



## Angles turtle – Year 7

### Objectives

#### 4.1 Geometrical reasoning

- Identify parallel and perpendicular lines; know the sum of angles at a point, on a straight line and in a triangle; recognise vertically opposite angles.

#### 4.3 Construction and loci

- Use a ruler and protractor to:
  - measure and draw lines to the nearest millimetre and angles, including reflex angles, to the nearest degree
  - construct a triangle, given two sides and the included angle (SAS) or two angles and the included side (ASA).
- Use ICT to explore constructions.
- Use ruler and protractor to construct simple nets of 3-D shapes, e.g. cuboid, regular tetrahedron, square-based pyramid, triangular prism.

#### 4.4 Measures and mensuration

- Know and use the formula for the area of a rectangle; calculate the perimeter and area of shapes made from rectangles.

## 1. Lines, angles and shapes

### Configuration panel settings: default.

- Use the turtle to draw pairs of lines joined by an acute angle, a right angle and an obtuse angle. Discuss the requirements for an angle to be acute, right or obtuse and ask students to draw their own lines and angles and label them.
- Ask the class to draw a square, a rectangle, an equilateral triangle, an isosceles triangle and scalene triangles with and without an obtuse angle. Demonstrate these shapes on the board.
- Move the turtle towards the bottom of the board, set the angle to  $000^\circ$  and send him forwards 20 to draw a vertical line. Next drag him back down to the bottom and draw a parallel line close by. Point out that the diagram of the parallel lines involves no angles.
  - Drag the turtle to the left of the two lines and draw a perpendicular bisector to the pair of lines, turning him  $90^\circ$ . Use the protractor tool to show that perpendicular lines meet at a right angle.
- Draw a horizontal line and a bisector that is not perpendicular. Measure the two angles formed with the protractor tool and confirm that they total  $180^\circ$ .
- Use the turtle to draw a scalene triangle. Measure the interior angles with the protractor tool and demonstrate that the total is  $180^\circ$ .

## 2. Drawing triangles

### Configuration panel settings: default.

- Tell students to draw five pairs of lines separated by an angle: for example, 15 cm and 6 cm lines with an included angle of  $20^\circ$ . Encourage a mixture of acute, obtuse and reflex angles. Let them swap papers with a partner to check each other's lengths and angles for accuracy.



# Maths Toolkit

Teacher's notes



Ask them to turn their five constructions into triangles and measure the new length and angles. Let them swap papers again to check each other's measurements.

- b) Tell students to draw five horizontal lines with an angle at each end (from which to construct a triangle). For example: 12 cm line,  $40^\circ$  angle from left hand edge,  $50^\circ$  from right hand edge.

Ask them to complete the triangles and measure the new lengths and angle.

Demonstrate some of their triangles on the board, using the pen and protractor tools or the turtle.



## Angles turtle – Year 8

### Objectives

#### 4.1 Geometrical reasoning

- Identify alternate angles and corresponding angles; understand a proof that:
  - the angle sum of a triangle is  $180^\circ$  and of a quadrilateral is  $360^\circ$
  - the exterior angle of a triangle is equal to the sum of the two interior opposite angles.

#### 4.3 Construction and loci

- Use straight edge and compasses to construct:
  - the midpoint and perpendicular bisector of a line segment
  - the bisector of an angle
  - the perpendicular from a point to a line
  - the perpendicular from a point on a line
  - a triangle, given three sides (SSS).
- Use ICT to explore these constructions.
- Find simple loci, both by reasoning and by using ICT, to produce shapes and paths, e.g. an equilateral triangle.

#### 4.4 Measures and mensuration

- Use bearings to specify direction.

## 1. Alternate and corresponding angles

### **Configuration panel settings: default.**

- a) Move the turtle towards the bottom of the board and send him forwards 20 to draw a vertical line.

Drag him back down to the bottom and draw a parallel line close by.

Drag the turtle to the left of the two lines and draw a line intersecting the parallel lines, turning him  $65^\circ$ .

- b) Demonstrate the properties of alternate and corresponding angles, measuring the angles with the protractor tool.

## 2. Angles in a triangle

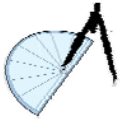
### **Configuration panel settings: default.**

- a) Using the ruler and pen tools, draw a triangle labelled AB (horizontal) and C (above).

Extend AB from B to a point D.

Draw a line from B, parallel to AC, to a point E.

- b) Demonstrate that angles CAB and EBD are corresponding and so equal, and that ACB and CBE are alternate and so equal. Show that this means the three angles in the triangle add up to the angles on a straight line,  $180^\circ$ .



### 3. Constructions

**Configuration panel settings: default.**

- a) Draw a horizontal line of 8 cm with the pen and ruler tools.

Set the compasses to a width of 5 cm (using the ruler to measure) and draw two arcs above the approximate midpoint from the edges of the line. Also draw two similar arcs below the line.

Demonstrate that a perpendicular line joining the points where the arcs cross forms a perpendicular bisector of the original line. Tell students to produce perpendicular bisectors for other lines independently.

- b) Draw two lines of 9 cm and 12 cm, separated by an angle of  $30^\circ$ . Label the point of the angle A.

Set the compasses to 3 cm and draw an arc from A that cuts both lines. Label these points B and C.

Now set the compasses to 5 cm and draw two arcs from B and C so that they intersect at point D. Draw in the angle bisector AD.

Tell students to follow this working to construct angle bisectors for different angles.

- c) Demonstrate how to construct a triangle with sides 10 cm, 8 cm and 6 cm long. Draw a horizontal line AB 10 cm long. From A draw an arc of radius 8 cm and from B an arc of radius 6 cm. Use the point where these arcs meet as the apex of the triangle.

Ask the class to follow this working to draw other triangles. Demonstrate how some of these triangles should appear using the turtle.

### 4. Bearings

**Configuration panel settings: select bearings “on”, and “show map background”. It may be easier to deselect “show turtle” and use a point instead.**

- a) Move on a bearing of  $60^\circ$  and ask the class what bearing to take to get back. Practise entering the right bearing to complete a triangle back to the original point after two moves.
- b) Start from a point of interest on the map and discuss with the class what moves to make to reach another point on the map, avoiding hazards on the way.



## Angles turtle – Year 9

### Objectives

#### 4.1 Geometrical reasoning

- Explain how to find, calculate and use:
  - the sums of the interior and exterior angles of quadrilaterals, pentagons and hexagons
  - the interior and exterior angles of regular polygons
- Solve problems using properties of angles, of parallel and intersecting lines, and of triangles and other polygons, justifying inferences and explaining reasoning with diagrams and text.

#### 4.2 Transformations and coordinates

- Use and interpret maps and scale drawings in the context of mathematics and other subjects.

#### 4.3 Construction and loci

- Use straight edges and compasses to construct triangles, given right angle, hypotenuse and side (RHS).
- Use ICT to explore constructions of triangles and other 2-D shapes.
- Find the locus of a point that moves according to a simple rule, both by reasoning and by using ICT.

## 1. Drawing regular polygons

### Configuration panel settings: default.

- Set the turtle to turn  $60^\circ$  and move 5. Do this 6 times to make a regular hexagon and measure the interior angles with the protractor tool. Point out that the total distance the turtle has moved, displayed at the top of the board, is the perimeter of the hexagon.
- Draw 5 lines to make a regular pentagon, turning  $72^\circ$  each time, and measure the interior angles. Discuss the sum of the interior angles of triangles and quadrilaterals and work towards finding a pattern that will enable them to draw other regular polygons.
- Use the turtle to draw all the regular polygons up to a decagon, which you can make with 10 turns through  $36^\circ$ .

## 2. Drawing right-angled triangles

### Configuration panel settings: default.

- Use the turtle to draw a horizontal line 8 cm long and a long vertical line from the right hand edge.  
  
From the left hand edge, set the compasses to 10 cm (using the ruler to measure) and draw an arc so that it intersects the vertical line.  
  
Draw the hypotenuse from this intersection point to the left hand edge of the line.
- Give the class other side lengths and hypotenuse lengths from which to construct right-angled triangles and demonstrate some more of these on the board.