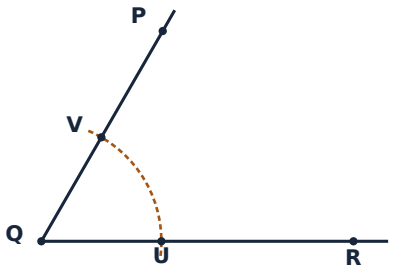
1. Bisect an angle

Given angle PQR with vertex Q.

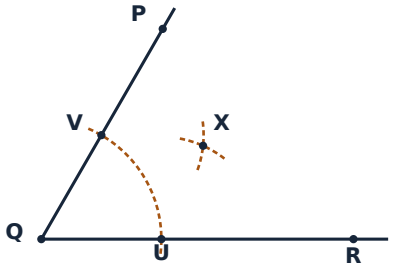
STEP 1

From Q, draw one arc cutting both arms at U and V.



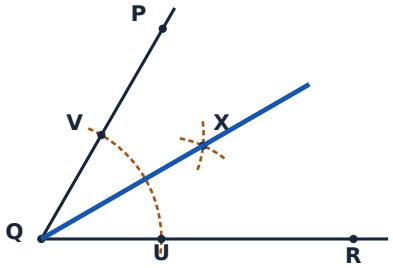
STEP 2

With one compass width, draw arcs from U and V that cross inside the angle at X.



STEP 3

Draw the ray from Q through X.



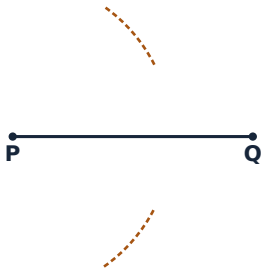
Check: The two angles on either side of QX are equal.

2. Perpendicular bisector

Given segment PQ.

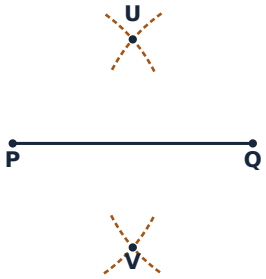
STEP 1

Open the compass wider than half of PQ. From P, draw arcs above and below PQ.



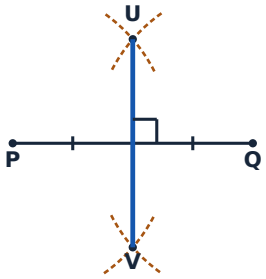
STEP 2

Keep the same width. Repeat from Q, crossing the first arcs at U and V.



STEP 3

Draw UV through the two intersections.



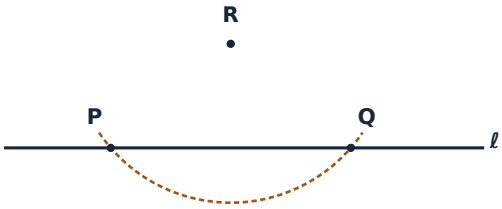
Check: The new line meets PQ at 90° and bisects it.

3. Perpendicular through an external point

HIGHER LEVEL ONLY · Given a point R outside line ℓ.

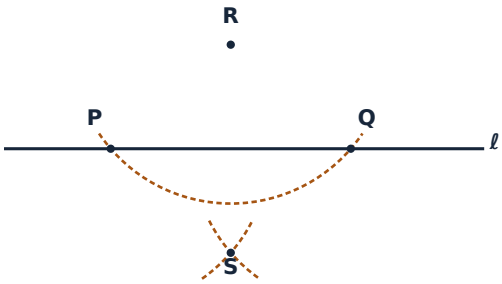
STEP 1

From R, draw an arc wide enough to cut ℓ twice. Label the cuts P and Q.



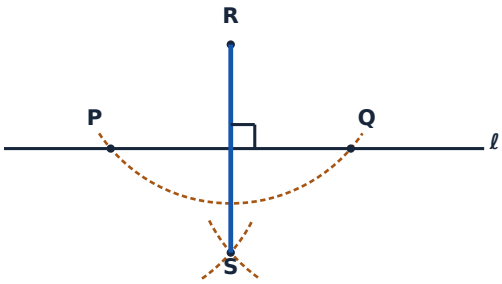
STEP 2

Keep the same radius. From P and Q draw arcs meeting on the far side of ℓ at S.



STEP 3

Draw RS and extend it to the line.



Check: R and S are both equidistant from P and Q, so RS is their perpendicular bisector.

4. Perpendicular at a point on a line

Given a point K on line ℓ.

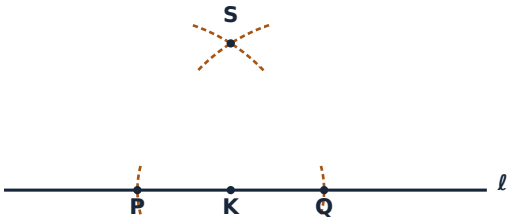
STEP 1

Use one radius from K to mark P and Q on the line, the same distance from K.



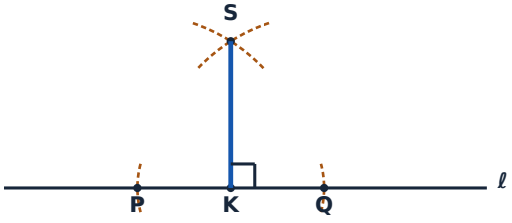
STEP 2

Increase the width. From P and Q draw equal-radius arcs crossing at S.



STEP 3

Draw KS.



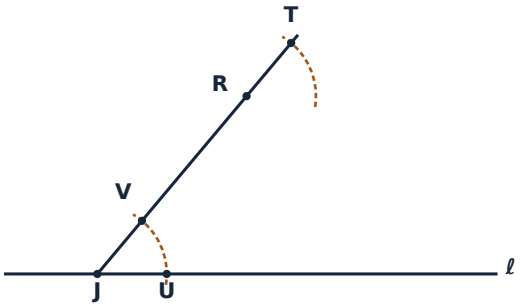
Check: KS is perpendicular to ℓ at K.

5. Parallel through a point

Given line ℓ and point R outside it.

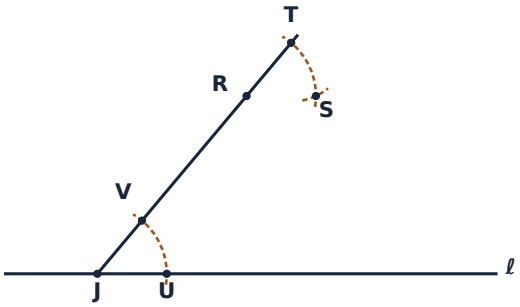
STEP 1

Draw a transversal through R meeting ℓ at J. Use the same radius at J and R to draw the two arcs shown.



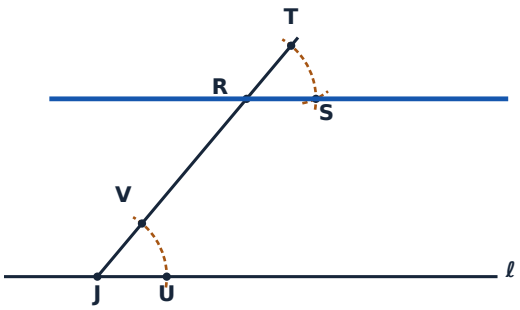
STEP 2

Set the compass to chord UV. With centre T, mark S on the upper arc on the same side of the transversal as U.



STEP 3

Draw the line through R and S.



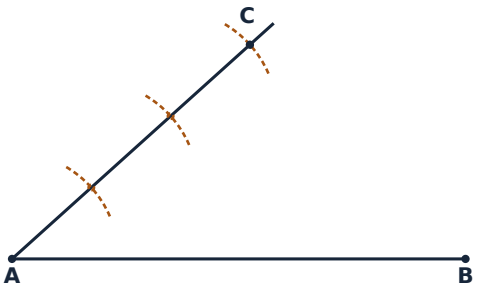
Check: The copied corresponding angles are equal, so RS is parallel to ℓ.

6. Divide a segment into two or three

Given segment AB. The example shows three parts.

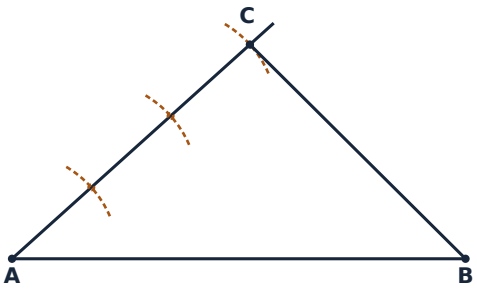
STEP 1

Draw a slanted ray from A. Step one compass width along it 3 times. Call the last mark C.



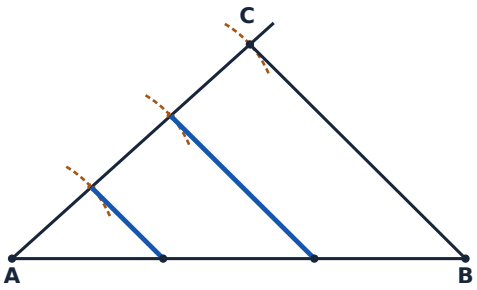
STEP 2

Join C to B. This is the direction for all the parallel lines in the next step.



STEP 3

Use Construction 5 or slide a set square to draw a parallel to CB through each earlier mark. Their intersections divide AB equally.



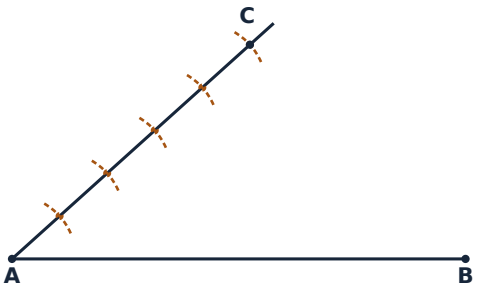
Check: For two parts use two steps; for any n use n steps. The intercept theorem gives equal parts on AB.

7. Divide a segment into n equal parts

HIGHER LEVEL ONLY · Given segment AB. The example shows n = 5.

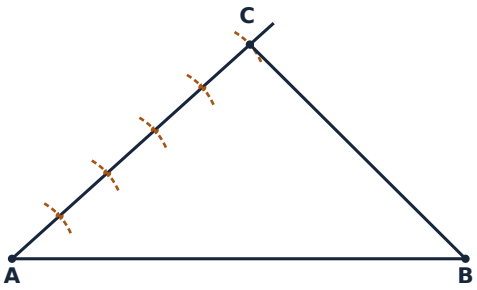
STEP 1

Draw a slanted ray from A. Step one compass width along it 5 times. Call the last mark C.



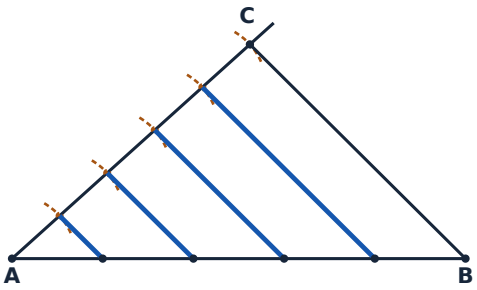
STEP 2

Join C to B. This is the direction for all the parallel lines in the next step.



STEP 3

Use Construction 5 or slide a set square to draw a parallel to CB through each earlier mark. Their intersections divide AB equally.



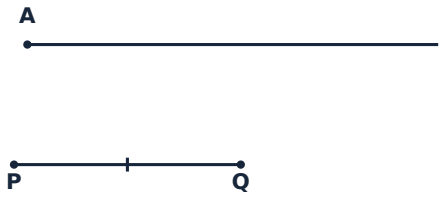
Check: For two parts use two steps; for any n use n steps. The intercept theorem gives equal parts on AB.

8. Copy a length onto a ray

Given segment PQ and a ray starting at A.

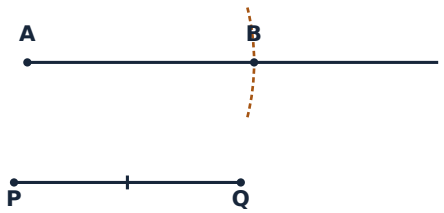
STEP 1

Set the compass width to PQ without measuring it with a ruler.



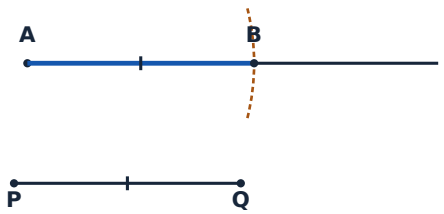
STEP 2

Keeping the width fixed, place the point at A and mark the ray at B.



STEP 3

Identify the copied segment AB.



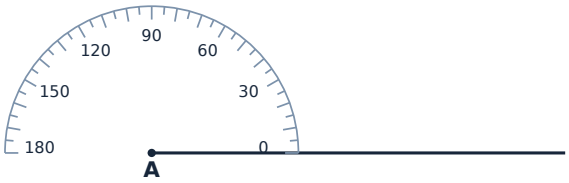
Check: AB and PQ have the same length.

9. Construct an angle of a given size

Example: construct an angle of 55° on the given ray.

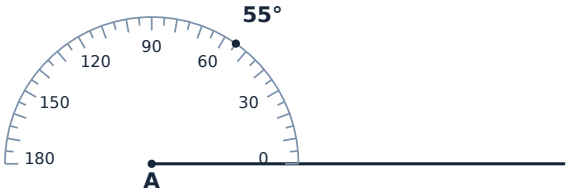
STEP 1

Place the protractor centre on A and align the zero ray with the given ray.



STEP 2

Read from that zero. Mark the 55° direction.



STEP 3

Remove the protractor and draw the second ray through the mark.



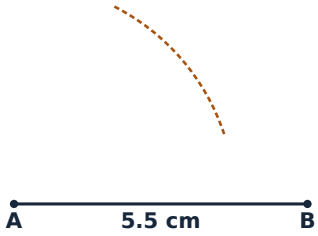
Check: Read the scale that starts at 0° on the given ray.

10. Triangle from three sides (SSS)

Example: AB = 5.5 cm, AC = 4.15 cm and BC = 3.6 cm.

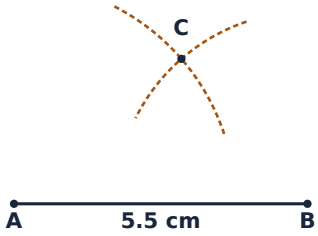
STEP 1

Copy AB. With centre A and compass width AC, draw the first arc.



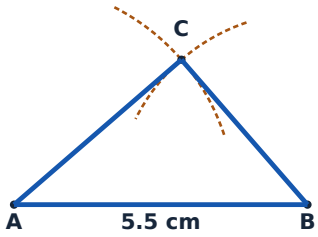
STEP 2

From B draw an arc with radius BC. Label its intersection with the first arc C.



STEP 3

Join A to C and B to C. Leave both arcs visible.



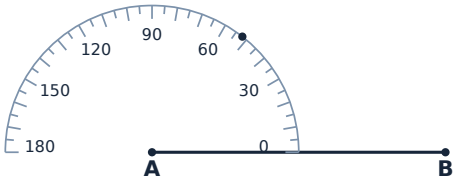
Check: The same three lengths also give a reflected triangle on the other side of AB.

11. Triangle from two sides and included angle (SAS)

Example: AB = 5.5 cm, AC = 4.45 cm and angle A = 52°.

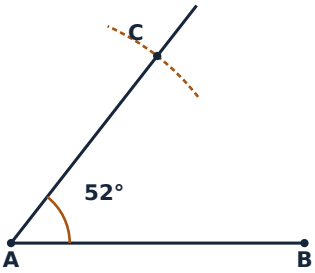
STEP 1

Copy AB. At A, use a protractor to mark a ray 52° from AB.



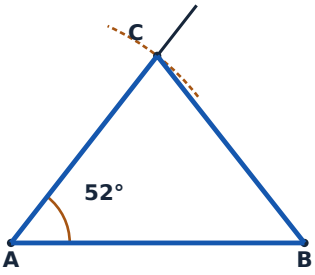
STEP 2

Open the compass to AC. With centre A, cut the new ray at C.



STEP 3

Join C to B to complete the triangle.



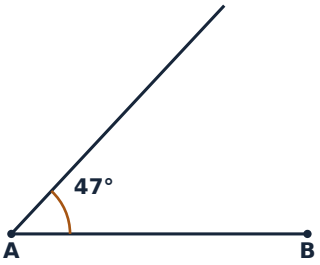
Check: The 52° angle is between the two given sides.

12. Triangle from two angles and included side (ASA)

Example: AB = 5.55 cm, angle A = 47° and angle B = 58°.

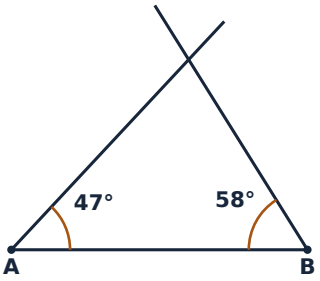
STEP 1

Copy AB. At A construct a 47° ray measured from AB.



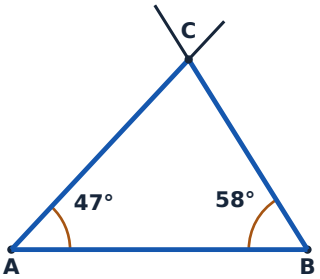
STEP 2

At B construct a 58° ray measured from BA, on the same side of AB.



STEP 3

Label their intersection C. The three points determine triangle ABC.



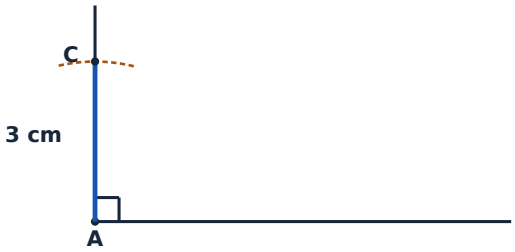
Check: The third angle is 75°. At B start from BA, not from the extension to the right.

13. Right triangle from hypotenuse and a leg (RHS)

Example: right angle at A, AC = 3 cm and BC = 5 cm.

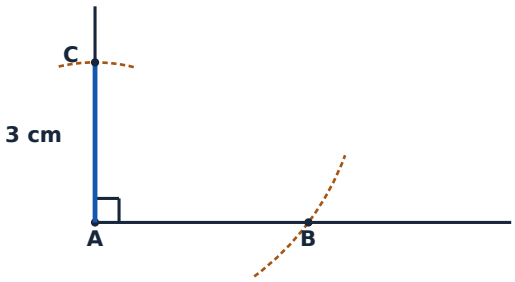
STEP 1

Draw perpendicular rays at A and mark the 3 cm leg AC on one ray.



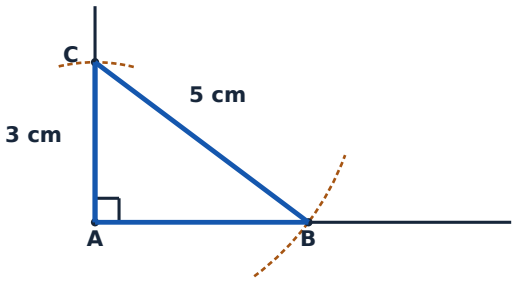
STEP 2

With centre C and radius 5 cm, cut the other ray at B.



STEP 3

Join B to C.



Check: The hypotenuse BC is opposite the right angle.

14a. Right triangle: given the adjacent leg

Example: AB = 6.2 cm and angle B = 25°.

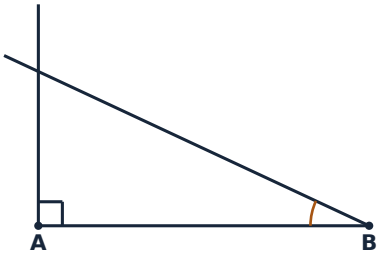
STEP 1

Draw AB and construct a perpendicular ray at A.



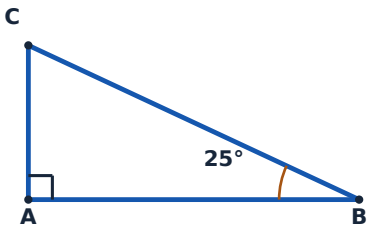
STEP 2

At B, measure 25° from BA and draw the ray on the side of the perpendicular shown.



STEP 3

The two rays meet at C.



Check: The acute angles are B = 25° and C = 65°; the right angle is at A.

14b. Right triangle: given the opposite leg

Example: AC = 3 cm and angle B = 25°.

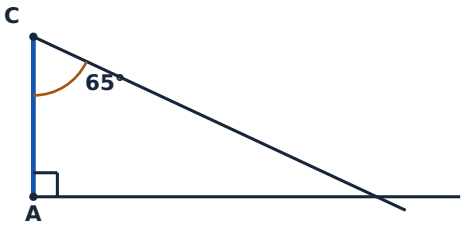
STEP 1

Draw the 3 cm leg AC. At A, construct the perpendicular ray AB.



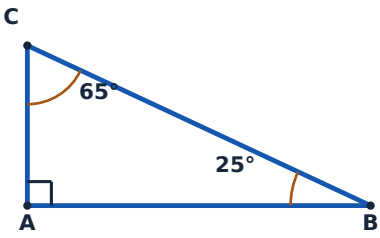
STEP 2

At C, measure 65° from CA and draw the ray towards the perpendicular.



STEP 3

The two rays meet at B. The angle at B is 25°.



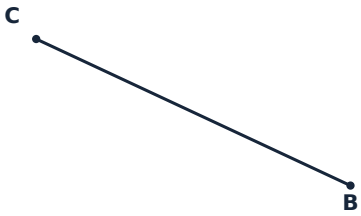
Check: The acute angles are B = 25° and C = 65°; the right angle is at A.

14c. Right triangle: given the hypotenuse

Example: BC = 6.5 cm and angle B = 25°.

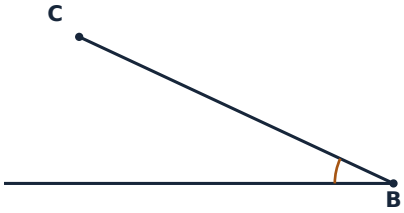
STEP 1

Draw the 6.5 cm hypotenuse BC.



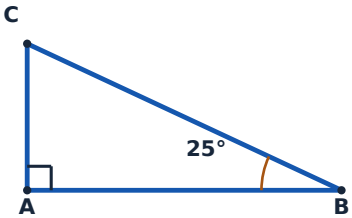
STEP 2

At B, draw ray BA at 25° below BC as shown.



STEP 3

Through C, construct a perpendicular to BA. Its foot is A.



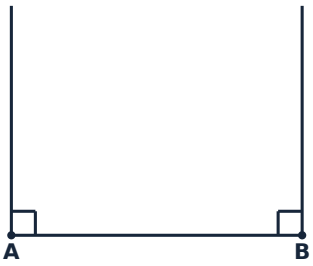
Check: The acute angles are B = 25° and C = 65°; the right angle is at A.

15. Rectangle from its side lengths

Example: length 5.45 cm, width 3.05 cm.

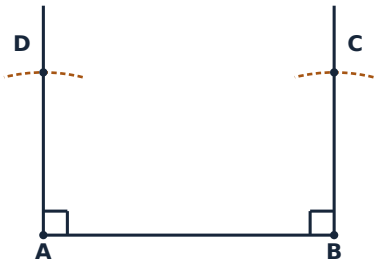
STEP 1

Copy AB to the required length. Construct perpendiculars at A and B on the same side.



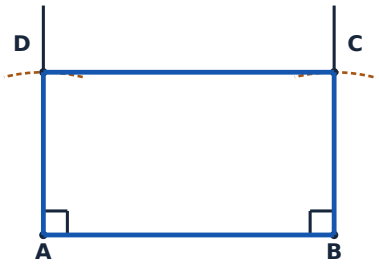
STEP 2

Use one compass width to mark the given width at D and C.



STEP 3

Join D to C to complete the rectangle.



Check: Opposite sides are equal, and all four angles are right angles.

JUNIOR CYCLE HIGHER LEVEL · CHAPTER PRACTICE

Constructions 1–15

Try the questions before opening the separate answer key. Show one step per line.

22.1 · Fluency

Construct the perpendicular bisector of a 7 cm segment using compass and straight edge only.

22.2 · Variation

Construct triangle ABC with AB = 6 cm, AC = 4 cm and BC = 5 cm.

22.3 · Choose a method

Construct a right triangle with right angle A, AC = 4 cm and angle B = 30°. Leave guide lines visible.

Check your work: are the sign, units and level of accuracy appropriate?