Angles in polygons with...

Ratio

A regular polygon has interior and exterior angles in the ratio

$$5 : 1$$

How many sides does it have?

Simultaneous Equations

A regular polygon's interior angles are $120°$ bigger than its exterior angles.

How many sides does it have?

Percentages

A regular polygon has exterior angles that are 2.5% of the size of the sum of its interior angles.

How many sides does it have?

Averages

A polygon has one right angle. The mean of its other angles is $150°$.

How many sides does it have?

Bounds

A regular polygon has interior angles that round to $150°$ to 2 significant figures.

How many sides could it have?

Sequences

A polygon has angles that form an arithmetic sequence.
Its smallest angle is $135°$ and its largest angle is $177°$.

How many sides does it have?

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How many sides does it have?

	Int.	Ext.	Total	
×30°	5	1	6	×30°
	150°	30°	180°	

$$n = \frac{360°}{30°} = 12$$

Percentages

A regular polygon has exterior angles that are 2.5% of the size of the sum of its interior angles.

How many sides does it have?

If the polygon has n sides:

Exterior angle $= \frac{360}{n}$

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

So, $\frac{360}{n} = 0.025(180n - 360)$

$360 = 4.5n^2 - 9n$

$0 = n^2 - 2n - 80$

$0 = (n - 10)(n + 8)$

$$n = 10$$

Bounds

A regular polygon has interior angles that round to 150° to 2 significant figures.

How many sides could it have?

$145° \leq \text{int.} < 155°$

$35° < \text{ext.} \leq 25°$

$$\frac{360}{35} < n \leq \frac{360}{25}$$

$10.3 < n \leq 14.4$

n is 11, 12, 13 or 14

Angles in polygons with…

Simultaneous Equations

A regular polygon's interior angles are $120°$ bigger than its exterior angles.

How many sides does it have?

$$I + E = 180°$$
$$I - E = 120°$$

So, $2I = 300°$
$I = 150°$ and $E = 30°$

$$n = \frac{360}{30} = 12 \text{ sides}$$

Averages

A polygon has one right angle. The mean of its other angles is $150°$.

How many sides does it have?

If the polygon has n sides:
Sum of interior angles $= 180(n - 2)$.

Sum of 'other angles' $= 150(n - 1)$.

So, $90 + 150(n - 1) = 180(n - 2)$
$150n + 60 = 180n - 360$
$420 = 30n$

$$n = 14$$

Sequences

A polygon has angles that form an arithmetic sequence.
Its smallest angle is $135°$ and its largest angle is $177°$.

How many sides does it have?

Exterior angles have sequence:
$3°, \ldots, 45°$

So, the mean exterior angle is
$\frac{3 + 45}{2} = 24°$

$$n = \frac{360}{24} = 15$$