Exercise walk-through

4.1
Angles, parallel lines and polygons (G1–G3)

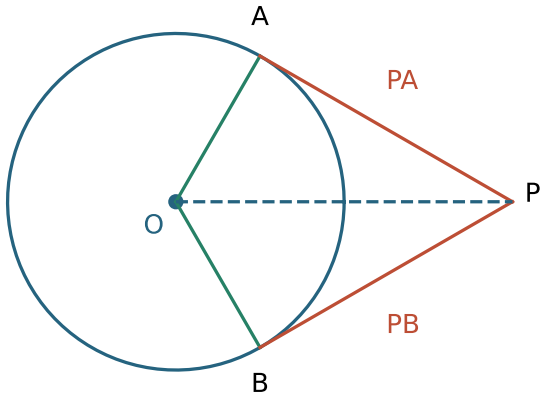
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Angles and polygons

- Angles at a point add up to $360°$; angles on a straight line add up to $180°$.
- Vertically opposite angles are equal.
- Where a line crosses two parallel lines, alternate angles are equal, **corresponding angles** are equal, and co-interior angles add up to $180°$. Write "alternate angles are equal", never "Z-angles".
- The angles in a triangle add up to $180°$.

Figure: Congruence, similarity and circles (4)

Shared OP and equal radii → RHS → PA = PB



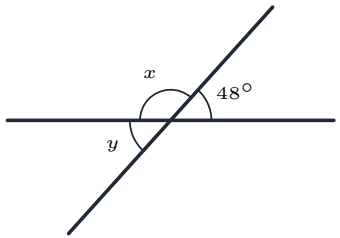
- Equal radii, shared OP and right angles give congruent triangles (RHS), so PA = PB
- Match each part of the diagram to the text.

Vectors and coordinate geometry (2)

- Add and subtract vectors by adding and subtracting their parts: with $\mathbf{a} = \begin{pmatrix} 4 \\ 1 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}$, $\mathbf{a} + \mathbf{b} = \begin{pmatrix} 5 \\ 4 \end{pmatrix}$ and $2\mathbf{a} - \mathbf{b} = \begin{pmatrix} 7 \\ -1 \end{pmatrix}$.
- **Vector proofs (H).** If one vector is a number times another, the lines are parallel.

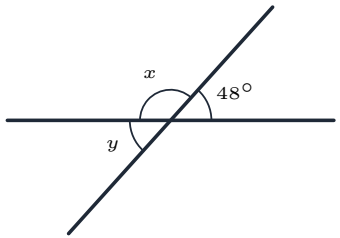
Exercise 2.1

2.1 Two straight lines cross. Find x and y. Give a reason for each answer. [2]



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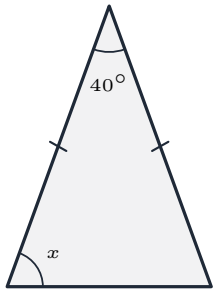


2.1

- $x = 180 - 48 = \mathbf{132}°$, angles on a straight line
- $y = \mathbf{48}°$, vertically opposite angles

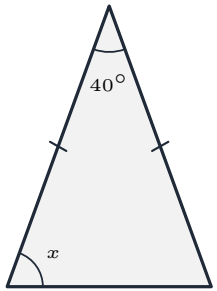
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2.2 The triangle is isosceles. Find x. [2]



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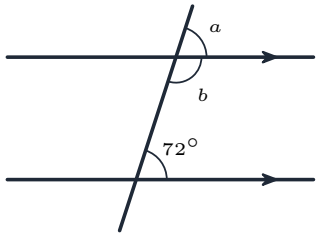


2.2

- $180 - 40 = 140$
- $x = 140 \div 2 = \mathbf{70}°$

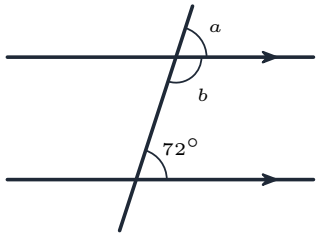
Exercise 2.3

2.3 A line crosses two parallel lines. Find a and b. Give a reason for each answer. [2]



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2.3

- $a = \mathbf{72}°$, corresponding angles
- $b = 180 - 72 = \mathbf{108}°$, co-interior angles

Exercises 2.4·3.1

2.4 Work out the size of each exterior angle and each interior angle of a regular pentagon. [2]



3.1 Each interior angle of a regular polygon is 156°. How many sides does the polygon have? [3]

regular polygon | interior angle $156°$

Exercises 2.4·3.1

2.4 Work out the size of each exterior angle and each interior angle of a regular pentagon. [2]



2.4

- exterior $360 \div 5 = \mathbf{72}^\circ$
- interior $180 - 72 = \mathbf{108}^\circ$

3.1 Each interior angle of a regular polygon is 156°. How many sides does the polygon have? [3]

regular polygon | interior angle 156°

3.1

- exterior angle $180 - 156 = 24^\circ$
- $360 \div 24$
- **15** sides

Exercise 3.2 (a)

3.2 A designer makes a floor pattern from regular octagons and squares. She also uses a tile shaped like the quadrilateral $ABCD$, where AB is parallel to DC.

(a) Work out the size of each interior angle of a regular octagon. [2]

Exercise 3.2 (a)

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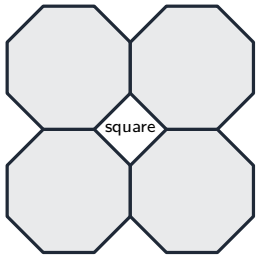
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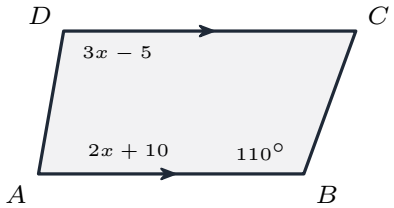
(a) exterior $360 \div 8 = 45°$; interior $\mathbf{135}°$

Exercise 3.2 (b)

3.2 A designer makes a floor pattern from regular octagons and squares. She also uses a tile shaped like the quadrilateral $ABCD$, where AB is parallel to DC.

(b) Show that two regular octagons and a square fit together at a point with no gaps. [3]

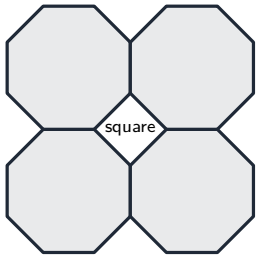


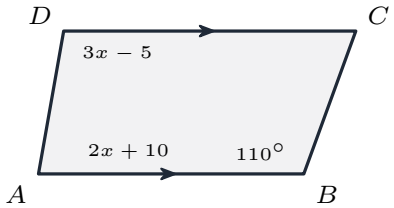


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(b) Show that two regular octagons and a square fit together at a point with no gaps. [3]





(b) $135 + 135 + 90 = 360°$; angles around a point add to $360°$, so there is no gap

Exercise 3.2 (c)

3.2 A designer makes a floor pattern from regular octagons and squares. She also uses a tile shaped like the quadrilateral $ABCD$, where AB is parallel to DC.

(c) Explain why regular pentagons alone cannot cover a floor with no gaps. A regular hexagon, a square and a regular polygon P fit together at a point. How many sides does P have? [4]

Exercise 3.2 (c)

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(c) interior angle of a pentagon is $108°$; $360 \div 108 = 3.33\ldots$ is not a whole number, so there are gaps; $360 - 120 - 90 = 150°$; exterior $30°$, so P has **12** sides

Exercise 3.2 (d)

3.2 A designer makes a floor pattern from regular octagons and squares. She also uses a tile shaped like the quadrilateral $ABCD$, where AB is parallel to DC.

(d) In $ABCD$, angle $DAB = (2x + 10)°$, angle $ADC = (3x - 5)°$ and angle $ABC = 110°$. Work out x, and the sizes of angles DAB, ADC and BCD. [5]

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(d) co-interior angles: $(2x + 10) + (3x - 5) = 180$; $5x + 5 = 180$; $x = \mathbf{35}$; $DAB = \mathbf{80}°$, $ADC = \mathbf{100}°$; $BCD = 180 - 110 = \mathbf{70}°$