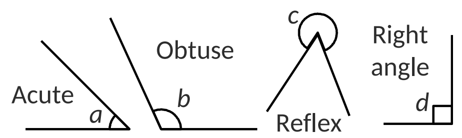
Angle names

Angles can be shown with small arcs and labelled with an italic lower case letter...

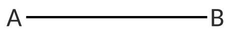


Acute angle *a* is less than 90°,
b is an obtuse angle (between 90° and 180°),
c is a reflex angle (between 180° and 360°),
d is a right-angle exactly 90°.

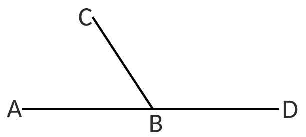
Point letter notation

Points can be labelled with capital letters.

Below is the line segment AB.



In the diagram below line CB meets the line AD.



Angle ABC is acute.

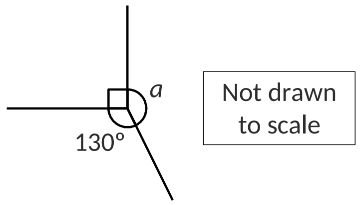
Trace out the path from point A to point B then up to point C. The angle has a centre on point B.

Angle CBD is obtuse. Trace the angle again.

Point notation is better for more complex diagrams as you need fewer labels on the diagram.

Angles at a point add to 360°

Work out the size of angle *a*.



The three angles must add up to 360°.

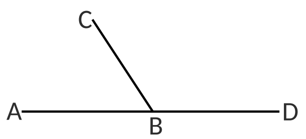
The 'box' means a right angle which is 90°

So 90 + 130 + *a* = 360 and *a* = 140°

Angles on a straight line add to 180°

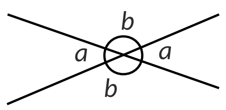
Supplementary angles add to 180°.

Angle CBD = 120°, work out the size of angle ABC.



120 + angle ABC = 180 so angle ABC = 60°

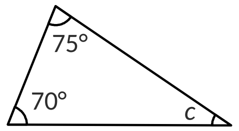
Vertically opposite angles are equal



For two crossed straight lines opposite angles are equal. The angles don't have to be 'vertical'.

The angles in a triangle add to 180°

Work out the size of angle *c* in the triangle below.



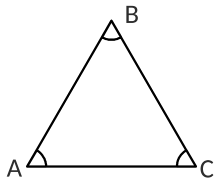
c = 180 – (70 + 75) = 35°

This particular triangle is called a scalene triangle because the sides are unequal to each other.

Equilateral triangle: all sides equal

An equilateral triangle has three sides the same length and each of the internal angles must be 60°.

In triangle ABC, the length of AB = BC = CA.

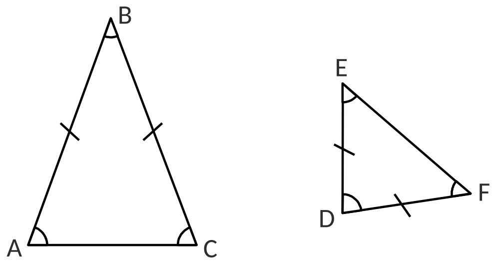


Write down the size of angle BAC.

Triangle ABC is equilateral so each of the internal angles must be 60°. Angle BAC = 60°.

Isosceles Triangle: two sides equal

The word 'isoskeles' means with equal legs in Greek. The **two equal angles** are at the 'foot' of each of the equal sides.



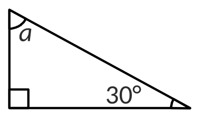
Triangle ABC has AB = BC so angle BAC = ACB

In triangle DEF, angle FDE = 80°.

Work out the size of angle DFE.

Angle DFE = DEF = (180 – 80) ÷ 2 = 50°

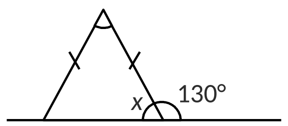
Right-angled triangle



Work out the size of angle *a*

a = 180 – 90 – 30 = 60°

External and internal angles add to 180°

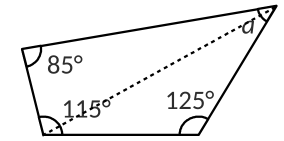


The angle labelled 130° is exterior angle and x is an interior angle. They add to 180°, so x = 50°.

Quadrilaterals: angles add to 360°

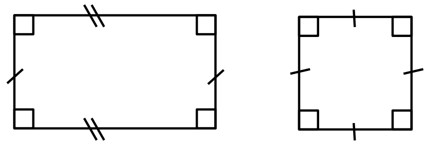
You can split a quadrilateral into two triangles and the interior angles of each triangle add to 180°, so the interior angles of a quadrilateral must add to 360°.

Work out the value of angle *a*.



Angle *a* = 360 – 125 – 115 – 85 = 35°

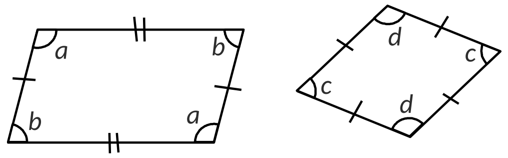
Rectangle: four equal angles of 90°



Two pairs of parallel sides of equal length, two axes of symmetry and rotational symmetry of order 2

A square has four equal sides, four axes of symmetry and rotational symmetry of order 4

Parallelogram: two pairs of equal angles



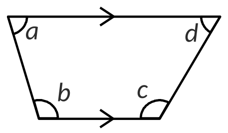
A parallelogram has two pairs of parallel sides and two pairs of equal angles.

Angles *a* + *b* = 180°.

The parallelogram has rotational symmetry order 2 but has no lines of symmetry.

A rhombus is a parallelogram with four equal sides. It has two lines of symmetry and rotational symmetry order 2. Angles *c* + *d* = 180°.

Trapezium: one pair of parallel sides

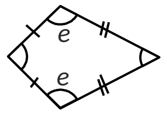


None of the angles have to be equal, and a trapezium does not automatically have any rotational symmetry or lines of symmetry.

Angles *a* + *b* = 180° and angles *c* + *d* = 180°.

It is possible to draw a trapezium with one mirror line bisecting the two parallel sides.

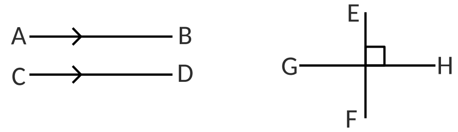
Kite: two equal angles and one mirror line



A kite has two sets of sides of equal length.

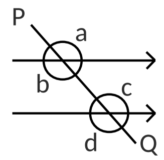
It has one pair of equal angles opposite each other.

Parallel and perpendicular lines



Line AB is parallel to line CD. The lines are the same distance apart. Parallel lines are labelled with arrows to show they are parallel.
The right angle sign shows that line EF is perpendicular to line GH.

Parallel lines crossed by a transverse line



The line PQ crosses the two parallel lines and is called a transverse line or transversal.

Angles a and b are vertically opposite as are angles c and d.

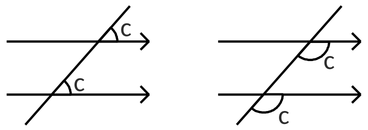
The four obtuse angles a, b, c and d are equal.

The acute angles are also equal to each other.

Some of the relationships between the angles made by a transverse line crossing parallel lines are given special names.

Corresponding angles are equal

The left hand diagram shows two corresponding acute angles. The right hand diagram illustrates two corresponding obtuse angles.

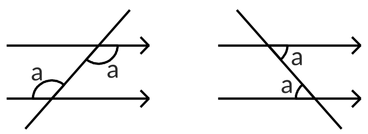


Corresponding angles are both on the same side of the transverse line.

One angle in each pair is inside the parallel lines and the other angle is outside the parallel lines.

Some textbooks call these 'F' angles.

Alternate angles are equal

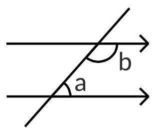


Alternate angles are both inside the parallel lines.

The angles are on opposite sides of the transversal.

Some books call these 'Z' angles.

Co-interior angles add to 180°



One angle is acute and the other obtuse.

Both angles are inside the parallel lines and both angles are on the same side of the transverse line.

Some books call these 'C' angles.

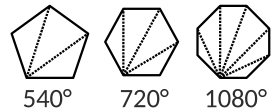
Polygons: vocabulary

A polygon is a two dimensional shape that has sides that are straight lines.

A regular polygon has sides of equal length and therefore has the same angle between the sides at each vertex.

Polygons include: triangle, quadrilateral, pentagon, hexagon, heptagon, octagon, nonagon and decagon. A 12 sided polygon is called a dodecagon.

Polygons: Sum of the interior angles

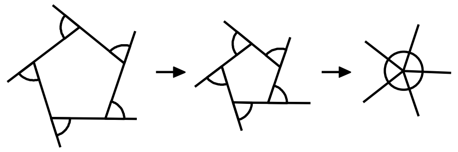


Sum of interior angles = 180(*n* - 2)

Each triangle in a polygon contributes 180° to the sum of the interior angles for that polygon.

Exterior angles of a polygon add to 360°

The exterior angle of a polygon is defined so that all the external angles add to 360°.

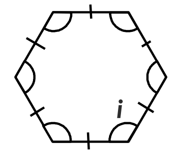


As the pentagon shrinks to a point you can see how the external angles coalesce to form a circle.

Internal and external angles add to 180°

See the triangle in column 2 of this sheet.

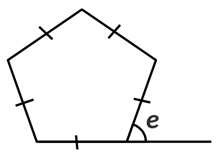
Regular polygons: internal angle formula



$$i = \frac{180(n-2)}{n}$$

For the regular hexagon shown, each of the internal angles *i* = 180 × 4 ÷ 6 = 120°.

Regular polygons: external angle formula



$$e = \frac{360}{n}$$

For the regular pentagon shown, each of the external angles *e* = 360 / 5 = 72°.

This formula is easier to remember. You can find the interior angle of a regular polygon by first finding the exterior angle then using the angle on a straight line fact.

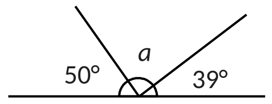
You can also transpose the formula to give the number of sides of a regular polygon corresponding to a given external angle...

$$n = \frac{360}{(e)}$$

(k58.uk/angle-facts.pdf for latest version)

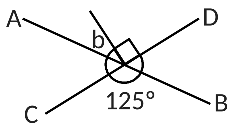
Questions

Question 1: Work out the value of angle *a*.



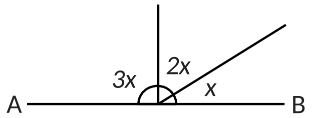
Question 2: AB and CD are straight lines.

Work out the size of angle *b*.

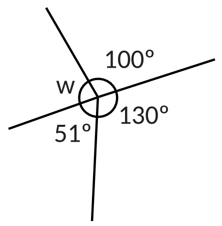


Question 3: AB is a straight line.

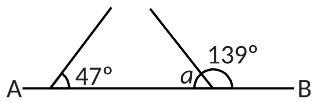
Calculate the size of angle *x*.



Question 4: Work out the size of angle *w*.



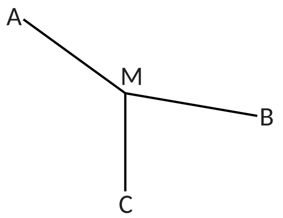
Question 5: AB is a straight line.
Work out the size of angle *a*.



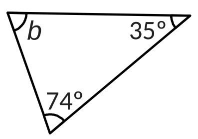
Question 6: Angle AMB = 170°

Angles AMC and CMB are in the ratio 3:2

Calculate the size of angle CMB.

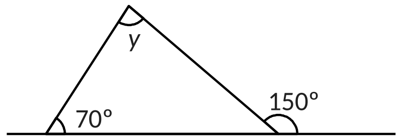


Question 7: Calculate the size of angle *b* in the triangle below.

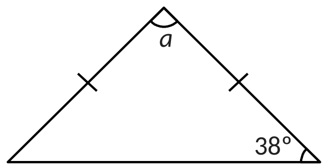


Question 8: A triangle has angles in the ratio 4:4:1.
Calculate the size of the smallest angle.

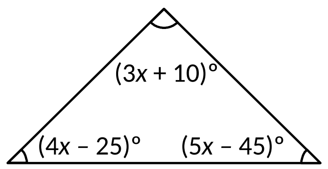
Question 9: Work out the size of angle *y* in the diagram below.



Question 10: Calculate the size of angle *a* in the isosceles triangle below.

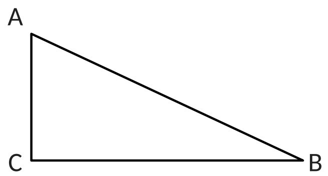


Question 11: In the triangle below, the angles are represented by algebraic expressions.



Work out the value of *x* by solving an equation.
What kind of triangle is this?

Question 12: ABC is a triangle.

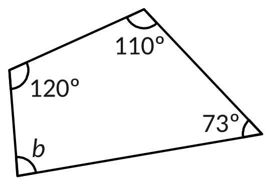


Angle ACB is a right angle.

Angle CAB is twice the size of angle ABC.

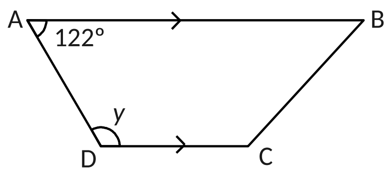
Work out the size of angle CAB.

Question 13: Work out the size of angle *b*.



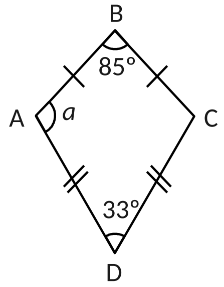
Question 14: ABCD is a trapezium.

Line AB is parallel to CD.



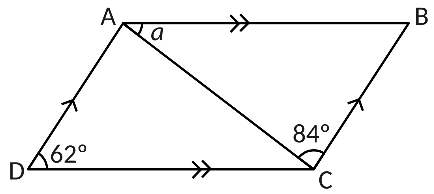
Work out the size of angle *y*.

Question 15: ABCD is a kite.



Work out the size of angle *a*.

Question 16: ABCD is a parallelogram.



Line AB is parallel to line CD.

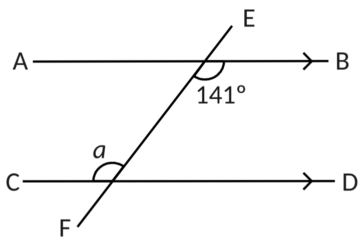
Line AD is parallel to line BC.

Line AC is a diagonal.

Calculate the size of angle *a*.

Question 17: Line AB is parallel to line CD

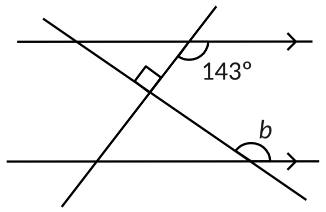
Line EF is a transversal that crosses the two parallel lines.



Write down the size of angle *a*.

Explain how you know the value of *a*.

Question 18: The diagram below shows a pair of parallel lines that are crossed by two transversal lines.



The transversal lines are perpendicular to each other.

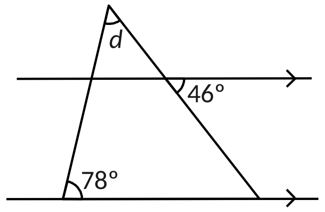
Work out the value of angle *b*.

Explain each step in your reasoning.

Question 19: An isosceles triangle contains an angle of 34° and an angle of 73°.

Work out the value of the missing angle.

Question 20: The diagram shows a scalene triangle is drawn on a pair of parallel lines.

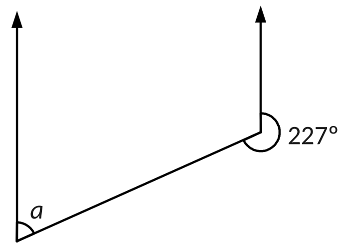


Work out the size of angle *d*.

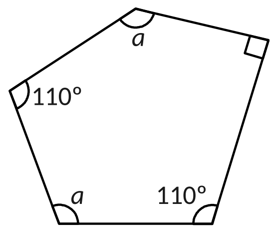
Explain each step in your reasoning.

Question 21: Work out the value of angle *a*.

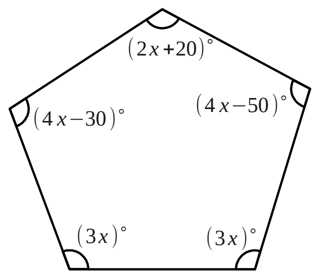
Explain the steps in your reasoning.



Question 22: Calculate the value of angle *a* in the diagram below.



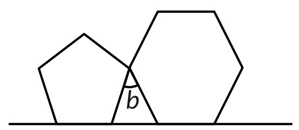
Question 23: The interior angles in the **irregular** pentagon below are shown as algebraic expressions.



Calculate the size of the **largest** interior angle In the pentagon.

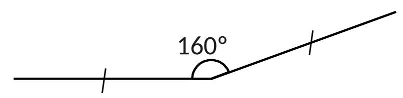
Question 24: In the diagram below a **regular** pentagon and a **regular** hexagon have been drawn on the same base line.

The sizes of the pentagon and hexagon have been arranged so that they touch at two of the vertices.



Calculate the size of angle *b*.

Question 25: The diagram below shows one vertex and two sides of a **regular** polygon.



How many sides does the regular polygon have?

Question 26: Diagram A below shows a diamond shape made from two isosceles triangles joined base to base.

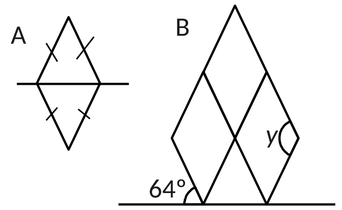
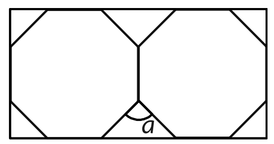


Diagram B shows a pattern made from three copies of the diamond drawn on the same base.

Calculate the size of angle *y*.

Question 27: Two identical regular octagons are drawn inside a rectangle as shown in the diagram below.

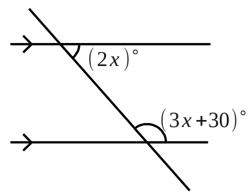


Calculate the size of the angle marked *a*.

Question 28: A quadrilateral has interior angles in the ratio 1:2:3:4.

Work out the value of the **largest** angle in the quadrilateral.

Question 29: The diagram below shows two parallel lines crossed by a transversal.



Solve an equation to work out the value of the larger of the two labelled angles.

Answers

Below are the numerical answers.

18, 20, 20, 30, 34, 35, 41, 47, 48, 56,
57, 58, 60, 71, 73, 76, 79, 80, 90, 91, 104, 115,
120, 120, 121, 127, 128, 141, 144

Find and cross off a number as you answer each question.

If you can't find an answer in the list then one of us has made a mistake!