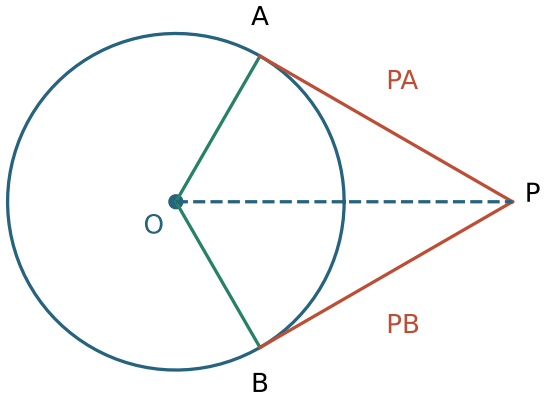
Exercise walk-through

4.4.3 Constructions

AQA · GCSE · Mathematics

Figure: Congruence, similarity and circles (4)

Shared OP and equal radii → RHS → PA = PB



- Equal radii, shared OP and right angles give congruent triangles (RHS), so PA = PB
- Match each part of the diagram to the text.

Perimeter, area and volume

- Triangle: $\frac{1}{2} \times b \times h$, where h is the **perpendicular height** .
- Parallelogram: $b \times h$.
- Trapezium: $\frac{1}{2}(a+b)h$, where a and b are the parallel sides.
- Circle: $A = \pi r^2$, and the **circumference** is $C = 2\pi r = \pi d$.

$$\text{arc length} = \frac{\theta}{360} \times 2\pi r \qquad \text{sector area} = \frac{\theta}{360} \times \pi r^2$$

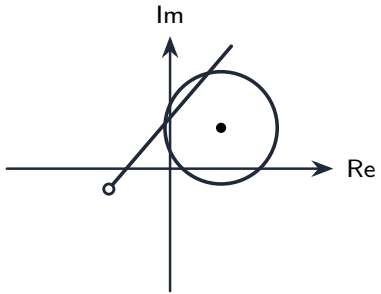
Pythagoras and trigonometry

- **Pythagoras' theorem.** In a right-angled triangle, $a^2 + b^2 = c^2$, where c is the **hypotenuse**, the longest side, opposite the right angle.
- A ladder whose foot is 3 m from a wall and whose top is 4 m up the wall is $\sqrt{9+16} = 5$ m long.
- **Trigonometric ratios.** Label the sides from the angle θ: opposite, **adjacent** (next to the angle) and **hypotenuse**.
- **Worked example 12.** In a right-angled triangle the hypotenuse is 23.7 cm and x is the side **adjacent** to an angle of $52°$.

$$\sin\theta = \frac{\text{opp}}{\text{hyp}} \qquad \cos\theta = \frac{\text{adj}}{\text{hyp}} \qquad \tan\theta = \frac{\text{opp}}{\text{adj}}$$

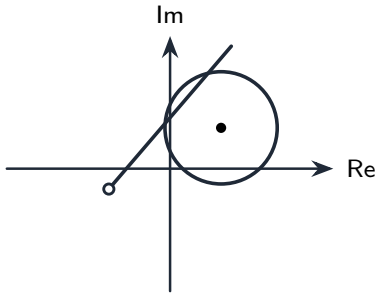
Exercise 2.1

2.1 Describe the locus of points exactly 3 cm from a point P. [1]



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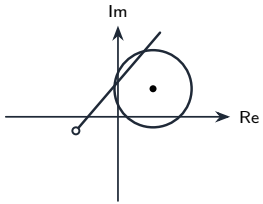


2.1

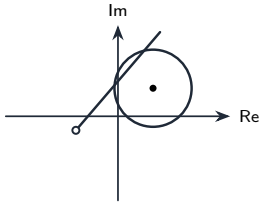
- a **circle**, centre P, radius 3 cm

Setup for exercise 2.2

2.2 Describe the locus of points equidistant from two points A and B. [1]



2.3 Describe the locus of points equidistant from two lines that cross. [1]



2.4 Draw a line AB 8 cm long. Construct its perpendicular bisector, showing all your construction arcs. [2]

Exercise 2.2

2.5 Draw a line and construct an angle of 60° at one end of it, using a ruler and compasses only. [2]

Exercise 2.2

2.5 Draw a line and construct an angle of 60° at one end of it, using a ruler and compasses only. [2]

2.2

- the **perpendicular bisector** of AB

2.3

- the **bisectors of the angles** between the lines

2.4

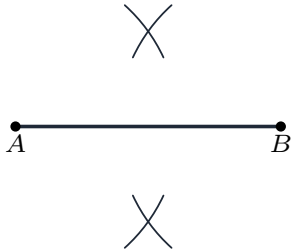
- equal arcs from A and B, radius more than 4 cm, crossing above and below AB
- the line through the two crossings, at right angles to AB through its midpoint, 4 cm from each end, arcs visible

2.5

- arc from the end O cutting the line at X; the same radius from X cuts the first arc at Y
- OY drawn: angle $XOY = 60°$ (within $\pm 2°$), arcs visible

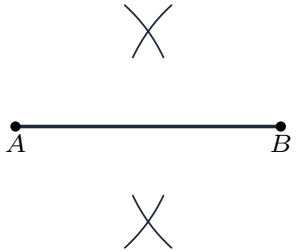
Exercise 3.1

3.1 Ella sets her compasses to 2 cm to bisect a line 8 cm long. Explain why her arcs will not work. [1]



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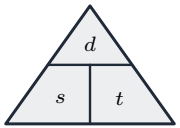
3.1

- the arcs must have radius **more than half** AB (more than 4 cm); 2 cm arcs from A and B never meet

Setup for exercise 3.2

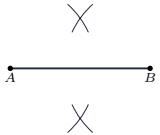
3.2 Draw an angle of 70° with a protractor. Construct its bisector, showing all your construction arcs. [2]

3.3 A and B are 10 cm apart. Point P is equidistant from A and B and 13 cm from A. Work out the distance from P to the line AB. [3]

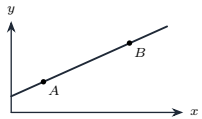


Exercise 3.2

3.4 A and B are 6 cm apart. Shade the region of points that are less than 4 cm from A **and** closer to B than to A. Show your construction arcs. [3]

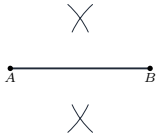


3.5 Radio masts A and B are 50 km apart. Each mast's signal reaches 30 km. Work out the length of the straight line joining the two points where the edges of the signal areas cross. [4]

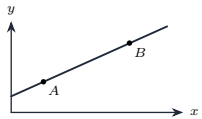


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3.2

- an arc from the vertex cuts both arms; equal arcs from those two points cross inside the angle

Full solution on next slide

Full solution 3.2 (1/2)

3.2

- an arc from the vertex cuts both arms; equal arcs from those two points cross inside the angle
- line from the vertex through the crossing, making two $35°$ angles ($\pm 2°$), arcs visible

3.3

- P is on the perpendicular bisector, which meets AB at M with $AM = 5$ cm
- $MP^2 = 13^2 - 5^2 = 169 - 25 = 144$
- $MP = \mathbf{12}$ cm

Full solution 3.2 (2/2)

3.4

- a circle, centre A, radius 4 cm
- the perpendicular bisector of AB, constructed with arcs
- the shaded region is inside the circle **and** on B's side of the bisector: the part of the circle beyond the bisector, 3 cm to 4 cm from A along AB

3.5

- the crossing points lie on the perpendicular bisector, 25 km from each mast along AB
- half the line: $h = \sqrt{30^2 - 25^2} = \sqrt{275} = 16.58\ldots$ km

- length $= 2h =$ **33.2** km