

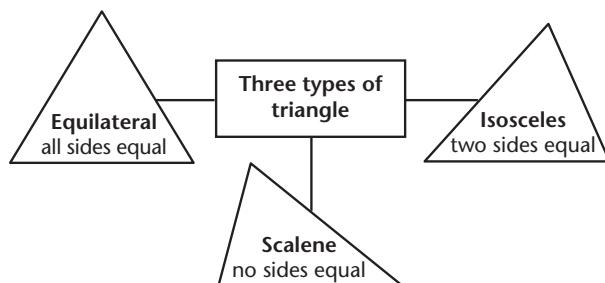
Geometric shapes

Extension material for Level 1 Design and Visual Communication Study Guide
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Polygons

A **polygon** is defined as a many-sided shape; 3-sided are triangles; 4-sided are **quadrilaterals**; 5-sided are pentagons; 6-sided are hexagons; 7-sided are **heptagons**; 8-sided are octagons; 9-sided are **nonagons** and 10-sided are decagons.

Regular polygons have sides of equal lengths and equal internal angles.



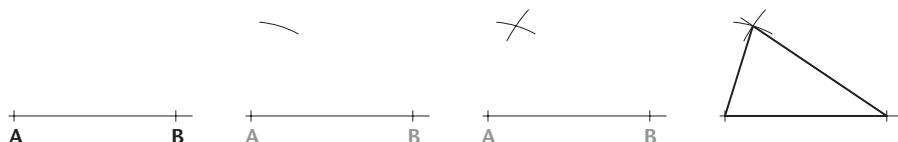
To draw a triangle given the length of its sides

1. Draw the first side, AB.

2. Set the compass to the length of another side, and draw an arc from A.

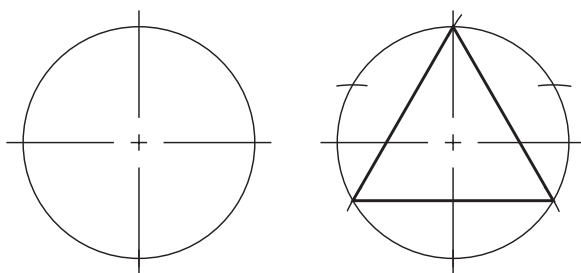
3. Set the compass to the length of the third side, and draw an arc from B to intersect.

4. Complete the triangle.



Drawing a triangle given the lengths of its sides

To draw an equilateral triangle in a circle, step out the radius of the circle around the circumference and join every second mark.



Equilateral triangle in a circle

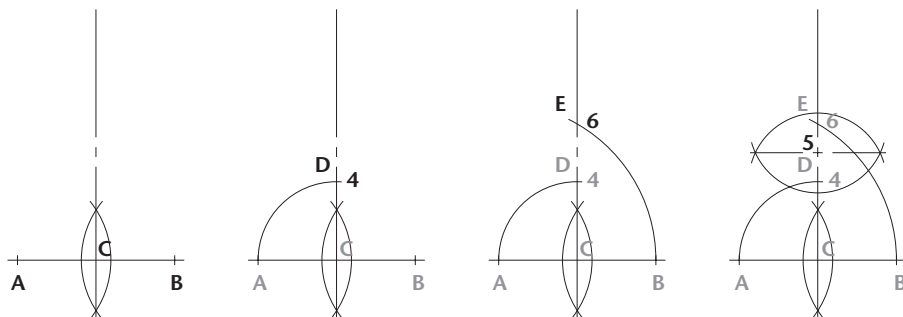
Generic method for constructing any regular polygon given a side

1. Draw the side **AB** and bisect it to get **C**.

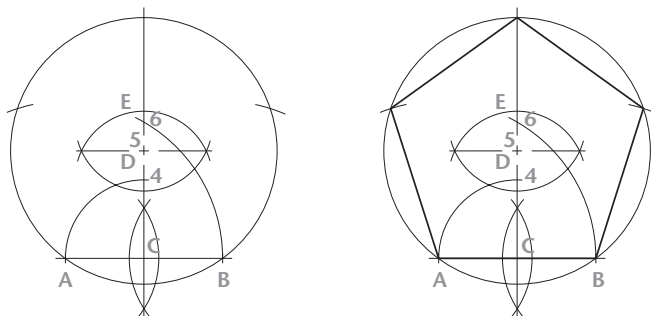
2. With centre **C** and radius **CA**, draw an arc to cut the centreline at **D**. Call this point **4**.

3. With centre **B** and radius **BA**, draw an arc to cut the centreline at **E**. Call this point **6**.

4. Bisect **DE** and call the point **5**.

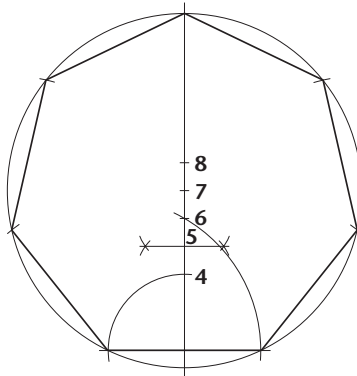


5. The points **4**, **5** and **6** are the centres of circles along the circumference of which the given sides may be stepped out to produce a square, a pentagon, or a hexagon.



Constructing a pentagon given a side

For polygons with more than six sides, use dividers to transfer the vertical distance between points '4' and '5' and place above '6' to get '7', etc. (The point '7' is the centre of a circle along the circumference of which the given side may be stepped out to produce a heptagon.)



Using the generic method to construct a polygon with seven sides

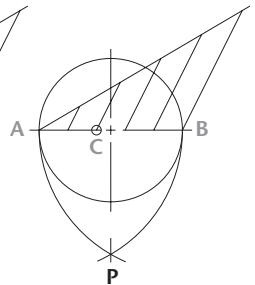
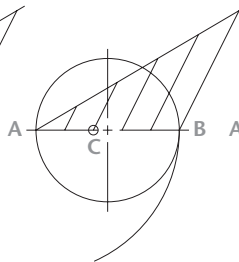
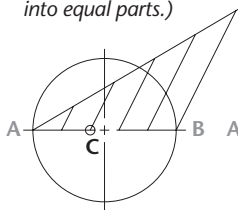
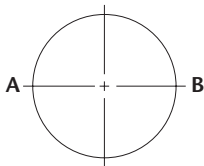
Generic method for constructing any regular polygon within a circle

1. Draw the circle, put in the diameter **AB**.

2. Divide the diameter into the same number of divisions as there are sides of the polygon, and note the 2nd division. Mark it **C**. (See Fig. 6.11: Dividing a line into equal parts.)

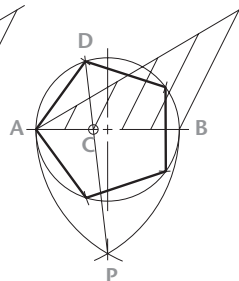
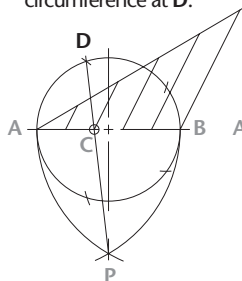
3. With centre **A** and radius **AB**, draw an arc.

4. With centre **B** and radius **AB**, draw an arc to intersect the first arc at **P**.



5. Project a line from **P** through **C** to the circumference at **D**.

6. Set the compass to **AD** and step around the circle.

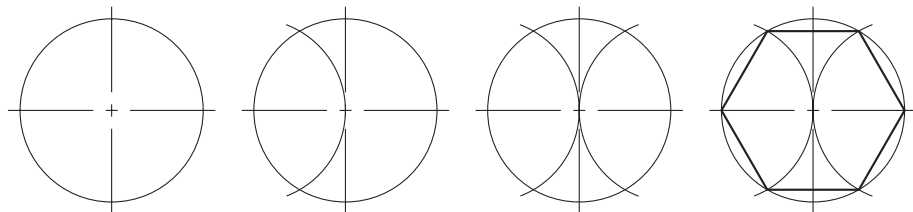


Generic method for constructing polygons in a circle

There are some short cuts and special cases, as shown in Figures 7.12–7.13.

To draw a regular hexagon in a circle

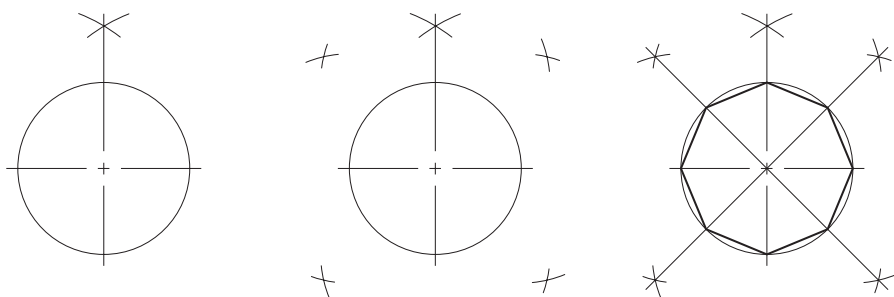
Draw the circle with a radius the same as that of the side of the hexagon required. Put in a diameter and draw arcs, as shown. Join the points where the arcs intersect the circumference.



Hexagon in a circle

To draw a regular octagon in a circle

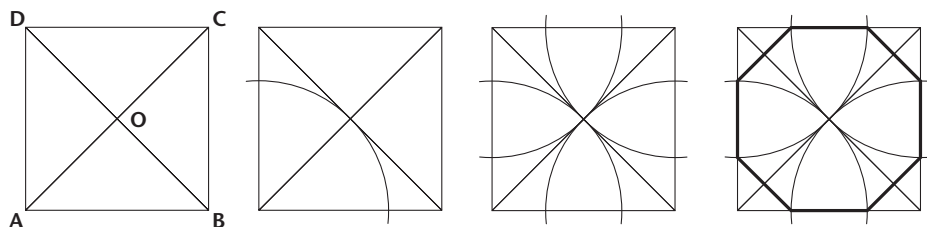
Draw a circle, put in the diameter and bisect it. Bisect each quadrant and project to the circumference. Complete the **octagon**.



Octagon in a circle

To draw a regular octagon in a square

Draw a square **ABCD** and put in the diagonals intersecting at **O**. With centre **A** and radius **AO**, draw an arc to cut the sides of the square. Repeat from centres **B**, **C** and **D**. Complete the octagon.



Octagon in a square

Ellipses

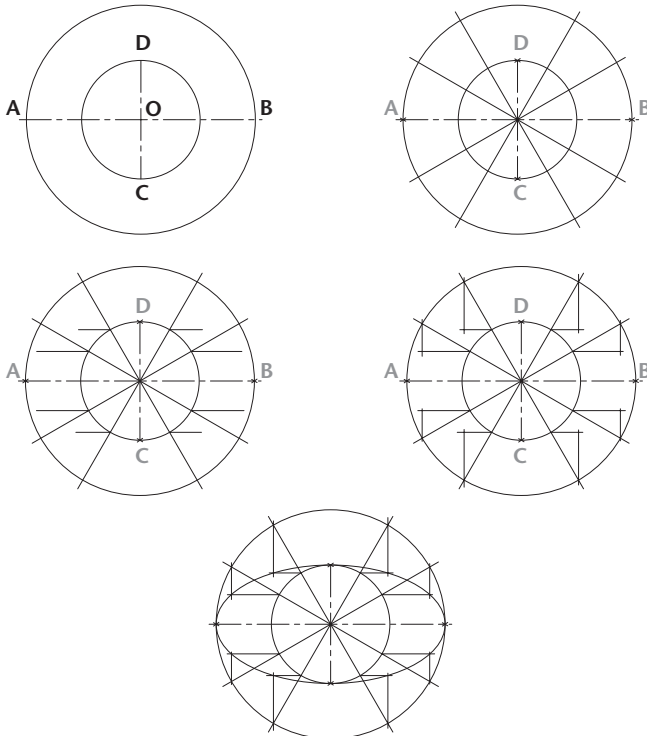
Ellipses are oval shapes. They have two axes, the longer one is the major and the shorter is the minor axis. They are perpendicular to each other.

Example

If a garden bed were required to be circular, an easy way to lay it out would be to put a stake in the ground, put a loop of rope around it, keep it taut and mark the circle around the stake. An elliptical bed can be laid out similarly, but by using two stakes. The following method of drawing an ellipse is known as the concentric circle method.

Constructing an ellipse

1. Draw the two axes, AB and CD, perpendicular to each other (as shown). Where they intersect is O.
2. With centre O and radius OC, draw a circle, and with centre O and radius OA, draw another circle. Put in a number of diagonal lines through O (about three per quadrant). Put in small crosses to mark the known points at the end of each of the axes.
3. Draw construction lines from where diagonal lines cross the small circle parallel to the major axis (AB).
4. Draw more construction lines from where the same diagonal lines cross the large circle parallel to the minor axis (CD), and note where they intersect.
5. Draw a smooth curve through these points.



Constructing an ellipse

Parabolas

An example of a parabolic curve is the path a cricket ball follows when it is thrown in the air; another example is the *McDonald's* logo (which uses two **parabolas**). Points on a parabolic curve are equidistant from a given line and a given point

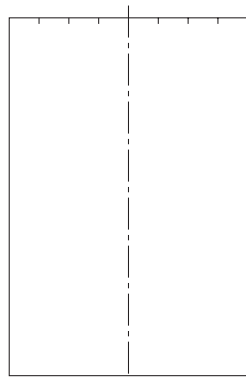
To construct a parabola, its height and width must be known. A box is drawn using these dimensions, and the parabola drawn inside it, as follows.

1. Draw a rectangle the height and width of the parabola. Put in a centreline. Divide one half of the top into four equal spaces and annotate from the centre as **1, 2, 3** and **4**; repeat on the other side.

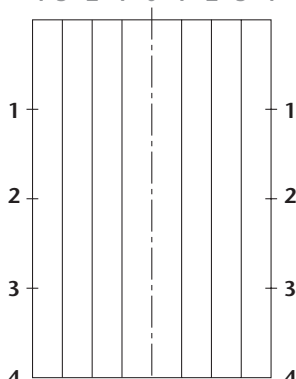
2. Project vertical construction lines. Divide the side up into four equal spaces, and annotate from the top as **1, 2, 3** and **4**; repeat on the other side.

3. Put in the known points on the parabolic curve, ie the centre at the top and the two points at the base. From the top centre, draw a diagonal line to **1** on the side, then from the top centre to **2**, and again to **3**.

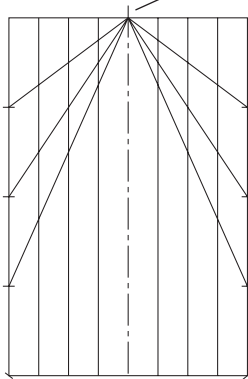
4 3 2 1 0 1 2 3 4



4 3 2 1 0 1 2 3 4



0 centre

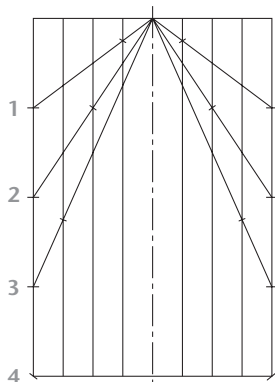


point at base

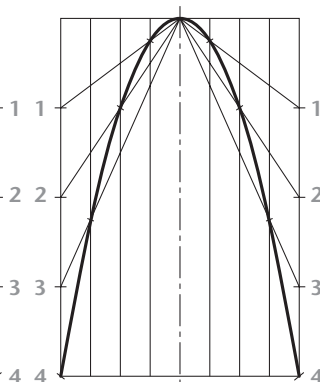
4. Where these diagonal lines intersect with the vertical construction lines, points are plotted.

5. A smooth curve is drawn through these points.

4 3 2 1 0 1 2 3 4



4 3 2 1 0 1 2 3 4



Constructing a parabola

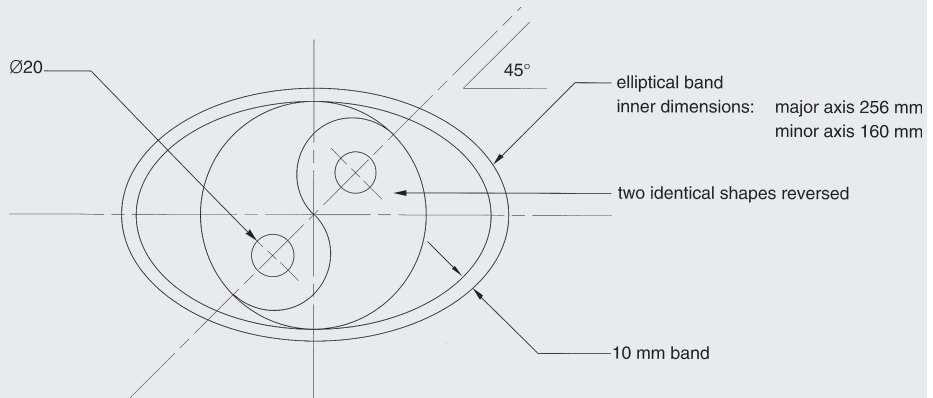
Activity A: Skateboard logo

Below is a designer's final concept sketch of a logo for a skateboard company.

Accurately draw the logo, using the given sizes, to a scale of 1 : 1.

Geometric drawing methods must be used.

Leave all construction lines visible.



Designer's sketch of company logo (not to scale)

Activity B: Polygons, ellipses and parabolas

1. What is a polygon?
2. Draw the plan of a small garden which includes an elliptical pond.
3. Draw the elevation of a bridge based on parabolic curves.