



Properties of polygons

Year 8 About 60 minutes No calculator 46 marks

Date _____

A Do Now

Quick questions to start.

- A1** [Needed today] [1 mark] Two angles on a straight line. One is 47° . Work out the other.
- A2** [Needed today] [1 mark] Two angles of a triangle are 58° and 71° . Work out the third.

Answer

Answer

- A3** [Last lesson] [1 mark] Solve $\frac{x}{4} + 3 = 9$.
- A4** [From chapter 1] [1 mark] Increase £60 by 15%.

Answer

Answer

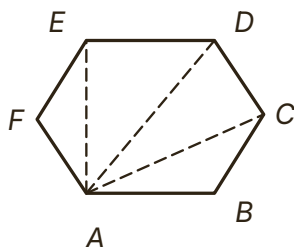
B Example, then your turn

Year 8

Your teacher works through each example with you. Then try the one beside it.

EXAMPLE 1

The diagonals from A split the hexagon into triangles. Work out the sum of the interior angles of a hexagon.



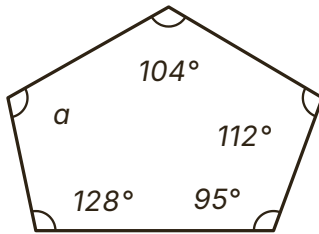
Hint Count the triangles. The angles of each triangle add up to 180° .

- B1** (a) Work out the sum of the interior angles of a decagon (10 sides). [3 marks]
- (b) Write a formula for the sum of the interior angles of a polygon with n sides.

Answer (a) $^\circ$ (b)

EXAMPLE 2

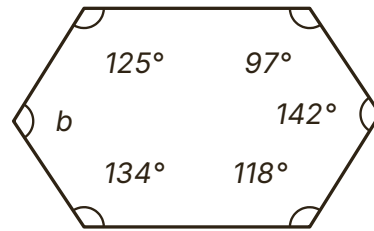
Work out the size of angle a in this pentagon.



Not drawn accurately

Hint First work out what the five angles of a pentagon add up to.

B2 Work out the size of angle b in this hexagon. [2 marks]

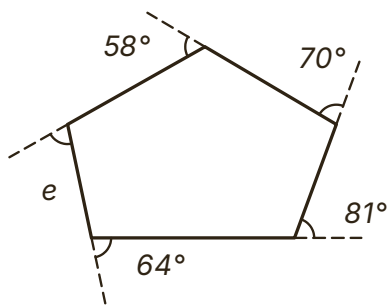


Not drawn accurately

Answer $b = \dots\dots^\circ$

EXAMPLE 3

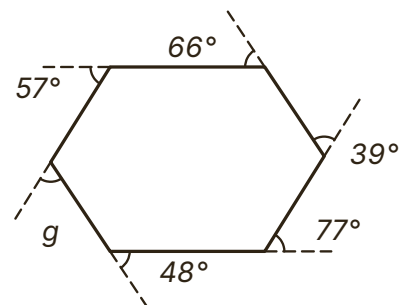
Each side of this pentagon is extended to show its exterior angles. Work out the exterior angle e , then the interior angle at that vertex.



Not drawn accurately

Hint The exterior angles of any polygon add up to 360° . At each vertex, interior + exterior = 180° .

B3 Each side of this hexagon is extended. Work out the exterior angle g , then the interior angle at that vertex. [3 marks]

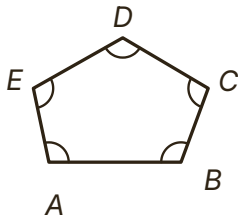


Not drawn accurately

Answer $g = \dots\dots^\circ$ interior $\dots\dots^\circ$

EXAMPLE 4

In pentagon $ABCDE$, angle $A = 2x^\circ$, $B = (x + 40)^\circ$, $C = (3x - 20)^\circ$, $D = (2x + 15)^\circ$ and $E = (x + 55)^\circ$. Work out the value of x and the size of the largest angle.

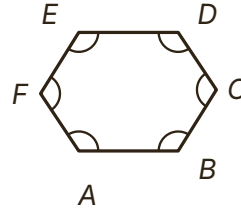


Not drawn accurately

Hint Add the five expressions and set the total equal to the angle sum of a pentagon.

B4 In hexagon $ABCDEF$, angle [3 marks]

$A = (x + 30)^\circ$, $B = 2x^\circ$, $C = (2x - 10)^\circ$, $D = (x + 50)^\circ$, $E = (3x - 40)^\circ$ and $F = (3x - 30)^\circ$. Work out the value of x and the size of the smallest angle.



Not drawn accurately

Answer $x = \dots\dots$ smallest $\dots\dots^\circ$

c Practice

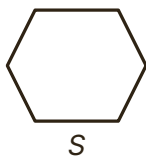
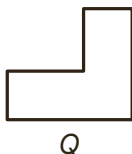
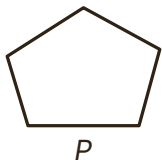
Year 8

C1 Could the interior angles of a polygon add up to 1000° ? Give a reason for your answer. [2 marks]

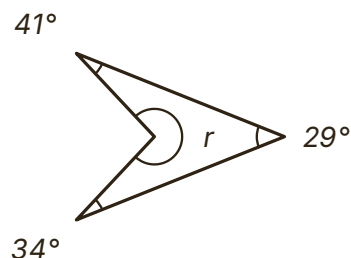
C2 At one vertex of a polygon, the interior angle is 4 times the exterior angle. Work out the size of the exterior angle. [2 marks]

Answer

C3 Write down the letters of the shapes that are concave polygons. [2 marks]



C4 This quadrilateral is concave. Work out the size of the reflex angle r . [2 marks]



Not drawn accurately

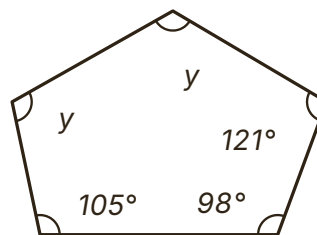
Answer $r = \dots\dots^\circ$

Answer

- C5** The interior angles of a polygon add up to 1980° . How many sides does the polygon have? [2 marks]

Answer sides

- C6** Two angles of this pentagon are equal. Work out the size of angle y . [2 marks]



Not drawn accurately

Answer $y = \dots\dots^\circ$

D Exam-style questions

GCSE Foundation

- D1** Tom says, "The interior angles of a hexagon add up to 720° , so its exterior angles add up to 720° too." [2 marks]

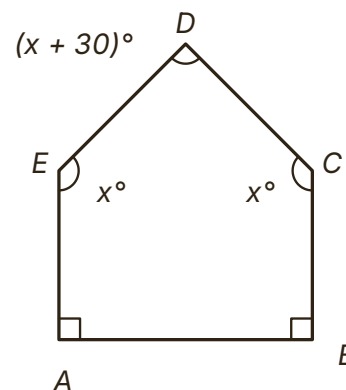
Explain why Tom is wrong.

- D2** $ABCDE$ is a pentagon. Angle A and angle B are right angles.

- (a) Work out the value of x . You must show your working. [3 marks]

Answer $x = \dots\dots$

- (b) Work out the size of the exterior angle at D . [2 marks]



Not drawn accurately

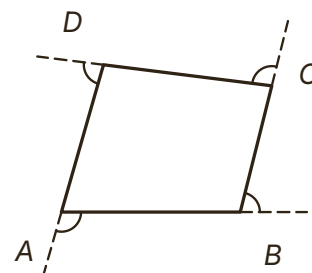
Answer

Total for D2: 5 marks

- D3** The five interior angles of a pentagon go up by 14° each time, from the smallest to the largest. Show that the largest angle is 136° . [4 marks]

- D4** The sides of quadrilateral $ABCD$ are extended to show its exterior angles. The exterior angles at A , B , C and D are x° , $2x^\circ$, $(x + 30)^\circ$ and $(2x - 30)^\circ$. Work out the size of the smallest interior angle of $ABCD$. [4 marks]

Answer



Not drawn accurately

E Extension

Stretch

No route is given. The hints are at the end of the sheet. Use one at a time.

- E1** A diagonal joins two vertices of a polygon that are not next to each other. A pentagon has 5 diagonals. A polygon has 65 diagonals. How many sides does it have? [4 marks]

Answer

Extension hints

Cover these with paper. Uncover one at a time.

- E1** **Hint 1** Work out how many diagonals leave ONE vertex of a polygon with n sides.
- Hint 2** Each vertex has $n - 3$ diagonals, and each diagonal is counted twice (once from each end), so there are $\frac{n(n-3)}{2}$ diagonals.
- Hint 3** $n(n - 3) = 130$. Try values: $13 \times 10 = 130$, so $n = 13$.

How did it go?

Colour one circle on each line: not yet, nearly, yes.

- I can work out the sum of the interior angles of any polygon. ☐ ☐ ☐
- I can find a missing interior or exterior angle. ☐ ☐ ☐
- I can write and solve an equation from the angles of a polygon. ☐ ☐ ☐
- I can tell a convex polygon from a concave one. ☐ ☐ ☐