Chapter 14: Polygons
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Exercise: 14A

Question 1:
(i)
Solution: for a pentagon: n=5

$\therefore\ (\frac{360}{n})^o = (\frac{360}{5})^o = 72^o$

(ii)
Solution: For a hexagon: n=6

$\therefore\ (\frac{360}{n})^o = (\frac{360}{6})^o = 60^o$

(iii)
Solution: For a heptagon: n=7

$\therefore\ (\frac{360}{n})^o = (\frac{360}{7})^o = 51.43^o$

(iv)
Solution: For a decagon: n=10

$\therefore\ (\frac{360}{n})^o = (\frac{360}{10})^o = 36^o$

(v)
Solution: For a polygon of 15 sides: n=15

$\therefore\ (\frac{360}{n})^o = (\frac{360}{15})^o = 24^o$

Question 2:
Solution:

Each exterior angle of an *n*-sided polygon = $(\frac{360}{n})^o$

If the exterior angle is 50^o, then:

$\frac{360}{n} = 50^o$

N = 7.2

since *n* is not an integer, we cannot have a polygon with each exterior angle equal to 50^o

Question 3:

Solution: For a regular polygon with n sides:

Each interior angle = 180 – (Each exterior angle) = 180 - $\frac{360}{n}$

(i)

Solution: For a polygon with 10 sides:

Each exterior angle = $\frac{360}{10} = 36^o$

Each interior angle = 180 – 36 = 144^o

(ii)

Solution: For a polygon with 15 sides:

Each exterior angle = $\frac{360}{15} = 24^o$

Each interior angle = 180 - 24 = 156^o

Question 4:

Solution:

Each interior angle of a regular polygon having n sides = 180 - $\frac{360}{n} = \frac{180n - 360}{n}$

If each interior angle of the polygon is 100^o, then:

100 = $\frac{180n - 360}{n}$

100n = 180n – 360

180 n – 100 n = 360

80 n = 360

N = $\frac{360}{80}$ = 4.5

Since *n* is not an integer, it is not possible to have a regular polygon with each interior angle equal to 100^o.

Question 5:

Solution:

Sum of the interior angles of an n-sided polygon = (n-2) × 180^o

(i)

Solution: For a pentagon:

n = 5

∴ (n-2) ×180^o = (5 - 2) ×180^o = 3 × 180^o = 540^o

(ii)

Solution: For a hexagon:

n=6

$\therefore$ (n – 2) $\times 180^o$ = (6 – 2) $\times 180^o$ = 4$\times 180^o$ = 720^o

(iii)
Solution: For a nonagon:
n=9
$\therefore$ (n – 2) × 180° = (9 – 2) × 180° = 7 × 180^o = 1260^o

(iv)
Solution: For a polygon of 12 sides:
n=12
$\therefore$ (n – 2) $\times 180^o$ = (12 – 2) × 180^o = 10 $\times 180^o$ = 1800^o

Question 6:
Solution:
Number of diagonal in an n-sided polygon = $\frac{n(n-3)}{2}$

(i)
Solution: For a heptagon:

n=7$\Rightarrow \frac{n(n-3)}{2} = \frac{7(7-3)}{2} = \frac{28}{2}$=14

(ii)
Solution: For an octagon:

n=8$\Rightarrow \frac{\mathrm{n(n-3)}}{2} = \frac{8(8-3)}{2} = \frac{40}{2}$ =20

(iii)
Solution: For a 12-sided polygon:

n=12$\Rightarrow \frac{\mathrm{n(n-3)}}{2} = \frac{12(12-3)}{2} = \frac{108}{2}$ =54

Question 7:
Solution: Sum of all the exterior angles of a regular polygon is 360^o

(i)
Solution: Each exterior angle= 40^o

Number of sides of the regular polygon = $\frac{360^o}{40}$ = 9

(ii)
Solution: Each exterior angle= 36^o

Number of sides of the regular polygon= $\frac{360^o}{36}$ =10

(iii)

Solution: Each exterior angle= 72^o

Number of sides of the regular polygon = $\frac{360^o}{72}$ =5

(iv)

Solution: Each exterior angle= 30^o

Number of sides of the regular polygon = $\frac{360^o}{30}$ =12

Question 8:

Solution:

Sum of all the interior angles of an n-sided polygon = (n – 2) × 180^o

m $\angle ADC = 180^o - 50^o = 130^o$

m $\angle DAB = 180^o - 115^o = 65^o$

m $\angle BCD = 180^o - 90^o = 90^o$

m $\angle ADC$ + m $\angle DAB$ + m $\angle BCD$ +m $\angle ABC$ = n-2× 180^o = (4-2) × 180^o = 2× $180^o = 360^o$

m $\angle ADC$ + m∠DAB + m $\angle BCD$ +m $\angle ABC$ = 360^o

$130^o + 65^o + 90^o$ + m $\angle ABC$ = 360^o

285^o +m $\angle ABC = 360^o$

m $\angle ABC = 75^o$

m $\angle CBF$ = $180^o - 75^o = 105^o$

∴ x = 105^o

Question 9:

Solution:

For a regular n-sided polygon:

Each interior angle = $180^o - \frac{360}{n}$

In the given figure: n=5

$$x^o = 180^o - \frac{360}{5}$$

$$=180^o - 72^o$$

$$=108^o$$

∴ x = 108^o

Exercise: 14B
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Question 1:
Solution:
(a) 5
For a pentagon:
n=5
Number of diagonals = $\frac{n(n-3)}{2} = \frac{5(5-3)}{2}$ =5

Question 2:
Solution:
(c) 9
Number of diagonals in an n-sided polygon = $\frac{n(n-3)}{2}$
For a hexagon:
n=6∴ $\frac{n(n-3)}{2} = \frac{6(6-3)}{2}$
= $\frac{18}{9}$ = 9

Question 3:
Solution:
(d) 20

For a regular n-sided polygon:
Number of diagonals = $\frac{n(n-3)}{2}$
Octagon:
n=8, $\frac{8(8-3)}{2} = \frac{40}{2}$ =20

Question 4:
Solution:
(d) 54
For an n-sided polygon:
Number of diagonals = = $\frac{n(n-3)}{2}$
∴ n=12 ⇒ $\frac{12(12-3)}{2}$ = 54

Question 5:
Solution:
(c) 9

$\frac{n(n-3)}{2}$ =27

N (n-3) =54

n^2 - 3n - 54 = 0

n^2 - 9n + 6n – 54 = 0

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

N = -6 or n = 9

Number of sides cannot be negative.

∴n =9

Question 6:
Solution:
(b) 68°

Sum of all the interior angles of a polygon with n sides = (n - 2) × 180^o

(5 - 2) × 180^o = x + x + 20 + x + 40 + x + 60 + x + 80

540 = 5x + 200

5x = 340

x = 68^o

Question 7:
Solution:
(b) 9

Each exterior angle of a regular n-sided polygon = $\frac{360}{n}$ =40

N = $\frac{360}{40}$ = 9

Question 8:
Solution:
(c) 5

Each interior angle for a regular n-sided polygon =180 - $\frac{360}{n}$

180-$\frac{360}{n}$ =108

$\frac{360}{n}$ =72

N = $\frac{360}{72}$ = 5

Question 9:
Solution:

(a) 8

Each interior angle of a regular polygon with n sides = 180 - $\frac{360}{n}$

$180 - \frac{360}{n} = 135$

$\frac{360}{n} = 45$

N = 8

Question 10:
Solution:
(b) 8
For a regular polygon with n sides:

Each exterior angle = $\frac{360}{n}$

Each interior angle = 180 - $\frac{360}{n}$

$180 - \frac{360}{n} = 3\left(\frac{360}{n}\right)$

$180 = 4\left(\frac{360}{n}\right)$

$n = \frac{4 \times 360}{180} = 8$

Question 11:
Solution:
(c) 144^o

Each interior angle of a regular decagon $= 180 - \frac{360}{10} = 180 - 36 = 144^o$

Question 12:
Solution:
(b) 8 right $\angle S$
Sum of all the interior angles of a hexagon is (2n – 4) right angles.
For a hexagon:
n = 6
(2n - 4) right $\angle S$ = (12-4) right $\angle S$ = 8 right $\angle S$

Question 13:
Solution:
(a) 135^o

$(2n - 4) \times 90 = 1080$
$(2n – 4) = 12$
$2n=16$
or $n=8$

Each interior angle $= 180 - \frac{360}{n}$

$=180 - \frac{360}{8}$

$=180 - 45$

$=135^o$

Question 14:
Solution:
(d) 10

Each exterior angle of a regular polygon $= \frac{360}{n}$

Each interior angle of a regular polygon $= 180-\frac{360}{n}$

$180 - \frac{360}{n} - 108 = \frac{360}{n}$

$\frac{720}{n} =180-108=72$

$n=\frac{720}{72}$

$n =10$