14. Polygons

Exercise 14A

1. Question

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) × 180° [n is number of sides of polygon)]

(5 – 2) × 180°= 540°.

Each interior angle = 540/5 = 108^0

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

Exterior Angle + Interior Angle = 180°

Exterior Angle +108° =180°

So, Exterior Angle = 180°- 108°

=72°

(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) × 180° [n is number of sides of polygon)]

(6 – 2) × 180°= 720°

Each interior angle = 720/6 = 120°

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

Exterior Angle + Interior Angle = 180°

Exterior Angle +120° = 180°

So, Exterior Angle = 180°- 120°

= 60°

(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) × 180° [n is number of sides of polygon)]

(7 – 2) X 180°= 900°.

Each interior angle = 900/7 = 128.57^0

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

Exterior Angle + Interior Angle = 180°

Exterior Angle +128.57° =180°

So, Exterior Angle = 180°– 128.57°

=51.43°

(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) × 180° [n is number of sides of polygon)]

(10 – 2) X 180°= 1440°.

Each interior angle = 1440/10 = 144^0

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

Exterior Angle + Interior Angle = 180°

Exterior Angle +144° =180°

So, Exterior Angle = 180°- 144°

=36°

(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) × 180° [n is number of sides of polygon)]

(15 – 2) X 180°= 2340°.

Each interior angle = 2340/15 = 156^0

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

Exterior Angle + Interior Angle = 180°

Exterior Angle +156° =180°

So, Exterior Angle = 180°- 156°

=24°

2. Question

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°.

3. Question

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) × 180° [n is number of sides of polygon)]

(10 – 2) X 180°= 1440°.

Each interior angle = 1440/10

= 144^0

(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 10 sides is

(n – 2) × 180° [n is number of sides of polygon)]

(15 – 2) X 180°= 2340°.

Each interior angle = 2340/15

= 156°

4. Question

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° - 100°

= 80°

No. of Sides = 360° / 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°.

5. Question

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) × 180° [n is number of sides of polygon)]

= (5 – 2) X 180°

= 540°.

(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) × 180° [n is number of sides of polygon)]

= (6 – 2) X 180°

= 720°.

(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) × 180° [n is number of sides of polygon)]

= (9 – 2) X 180°

= 1260°.

(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) × 180° [n is number of sides of polygon)]

= (12 – 2) X 180°

= 1800°.

6. Question

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

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

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

$= n \times \frac{n-3}{2}$ [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.

7. Question

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°/Exterior Angle

= 360/40

= 9

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

(ii) No. of Sides = 360° / Exterior Angle

= 360/36

= 10

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

(iii) No. of Sides = 360° / Exterior Angle

= 360/72

= 5

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

(iv) No. of Sides = 360° / Exterior Angle

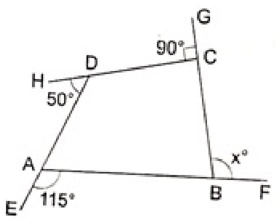
= 360/30

= 12

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

8. Question

In the given figure, find the angle measure x.



Answer

Sum of all the exterior angles = 360°

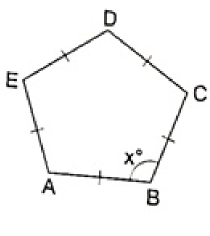
90° + 50°+ 115°+ x=360°

X = 360° - 90° - 50°- 115°

X = 105°

9. Question

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 poligon is

= (n – 2) × 180° [n is number of sides of polygon)]

= (5 – 2) X 180° [for pentagon n=5]

= 540°

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

Size of Interior Angle x = 540/5

= 108°

Exercise 14B

1. Question

How many diagonals are there in a pentagon?

A. 5

B. 7

C. 6

D. 10

Answer

Number of diagonals in Pentagon is

$= n \times \frac{n-3}{2}$ [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.

2. Question

How many diagonals are there in a hexagon?

A. 6

B. 8

C. 9

D. 10

Answer

Number of diagonals in Hexagon is

$= n \times \frac{n-3}{2}$ [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.

3. Question

How many diagonals are there in an octagon?

A. 8

B. 16

C. 18

D. 54

Answer

Number of diagonals in Octagon is

$= n \times \frac{n-3}{2}$ [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.

4. Question

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 having12 sides is

$= n \times \frac{n-3}{2}$ [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.

5. Question

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,

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 or 9

Since, no of sides can’t be negative.

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

6. Question

The angles of a pentagon are x°, (x + 20)°. (x + 40)°, (x + 60)° and (x + 80)°. 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) × 180° [n is number of sides of polygon)]

= (5 – 2) X 180°

= 540°

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

5x + 200 = 540

5x = 340

X = 340 / 5

= 68°

So, smallest angle of pentagon is 68°

7. Question

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

Exterior Angle = 40°

No. of Sides = 360 / Exterior Angle

= 360 / 40

= 9

8. Question

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

A. 8

B. 6

C. 5

D. 7

Answer

Interior Angle = 108°

Interior Angle + Exterior Angle = 180°

Exterior Angle = 180° - 108°

= 72°

No. of Sides = 360 / Exterior Angle

= 360 / 72

= 5

9. Question

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

A. 8

B. 7

C. 6

D. 10

Answer

Interior Angle = 135°

Interior Angle + Exterior Angle = 180°

Exterior Angle = 180° - 135°

= 45°

No. of Sides = 360 / Exterior Angle

= 360 / 45

= 8

10. Question

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°

X= 180/4

= 45°

So, Exterior Angle = 45°

No. of Sides = 360 / Exterior Angle

= 360 / 45

= 8

11. Question

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) × 180° [n is number of sides of polygon)]

= (10 – 2) X 180°

= 1440°·

Each interior angle = 1440/10

= 144°

12. Question

The sum of all interior angles of a hexagon is

A. 6 right ∠s

B. 8 right ∠s

C. 9 right ∠s

D. 12 right ∠s

Answer

The sum of interior angles of hexagon is

= (n – 2) × 180° [n is number of sides of polygon)]

= (6 – 2) X 180°

= 720°·

1 right ∠s = 90°

So, 720°= 8 right ∠s

13. Question

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° = (n – 2) × 180° [n is number of sides of polygon)]

n - 2 = 1080° / 180°

n = 6 + 2

= 8

No. of Sides = 360 / Exterior Angle

8 = 360 / Exterior Angle

So, Exterior Angle = 360 / 8

= 45°

Exterior Angle + Interior Angle = 180°

Interior Angle = 180°- 45°

= 135°

14. Question

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

Interior Angle = x + 108°

Interior Angle + Exterior Angle = 180°

X + (x + 108°) = 180°

2x= 180° - 108°

2x =72°

= 36°

So, Exterior Angle = 36°

No. of Sides = 360 / Exterior Angle

$= 360 / 36$

$= 10$