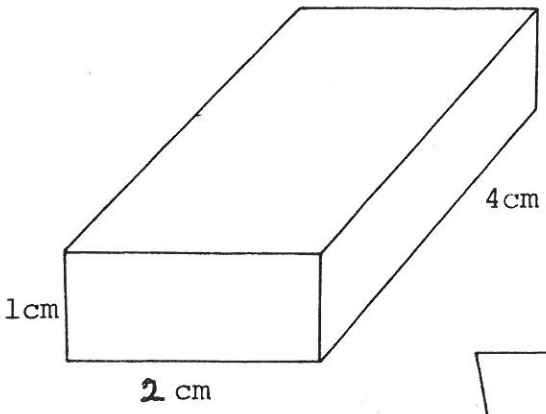
SMILE WORKCARDS

Drawing Pack Two

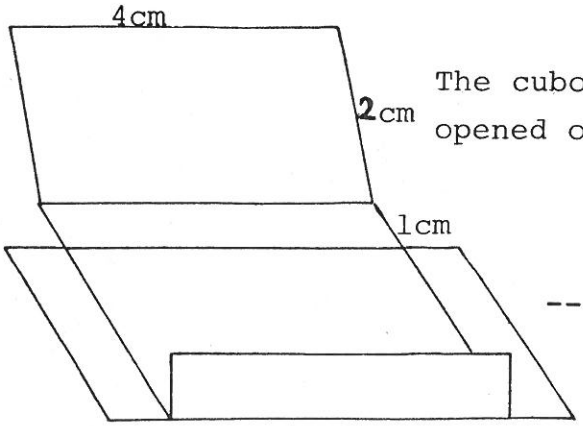
Contents

You will need: cm squared paper, scissors, sellotape

CUBOID NETS

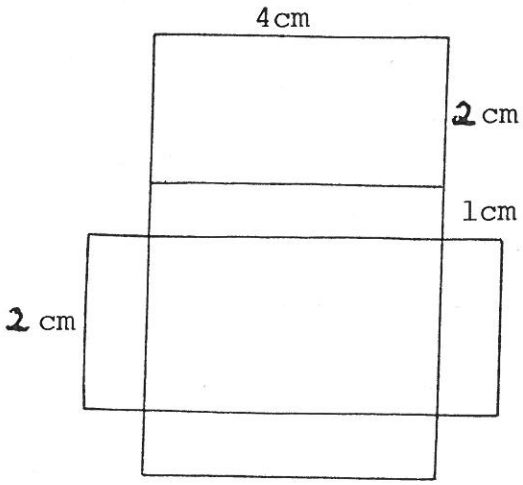


Look at this box. It is called a cuboid.
How many faces has it?
What shape are they?



The cuboid is being opened out -------

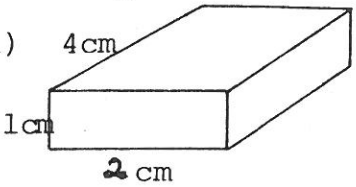
---- here is its net.



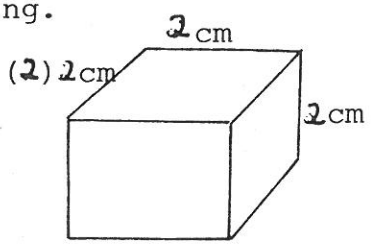
(1) Draw this net accurately.
(2) Cut it out.
(3) Fold it into a cuboid.

Draw the nets of these cuboids; check they are right by cutting and folding.

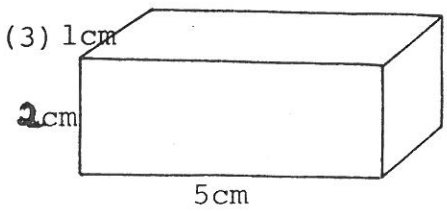
(1)



(2)



(3)



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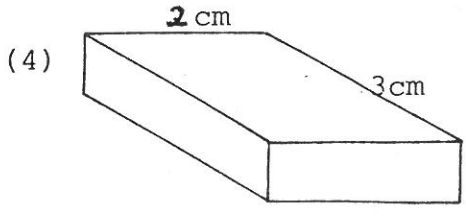
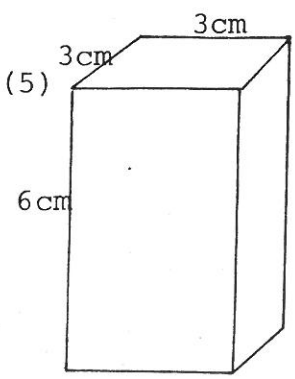


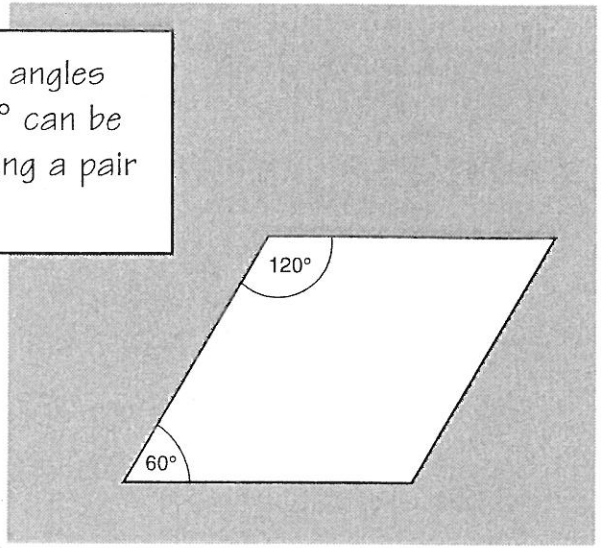
(5)



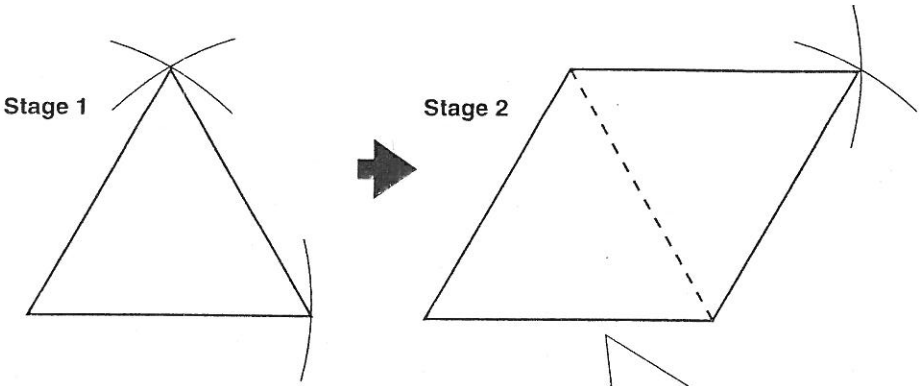
Start with 60°

You will need: a pair of compasses, a sharp pencil and a ruler.

A rhombus with angles of 120° and 60° can be constructed using a pair of compasses.



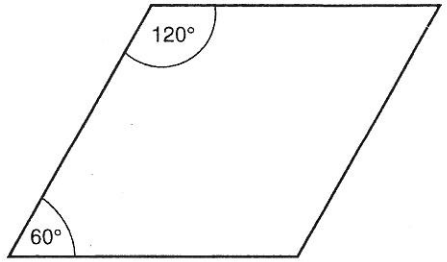
There are two stages.



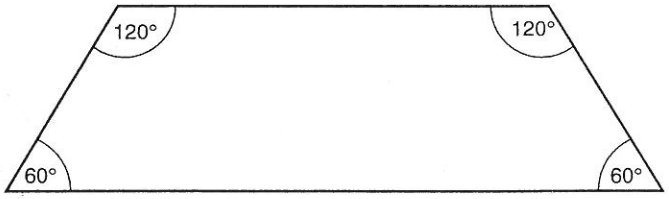
A reminder of how to construct an angle of 60° using a pair of compasses is on the back page.

1 Use this method to construct:

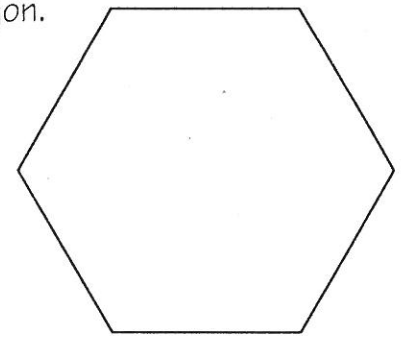
a) a similar rhombus



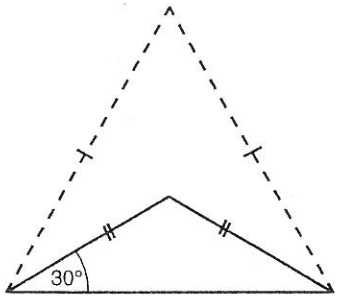
b) a trapezium



c) a regular hexagon.



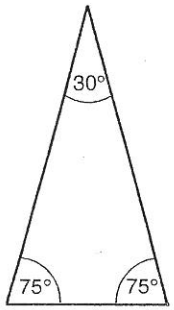
2 Construct an isosceles triangle with angles of 30°.

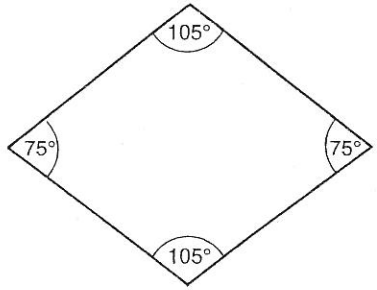


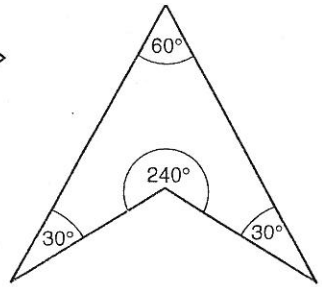
See the back page for a reminder of how to bisect an angle.

CHALLENGE

Construct these using only a pair of compasses, a sharp pencil and a ruler.

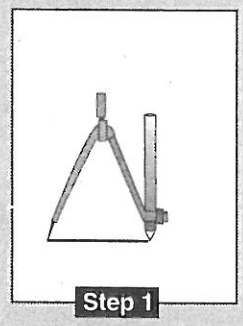




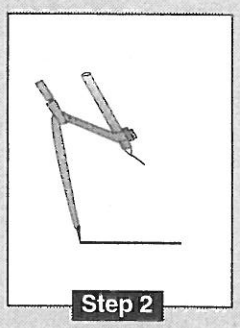


Do not use an angle indicator.

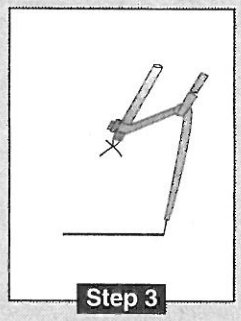
Constructing 60° angles.



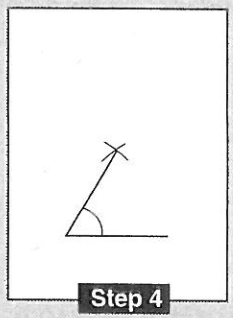
Draw a line.
Open the compasses to the same length as the line.



Put the point of the compasses at one end of the line.
Draw an arc.



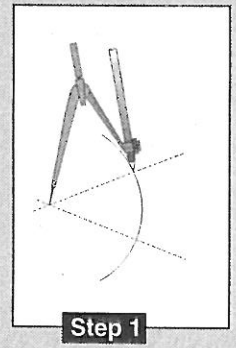
Put the point of the compasses at the other end of the line.
Draw an arc which intersects the first arc.



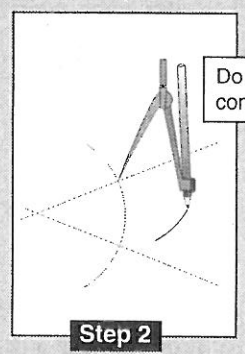
Join the point of intersection to one end of the line.
Check that the angle measures 60°.

Bisecting an angle.

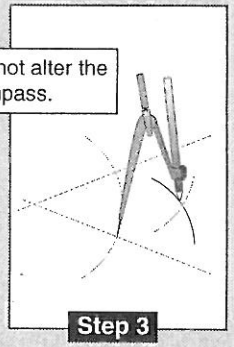
Begin with any angle.



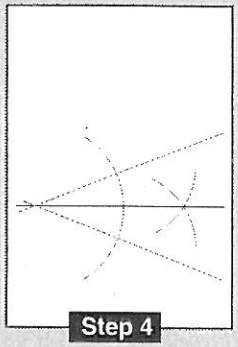
Draw an arc.



Draw an arc.



Draw another arc.



Draw a straight line.

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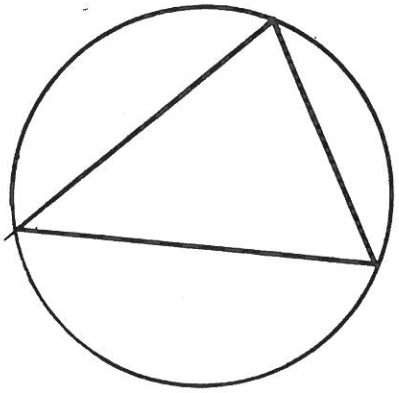
You will need: ruler compass sharp pencil

The Circumcircle



Here is a triangle and its circumcircle.

The centre of this circumcircle is where the perpendicular bisectors of the 3 sides of the triangle meet.

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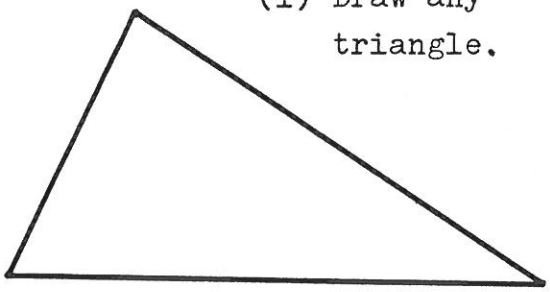
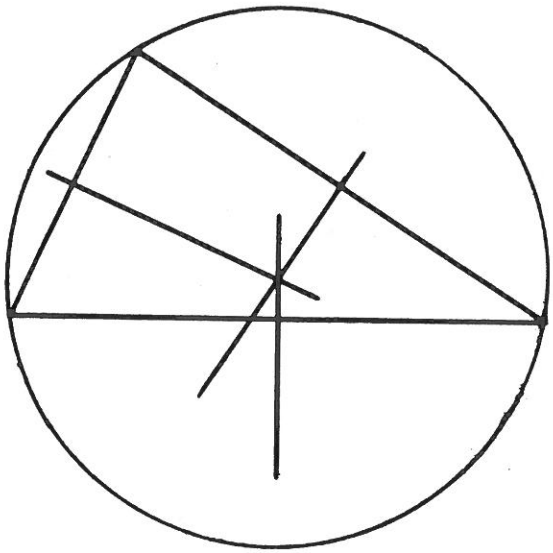
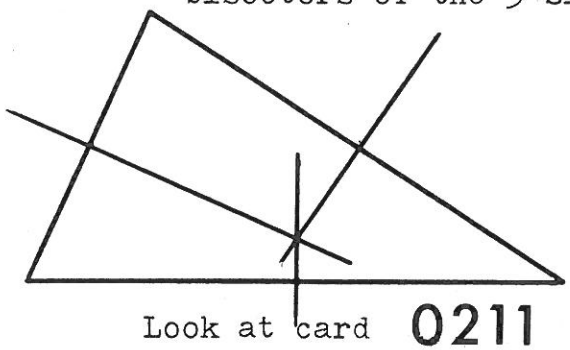
(1) Draw any triangle.





(2) Draw the perpendicular bisectors of the 3 sides.



Look at card **0211** if you need a reminder.

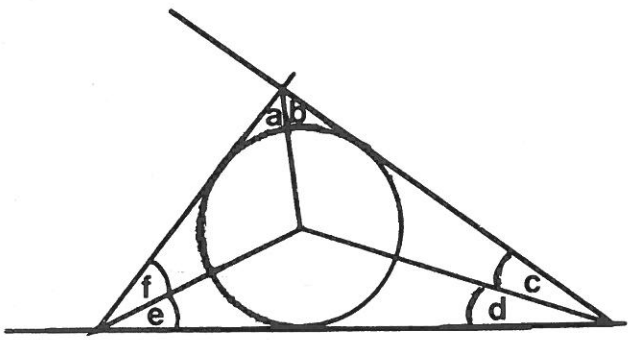
(3) Draw in the circumcircle so that it passes through each vertex of the triangle.

Draw the circumcircles of 2 acute-angled triangles, 2 obtuse-angled triangles, and 2 right-angled triangles.
Where do the centres of the circumcircles lie for these triangles?

ilea
© 1974

You will need: compasses, protractor, sharp pencil

Inscribed Circle



(1) Draw a circle.
(2) Draw a triangle so that each side touches the circle.
(3) Draw straight lines from the centre of the circle to each vertex of the triangle.

(4) Measure angles a, b, c, d, e, f.
(5) Repeat this with another triangle drawn around a circle. Notice anything?
(6) So what are the straight lines called that you drew in (3)?

The centre of the inscribed circle is where the three angle bisectors meet.

(7) Now draw any triangle.
(8) Construct the 3 angle bisectors.

(see card 0212 for a reminder)

They should meet in one point.

(9) Draw the inscribed circle.
(10) Repeat this with a different triangle.

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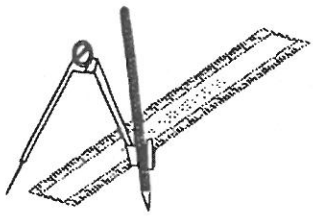
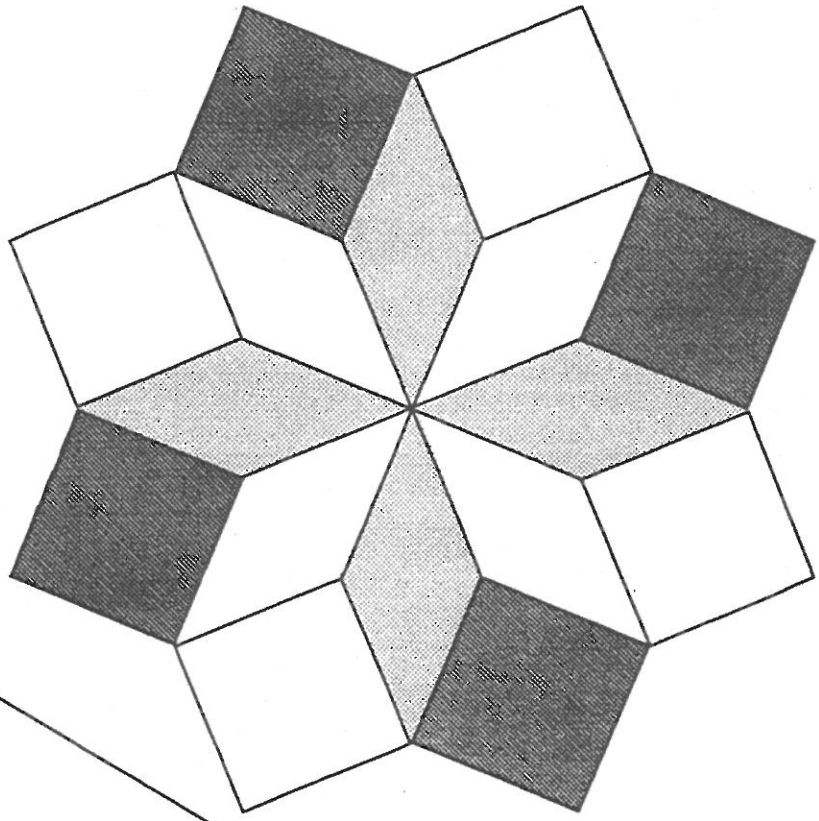
©1974

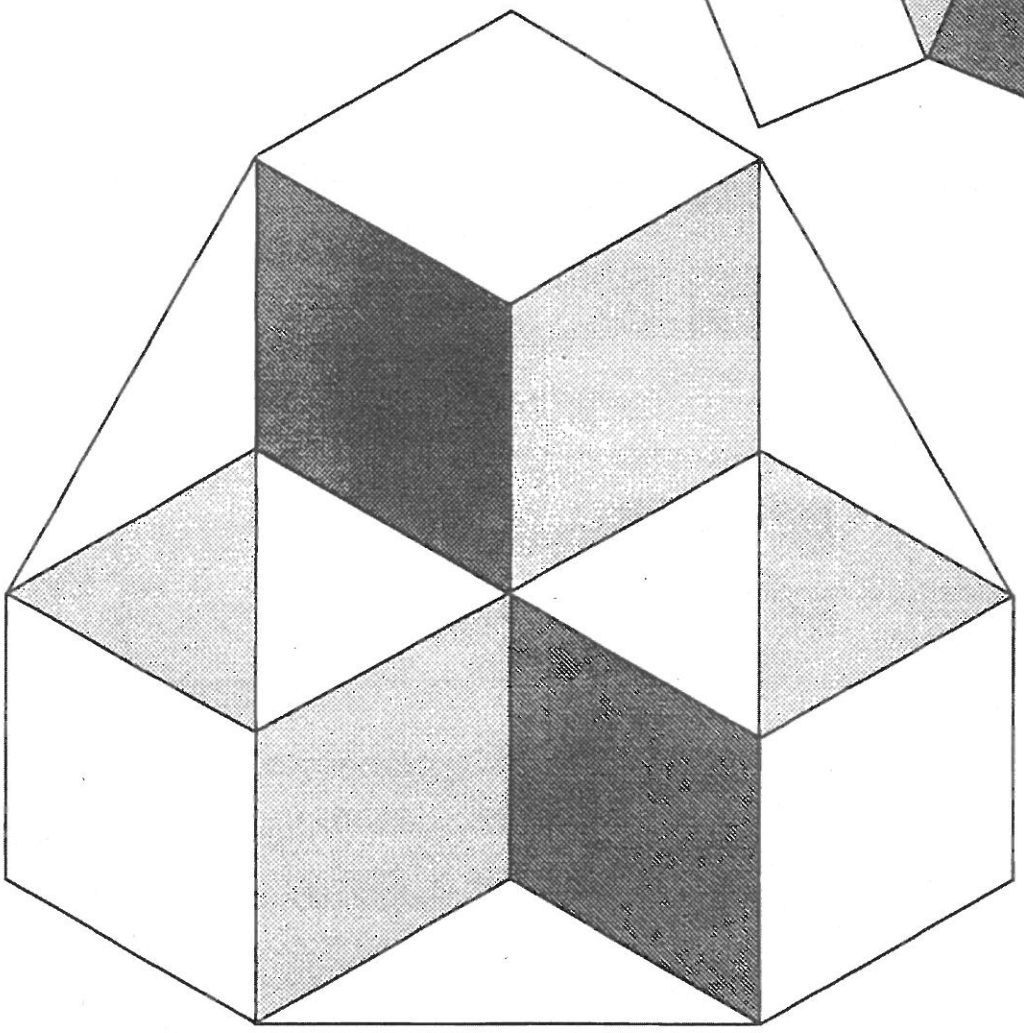
COMPASS CONSTRUCTIONS



These two designs have been drawn using only a ruler and a compass.

Try to reconstruct them using only a ruler and compass.





You could also try to create these designs using **LOGO**.

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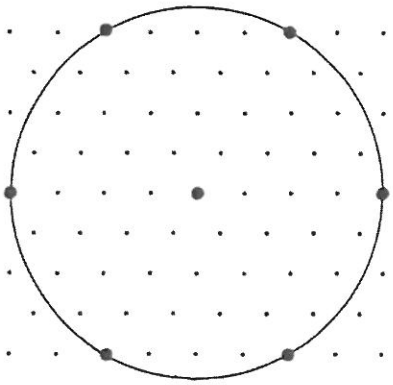
Polygons in Circles

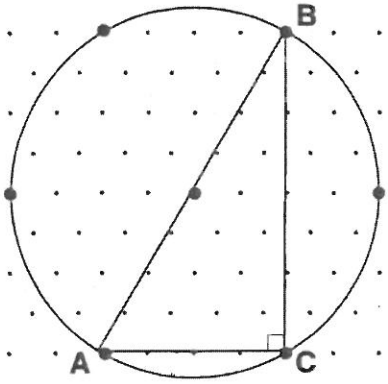
Smile **2375**

You will need 1cm dotted isometric paper and a pair of compasses.

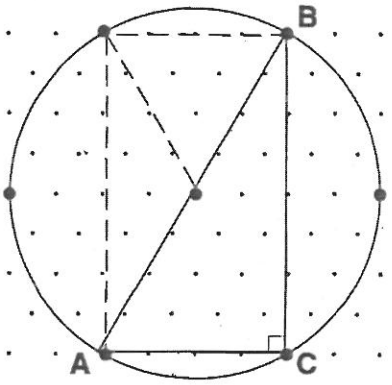
1. a) Draw a circle radius 4cm on isometric paper. There should be 6 points on the circumference of the circle.



b) Using these 6 points and the centre of the circle, construct a right-angled triangle.



c) Draw the dotted lines and explain why
$\angle BAC = 60°$ and
$\angle ABC = 30°$



2. By drawing similar circles construct the following polygons and work out the angles in the polygons. You might like to use Smile 2163 Geometry Facts.

a) An equilateral triangle.
b) An isosceles triangle.
c) A rectangle.
d) A trapezium.
e) An arrowhead.
f) A rhombus.
g) A hexagon.
h) A pentagon.

3. Which of your polygons are cyclic?

Definition of a cyclic polygon:

Any polygon whose vertices all lie on the circumference of a circle is called a cyclic polygon.

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Curvy Tiles in LOGO

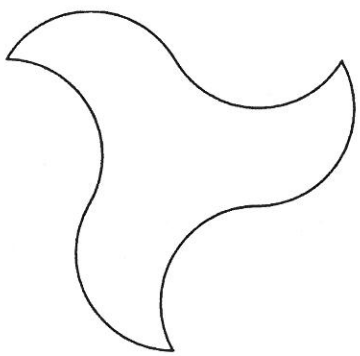
1. a) Give the turtle this instruction.
   arcr 20 120
   Describe what you see.
   If the turtle does not understand your instruction look in the SMILE Answer Book for help.

   b) What happens if you give this instruction?
   arcl 20 120

2. Investigate what happens when you change:
   a) the first number (**20**)
   b) the second number (**120**)

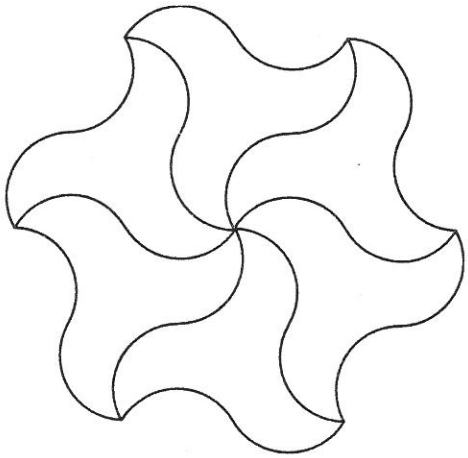
3. Create a circle using **arcl**

4. This tile is created using **arcr 20 120** and **arcl 20 120**



- Write a procedure to create it.

5. Use your procedure to create this pattern.

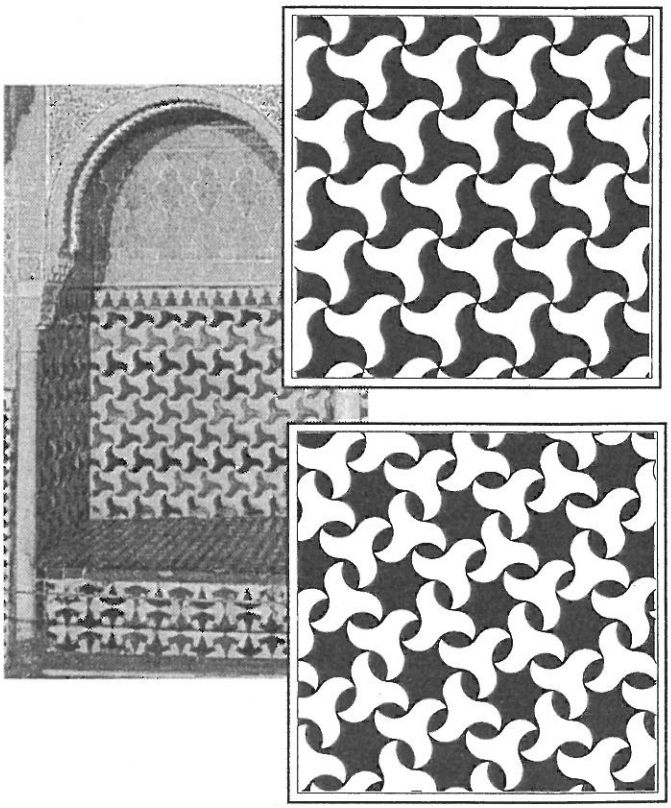


Challenge

Tessellations using tiles similar to the ones you have created are used in Islamic architecture.

Below are examples from the Alhambra in Granada, Spain.

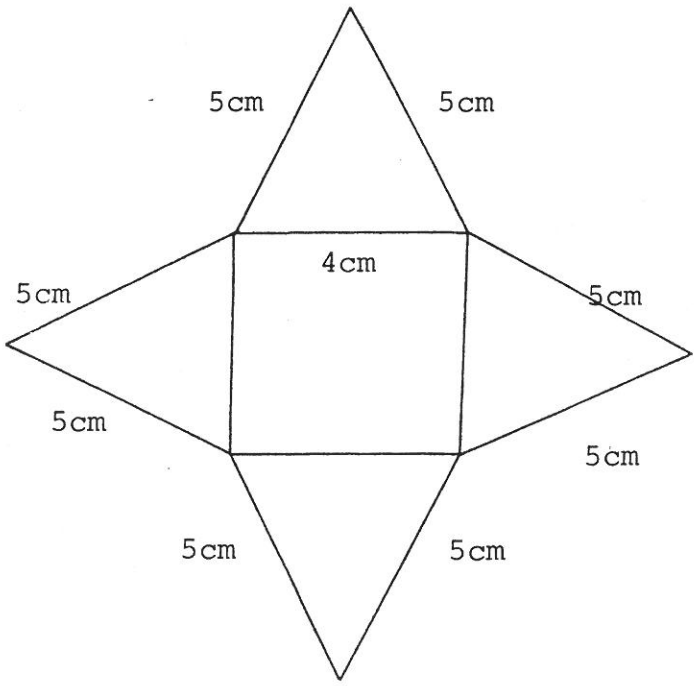
- Recreate one of them and write down the procedures you have used.



© RBKC SMILE 1996.

You will need: compasses, card, sharp pencil, sellotape

NETS OF PYRAMIDS



(1) Draw this net - ruler and compasses only.

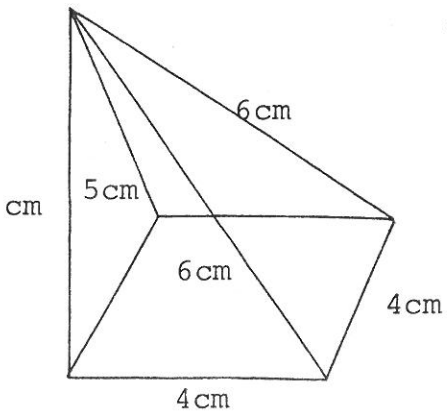
First draw the square. Then use compasses to draw the triangles accurately (see card 0732).

Cut it out and fold it to make a square based pyramid.

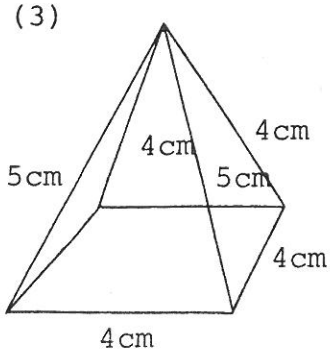
In this pyramid, the top should be directly above the centre of the square base. It is a RIGHT PYRAMID

The pyramids below all have square bases but they are not right pyramids.
Draw sketches of their nets.
When you are convinced that the sketches are right, draw the nets accurately. Check by cutting and folding.

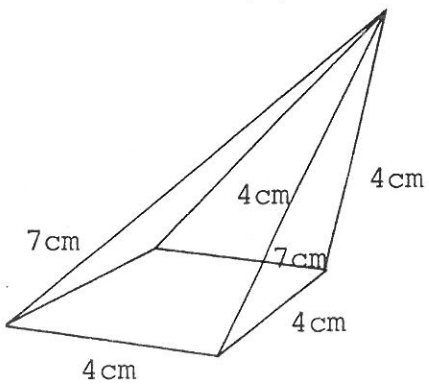
(2)



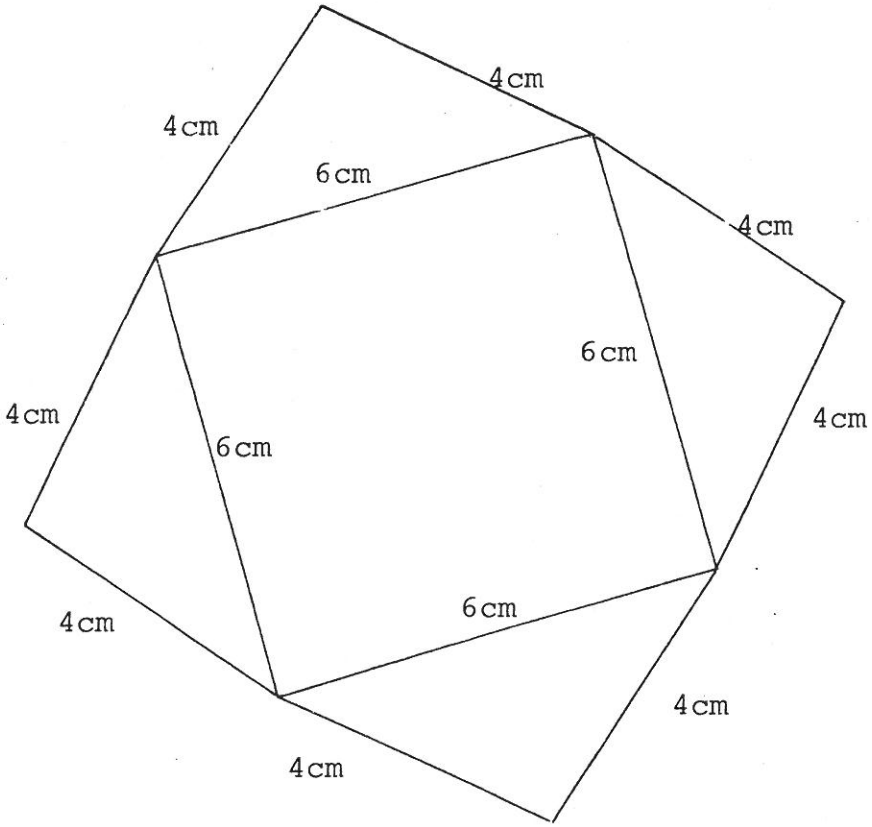
(3)

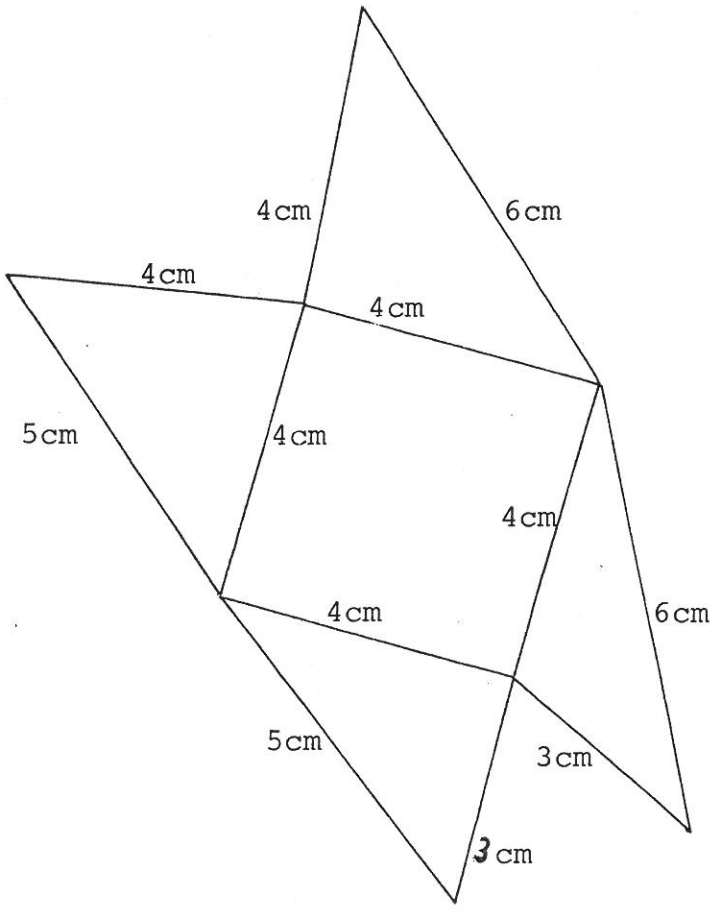


(4)



(5) Draw these accurately.





Cut and fold.
What happens?

WHY?

Spiralling Squares Patterns

You will need 2 copies of Smile Worksheet **2031a**, each in a different colour, and a large sheet of paper.

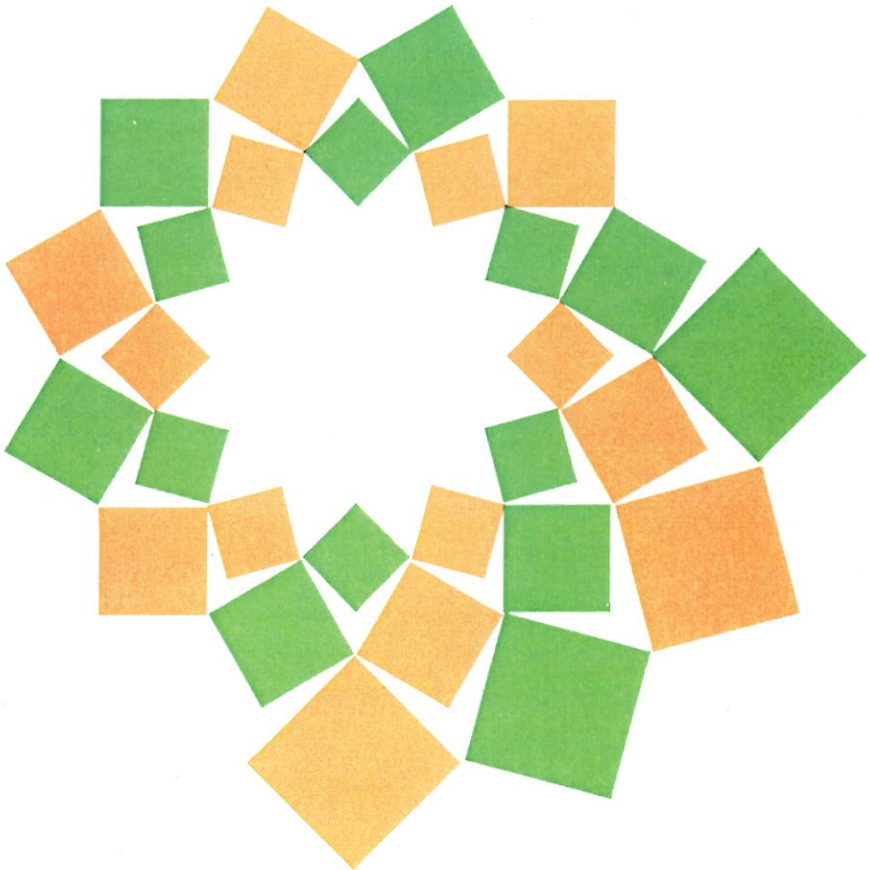
You may like to work with a partner.

Look at the *Square Spiral* * poster or the picture below.

Cut out the squares from the worksheets.
Use all the pieces to make a similar poster.

When you have made the poster, work out how big the next square would be.

What shapes can you see?
Can you see any patterns?

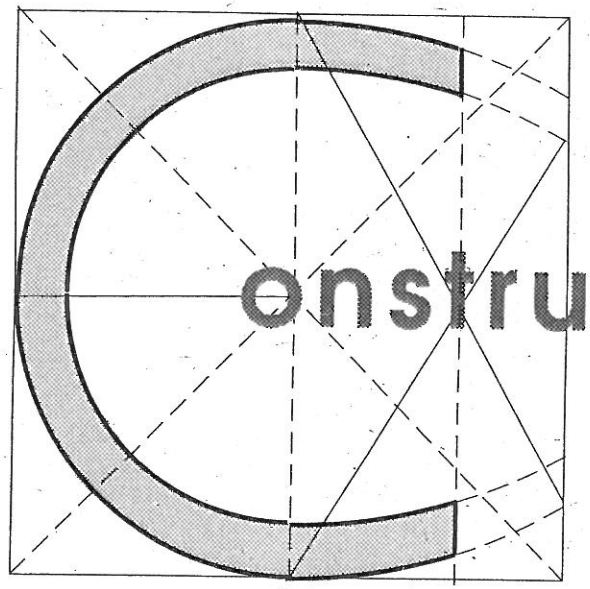


* poster available from Leapfrogs.

© 1992 RBKC SMILE

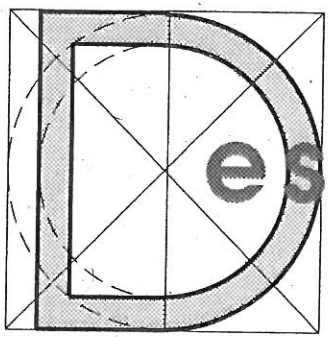
You will need 2 copies of this worksheet.
Each copy should be on a different colour paper.

Cut out all the squares.



onstructive

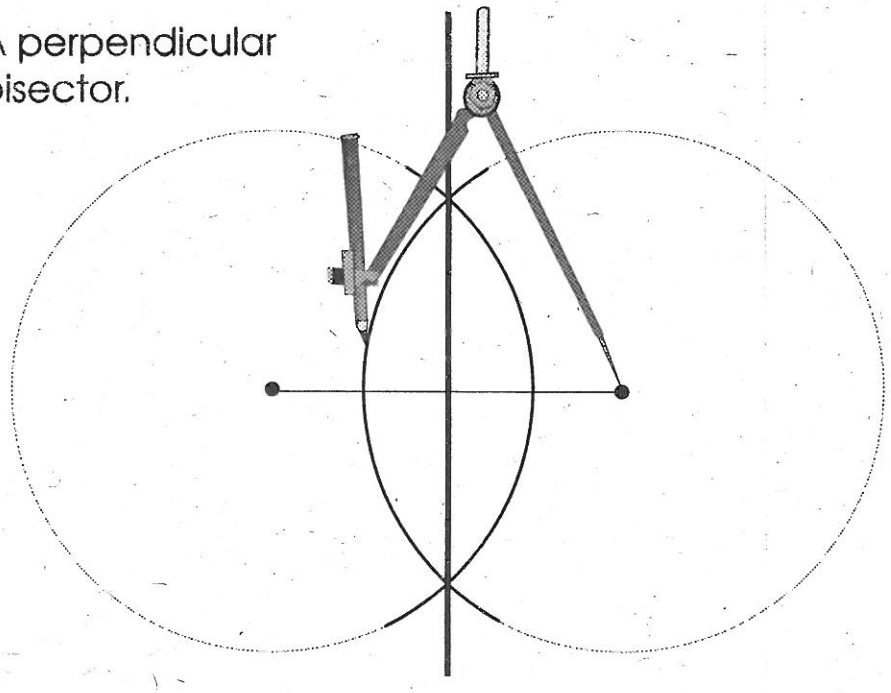
An activity for a small group.



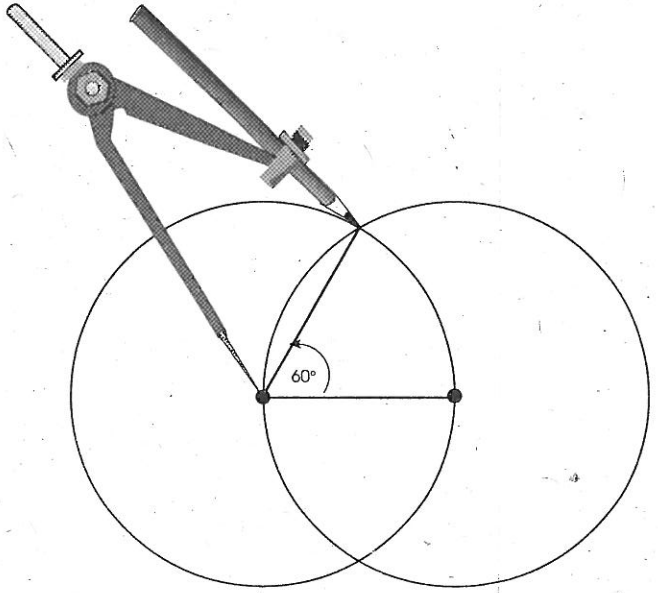
esigns

This pack contains **8** different constructions for you to recreate, using pencil, compass and straight edge only. Alternatively you could use a geometry software package such as *Cabri-Géomètre* or *Geometry Inventor*.

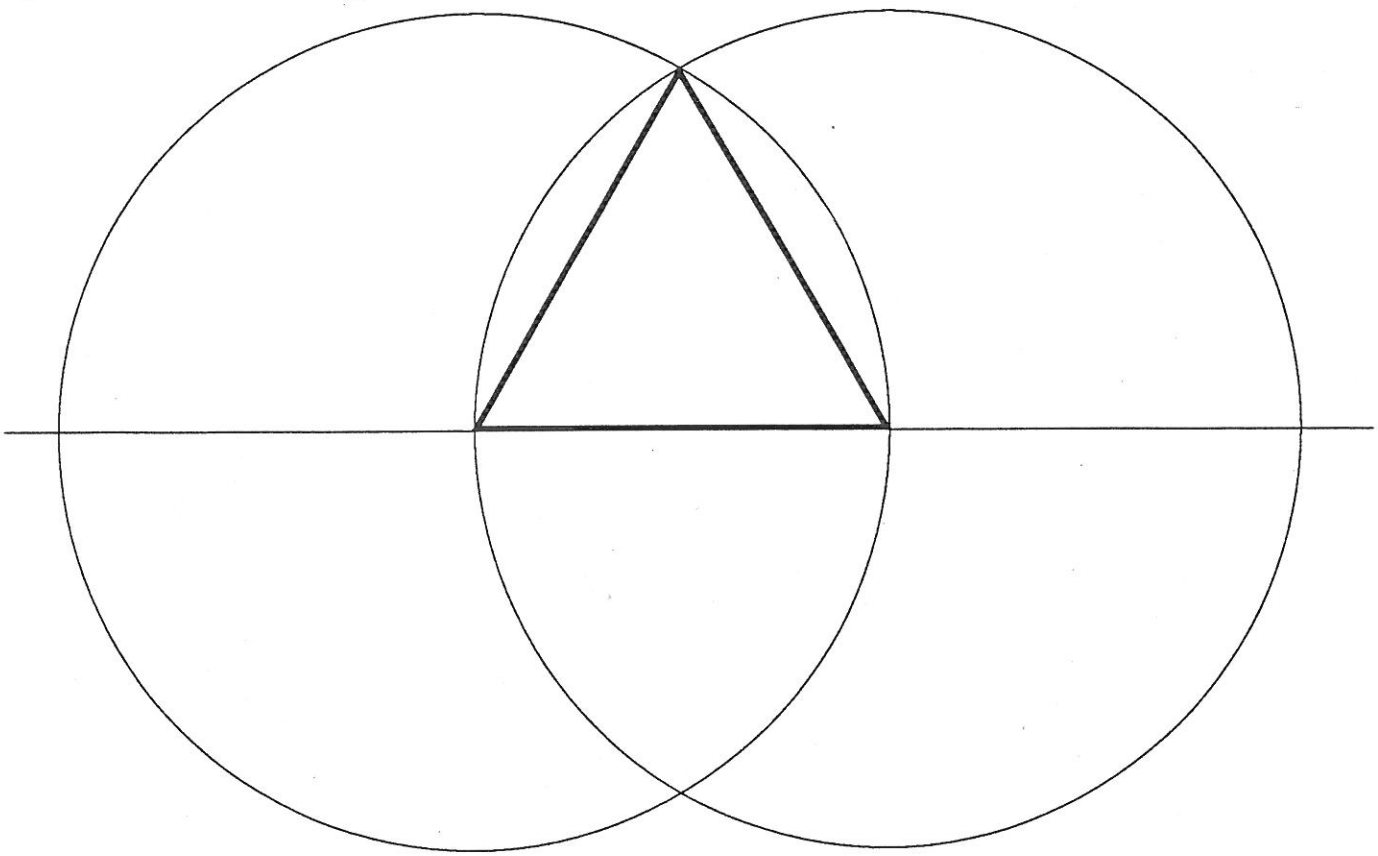
A perpendicular bisector.



A 60° angle.

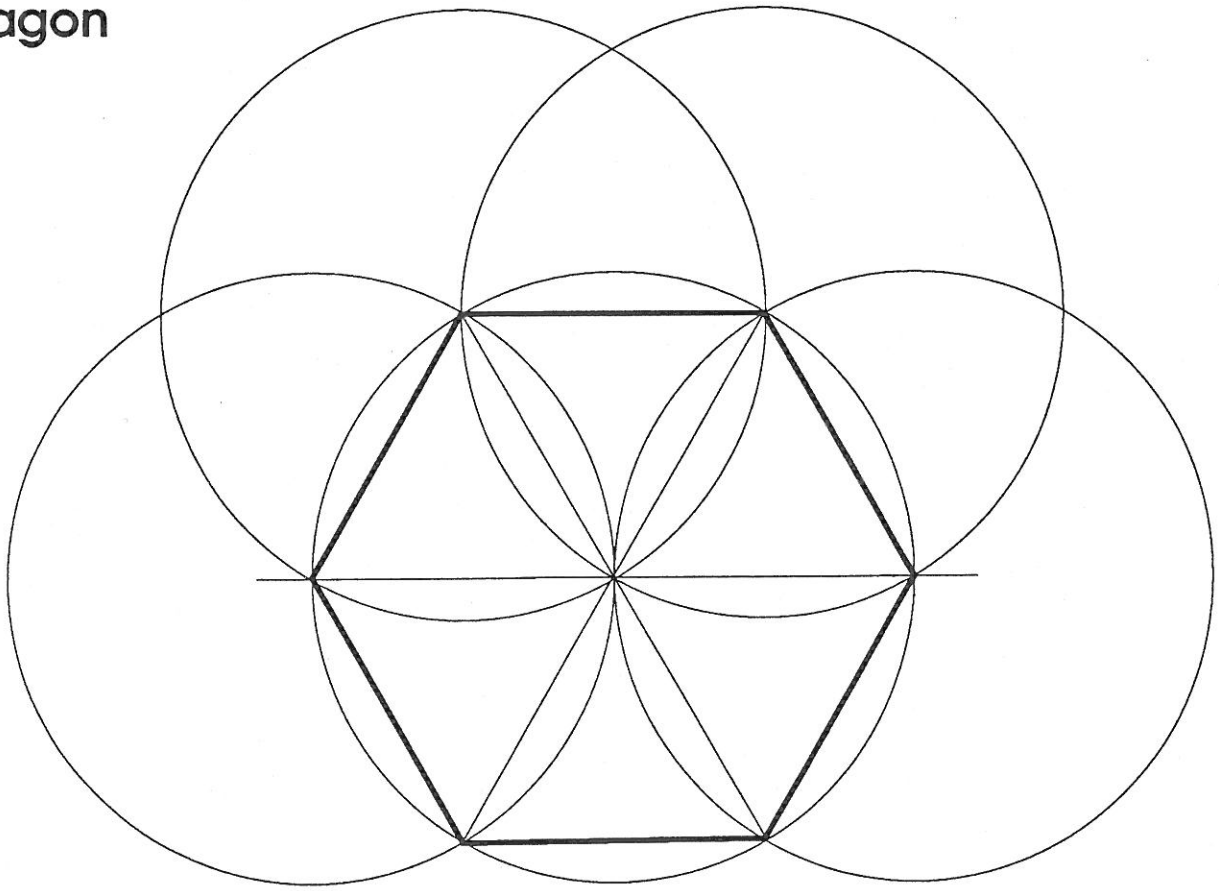


Equilateral Triangle



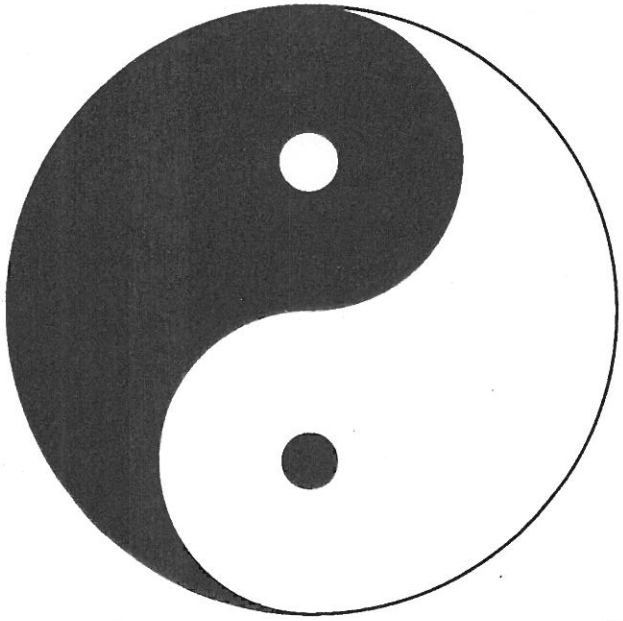
Explain why the triangle is equilateral.

Hexagon

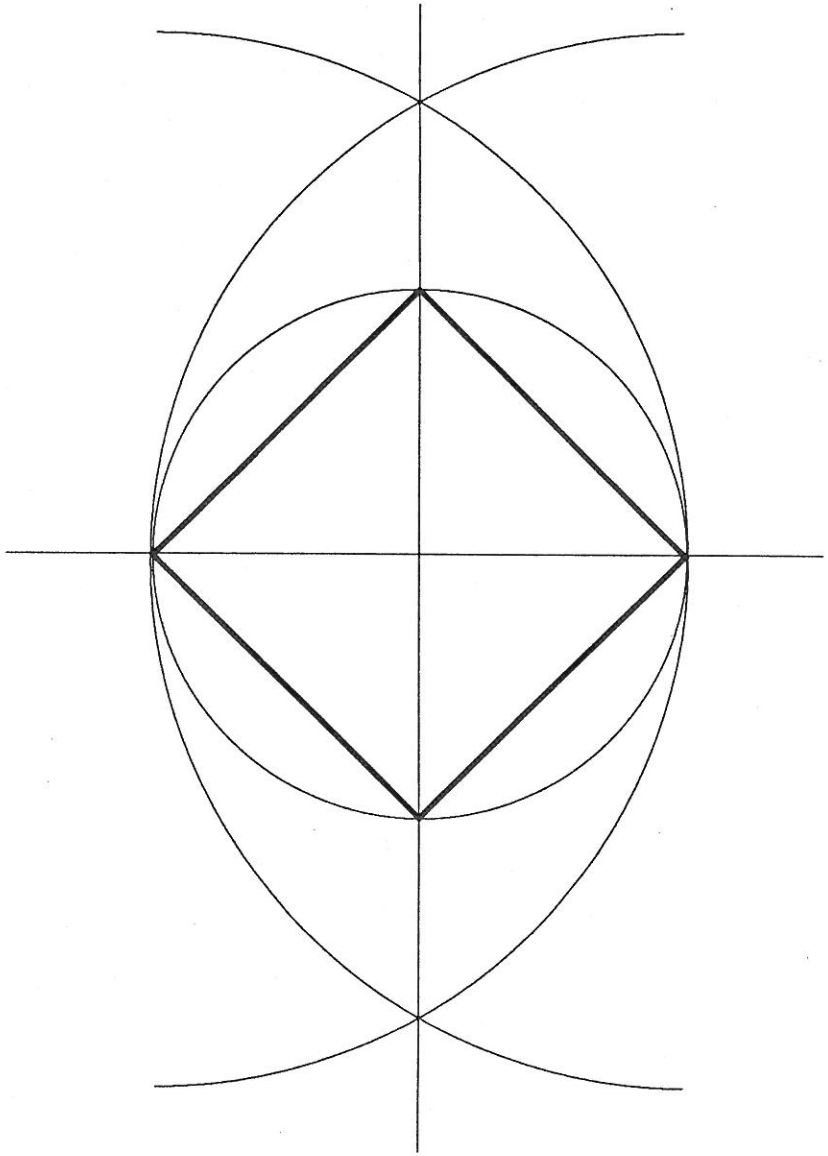


Make a design based on the hexagon or extend the pattern.

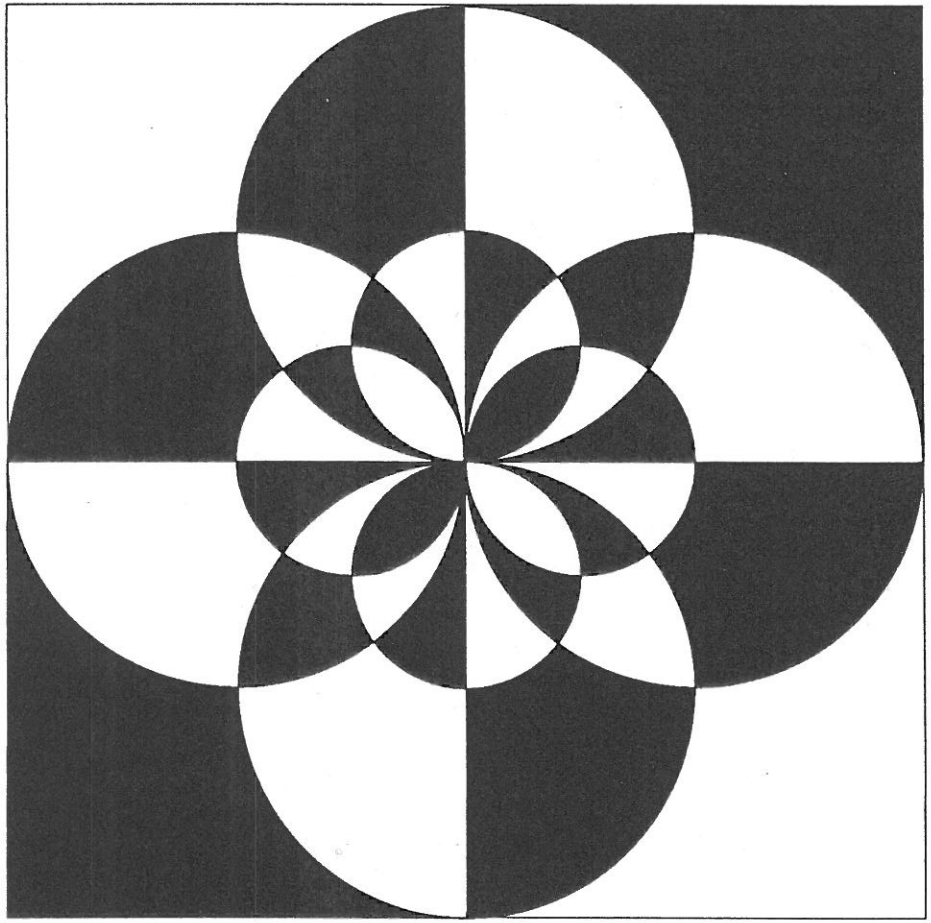
Yin Yang symbol



Square



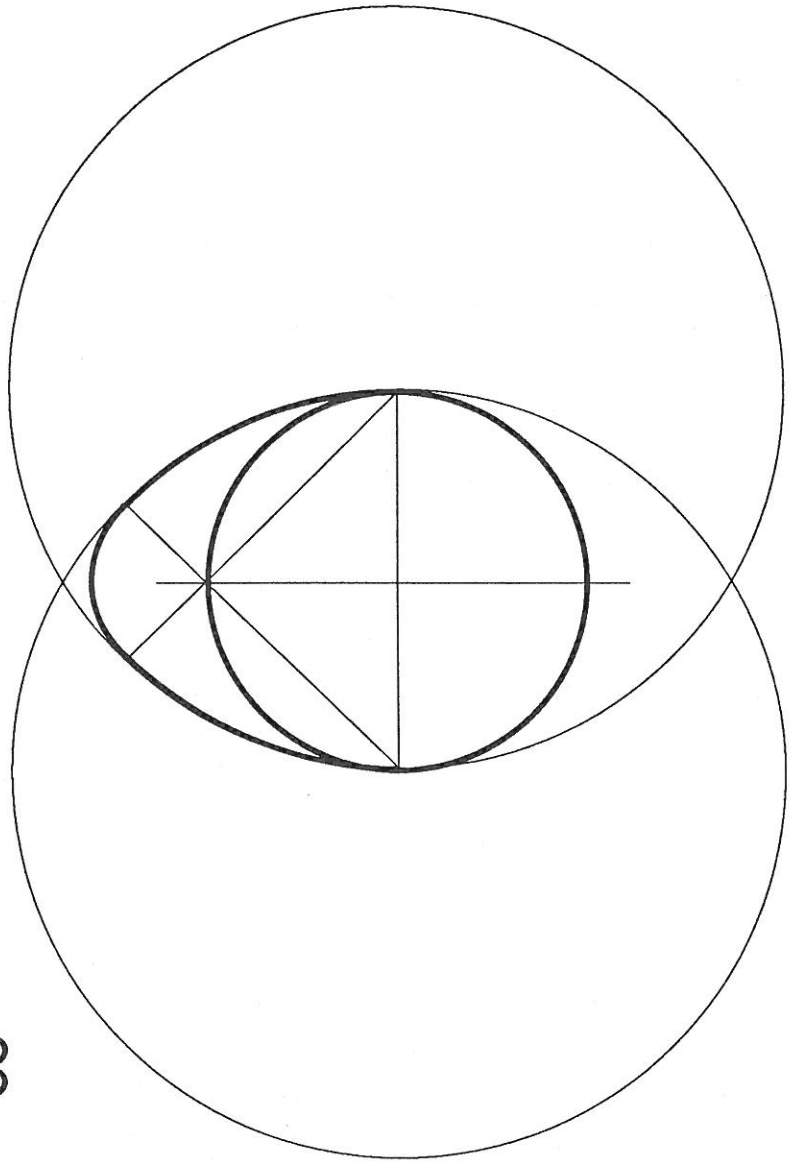
What other quadrilaterals can you create?



Is it half black and half white?

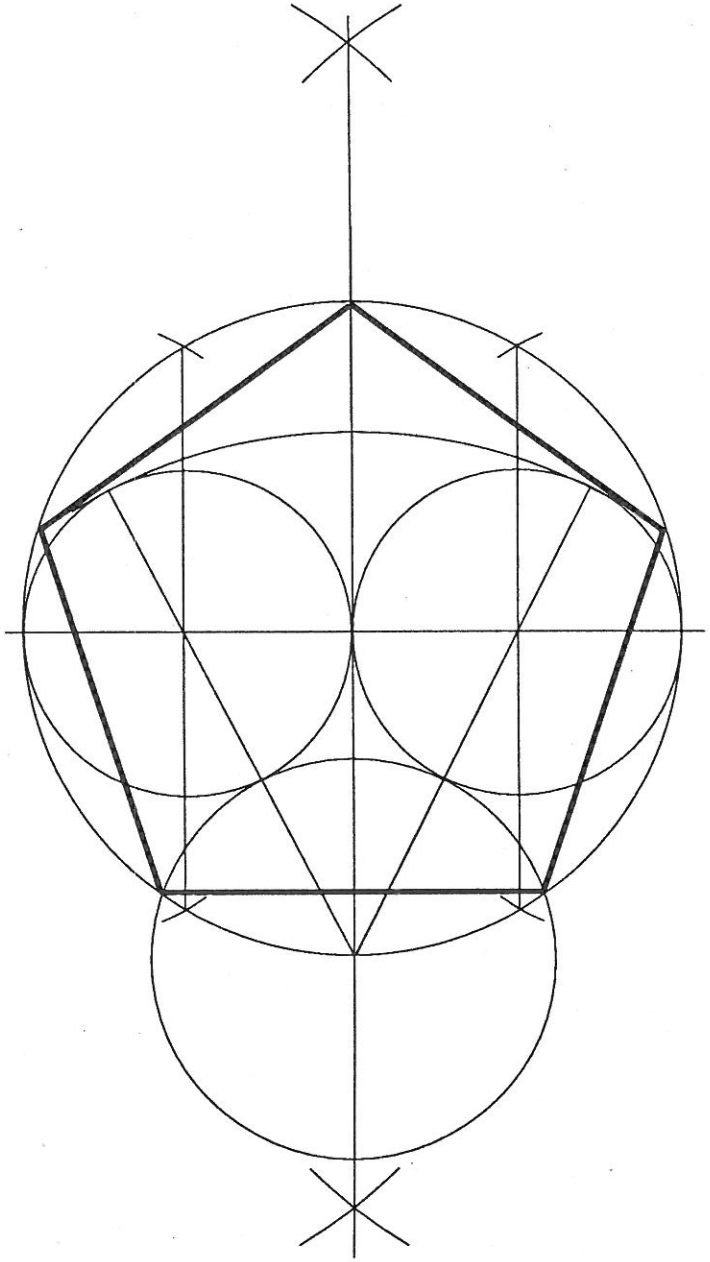
How can you be sure?

Moss' Egg

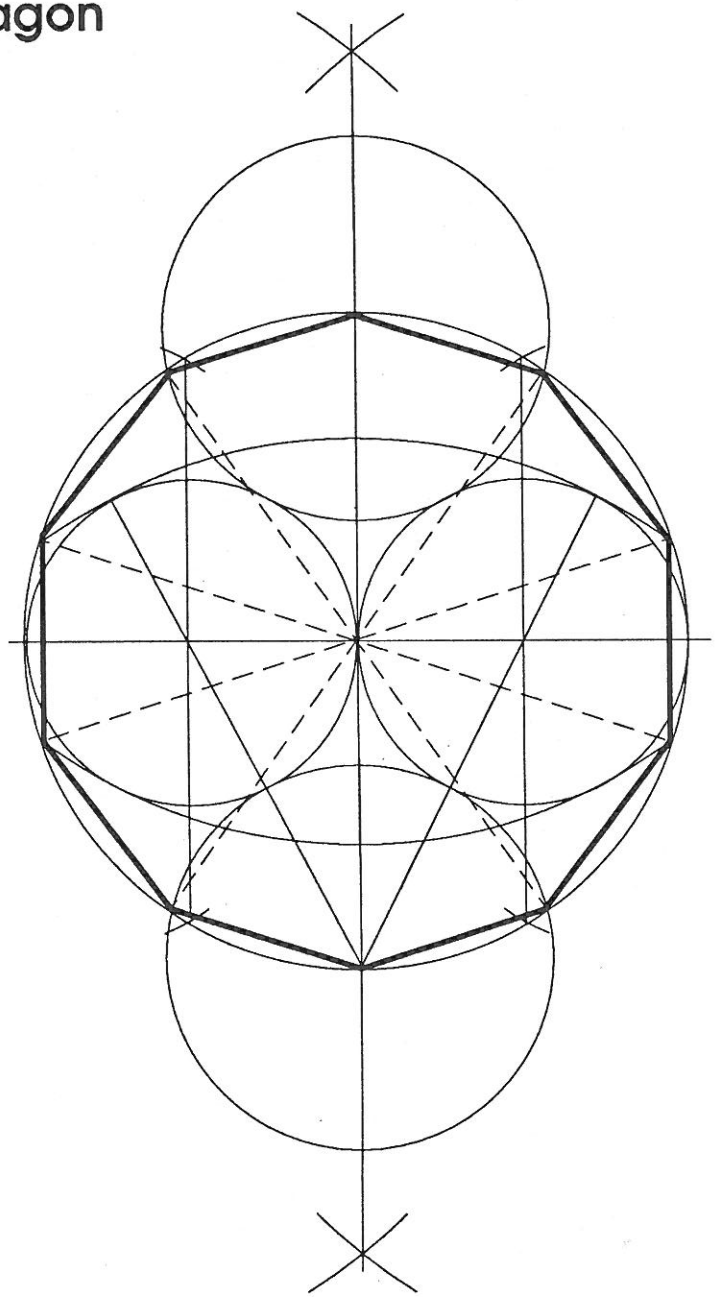


Can you draw an ellipse based on Moss' Egg?

Pentagon



Decagon



What has been added to the pentagon construction?

You will need large sheets of cm² paper.

TIES

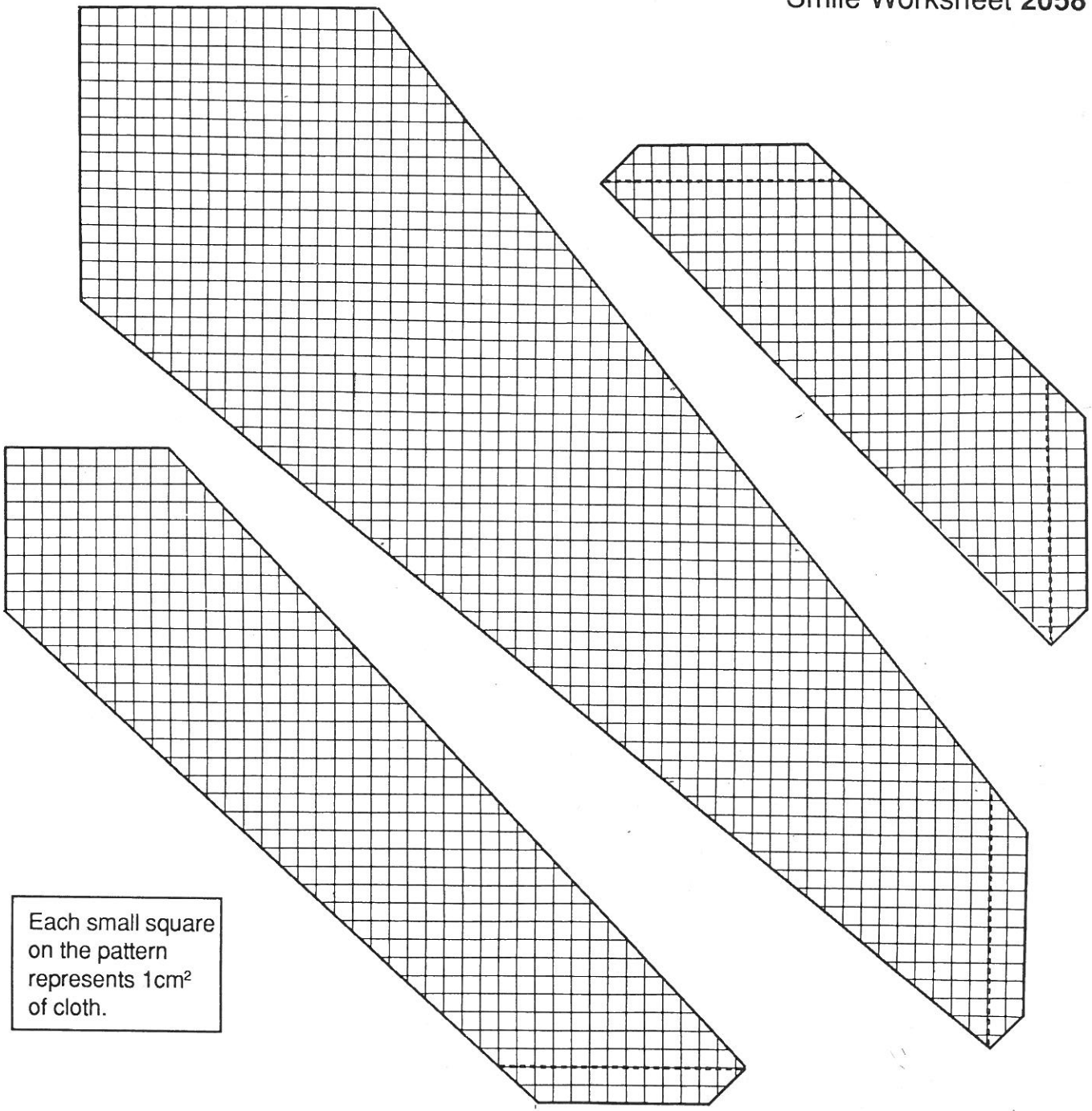
An activity for a small group.

Ties are made from 3 pieces of cloth cut accurately on the true cross.

- Make a full size pattern for a tie using cm² paper.

Silk, hand-made ties are often made from cloth 1m wide.

- Explore different layouts of the pieces so that the minimum amount of material is wasted.
- What is the shortest length of plain silk you would need to cut out 4 ties?
- Using patterned material or paper, can you lay out the pieces so that when you cut them out and sew them together, there will be no break in the design?



Each small square on the pattern represents 1cm² of cloth.

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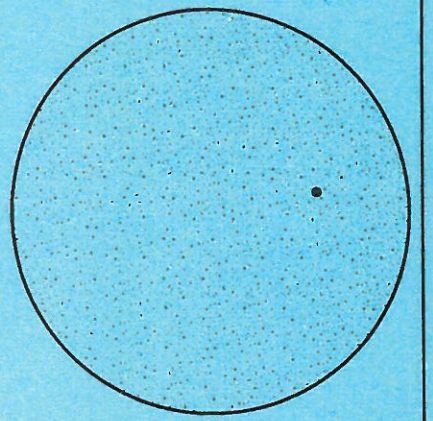
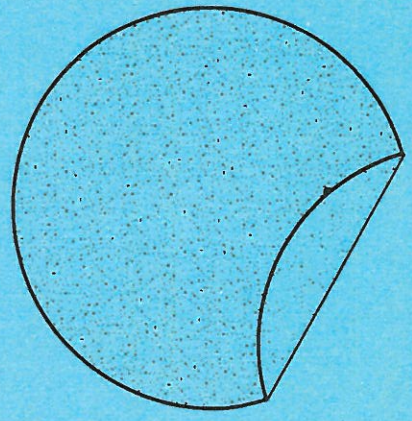
Ellipses by folding

You will need circular paper.

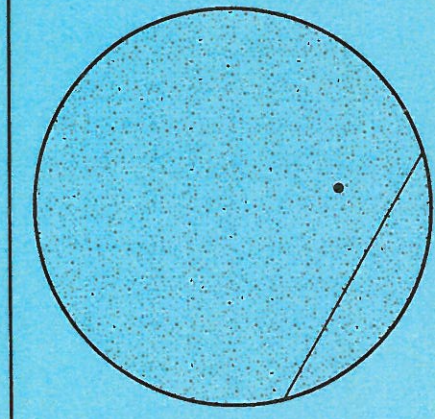
Mark a dot inside the circle.



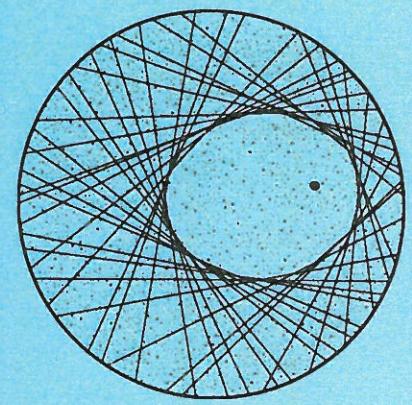
Fold the paper so that the circumference of the circle just touches the dot.



Unfold and draw a line along the fold.



Repeat.



Try putting the dot in different places. What happens when the dot is . . . very near the centre of the circle?

. . . very near the circumference?

. . . equidistant from the centre and circumference?

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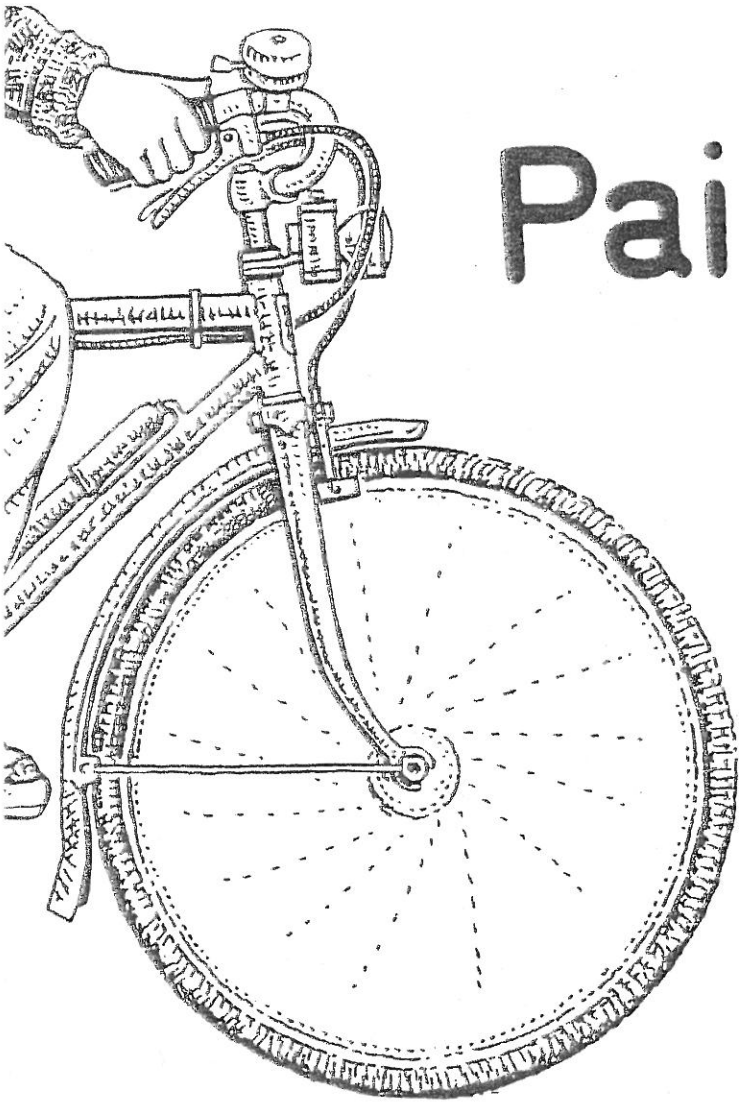
Painted Tyres

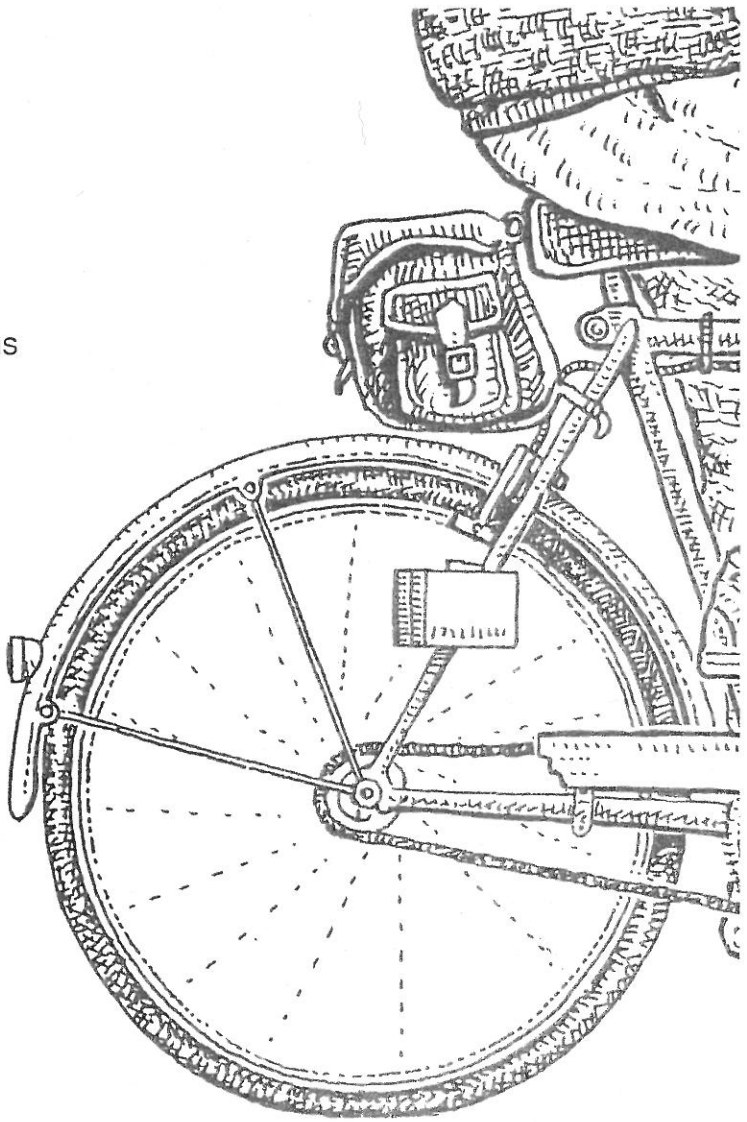


While riding my bicycle along a path I went through a small patch of paint.

A little later I looked back at the paint marks left by my tyres.

What did I see?

There are some hints on the back if you need them.



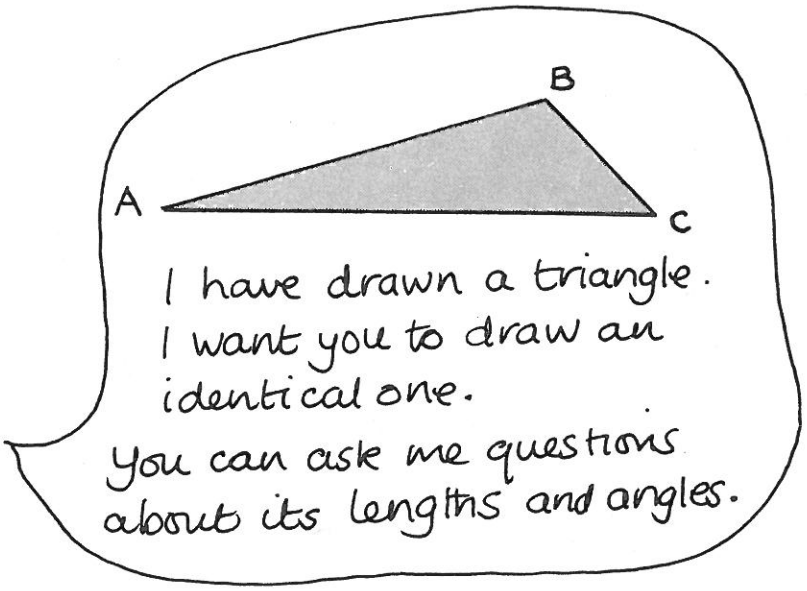
Hints

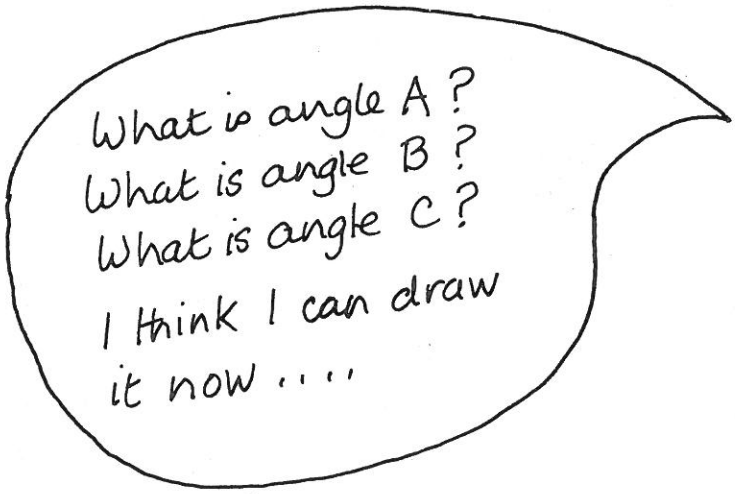
It may help to make a scale drawing of any patterns formed **showing the original patch of paint.**

- ✶ What happens if you change the distant between the wheels ?
- ✶ What happens if the diameter of the wheels is different ?
- ✶ What happens if you turn a corner ?
- ✶ Do both the wheels travel the same distance ?

MINIMUM INFORMATION

Geeta





Meena

Can Meena really draw a triangle identical to Geeta's?

Investigate different sets of questions that Meena could ask.

What is the smallest number of questions she needs to ask?