

Chapter 14

Polygons

Exercise 14.1

Q. 1 Find the measure of each exterior angle of a regular

(i) pentagon

(ii) hexagon

(iii) heptagon

(iv) decagon

(v) polygon of 15 sides.

Answer:

(i) In Regular Pentagon, all sides are of same size and measure of all interior angles are same.

The sum of interior angles of pentagon is $(n - 2) \times 180^\circ$ [n is number of sides of polygon] $(5 - 2) \times 180^\circ = 540^\circ$.

Each interior angle = $540/5 = 108^\circ$

As, we know that Sum of Interior Angle and Exterior Angle is 180°

Exterior Angle + Interior Angle = 180°

Exterior Angle + $108^\circ = 180^\circ$

So, Exterior Angle = $180^\circ - 108^\circ = 72^\circ$

(ii) In Regular Hexagon, all sides are of same size and measure of all interior angles are same.

The sum of interior angles of hexagon is $(n - 2) \times 180^\circ$ [n is number of sides of polygon] $(6 - 2) \times 180^\circ = 720^\circ$

Each interior angle = $720/6 = 120^\circ$

As, we know that Sum of Interior Angle and Exterior Angle is 180°

Exterior Angle + Interior Angle = 180°

Exterior Angle + $120^\circ = 180^\circ$

So, Exterior Angle = $180^\circ - 120^\circ = 60^\circ$

(iii) In Regular Heptagon, all sides are of same size and measure of all interior angles are same.

The sum of interior angles of heptagon is

$(n - 2) \times 180^\circ$ [n is number of sides of polygon]

$(7 - 2) \times 180^\circ = 900^\circ$.

Each interior angle = $900/7 = 128.570$

As, we know that Sum of Interior Angle and Exterior Angle is 180°

Exterior Angle + Interior Angle = 180°

Exterior Angle + $128.57^\circ = 180^\circ$

So, Exterior Angle = $180^\circ - 128.57^\circ = 51.43^\circ$

(iv) In Regular Decagon, all sides are of same size and measure of all interior angles are same.

The sum of interior angles of decagon is $(n - 2) \times 180^\circ$ [n is number of sides of polygon] $(10 - 2) \times 180^\circ = 1440^\circ$.

Each interior angle = $1440/10 = 144$

As, we know that Sum of Interior Angle and Exterior Angle is 180°

Exterior Angle + Interior Angle = 180°

Exterior Angle + $144^\circ = 180^\circ$

So, Exterior Angle = $180^\circ - 144^\circ = 36^\circ$

(v) In Regular Polygon of 15 sides, all sides are of same size and measure of all interior angles are same.

The sum of interior angles of polygon of 15 sides is $(n - 2) \times 180^\circ$ [n is number of sides of polygon] $(15 - 2) \times 180^\circ = 2340^\circ$.

Each interior angle = $2340/15 = 156^\circ$

As, we know that Sum of Interior Angle and Exterior Angle is 180°

Exterior Angle + Interior Angle = 180°

Exterior Angle + $156^\circ = 180^\circ$

So, Exterior Angle = $180^\circ - 156^\circ$
 $= 24^\circ$

Q. 2 Is it possible to have a regular polygon each of whose exterior angles is 50° ?

Answer:

No, since $\frac{360}{50}$ is not a whole number

Sum of exterior angles of regular polygon is 360°

When we divide the exterior angle by 360° , we get the numbers of exterior angle. Since, it is a regular polygon number of exterior angles will be equal to number to sides.

$N = 360/50 = 7.2$ [Number of sides of polygon]

7.2 is not an integer. So, it is not possible to have a regular polygon whose each exterior angle is 50° .

Q. 3 Find the measure of each interior angle of a regular polygon having

(i) 10 sides (ii) 15 sides.

Answer:

(i) In Regular Polygon of 10 sides, all sides are of same size and measure of all interior angles are same.

The sum of interior angles of polygon of 10 sides is $(n - 2) \times 180^\circ$ [n is number of sides of polygon] $(10 - 2) \times 180^\circ = 1440^\circ$.

Each interior angle = $1440/10 = 144^\circ$

(ii) In Regular Polygon of 15 sides, all sides are of same size and measure of all interior angles are same.

The sum of interior angles of polygon of 15 sides is $(n - 2) \times 180^\circ$ [n is number of sides of polygon] $(15 - 2) \times 180^\circ = 2340^\circ$.

Each interior angle = $2340/15 = 156^\circ$

Q. 4 Is it possible to have a regular polygon each of whose interior angles is 100° ?

Answer:

No, since $\frac{360}{80}$ is not a whole number

Sum of Interior Angle and Exterior Angle = 180°

Interior Angle = 100°

So, Exterior Angle = $180^\circ - 100^\circ = 80^\circ$

No. of Sides = $360^\circ / \text{Exterior Angle} = 360/80$

= 4.5

4.5 is not an integer. So, it is not possible to have a regular polygon whose interior angle is 100° .

Q. 5 What is the sum of all interior angles of a regular?

(i) pentagon

(ii) hexagon

(iii) nonagon

(iv) polygon of 12 sides

Answer:

(i) In Regular Pentagon, all sides are of same size and measure of all interior angles are same.

The sum of interior angles of regular pentagon is $= (n - 2) \times 180^\circ$ [n is number of sides of polygon] $= (5 - 2) \times 180 = 540^\circ$.

(ii) In Regular Hexagon, all sides are of same size and measure of all interior angles are same.

The sum of interior angles of regular hexagon is $= (n - 2) \times 180^\circ$ [n is number of sides of polygon] $= (6 - 2) \times 180^\circ = 720^\circ$.

(iii) In Regular Nonagon, all sides are of same size and measure of all interior angles are same.

The sum of interior angles of regular nonagon is

$= (n - 2) \times 180^\circ$ [n is number of sides of polygon]

$= (9 - 2) \times 180^\circ = 1260^\circ$.

(iv) In Regular Polygon of 12 sides, all sides are of same size and measure of all interior angles are same.

The sum of interior angles of regular polygon of 12 sides is $= (n - 2) \times 180^\circ$ [n is number of sides of polygon] $= (12 - 2) \times 180^\circ$

$= 1800^\circ$.

Q. 6 What is the number of diagonals in a?

(i) heptagon

(ii) octagon

(iii) polygon of 12 sides

Answer:

(i) Number of diagonals in Heptagon is

$$= n \times \frac{n-3}{2} \text{ [n represents number of sides]}$$

$$= 7 \times \frac{7-3}{2}$$

$$= 7 \times \frac{4}{2}$$

$$= 14$$

So, Number of diagonals in heptagon is 14.

(ii) Number of diagonals in Octagon is

$$= n \times \frac{n-3}{2} \text{ [n represents number of sides]}$$

$$= 8 \times \frac{8-3}{2}$$

$$= 8 \times \frac{5}{2}$$

$$= 20$$

So, Number of diagonals in octagon is 20.

(iii) Number of diagonals in polygon of 12 sides is

$$= n \times \frac{n-3}{2} \text{ [n represents number of sides]}$$

$$= 12 \times \frac{12-3}{2}$$

$$= 12 \times \frac{9}{2}$$

$$= 54$$

So, Number of diagonals in polygon of 12 sides is 54.

Q. 7 Find the number of sides of a regular polygon whose each exterior angle measures:

(i) 40°

(ii) 36°

(iii) 72°

(iv) 30°

Answer:

(i) No. of Sides = $360^\circ / \text{Exterior Angle}$

$$= 360/40 = 9$$

Number of sides is 9 of regular polygon whose exterior angle is 40° .

(ii) No. of Sides = $360^\circ / \text{Exterior Angle}$

$$= 360/36 = 10$$

Number of sides is 10 of regular polygon whose exterior angle is 36° .

(iii) No. of Sides = $360^\circ / \text{Exterior Angle}$

$$= 360/72 = 5$$

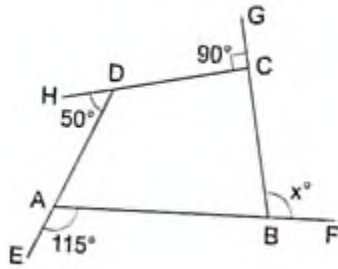
Number of sides is 5 of regular polygon whose exterior angle is 72° .

(iv) No. of Sides = $360^\circ / \text{Exterior Angle}$

$$= 360/30 = 12$$

Number of sides is 12 of regular polygon whose exterior angle is 30° .

Q. 8 In the given figure, find the angle measure x .



Answer:

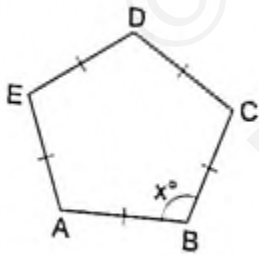
Sum of all the exterior angles = 360°

$$90^\circ + 50^\circ + 115^\circ + x = 360^\circ$$

$$x = 360^\circ - 90^\circ - 50^\circ - 115^\circ$$

$$x = 105^\circ$$

Q. 9 Find the angle measure x in the given figure.



Answer:

This is a regular pentagon, as all sides are of equal length.

$$AB = BC = CD = DE = EA$$

The sum of interior angles of polygon is

$$= (n - 2) \times 180^\circ \text{ [n is number of sides of polygon]}$$

$$= (5 - 2) \times 180^\circ \text{ [for pentagon n=5]}$$

$$= 540^\circ$$

Since, it is a regular pentagon. It's all interior angle will be equal.

$$\text{Size of Interior Angle } x = 540/5$$

$$= 108^\circ$$

© PRAADIS
EDUCATION
DO NOT COPY

Exercise 14.2

Q. 1 How many diagonals are there in a pentagon?

- A. 5
- B. 7
- C. 6
- D. 10

Answer:

Number of diagonals in Pentagon is

$$= n \times \frac{n-3}{2} \text{ [n represents number of sides]}$$

$$= 5 \times \frac{5-3}{2}$$

$$= 5 \times \frac{2}{2}$$

$$= 5$$

So, Number of diagonals in pentagon is 5.

Q. 2

How many diagonals are there in a hexagon?

- A. 6
- B. 8
- C. 9
- D. 10

Answer:

Number of diagonals in Hexagon is

$$= n \times \frac{n-3}{2} \text{ [n represents number of sides]}$$

$$= 6 \times \frac{6-3}{2}$$

$$= 6 \times \frac{3}{2}$$

$$= 9$$

So, Number of diagonals in hexagon is 9.

Q. 3 How many diagonals are there in an octagon?

A. 8

B. 16

C. 18

D. 54

Answer:

Number of diagonals in Octagon is

$$= n \times \frac{n-3}{2} \text{ [n represents number of sides]}$$

$$= 8 \times \frac{8-3}{2}$$

$$= 8 \times \frac{5}{2}$$

$$= 20$$

So, Number of diagonals in octagon is 20.

Q. 4 How many diagonals are there in a polygon having 12 sides?

- A. 12
- B. 24
- C. 36
- D. 54

Answer:

Number of diagonals in Polygon having 12 sides is

$$= n \times \frac{n-3}{2} \text{ [n represents number of sides]}$$

$$= 12 \times \frac{12-3}{2}$$

$$= 12 \times \frac{9}{2}$$

$$= 54$$

So, Number of diagonals in polygon having 12 sides is 54.

Q. 5 A polygon has 27 diagonals. How many sides does it have?

- A. 7
- B. 8
- C. 9
- D. 12

Answer:

Let x be sides of polygon.

No. of Diagonals = 27

According to formula,

$$\text{No. of Diagonals} = n \times \frac{n-3}{2}$$

$$27 = n \times \frac{n-3}{2}$$

$$n(n - 3) = 54$$

$$n^2 - 3n - 54 = 0$$

$$(n + 6)(n - 9) = 0$$

$$n = -6 \text{ or } 9$$

Since, no of sides can't be negative.

So, No. of sides of polygon will be 9.

Q. 6 The angles of a pentagon are x° , $(x + 20)^\circ$, $(x + 40)^\circ$, $(x + 60)^\circ$ and $(x + 80)^\circ$. The smallest angle of the pentagon is

A. 75°

B. 68°

C. 78°

D. 85°

Answer:

The sum of interior angles of pentagon is $= (n - 2) \times 180^\circ$ [n is number of sides of polygon]

$$= (5 - 2) \times 180^\circ$$

$$= 540^\circ$$

$$x + (x + 20) + (x + 40) + (x + 60) + (x + 80) = 540$$

$$5x + 200 = 540^\circ$$

$$5x = 340^\circ$$

$$x = 340^\circ / 5$$

$$= 68^\circ$$

So, smallest angle of pentagon is 68°

Q. 7 The measure of each exterior angle of a regular polygon is 40° .
How many sides does it have?

- A. 8
- B. 9
- C. 6
- D. 10

Answer:

$$\text{Exterior Angle} = 40^\circ$$

$$\text{No. of Sides} = 360 / \text{Exterior Angle}$$

$$= 360 / 40$$

$$= 9$$

Q. 8 Each interior angle of a polygon is 108° . How many sides does it have?

- A. 8
- B. 6
- C. 5
- D. 7

Answer:

$$\text{Interior Angle} = 108^\circ$$

$$\text{Interior Angle} + \text{Exterior Angle} = 180^\circ$$

$$\text{Exterior Angle} = 180^\circ - 108^\circ$$

$$= 72^\circ$$

$$\text{No. of Sides} = 360 / \text{Exterior Angle}$$

$$= 360 / 72$$

$$= 5$$

Q. 9 Each interior angle of a polygon is 135° . How many sides does it have?

A. 8

B. 7

C. 6

D. 10

Answer:

$$\text{Interior Angle} = 135^\circ$$

$$\text{Interior Angle} + \text{Exterior Angle} = 180^\circ$$

$$\text{Exterior Angle} = 180^\circ - 135^\circ$$

$$= 45^\circ$$

$$\text{No. of Sides} = 360 / \text{Exterior Angle}$$

$$= 360 / 45$$

$$= 8$$

Q. 10 In a regular polygon, each interior angle is thrice the exterior angle. The number of sides of the polygon is

A. 6

B. 8

C. 10

D. 12

Answer:

Let x be the exterior angle

Interior Angle = $3x$

Interior Angle + Exterior Angle = 180°

$$4x = 180^\circ$$

$$x = 180/4$$

$$= 45^\circ$$

So, Exterior Angle = 45°

No. of Sides = $360 / \text{Exterior Angle}$

$$= 360 / 45$$

$$= 8$$

Q. 11 Each interior angle of a regular decagon is

A. 60°

B. 120°

C. 144°

D. 180°

Answer: In Regular Decagon, all sides are of same size and measure of all interior angles are same.

The sum of interior angles of decagon is

$$= (n - 2) \times 180^\circ \text{ [n is number of sides of polygon]}$$

$$= (10 - 2) \times 180^\circ$$

$$= 1440^\circ.$$

$$\text{Each interior angle} = 1440^\circ/10$$

$$= 144^\circ$$

Q. 12 The sum of all interior angles of a hexagon is

A. 6 right \angle s

B. 8 right \angle s

C. 9 right \angle s

D. 12 right \angle s

Answer:

The sum of interior angles of hexagon is

$$= (n - 2) \times 180^\circ \text{ [n is number of sides of polygon]}$$

$$= (6 - 2) \times 180^\circ$$

$$= 720^\circ.$$

$$1 \text{ right } \angle \text{s} = 90^\circ$$

$$\text{So, } 720^\circ = 8 \text{ right } \angle \text{s}$$

Q. 13 The sum of all interior angles of a regular polygon is 1080° . What is the measure of each of its interior angles?

A. 135°

B. 120°

C. 156°

D. 144°

Answer:

The sum of interior angles of regular polygon is

$$1080^\circ = (n - 2) \times 180^\circ \text{ [n is number of sides of polygon]}$$

$$n - 2 = 1080^\circ / 180^\circ$$

$$n = 6 + 2$$

$$= 8$$

No. of Sides = $360 / \text{Exterior Angle}$

$$8 = 360 / \text{Exterior Angle}$$

$$\text{So, Exterior Angle} = 360 / 8$$

$$= 45^\circ$$

$$\text{Exterior Angle} + \text{Interior Angle} = 180^\circ$$

$$\text{Interior Angle} = 180^\circ - 45^\circ$$

$$= 135^\circ$$

Q. 14 The interior angle of a regular polygon exceeds its exterior angle by 108° . How many sides does the polygon have?

A. 16

B. 14

C. 12

D. 10

Answer:

Let x be the exterior angle

$$\text{Interior Angle} = x + 108^\circ$$

$$\text{Interior Angle} + \text{Exterior Angle} = 180^\circ$$

$$x + (x + 108^\circ) = 180^\circ$$

$$2x = 180^\circ - 108^\circ$$

$$2x = 72^\circ$$

$$x = 36^\circ$$

$$\text{So, Exterior Angle} = 36^\circ$$

$$\text{No. of Sides} = 360 / \text{Exterior Angle}$$

$$= 360 / 36$$

$$= 10$$

So, Number of diagonals in pentagon is 5.