Constructions and clear geometry reasoning

Leaving Certificate · Ordinary Level

Understand the idea

How to start

A construction uses compass arcs and a straightedge to locate points. Leave the arcs visible.

1. Read what you are asked to find.
2. Write down the known numbers and choose the matching rule.
3. Do one step at a time and check the result.

Key terms & definitions

Median
A segment joining a vertex to the midpoint of the opposite side.

Circumcentre
The intersection of perpendicular bisectors of triangle sides.

Incentre
The intersection of internal angle bisectors.

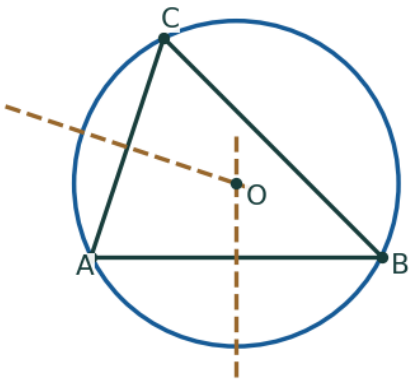
Key ideas

• State the given conditions when explaining a geometric result. A sketch alone does not establish equal lengths or parallel lines.

Construction methods and reasoning

16 · Circumcentre and circumcircle

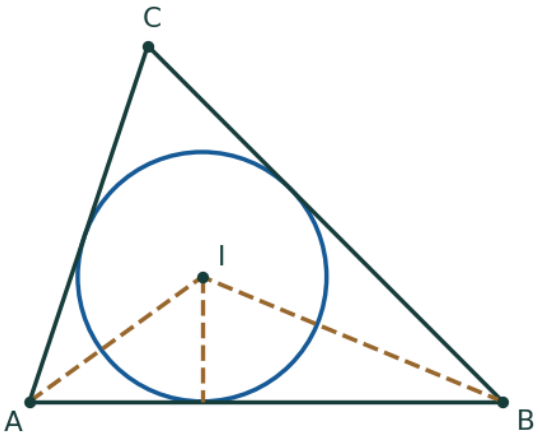
With compass and straightedge, construct perpendicular bisectors of two sides. Their intersection O is the centre. Draw the circle centred at O through any vertex.



Circumcentre and circumcircle — completed construction with guide lines

17 · Incentre and incircle

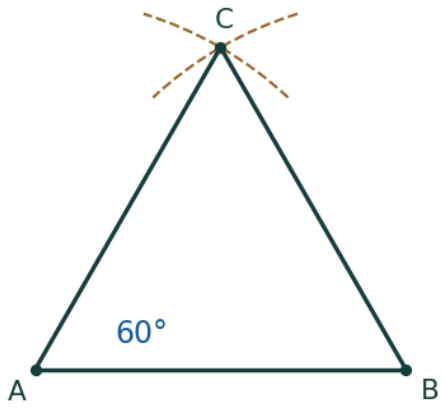
With compass and straightedge, bisect two internal angles. Their intersection I is the centre. Drop a perpendicular from I to a side to get the radius; draw the circle.



Incentre and incircle — completed construction with guide lines

18 · *A*60° **angle**

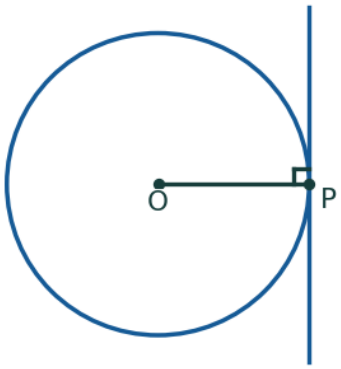
Without a protractor or set square, choose B on ray AB. Use the same radius AB to draw arcs centred at A and B. Join A to their intersection C. Triangle ABC is equilateral.



*A*60° angle — completed construction with guide lines

19 · **Tangent at a point on a circle**

Join centre O to the given point P. Construct the perpendicular to OP at P; this is the tangent.



Tangent at a point on a circle — completed construction with guide lines

20 · Parallelogram from sides and angle

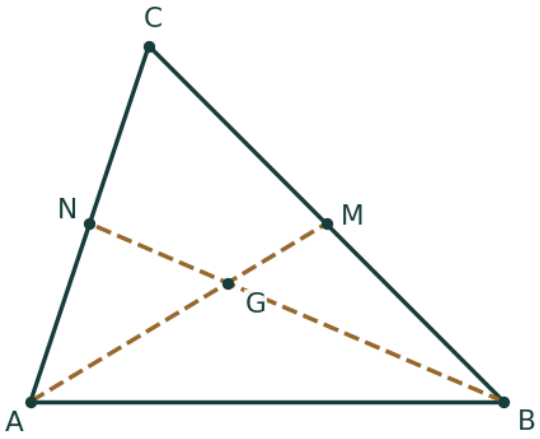
Draw AB to length. Construct the given angle at A and mark D at the second side length. Draw parallels to AD through B and to AB through D. Their intersection is C.



Parallelogram from sides and angle — completed construction with guide lines

21 · Centroid

Construct the midpoints of two sides. Join each midpoint to the opposite vertex. The two medians meet at the centroid.



Centroid — completed construction with guide lines

Quick reminder

• 16 : Circumcircle. Construct perpendicular bisectors of two triangle sides. Their intersection is the circumcentre. Draw a circle from it through a vertex.

• 17 : Incircle. Construct two internal angle bisectors. Their intersection is the incentre. Construct its perpendicular distance to a side as the radius.

Worked examples

Example 01 · Tangent at a known point

Construct a tangent at P on a circle with centre O.

Why this method?

Use the defining property of the required construction; keep the construction lines visible.

OP	**Step 1** Join the centre O to P.
ConstructaperpendiculartoOPatP.	**Step 2** The radius is perpendicular to the tangent at the point of contact.

Example 02 · Locate a circumcentre

Find the centre of the circle through three non-collinear points A, B, C.

Why this method?

Use the defining property of the required construction; keep the construction lines visible.

BisectABperpendicularly.	**Step 1** Every point on that bisector is equally distant from A and B.
BisectBCperpendicularly.	**Step 2** The intersection O is equally distant from A, B and C.
DrawthecirclewithcentreOandradiusOA.	**Step 3** The circle passes through all three points.

Example 03 · Locate a centroid

Construct the centroid of triangle ABC.

Why this method?

Use the defining property of the required construction; keep the construction lines visible.

ConstructthemidpointMofBC.	**Step 1** A median joins a vertex to the opposite side midpoint.
ConstructthemidpointNofAC.	**Step 2** We need two medians to locate their intersection.
JoinAtoMandBtoN.	**Step 3** Their intersection is the centroid.

Example 04 · Find an incentre and draw the incircle

Construct the incircle of a given triangle.

Bisect two internal angles.	**Step 1** Their crossing I is equally far from all three sides.
Draw the perpendicular from I to one side.	**Step 2** Its length is the radius; do not measure to a vertex.
Draw the circle centred at I.	**Final step** Set the compass to that perpendicular distance.

Common mistake

Erasing the compass arcs after finishing a construction. The arcs show how the required point or line was found. Leave the useful construction marks visible; do not replace the method with a measured guess.

Exam technique

Leave compass arcs and construction lines visible.

Try it yourself

Work on paper before checking the answers at the end. These questions are for self-checking, not submitted homework.

Question 1

Where does the centre of an incircle lie?

Watch an explanation

Corbettmaths — Constructions: perpendicular bisector

Corbettmaths — Constructions: angle bisector

Corbettmaths — Constructions: triangles SSS

Corbettmaths — Constructions: perpendicular to point

Open the website chapter to load the embedded players. Use the rates and rules in your question for financial examples.

Self-check answers

Question 1

At the intersection of the internal angle bisectors.

Open the full chapter online