

How many sides does a pentagon have? Five. The pentagon's facts and the polygon names chart

The pentagon

Fact	Any pentagon	Regular pentagon (equal sides and angles)
sides, vertices, angles	5, 5, 5	5 equal sides
interior angles	add to 540°	108° each
exterior angles	add to 360°	72° each
diagonals	5	5, forming a five-pointed star
lines of symmetry	0 to 5	5; rotational symmetry of order 5
area	split into triangles	about $1.72 \times \text{side}^2$
real examples	home plate in baseball (angles 90, 90, 135, 135, 90)	the Pentagon building (sides about 921 ft), a football's 12 black patches, the US school-zone sign

Why 540° : from one corner, two diagonals split the pentagon into three triangles, $3 \times 180^\circ = 540^\circ$. Regular: $540 \div 5 = 108^\circ$ each; exterior $180 - 108 = 72^\circ$, and $5 \times 72 = 360^\circ$. Regular, irregular, convex (no angle over 180°) and concave (a dent) pentagons are all pentagons: five straight sides.

The formulas for any polygon with n sides

Sum of interior angles	Each interior angle (regular)	Each exterior angle (regular)	Number of diagonals	Triangles from one corner
$(n - 2) \times 180^\circ$	$(n - 2) \times 180^\circ \div n$	$360^\circ \div n$	$n(n - 3) \div 2$	$n - 2$

The chart

Sides	Name	Angle sum	Each angle (regular)	Diagonals
3	triangle	180°	60°	0
4	quadrilateral	360°	90°	2
5	pentagon	540°	108°	5
6	hexagon	720°	120°	9
7	heptagon	900°	128.57°	14
8	octagon	$1,080^\circ$	135°	20
9	nonagon (enneagon)	$1,260^\circ$	140°	27
10	decagon	$1,440^\circ$	144°	35
11	hendecagon	$1,620^\circ$	147.27°	44
12	dodecagon	$1,800^\circ$	150°	54
13	tridecagon	$1,980^\circ$	152.31°	65
14	tetradecagon	$2,160^\circ$	154.29°	77
15	pentadecagon	$2,340^\circ$	156°	90
16	hexadecagon	$2,520^\circ$	157.5°	104
17	heptadecagon	$2,700^\circ$	158.82°	119
18	octadecagon	$2,880^\circ$	160°	135
19	enneadecagon	$3,060^\circ$	161.05°	152
20	icosagon	$3,240^\circ$	162°	170
30	triacontagon	$5,040^\circ$	168°	405
100	hectagon	$17,640^\circ$	176.4°	4,850
1000	chiliagon	$179,640^\circ$	179.64°	498,500
n	n-gon	$(n - 2) \times 180^\circ$	$(n - 2) \times 180^\circ \div n$	$n(n - 3) \div 2$

Polygon notes and practice

Worth knowing

- [] The exterior angles of any convex polygon add to 360° : walking round it turns you through one full circle
- [] Only the regular triangle, square and hexagon tile a floor alone (60° , 90° , 120° divide 360°); a regular pentagon's 108° does not, which is why a football needs hexagons between its pentagons
- [] Above 12 sides say "13-gon", "20-gon"; the Greek names are rarely used
- [] A shape with a curved side is not a polygon: every side must be straight
- [] Four-sided names: square, rectangle, rhombus, parallelogram, trapezium (trapezoid in the US), kite
- [] Finding a missing angle: subtract the known angles from the angle sum. Finding n from a regular angle: exterior = $180 - \text{interior}$, then $n = 360 \div \text{exterior}$

Practice

- [] 1. How many sides, corners and angles does a pentagon have?
- [] 2. What do the interior angles of a pentagon add to?
- [] 3. Each angle of a regular pentagon is how big?
- [] 4. Four angles of a pentagon are 100° , 110° , 120° and 90° . The fifth?
- [] 5. How many diagonals has a pentagon?
- [] 6. The exterior angle of a regular pentagon?
- [] 7. Name the polygons with 6, 7, 8 and 10 sides.
- [] 8. The angle sum of a hexagon?
- [] 9. How many diagonals has an octagon?
- [] 10. Each angle of a regular polygon is 150° . How many sides?
- [] 11. Is a shape with five sides, one curved, a pentagon?
- [] 12. A regular pentagon has 10 cm sides. Estimate its area.

Answers

- 1) 5, 5, 5 2) 540° 3) 108° 4) $540 - 420 = 120^\circ$ 5) 5 6) 72° 7) hexagon, heptagon, octagon, decagon 8) 720° 9) $8 \times 5 \div 2 = 20$ 10) exterior 30° , so $360 \div 30 = 12$, a dodecagon 11) no, sides must be straight 12) about $1.72 \times 100 = 172 \text{ cm}^2$

Draw and label

A regular pentagon with one angle marked 108° : _____

An irregular (concave) pentagon: _____

A hexagon with all 9 diagonals: _____

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