

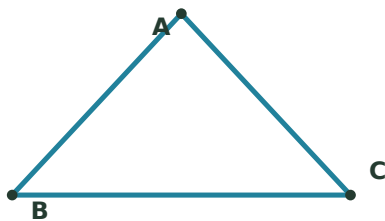
Supplementary practice

Questions 1–4 | Triangles

Q1 Isosceles angles

In $\triangle ABC$, $AB = AC$, $\angle ABC = \angle ACB = 47^\circ$.

- Find $\angle BAC$.
- Identify the longest side.
- Classify $\triangle ABC$ by its angles.

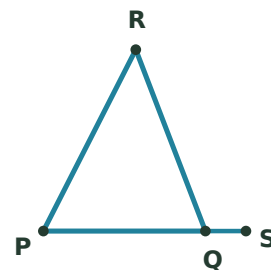


Working space

Q2 Exterior angle

In $\triangle PQR$, PQ is extended beyond Q to S .

Given $\angle RPQ = 63^\circ$ and $\angle PRQ = 48^\circ$, find $\angle RQS$ and $\angle PQR$. Give reasons.



Working space

Q3 Triangle inequality

- Can segments of 4 cm, 7 cm and 12 cm form a triangle? Explain.
- Two sides of a triangle are 5 cm and 8 cm. State the range of the third side x .
- How many whole-number values of x are possible?

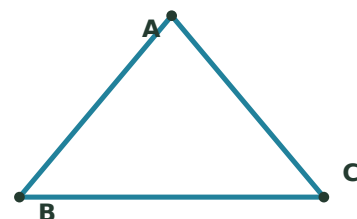
Working space

Q4 Algebra and angles

In isosceles $\triangle ABC$, $AB = AC$.

$\angle BAC = (2x + 20)^\circ$ and $\angle ABC = (x + 20)^\circ$.

Find x and all three angles. Show your equation.



Working space

Supplementary practice

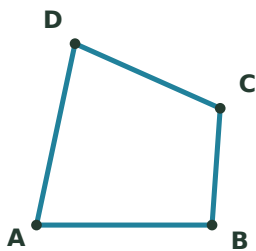
Questions 5-8 | Quadrilaterals

Q5 Angle sum

In convex quadrilateral ABCD:

$\angle A = 78^\circ$, $\angle B = 94^\circ$ and $\angle C = 110^\circ$.

Find $\angle D$. State the angle property used.



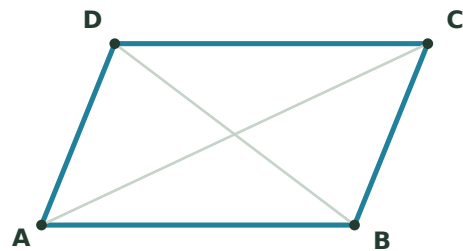
Working space

Q6 Parallelogram

ABCD is a parallelogram with $\angle DAB = 68^\circ$.

Its diagonals AC and BD meet at E.

Find (a) $\angle ABC$, (b) $\angle BCD$ and (c) AC if $AE = 6.5$ cm.



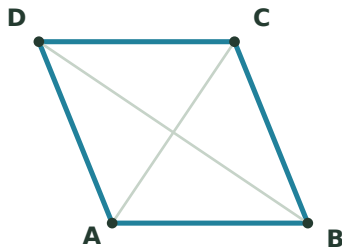
Working space

Q7 Rhombus

ABCD is a rhombus. Its diagonals AC and BD meet at E.

Given $\angle DAB = 112^\circ$, find:

(a) $\angle DAC$ (b) $\angle ABE$ (c) $\angle AEB$.



Working space

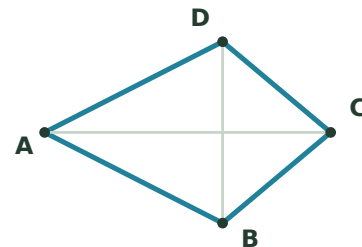
Q8 Kite: multi-step

ABCD is a kite: $AB = AD$ and $BC = CD$.

Diagonals AC and BD meet at E.

Given $\angle BAC = 27^\circ$ and $\angle ABC = 113^\circ$, find:

(a) $\angle BAD$ (b) $\angle ABE$ (c) $\angle EBC$.



Working space

Supplementary practice

Questions 9–10 | Triangle constructions

Q9 Three sides (SSS)

Construct $\triangle ABC$ with $AB = 7$ cm, $AC = 5$ cm and $BC = 6$ cm.

Label A, B and C. State the shortest side and its opposite angle.

Construction / working area

Keep arcs visible. Use a sharp pencil, ruler, protractor and compasses.

Q10 Two sides and an included angle (SAS)

Construct $\triangle PQR$ with $PQ = 7$ cm, $PR = 5$ cm and $\angle QPR = 60^\circ$.

Measure QR and record your answer to the nearest 0.1 cm.

Construction / working area

Keep arcs visible. Use a sharp pencil, ruler, protractor and compasses.

Supplementary practice

Questions 11-12 | Construction challenges

Q11 Two possible triangles

Construct $\triangle ABC$ with $AB = 8$ cm, $BC = 5$ cm and $\angle BAC = 30^\circ$.

Show both possible positions of C. Explain why two triangles are possible.

Construction / working area

Keep arcs visible. Use a sharp pencil, ruler, protractor and compasses.

Q12 Parallelogram construction

Construct parallelogram ABCD with $AB = 8$ cm, $BC = 5$ cm and $\angle ABC = 60^\circ$.

Keep the compass arcs visible. Measure AC, then calculate $\angle BAD$.

Construction / working area

Keep arcs visible. Use a sharp pencil, ruler, protractor and compasses.

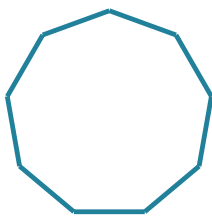
Supplementary practice

Questions 13–16 | Polygons and symmetry

Q13 Regular nonagon

A regular nonagon has nine sides.

- Find (a) the sum of its interior angles,
 (b) one interior angle and
 (c) one exterior angle.

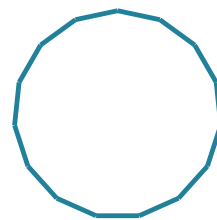


Working space

Q14 Reverse the angle rule

Each exterior angle of a regular polygon is 24° .

- Find (a) its number of sides,
 (b) one interior angle, and
 (c) the sum of all its interior angles.



Working space

Q15 Irregular hexagon

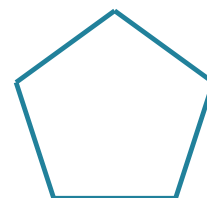
A convex hexagon has interior angles 118° , 127° , 145° , 116° , 132° and x° .

- (a) Find x .
 (b) State the interior angle of a regular hexagon.
 (c) Which angle is larger: x or the regular hexagon angle?

Working space

Q16 Two types of symmetry

- (a) For a regular pentagon, state its number of lines of symmetry, rotational order and smallest angle of rotation.
 (b) For a non-square rectangle, state its number of lines of symmetry and rotational order.



Working space

Worked solutions

Questions 1–4 | Answers and reasons

Q1 Isosceles angles

- (a) $\angle BAC = 180^\circ - 47^\circ - 47^\circ = 86^\circ$ (angles in a triangle).
 (b) BC is the longest side: it is opposite $\angle A$, the largest angle (86°).
 (c) Acute-angled: all three angles are below 90° .

Q2 Exterior angle

- $\angle RQS = 63^\circ + 48^\circ = 111^\circ$ (exterior angle of a triangle).
 $\angle PQR = 180^\circ - 111^\circ = 69^\circ$ (angles on a straight line).
 Check: $63^\circ + 48^\circ + 69^\circ = 180^\circ$.

Q3 Triangle inequality

- (a) No. $4 + 7 = 11$, and $11 < 12$. The shorter lengths must add to more than the longest.
 (b) $8 - 5 < x < 8 + 5$, so $3 < x < 13$.
 (c) The whole numbers 4, 5, 6, 7, 8, 9, 10, 11 and 12 are possible: 9 values.

Q4 Algebra and angles

- $AB = AC$, so $\angle B = \angle C = (x + 20)^\circ$ (equal base angles).
 $(2x + 20) + 2(x + 20) = 180^\circ$; $4x + 60 = 180$.
 Therefore $x = 30$. $\angle A = 80^\circ$ and $\angle B = \angle C = 50^\circ$.
 Check: $80^\circ + 50^\circ + 50^\circ = 180^\circ$.

Worked solutions

Questions 5-8 | Answers and reasons

Q5 Angle sum

$$\angle D = 360^\circ - (78^\circ + 94^\circ + 110^\circ).$$

$$\angle D = 360^\circ - 282^\circ = 78^\circ.$$

Reason: the interior angles of a quadrilateral sum to 360° .

Q6 Parallelogram

(a) $\angle ABC = 180^\circ - 68^\circ = 112^\circ$ (adjacent angles sum to 180°).

(b) $\angle BCD = 68^\circ$ (opposite angles are equal).

(c) $AC = 2 \times AE = 2 \times 6.5 = 13$ cm (diagonals bisect each other).

Q7 Rhombus

(a) $\angle DAC = 112^\circ \div 2 = 56^\circ$ (diagonal AC bisects $\angle DAB$).

(b) $\angle ABC = 180^\circ - 112^\circ = 68^\circ$. Hence $\angle ABE = 68^\circ \div 2 = 34^\circ$.

(c) $\angle AEB = 90^\circ$ (diagonals of a rhombus meet at right angles).

Q8 Kite: multi-step

(a) $\angle BAD = 2 \times 27^\circ = 54^\circ$ (AC bisects $\angle BAD$).

(b) In right-angled $\triangle ABE$, $\angle ABE = 180^\circ - 90^\circ - 27^\circ = 63^\circ$.

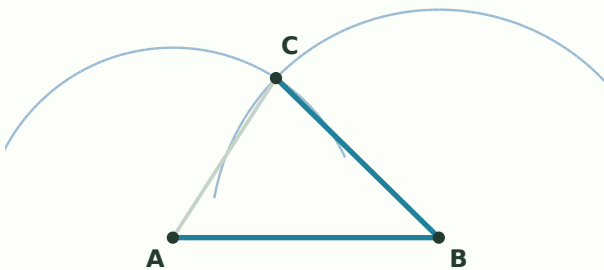
(c) $\angle EBC = \angle ABC - \angle ABE = 113^\circ - 63^\circ = 50^\circ$.

Worked solutions

Questions 9-10 | Construction guidance

Q9 SSS triangle

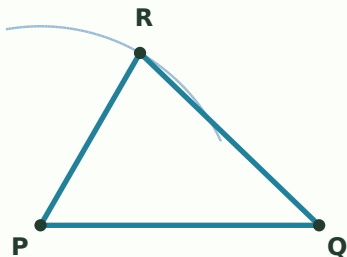
1. Draw $AB = 7$ cm. From A, draw an arc with radius 5 cm.
2. From B, draw an arc with radius 6 cm to meet the first arc at C.
3. Join AC and BC. Keep the construction arcs.



$AC = 5$ cm is the shortest side, so its opposite angle, $\angle ABC$, is the smallest angle.

Q10 SAS triangle

1. Draw $PQ = 7$ cm. At P, construct a 60° ray from PQ.
2. On the ray, mark R with $PR = 5$ cm. Join QR.
3. Use a ruler to measure QR to the nearest millimetre.



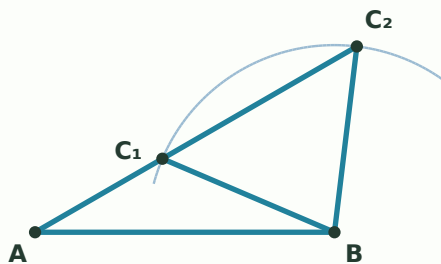
Expected $QR \approx 6.2$ cm. A small difference is possible from manual measurement. Check the marked angle and side lengths.

Worked solutions

Questions 11-12 | Construction guidance

Q11 Two possible triangles

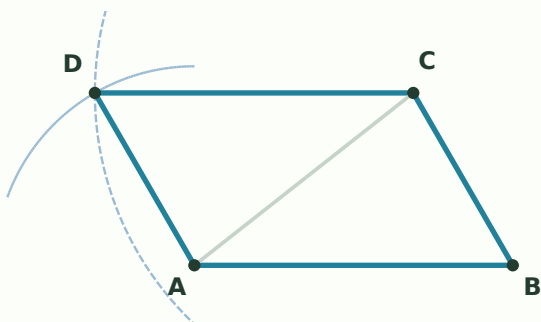
1. Draw $AB = 8$ cm. At A, construct a ray 30° above AB.
2. With B as centre and radius 5 cm, draw an arc.
3. Mark both intersections of the arc with the ray as C_1 and C_2 .
4. Join BC_1 and BC_2 to obtain two triangles.



The 5 cm arc cuts the 30° ray twice. Thus both positions of C satisfy $BC = 5$ cm, giving two differently shaped triangles.

Q12 Parallelogram construction

1. Draw $AB = 8$ cm. At B, make $\angle ABC = 60^\circ$ and mark $BC = 5$ cm.
2. With A as centre, draw a 5 cm arc. With C as centre, draw an 8 cm arc.
3. Their intersection opposite B across AC is D. Join DA and DC.



AC measures about 7.0 cm. $\angle BAD = 180^\circ - 60^\circ = 120^\circ$ (adjacent angles of a parallelogram).

Worked solutions

Questions 13-16 | Answers and reasons

Q13 Regular nonagon

(a) Interior angle sum = $(9 - 2) \times 180^\circ = 1260^\circ$.

(b) Each interior angle = $1260^\circ \div 9 = 140^\circ$.

(c) Each exterior angle = $360^\circ \div 9 = 40^\circ$.

Check: $140^\circ + 40^\circ = 180^\circ$.

Q14 Reverse the angle rule

(a) Number of sides = $360^\circ \div 24^\circ = 15$.

(b) Each interior angle = $180^\circ - 24^\circ = 156^\circ$.

(c) Sum of interior angles = $(15 - 2) \times 180^\circ = 2340^\circ$.

Q15 Irregular hexagon

Interior angle sum = $(6 - 2) \times 180^\circ = 720^\circ$.

Known total = $118^\circ + 127^\circ + 145^\circ + 116^\circ + 132^\circ = 638^\circ$.

(a) $x = 720^\circ - 638^\circ = 82^\circ$. (b) Regular hexagon: $720^\circ \div 6 = 120^\circ$.

(c) The regular hexagon angle, 120° , is larger than $x = 82^\circ$.

Q16 Symmetry

(a) Regular pentagon: 5 lines of symmetry; rotational order 5.

Smallest angle of rotation = $360^\circ \div 5 = 72^\circ$.

(b) Non-square rectangle: 2 lines of symmetry; rotational order 2.

It maps onto itself after a 180° rotation.