Visual arts
Design & Create

Technical drawing

Level **II** ***SECONDARY***

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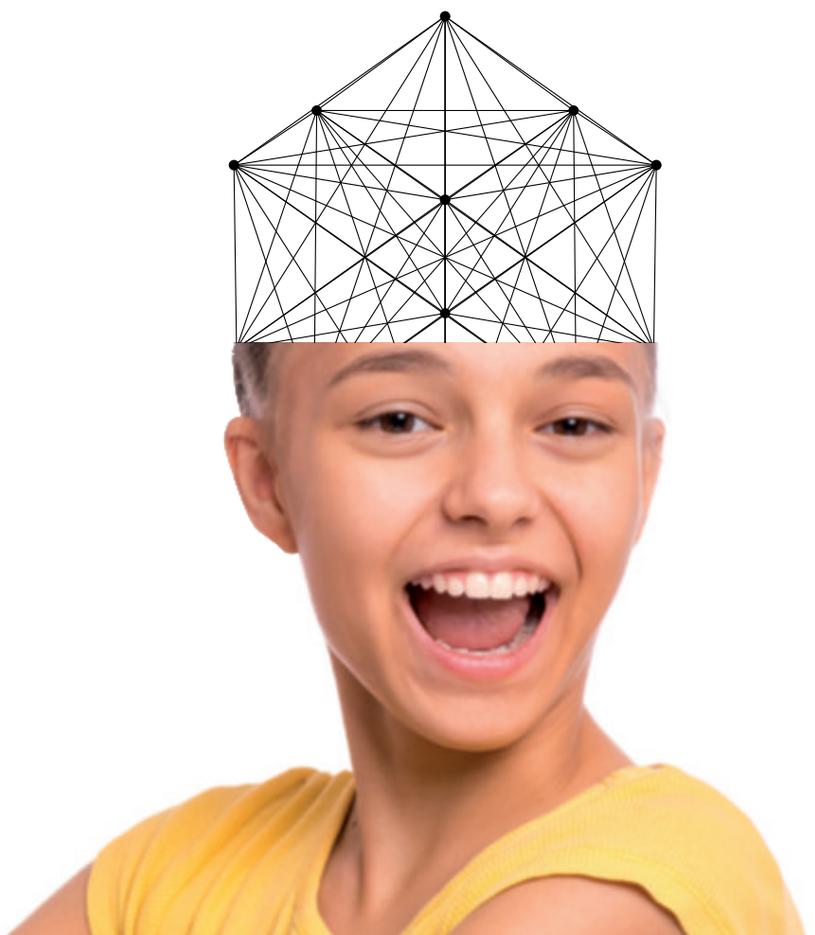


Richmond

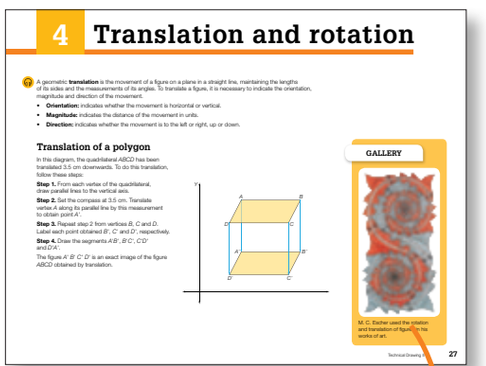
Santillana

Technical drawing II

Technical drawing II is organised into seven units, which aim to develop technical drawing skills.

Each unit contains the following sections:

Listen to the audio files at **santillana.es/clil**


4 Translation and rotation

A geometric **translation** is the movement of a figure on a plane in a straight line, maintaining the lengths of its sides and the measurements of its angles. To translate a figure, it is necessary to indicate the orientation, magnitude and direction of the movement.

- **Orientation:** indicates whether the movement is horizontal or vertical.
- **Magnitude:** indicates the distance of the movement in units.
- **Direction:** indicates whether the movement is to the left or right, up or down.

Translation of a polygon

In this diagram, the quadrilateral ABCD has been translated 3.5 cm downwards. To do this translation, follow these steps:

Step 1. From each vertex of the quadrilateral, draw parallel lines to the vertical axis.

Step 2. Set the compass at 3.5 cm. Translate vertex A along its parallel line by this measurement to obtain point A'.

Step 3. Repeat step 2 from vertices B, C and D. Label each point obtained B', C' and D', respectively.

Step 4. Draw the segments A'B', B'C', C'D' and D'A'.

The figure A' B' C' D' is an exact image of the figure ABCD obtained by translation.

GALLERY

M. C. Escher used the rotation and translation of figures in his works of art.

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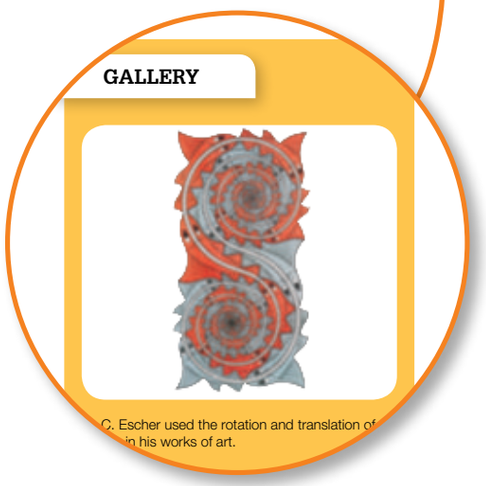
Content

The contents of the unit are introduced with examples that show you step-by-step how to draw geometric constructions.

These pages are intended to develop your **mathematical competence and competence in science, technology and engineering**.

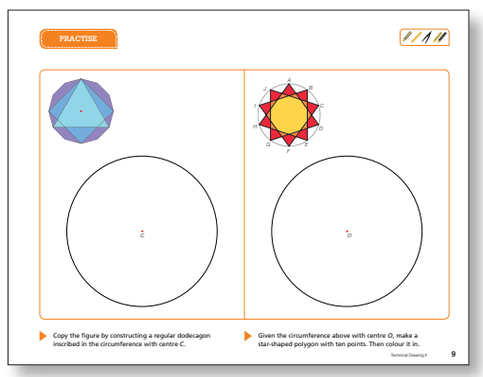

GALLERY

M. C. Escher used the rotation and translation of figures in his works of art.

Gallery

This section further develops your knowledge of technical drawing. Some additional information about the use of technical drawing in other areas is also included.

In addition, you will also develop your **personal**, **social and learning to learn competence** and **citizenship competence**.


PRACTISE

Copy the figure by constructing a regular dodecagon inscribed in the circumference with centre C.

Given the circumference above with centre O, make a star-shaped polygon with ten points. Then colour it in.

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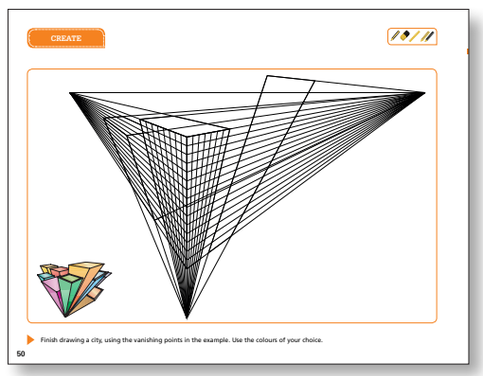
Practise

These activities enable you to put into practice what you have learned in the unit.

By doing these worksheets, you will improve your **personal, social and learning to learn competence** and **digital competence**.


CREATE

Finish drawing a city, using the vanishing points in the example. Use the colours of your choice.

50

Create

These activities allow you to apply and to show what you have learned about the subject.

By doing these worksheets, you will improve your **entrepreneurship competence** and **cultural awareness and expression competence**.

Contents

Instruments and recommendations for Technical drawing

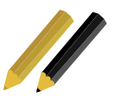
Protractor

French curve

Set squares

Rubber

Pencil



Coloured pencils

T-square

Compass

Ruler

Pencil sharpener

How to prepare the drawing instruments

- Keep the pencils sharpened.
- Clean the set squares and rulers before and after their use.
- Sharpen the lead point of the compass to get clear and precise measurements.
- Make sure the rubber has clean and sharp edges.

The drawing process

- Read the instructions carefully and refer to the images.
- Remember that each step of the process is given in a logical order.
- Draw the guidelines with a hard pencil (H), pressing lightly.
- Complete the final drawing lines with a soft pencil (B).
- Do not rub out the guidelines until the drawing is completely finished.

Take note

- Read the directions and instructions before starting the worksheet.
- Sign your worksheets with your name. Use technical lettering.
- Keep your desk and worksheets clean.

1 Regular polygons

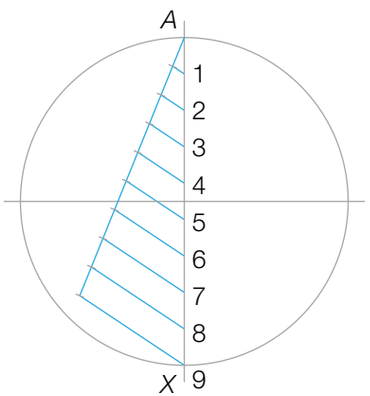
A **polygon** is a flat figure bounded by three or more segments called **sides**. These intersect at the endpoints of each segment at points called **vertices**.

Construction of regular polygons given a circumference

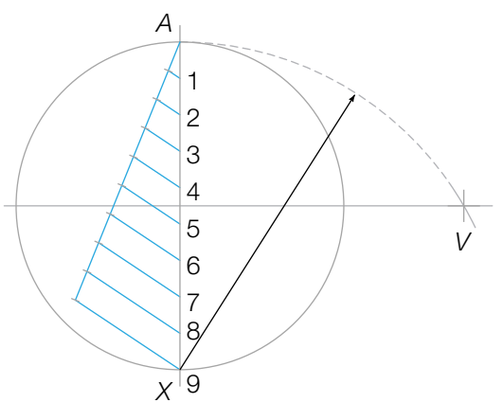
To draw a **regular polygon inscribed** in a circumference, follow these steps:

Step 1. Divide the diameter *AX* of the circumference into the same number of equal parts as the number of sides that the polygon will have (Thales' theorem).

In this case, we are going to draw a nonagon.

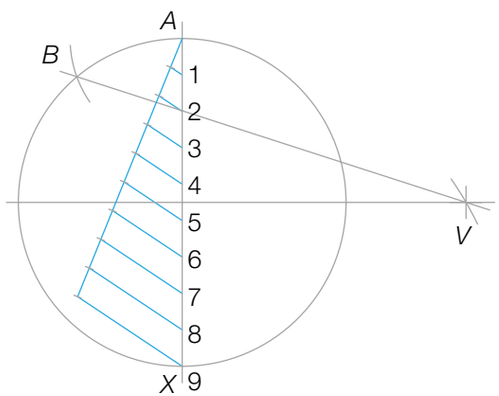


Step 2. Use centre point *X* and radius *AX*. Draw an arc that intersects the extension of the horizontal diameter line at *V*.



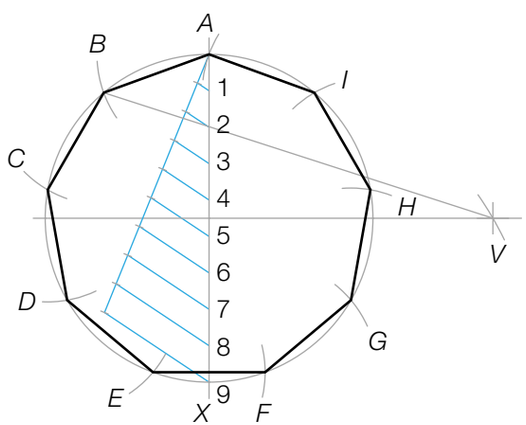
Step 3. Draw a straight line that passes through point *V* and the second division of the diameter (point 2).

Where the straight line intersects the circumference, label the intersection point B.



Step 4. Use radius *AB*. Draw the arcs that identify the vertices of the polygon.

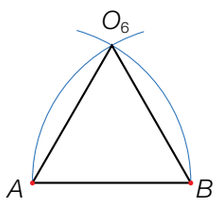
Then draw the sides.



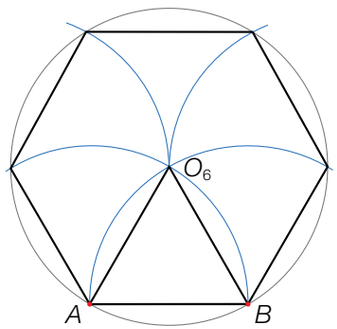
Construction of regular polygons given the length of a side

This is the general method for drawing regular polygons, given a segment.

Step 1. Given the side AB, draw an equilateral triangle.



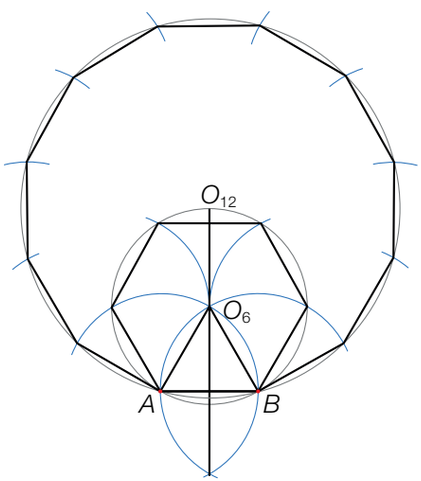
Step 2. Use centre point O_6. Draw the circumference in which we can inscribe the regular hexagon from side AB.



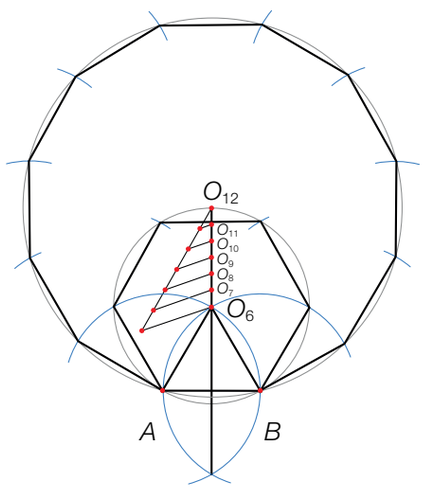
GALLERY

In nature we can often find objects in the shape of a regular polygon. This is the case with snowflakes or ice. When observed through a microscope, you can see their hexagonal forms.

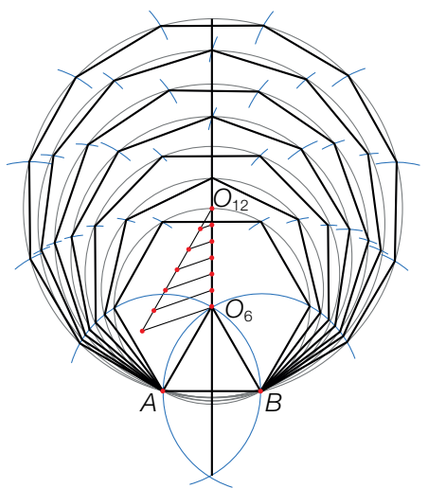
Step 3. Draw the perpendicular bisector of the segment AB. Where it intersects the circumference, we get point O_{12}. This is the centre of the circumference in which we can inscribe a regular dodecagon from side AB.



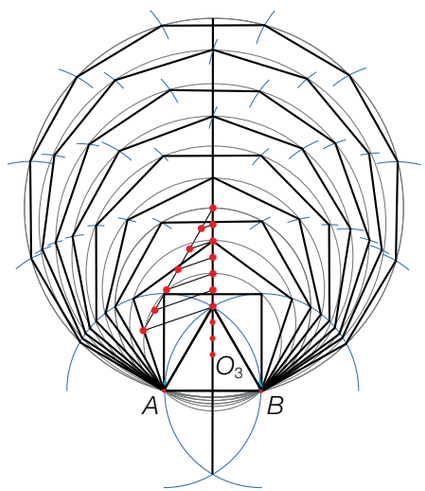
Step 4. Divide the segment O_6O_{12} into six equal parts (Thales' theorem). Find the centres of the circumferences in which we can inscribe a heptagon O_7, an octagon O_8, a nonagon O_9, a decagon O_{10} and a hendecagon O_{11}.



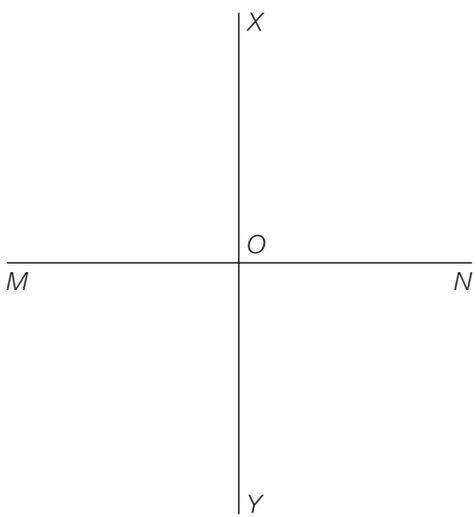
Step 5. Measure the distance between the centres of the circumferences.

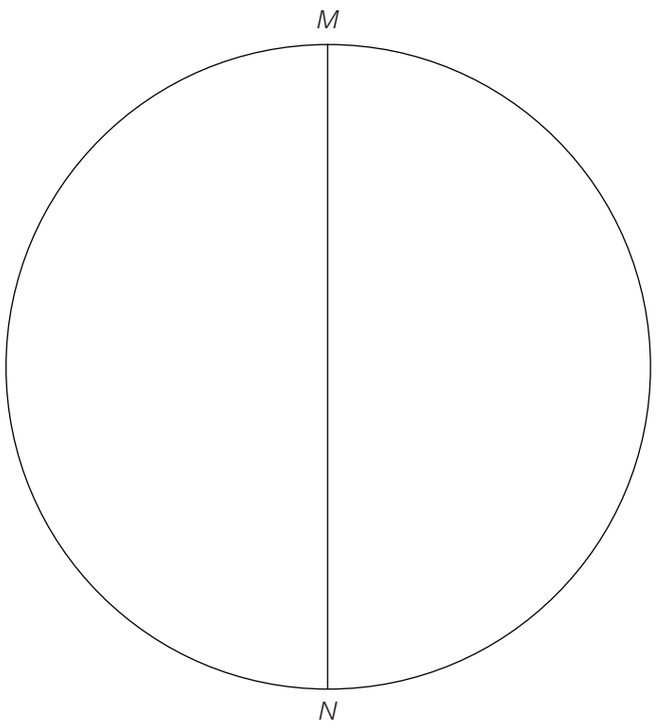


Step 6. Copy it onto the perpendicular bisector. This identifies the centres of the pentagon, square and equilateral triangle (O_3).



PRACTISE

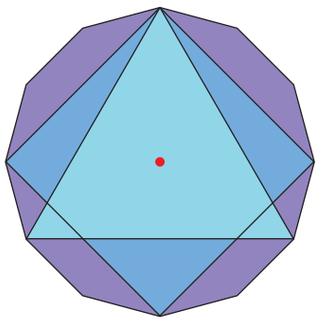


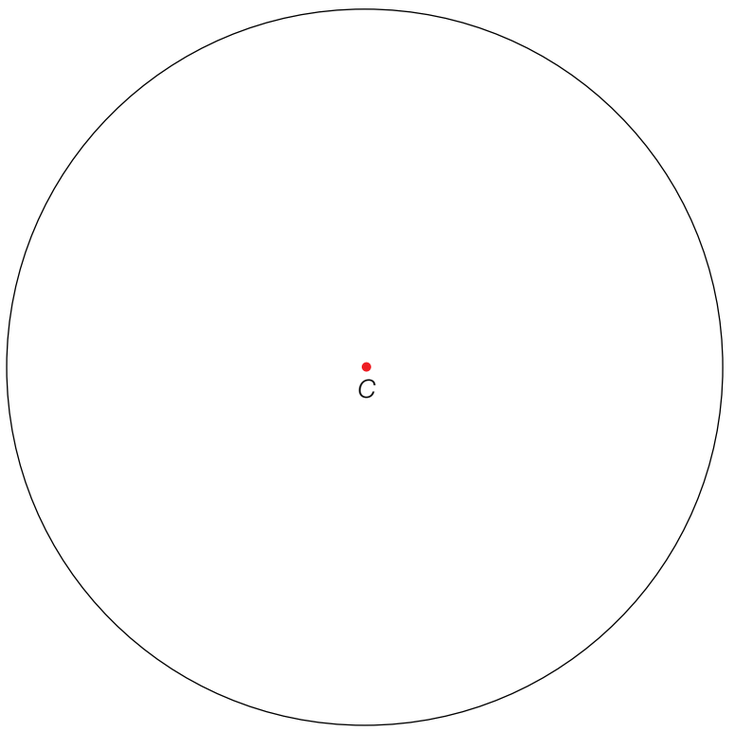


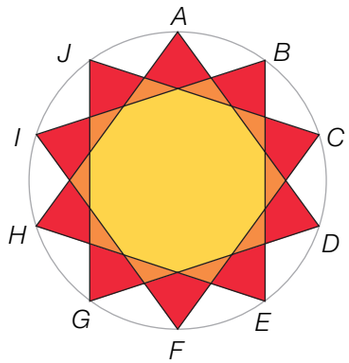
- *XY* and *MN* are the perpendicular diameters of a circumference with centre *O*. Construct a regular decagon.

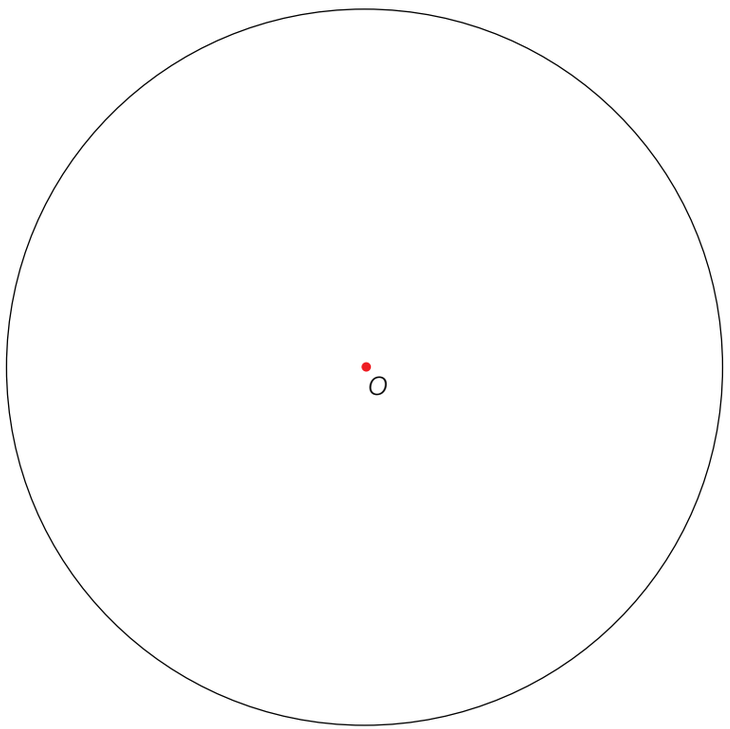
- Construct a heptagon inscribed in the circumference whose diameter is *MN*.

PRACTISE









Copy the figure by constructing a regular dodecagon inscribed in the circumference with centre *C*.

Given the circumference above with centre *O*, make a star-shaped polygon with ten points. Then colour it in.