°	C	126°	D	34°

8. What is the size of the missing angle?



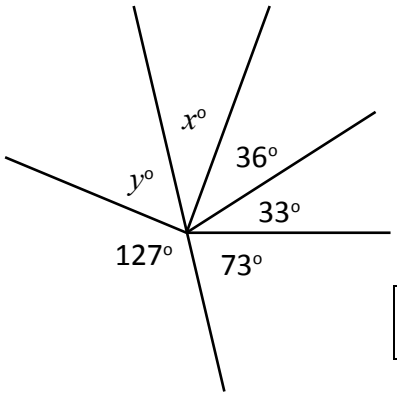
A	59°	B	73°	C	76°	D	49°

9. What is the size of the missing angle?



A	96°	B	122°	C	78°	D	103°

10. What is the value of x in this diagram?



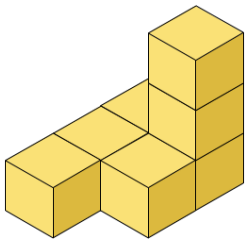
A	38°	B	53°	C	48°	D	63°

11. In the same diagram, what is the value of y?

A	38°	B	53°	C	48°	D	63°

Geometry 3a: Mastery questions

12. Which of these is the base diagram for this model?



A

1	1	2
0	1	3

B

0	1	3
1	1	1

C

1	1	1
0	1	3

D

1	1	3
0	1	1

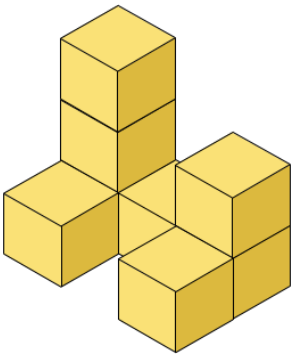
13. The model in Q11 is made of 2cm cubes. How high is the model?

A	3cm	B	6cm	C	9cm	D	12cm

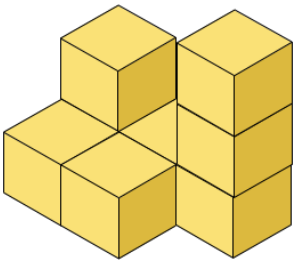
14. Which of these models is represented by this base diagram?

2	1	3
1	0	1

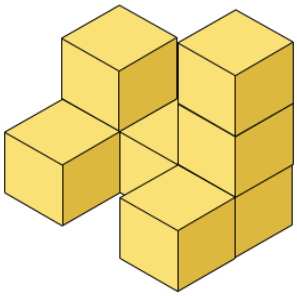
A



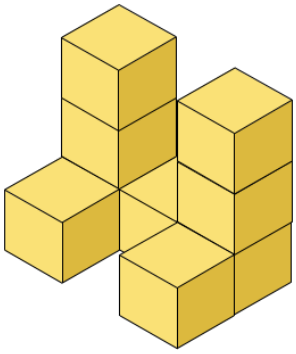
B



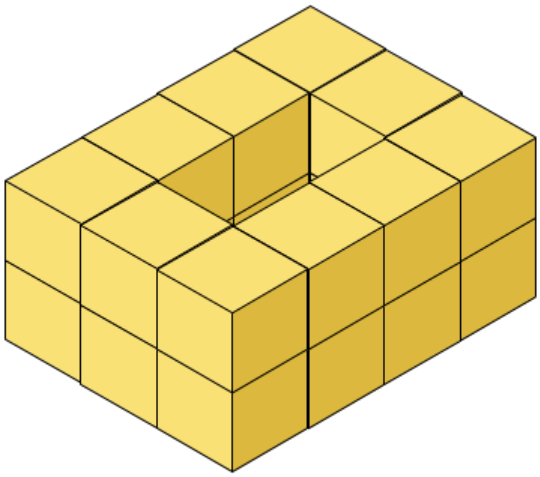
C



D

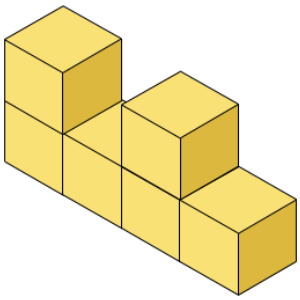


15. As shown below, a cuboid has a 2 cm by 2 cm by 1 cm hole in the middle.

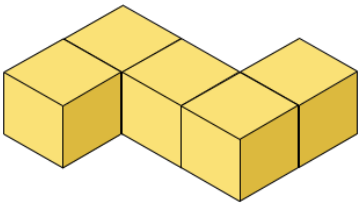


Which one of these shapes would be able to fit through the hole?

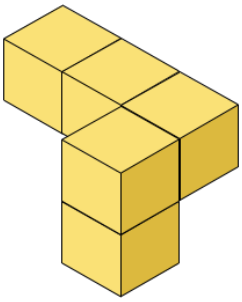
A



B



C



D

