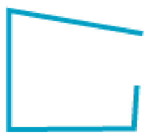
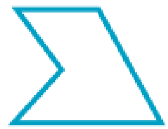
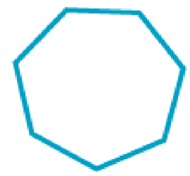
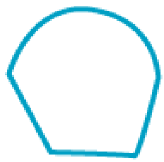
## EXERCISE 28(A)

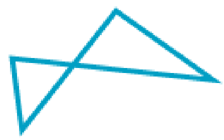
**1. State, which of the following are polygons:**

(i)


(ii)


(iii)


(iv)


(v)


**Solution:**

(i) The given figure is not closed.
Hence, the figure is not a polygon.
(ii) The given figure is closed.
Hence, the figure is a polygon.
(iii) The given figure is closed.
Hence, the figure is a polygon.
(iv) In the given figure, one of the sides is an arc.
Hence, the figure is not polygon.
(v) The side intersects each other in the given figure.
Hence, the figure is not polygon.

**2. Find the sum of interior angles of a polygon with:**
**(i) 9 sides**
**(ii) 13 sides**
**(iii) 16 sides**
**Solution:**
(i) 9 sides
Number of sides n = 9
The Sum of interior angles of polygon = $(2n - 4) \times 90^0$
$= (2 \times 9 - 4) \times 90^0$
$= (18 - 4) \times 90^0$
$= 14 \times 90^0$
We get,
$= 1260^0$
(ii) 13 sides
Number of sides n = 13
The sum of interior angles of polygon = $(2n - 4) \times 90^0$

$= (2 \times 13 - 4) \times 90^0$
$= (26 - 4) \times 90^0$
$= 22 \times 90^0$
We get,
$= 1980^0$
(iii) 16 sides
Number of sides n = 16
The sum of interior angles of polygon $= (2n - 4) \times 90^0$
$= (2 \times 16 - 4) \times 90^0$
$= (32 - 4) \times 90^0$
$= 28 \times 90^0$
We get,
$= 2520^0$

**3. Find the number of sides of a polygon, if the sum of its interior angles is:**
**(i) $1440^0$**
**(ii) $1620^0$**
**Solution:**
(i) $1440^0$
The sum of interior angles of polygon $= 1440^0$
Let the number of sides = n
The sum of interior angle of polygon is $(2n - 4) \times 90^0$
The side of polygon can be calculated as,
$(2n - 4) \times 90^0 = 1440^0$
$2n - 4 = 1440^0 / 90^0$
$2(n - 2) = 1440^0 / 90^0$
$n - 2 = 1440^0 / (2 \times 90^0)$
On further calculation, we get
$n - 2 = 720^0 / 2$
We get,
$n - 2 = 8$
$n = 8 + 2$
$n = 10$
Hence, the side of polygon = 10
(ii) $1620^0$
Given
The sum of interior angles of polygon $= 1620^0$
Let number of sides = n
The sum of interior angles of polygon $= (2n - 4) \times 90^0$

The side of polygon can be calculated as,
$(2n - 4) \times 90^0 = 1620^0$
$2(n - 2) \times 90^0 = 1620^0$
$n - 2 = 1620^0 / (2 \times 90^0)$
$n - 2 = 810^0 / 90^0$
We get,
$n - 2 = 9$
$n = 9 + 2$
$n = 11$
Hence, the side of polygon = 11

**4. Is it possible to have a polygon, whose sum of interior angles is $1030^0$.**
**Solution:**
Given
The sum of interior angles of polygon = $1030^0$
Let us consider the number of sides = n
The sum of interior angle of polygon = $(2n - 4) \times 90^0$
The side of polygon is calculated as,
$(2n - 4) \times 90^0 = 1030^0$
$2(n - 2)= 1030^0 / 90^0$
On further calculation, we get
$(n - 2) = 1030^0 / (2 \times 90^0)$
$(n - 2) = 103^0 / 18^0$
$n = 5.72 + 2$
$n = 7.72$
which is not a whole number.
Therefore, it is not a polygon, whose sum of interior angles is $1030^0$

**5. (i) If all the angles of a hexagon arc equal, find the measure of each angle.**
**(ii) If all the angles of an octagon are equal, find the measure of each angle.**
**Solution:**
(i) Number of sides of polygon n = 6
Let us consider each angle be = $x^0$
We know,
The sum of interior angles of hexagon = $6x^0$
The sum of interior angle of polygon = $(2n - 4) \times 90^0$
The sum of the interior angles of polygon can be calculated as,
$(2n - 4) \times 90^0$ = Sum of angles
$(2 \times 6 - 4) \times 90^0 = 6x^0$

$(12 - 4) \times 90^0 = 6x^0$
$6x^0 = 8 \times 90^0$
$x^0 = (8 \times 90^0) / 6$
We get,
$x = 120^0$
Therefore, each angle of hexagon = $120^0$
(ii) Number of sides of octagon n = 8
Let us consider each angle be = $x^0$
We know that,
The sum of interior angles of octagon = $8x^0$
The sum of interior angles of polygon = $(2n - 4) \times 90^0$
The sum of interior angles of polygon can be calculated as,
$(2n - 4) \times 90^0$ = Sum of angles
$(2n - 4) \times 90^0 = 8x^0$
$(2 \times 8 - 4) \times 90^0 = 8x^0$
$12 \times 90^0 = 8x^0$
$8x^0 = 12 \times 90^0$
$x^0 = (12 \times 90^0) / 8$
We get,
$x^0 = 135^0$
Therefore, each angle of octagon = $135^0$

**6. One angle of a quadrilateral is $90^0$ and all other angles are equal; find each equal angle**
**Solution:**
Let us consider all the three equal angle of a quadrilateral be $x^0$
The sum of angles of a quadrilateral = $360^0$
$x + x + x + 90^0 = 360^0$
$3x + 90^0 = 360^0$
$3x = 360^0 - 90^0$
$3x = 270^0$
$x = 270^0 / 3$
We get,
$x = 90^0$
The measure of each equal angle = $90^0$

**7. If angles of quadrilateral are in the ratio 4: 5: 3: 6; find each angle of the quadrilateral.**
**Solution:**

Let us consider the angles of quadrilateral be 4x, 5x, 3x and 6x
We know,
The sum of angles of quadrilateral = $360^0$
$4x + 5x + 3x + 6x = 360^0$
$18x = 360^0$
$x = 360^0 / 18$
We get,
$x = 20^0$
Now, all the angles are,
$4x = 4 \times 20^0$
$= 80^0$
$5x = 5 \times 20^0$
$= 100^0$
$3x = 3 \times 20^0$
$= 60^0$
$6x = 6 \times 20^0$
$= 120^0$
Therefore, the angles of the quadrilateral are $80^0$, $100^0$, $60^0$ and $120^0$

**8. If one angle of a pentagon is $120^0$ and each of the remaining four angles is $x^0$, find the magnitude of x.**
**Solution:**
Given
One angle of a pentagon = $120^0$
Number of sides of pentagon n = 5
Let us consider all other equal angle of pentagon be x
The sum of interior angle of polygon is $(2n – 4) \times 90^0$
The sum of the interior angle of pentagon can be calculated as,
$(2n – 4) \times 90^0 = (2 \times 5 – 4) \times 90^0$
$= 6 \times 90^0$
We get,
$= 540^0$
Therefore, the sum of interior angles of pentagon is $540^0$
Now,
$x + x + x + x + 120^0 = 540^0$
$4x + 120^0 = 540^0$
$4x = 540^0 - 120^0$
$4x = 420^0$
$x = 420^0 / 4$

We get,
$x = 105^0$
Hence, the value of $x = 105^0$

**9. The angles of a pentagon are in the ratio 5: 4: 5: 7: 6; find each angle of the pentagon.**
**Solution:**
Let us consider all the angle of pentagon as 5x, 4x, 5x, 7x and 6x
The sum of the interior angle of polygon is $(2n – 4) \times 90^0$
The sum of the interior angle of pentagon can be calculated as,
$(2n – 4) \times 90^0 = (2 \times 5 – 4) \times 90^0$
$= 6 \times 90^0$
We get,
$= 540^0$
The sum of interior angles of pentagon $= 540^0$
Hence,
$5x + 4x + 5x + 7x + 6x = 540^0$
$27x = 540^0$
$x = 540^0 / 27$
We get,
$x = 20^0$
Thus, each angle,
$5x = 5 \times 20^0$
$= 100^0$
$4x = 4 \times 20^0$
$= 80^0$
$5x = 5 \times 20^0$
$= 100^0$
$7x = 7 \times 20^0$
$= 140^0$
$6x = 6 \times 20^0$
$= 120^0$
Therefore, all the angles of a pentagon are $100^0$, $80^0$, $100^0$, $140^0$ and $120^0$

**10. Two angles of a hexagon are $90^0$ and $110^0$. If the remaining four angles arc equal, find each equal angle.**
**Solution:**
Let us consider all the angle of hexagon as x
Number of sides in hexagon n = 6

The sum of interior angle of polygon is $(2n - 4) \times 90^0$
The sum of interior angle of hexagon can be calculated as,
$(2n - 4) \times 90^0 = (2 \times 6 - 4) \times 90^0$
$= (12 - 4) \times 90^0$
$= 8 \times 90^0$
We get,
$= 720^0$
The sum of interior angles of pentagon is $720^0$
Hence,
$90^0 + 110^0 + x + x + x + x = 720^0$
$200^0 + 4x = 720^0$
$4x = 720^0 - 200^0$
$4x = 520^0$
We get,
$x = 130^0$
Hence, the measure of each equal angle = $130^0$

## EXERCISE 28(B)

**1. Fill in the blanks:**

**In case of regular polygon, with**

| Number of sides | Each exterior angle | Each interior angle |
|---|---|---|
| **(i) 6** | ………… | ………….. |
| **(ii) 8** | ………… | ………….. |
| **(iii) …………** | **$36^0$** | ………….. |
| **(iv) …………** | **$20^0$** | ………….. |
| **(v) …………** | …………… | **$135^0$** |
| **(vi) ………..** | …………... | **$165^0$** |

**Solution:**

| Number of sides | Each exterior angle | Each interior angle |
|---|---|---|
| (i) 6 | $60^0$ | $120^0$ |
| (ii) 8 | $45^0$ | $135^0$ |
| (iii) 10 | $36^0$ | $144^0$ |
| (iv) 18 | $20^0$ | $160^0$ |
| (v) 8 | $45^0$ | $135^0$ |
| (vi) 24 | $15^0$ | $165^0$ |

(i) Each exterior angle = $360^0 / 6$

= $60^0$

Each interior angle = $180^0 - 60^0$

= $120^0$

(ii) Each exterior angle = $360^0 / 8$

= $45^0$

Each interior angle = $180^0 - 45^0$

= $135^0$

(iii) Given that, each exterior angle = $36^0$

So, number of sides = $360^0 / 36^0$

= 10 sides

Each interior angle = $180^0 – 36^0$

= $144^0$

(iv) Given that, each exterior angle = $20^0$

Hence, number of sides = $360^0 / 20^0$

= 18 sides

Each interior angle = $180^0 - 20^0$

= $160^0$

(v) Given that, each interior angle = $135^0$

Hence, exterior angle = $180^0 - 135^0$

$= 45^0$
Therefore, number of sides = $360^0 / 45^0$
= 8 sides
(vi) Given that, each interior angle = $165^0$
Hence, exterior angle = $180^0 - 165^0$
$= 15^0$
Therefore, the number of sides = $360^0 / 15^0$
= 24 sides

**2. Find the number of sides in a regular polygon, if its each interior angle is:**
**(i) $160^0$**
**(ii) $150^0$**
**Solution:**
(i) $160^0$
Let the number of sides of a regular polygon = n
Each interior angle = $60^0$
The sum of interior angle of polygon can be calculated as,
$(2n – 4) \times 90^0 = 160^0 \times n$
$180^0n – 360^0 = 160^0n$
$180^0n – 160^0n = 360^0$
$20^0n = 360^0$
$n = 360^0 / 20^0$
We get,
n = 18
Hence, the number of sides = 18
(ii) $150^0$
Let us consider the number of sides of regular polygon be n
The sum of the interior angle of polygon = $(2n – 4) \times 90^0$
Each interior angle = $150^0$
The sum of the interior angle of polygon can be calculated as,
$(2n – 4) \times 90^0 = 150^0 \times n$
$180^0n – 360^0 = 150^0n$
$180^0n – 150^0n = 360^0$
$30^0n = 360^0$
$n = 360^0 / 30^0$
We get,
n = 12
Hence, the number of sides = 12

**3. Find number of sides in a regular polygon, if its each exterior angle is:**
**(i) $30^0$**
**(ii) $36^0$**
**Solution:**
(i) $30^0$
Let us assume the number of sides be n
Each exterior angle = $30^0$
Each exterior angle of polygon = $360^0$ / n
Now, we have
$360^0$ / n = $30^0$
n = $360^0$ / $30^0$
We get,
n = 12
Hence, the number of sides = 12
(ii) $36^0$
Let us assume the number of sides be n
Each exterior angle = $36^0$
Each exterior angle of polygon = $360^0$ / n
Now, we have
$360^0$ / n = $36^0$
n = $360^0$ / $36^0$
We get,
n = 10
Hence, the number of sides = 10

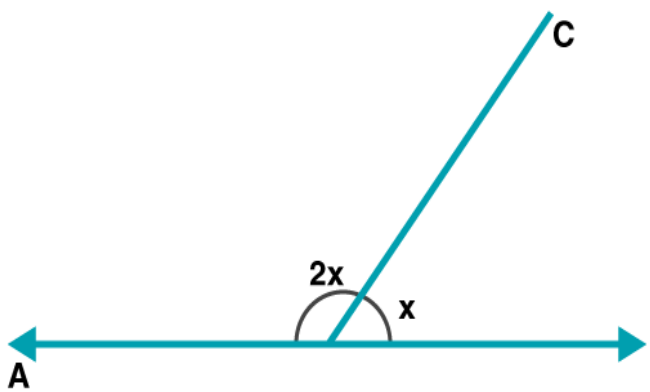
**4. Is it possible to have a regular polygon whose each interior angle is:**
**(i) $135^0$**
**(ii) $155^0$**
**Solution:**
(i) $135^0$
Let the number of sides of regular polygon be n
The sum of the interior angle of polygon = $(2n – 4) \times 90^0$
Each interior angle = $135^0$
The sum of interior angle of polygon can be calculated as,
$(2n – 4) \times 90^0 = 135^0 \times n$
$180^0n – 360^0 = 135^0n$
$180^0n – 135^0n = 360^0$
$45^0n = 360^0$
n = $360^0$ / $45^0$

We get,
n = 8
Since, it is a whole number
Therefore, it is possible to have a regular polygon whose interior angle is $135^0$
(ii) $155^0$
Let the number of sides of a regular polygon is n
The sum of the interior angle of polygon is $(2n – 4) \times 90^0$
Each interior angle = $155^0$
The sum of the interior angle of polygon can be calculated as,
$(2n – 4) \times 90^0 = 155^0 \times n$
$180^0n – 360^0 = 155^0n$
$180^0n – 155^0n = 360^0$
$25^0n = 360^0$
$n = 360^0 / 25^0$
We get,
$n = 72 / 5$
Since, it is not a whole number
Therefore, it is not possible to form a regular polygon whose interior angle is $155^0$

**5. Is it possible to have a regular polygon whose each exterior angle is:**
**(i) $100^0$**
**(ii) $36^0$**
**Solution:**
(i) $100^0$
Let the number of sides be n
Each exterior angle = $100^0$
Each exterior angle of a polygon is calculated as,
$360^0 / n$
So,
$360^0 / n = 100^0$
$n = 360^0 / 100^0$
We get,
$n = 18 / 5$
Since, it is not a whole number
Therefore, it is not possible to form a regular polygon
(ii) $36^0$
Let us consider the number of sides be n
Each exterior angle = $36^0$
Each exterior angle of polygon = $360^0 / n$

So,
$360^0 / n = 36^0$
$n = 360^0 / 36^0$
We get,
$n = 10$
Since, it is a whole number
Therefore, it is possible to form a regular polygon

**6. The ratio between the interior angle and the exterior angle of a regular polygon is 2: 1. Find:**
**(i) each exterior angle of this polygon.**
**(ii) number of sides in the polygon.**
**Solution:**
(i) Given
Interior angle: exterior angle = 2: 1
Let us assume the interior angle = $2x^0$ and the exterior angle = $x^0$




The sum of the interior angle and exterior angle is $180^0$
Hence,
$2x^0 + x^0 = 180^0$
$3x = 180^0$
$x = 180^0 / 3$
We get,
$x = 60^0$
Therefore, each exterior angle = $60^0$
(ii) Let us assume the number of sides be n
Each exterior angle = $60^0$
Each exterior angle of polygon = $360^0 / n$
So,
$360 / n = 60^0$

$n = 360^0 / 60^0$
We get,
$n = 6$
Hence, the number of sides = 6