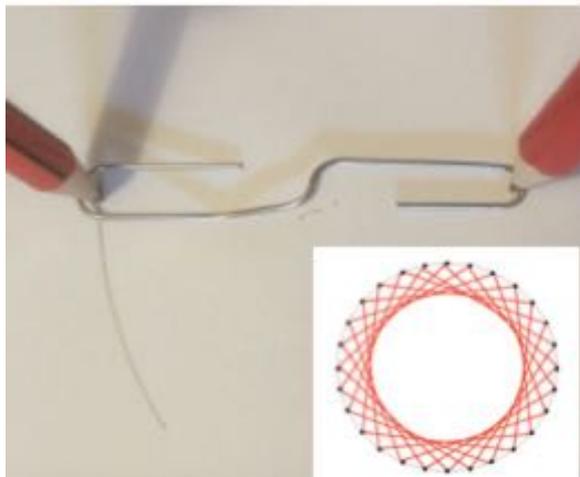


## CONSTRUCTING CIRCLE AND LINE PATTERNS

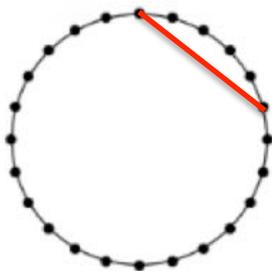
### PAPERCLIP COMPASS



The movie shows how to draw a circle using the paperclip compass.

### ENVELOPE PATTERNS WITH CIRCLES AND STRAIGHT LINES

1. Draw a circle and mark **24 points** equally spaced around the circumference. To do this, draw a circle and mark the centre, and mark your first point on the circumference.
2. With a protractor, starting from the radius from the centre to your 1<sup>st</sup> point, accurately measure an angle of  $15^\circ$  at the centre of the circle and mark the second point on the circumference. Why  $15^\circ$ ?
3. Continue to measure angles of  $15^\circ$  and to mark equally spaced points around the circle.
4. Then join each point to the 5<sup>th</sup> point around the circle missing 4 points between.



The inner circle that you see is called the **ENVELOPE** to the family of straight lines you have drawn. The lines are tangents to the envelope curve.

Experiment with different numbers of points around a circle, always joining points with straight lines and counting the same number of points between them.

What pattern would you get if you joined every 8<sup>th</sup> point on the 24 point circle?

*The envelope shown above is formed by marking 28 points around a circle and joining each point to the 7<sup>th</sup> point around the circle, missing 6 points between them. This is more difficult to draw accurately because the angle required is  $360/28 = 12.86^\circ$  (to 2 decimal places).*

## NOTES FOR TEACHERS

### Why do this activity?

This activity gives learners practice in using a ruler, protractor and compasses to draw accurate geometrical constructions. To make the patterns learners will need to measure lengths and angles, to draw circles, to follow instructions and to draw accurately. The activity offers opportunities for talking about the geometrical properties of the shapes.

Teachers can plan for learners of different abilities by giving learners different patterns to draw, for example slower learners could be given a circle with points already marked on the circumference to start with. The activity may improve learners' attitude to mathematics by appealing to some learners who do not like mathematics and to others who find it difficult. The activity encourages creativity. It offers opportunities for talking about the geometrical properties of the shapes.

### Intended learning outcomes

#### MEASURING ANGLES

- Accurately use a protractor to measure and classify angles:  $< 90^\circ$  (acute angles); Right-angles; angles  $> 90^\circ$  (obtuse angles); Straight angles;  $> 180^\circ$  (reflex angles)

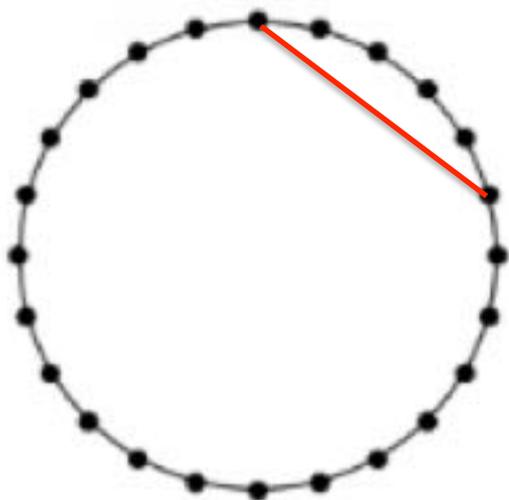
#### CONSTRUCTIONS

Use a compass, ruler and protractor appropriately to construct geometric figures accurately, including: angles, to one degree of accuracy and circles

### Suggestions for teaching

*Resources needed. Pencils, rulers, protractors and compasses.*

Start with the whole class and show them some pictures. Tell them that they are going to copy some of the designs and then to create some of their own. Tell them that the best designs will be put on display on the classroom wall.



Pin up a large copy of the 24-point circle.

Explain that the class will help to make a pattern by drawing straight lines to join every 5<sup>th</sup> point on the circle. Ask learners to say what sort of pattern they think it will be.

Ask learners in turn to come to the front and each one to draw the next line.

Did they expect to see another circle appear?

Then tell the class that you want them to draw the pattern but they must first draw a circle and then mark 24 points equally spaced around the circle. Ask for suggestions about how they could do that and write the instructions on the board.

Alternatively you could give the learners the instructions as they appear on page 1.

You might plan to cater for all abilities in your class by giving the slow learners a circle with the 24 points already marked and giving other learners circles with 6 or 12 points marked but not all of the points and asking the high flyers to mark all the points themselves.

## Key questions

What pattern would you get if you joined every 8<sup>th</sup> point on the 24 point circle?

What pattern would you get if you joined every 6<sup>th</sup> point on the 24 point circle?

What pattern would you get if you joined every 4<sup>th</sup> point on the 24 point circle?

What pattern would you get if you joined every 3<sup>th</sup> point on the 24 point circle?

What angle would you use to mark 30 points around the circle?

What points would you join on the 30 point circle to get a hexagon?

What points would you join on the 30 point circle to get a pentagon?

Could you make a square by joining equally spaced points on a 30 point circle? Why or why not?

What pattern would you get if you joined every 9<sup>th</sup> point on the 30 point circle?

## Possible extension

Mystic Rose <https://aiminghigh.aimssec.ac.za/grades-7-to-12-mystic-rose/>

## Possible support

See page 4 for circles with 6 points and 12 points already marked.

<b>Note: The Grades or School Years specified on the AIMING HIGH Website correspond to Grades 4 to 12 in South Africa and the USA and to Years 4 to 12 in the UK.</b>				
	Lower Primary or Foundation Phase	Upper Primary	Lower Secondary	Upper Secondary
South Africa	Grades R and 1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
USA	Kindergarten and G1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
UK	Reception and Years 1 to 3	Years 4 to 6	Years 7 to 9	Years 10 to 13
East Africa	Nursery and Primary 1 to 3	Primary 4 to 6	Secondary 1 to 3	Secondary 4 to 6

