Chapter - 5
Understanding Quadrilaterals

Exercise

In questions 1 to 52, there are four options, out of which one is correct. Write the correct answer.

1. If three angles of a quadrilateral are each equal to 75°, the fourth angle is
(a) 150° (b) 135° (c) 45° (d) 75°

Solution:
Given: Three angles of quadrilateral = $75°$
Let the forth angle be x.
As we know that sum of interior angles of quadrilateral is equal to to $360°$.
So,

$$75° + 75° + 75° + x = 360°$$
$$225° + x = 360°$$
$$x = 360° - 225°$$
$$x = 135°$$

Therefore, the fourth angle is$135°$.
Hence, the correct option is (B).

2. For which of the following, diagonals bisect each other?
(a) Square (b) Kite (c) Trapezium (d) Quadrilateral

Solution:
As we know that, the diagonals of a square bisect each other but the diagonals of kite, trapezium and quadrilateral do not bisect each other.
Hence, the correct option is (A).

3. For which of the following figures, all angles are equal?
(a) Rectangle (b) Kite (c) Trapezium (d) Rhombus

Solution:
In a rectangle, all angles are equal that is equal to 90°.
Hence, the correct option is (A).

4. For which of the following figures, diagonals are perpendicular to each other?
(a) Parallelogram (b) Kite (c) Trapezium (d) Rectangle

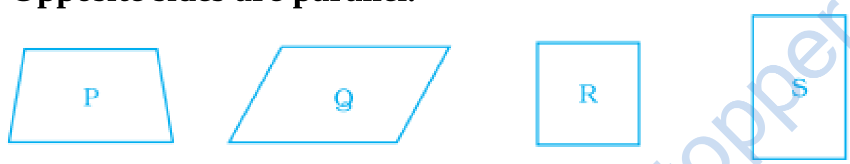
Solution:

As we know that the diagonals of a kite are perpendicular to each other.
Hence, the correct option is (B).

5. For which of the following figures, diagonals are equal?
(a) Trapezium (b) Rhombus (c) Parallelogram (d) Rectangle

Solution:
As we know that diagonals of rectangle are equal by the property of a rectangle,
Hence, the correct option is (D).

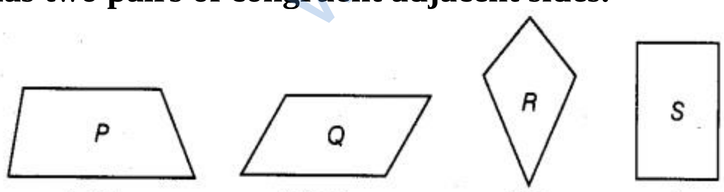
6. Which of the following figures satisfy the following properties?
- All sides are congruent.
- All angles are right angles.
- Opposite sides are parallel.



(a) P (b) Q (c) R (d) S

Solution:
As we know that all the properties mentioned above are related to square and we can see that figure R resembles a square.
Hence, the correct option is (C).

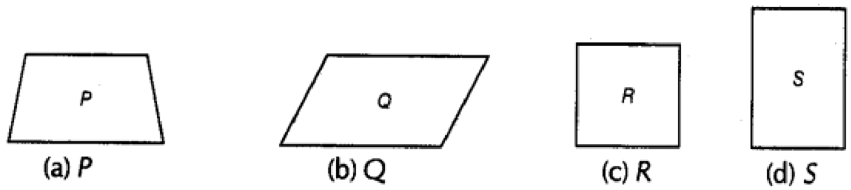
7. Which of the following figures satisfy the following property?
- Has two pairs of congruent adjacent sides.



(a) P (b) Q (c) R (d) S

Solution:
As we know that, a kite has two pairs of congruent adjacent sides and we can see that figure R resembles a kite.

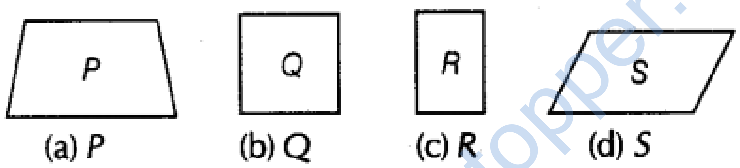
8. Which of the following figures satisfy the following property?
- Only one pair of sides are parallel.



Solution:

As we know that, in a trapezium, only one pair of sides are parallel and we can see that figure P resembles a trapezium.

9. Which of the following figures do not satisfy any of the following properties?
- All sides are equal.
- All angles are right angles.
- Opposite sides are parallel.



Solution:

As we can observe that the figure P does not satisfy any of the given properties.
Hence, the correct option is (A).

10. Which of the following properties describe a trapezium?
(a) A pair of opposite sides is parallel.
(b) The diagonals bisect each other.
(c) The diagonals are perpendicular to each other.
(d) The diagonals are equal.

Solution:

As we know that a pair of opposite sides are parallel in a trapezium.
Hence, the correct option is (A).

11. Which of the following is a property of a parallelogram?
(a) Opposite sides are parallel.
(b) The diagonals bisect each other at right angles.
(c) The diagonals are perpendicular to each other.
(d) All angles are equal.

Solution:

As we know that opposite are parallel in a parallelogram,
Hence, the correct option is (A).

12. What is the maximum number of obtuse angles that a quadrilateral can have?

(a) 1 (b) 2 (c) 3 (d) 4

Solution:

As we know that, an obtuse angle is more than 90° and less than 180° and also, the sum of all the angles of a quadrilateral is 360°.

Since, only 3 angles can be obtuse.

Hence, the correct option is (C).

13. How many non-overlapping triangles can we make in a n-gon (polygon having n sides), by joining the vertices?

(a) n –1 (b) n –2 (c) n –3 (d) n –4

Solution:

As we know that, the number of non-overlapping triangles in a n-gon = n – 2

Hence, the correct option is (B).

14. What is the sum of all the angles of a pentagon?

(a) 180° (b) 360° (c) 540° (d) 720°

Solution:

Sum of angles of a polygon = $(n - 2) \times 180°$

Where, n is the number of sides of polygon

As we know that, n = 5 in pentagon

So, sum of the angles = $(n - 2) \times 180°$

$= (5 - 2) \times 180°$

$= 3 \times 180°$

$= 540°$

Hence, the correct option is (C).

15. What is the sum of all angles of a hexagon?

(a) 180° (b) 360° (c) 540° (d) 720°

Solution:

Sum of angles of a polygon = $(n - 2) \times 180°$

Where, n is the number of sides of polygon

As we know that, n = 6 in hexagon

So, sum of the angles = $(n - 2) \times 180°$

$= (6 - 2) \times 180°$

$= 4 \times 180°$

= 720°
Hence, the correct option is (D).

16. If two adjacent angles of a parallelogram are (5x – 5)° and (10x + 35)°, then the ratio of these angles is
(a) 1 : 3 (b) 2 : 3 (c) 1 : 4 (d) 1 : 2

Solution:
As we know that adjacent angles of a parallelogram are supplementary and, its sum is equal to 180°.
So, $(5x - 5) + (10x + 35) = 180°$
$15x + 30° = 180°$
$15x = 180° - 30°$
$15x = 150°$
$x = 10°$

Thus, the both angle will be:
$(5x - 5)° = (5 \times 10 - 5)°$
$= (50 - 5)°$
$= 45°$

And: $(10x + 35)° = (10 \times 10 - 35)°$
$= (100 - 35)°$
$= 65°$
So, the ratio of these angle is = 45°:65° = 1: 3
Hence, the correct option is (A).

17. A quadrilateral whose all sides are equal, opposite angles are equal and the diagonals bisect each other at right angles is a __________.
(a) rhombus (b) parallelogram (c) square (d) rectangle

Solution:
As we know that, in rhombus, all sides are equal, opposite angles are equal and diagonals bisect each other at right angles.
Hence, the correct option is (A).

18. A quadrilateral whose opposite sides and all the angles are equal is a
(a) rectangle (b) parallelogram (c) square (d) rhombus

Solution:
In a rectangle, opposite sides and all the angles are equal.
Hence, the correct option is (A).

19. A quadrilateral whose all sides, diagonals and angles are equal is a

(a) square (b) trapezium (c) rectangle (d) rhombus

Solution:
As we know that in a square, all sides, diagonals and angles are equal.
Hence, the correct option is (A).

20. How many diagonals does a hexagon have?
(a) 9 (b) 8 (c) 2 (d) 6

Solution:
The formula of number of diagonal in a polygonal of n sides = $\frac{n(n-3)}{2}$

For hexagon, n = 6

So, number of diagonals in a hexagon = $\frac{6(6-3)}{2}=\frac{6\times3}{2}=9$

Hence, the correct option is (A).

21. If the adjacent sides of a parallelogram are equal then parallelogram is a
(a) Rectangle (b) trapezium (c) rhombus (d) square

Solution:
As we know that, in rhombus adjacent sides and as well as opposite sides are equal.
Hence, the correct option is (C).

22. If the diagonals of a quadrilateral are equal and bisect each other, then the quadrilateral is a
(a) rhombus (b) rectangle (c) square (d) parallelogram

Solution:
As we know that if diagonals are equal and bisect each other, then it will be a rectangle.
Hence, the correct option is (B).

23. The sum of all exterior angles of a triangle is
(a) 180° (b) 360° (c) 540° (d) 720°

Solution:
As we know that the sum of all exterior angles of a triangle is 360°
Hence, the correct option is (B).

24. Which of the following is an equiangular and equilateral polygon?
(a) Square (b) Rectangle (c) Rhombus (d) Right triangle

Solution:

Square have all the sides and all the angles are equal. Therefore, square is an equiangular and equilateral polygon.

Hence, the correct option is (A).

25. Which one has all the properties of a kite and a parallelogram?

(a) Trapezium (b) Rhombus (c) Rectangle (d) Parallelogram

Solution:

Properties of kite are:

Two pairs of equal sides.

Diagonals bisect at 90°.

One pair of opposite angles are equal.

Also, properties of parallelogram are:

Opposite angles are equal.

Diagonals bisect each other.

So, all these properties are satisfied by rhombus.

Hence, the correct option is (B).

26. The angles of a quadrilateral are in the ratio 1 : 2 : 3 : 4. The smallest angle is

(a) 72° (b) 144° (c) 36° (d) 18°

Solution:

Suppose the angles of the quadrilateral be a, 2a, 3a and 4a.

So, $a + 2a + 3a + 4a = 360°$ [Sum of all the angles of quadrilateral is $360°$]

$10a = 360°$

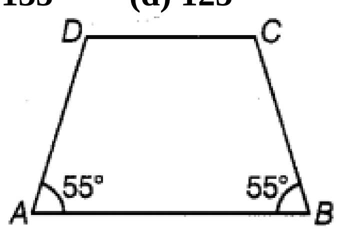
$a = 36°$

Therefore, the smallest angle is $36°$.

Hence, the correct option is (C).

27. In the trapezium ABCD, the measure of ∠D is

(a) 55° (b) 115° (c) 135° (d) 125°



Solution:
In the given trapezium ABCD,
$\angle A+\angle D=180°$ [Supplementary angles of trapezium]
$\angle A+\angle D=180°$
$55°+\angle D=180°$
$\angle D=180°-55°$
$\angle D=125°$
Hence, the correct option is (D).

28. A quadrilateral has three acute angles. If each measures 80°, then the measure of the fourth angle is
(a) 150° (b) 120° (c) 105° (d) 140°

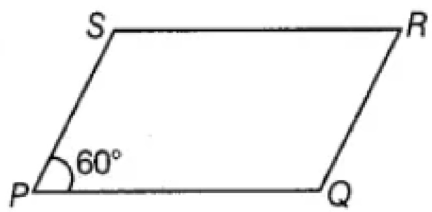
Solution:
Suppose the fourth angle is x.
Then, according to the question,
$80°+80°+80°+x=360°$ [Sum of all the angles of quadrilateral is $360°$]
$240°+x=360°$
$x=360°-240°$
$x=120°$
Hence, the correct option is (B).

29. The number of sides of a regular polygon where each exterior angle has a measure of 45° is
(a) 8 (b) 10 (c) 4 (d) 6

Solution:
Given:
Sum of exterior angles = 45°
As we know that sum of exterior angles of a polygon is $360°$.
Now, the formula to calculate the number sides of regular polygon is =
$$\frac{\text{Sum of exterior angles}}{\text{Measure of an exterior angle}}$$
$$=\frac{360°}{45°}$$
$$=8$$
Hence, the correct option is (A).

30. In a parallelogram PQRS, if ∠P = 60°, then other three angles are
(a) 45°, 135°, 120° (b) 60°, 120°, 120° (c) 60°, 135°, 135° (d) 45°, 135°, 135°

Solution:
Given: PQRS is a parallelogram and $\angle P = 60°$.



Then,
$\angle P + \angle Q = 180°$ [Sum of supplementary angle is equal to $180°$]
$60° + \angle Q = 180°$
$\angle Q = 180° - 60°$
$\angle Q = 120°$
Also, we know that opposite angles are equal in a parallelogram.
Therefore, the other three angles of parallelograms are $60°, 120°$ and $120°$.

Hence, the correct option is (B).

31. If two adjacent angles of a parallelogram are in the ratio 2 : 3, then the measure of angles are
(a) 72°, 108° (b) 36°, 54° (c) 80°, 120° (d) 96°, 144°

Solution:
Suppose two adjacent angles of a parallelogram be 2x and 3x. So,
$2x + 3x = 180°$ [Sum of adjacent angles of a parallelogram is $180°$]
$5x = 180°$
$x = \frac{180°}{5}$
$x = 36°$
Therefore, the two adjacent angles are:
$2x = 2 \times 36° = 72°$
$3x = 3 \times 36° = 108°$
Hence, the correct option is (A).

32. If PQRS is a parallelogram, then ∠P – ∠R is equal to
(a) 60° (b) 90° (c) 80° (d) 0°

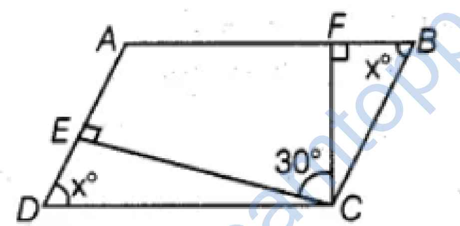
Solution:
As we know that in a parallelogram, opposite angles are equal. So, $\angle P - \angle R = 0$,
as $\angle P$ and $\angle R$ are opposite angles.
Hence, the correct option is (D).

33. The sum of adjacent angles of a parallelogram is
(a) 180°   (b) 120°   (c) 360°   (d) 90°

Solution:
As we know that, the sum of adjacent angles of a parallelogram is 180°.
Hence, the correct option is (A).

34. The angle between the two altitudes of a parallelogram through the same vertex of an obtuse angle of the parallelogram is 30°. The measure of the obtuse angle is
(a) 100°   (b) 150°   (c) 105°   (d) 120°

Solution:
Suppose EC and FC be altitudes and $\angle ECF = 30°$.



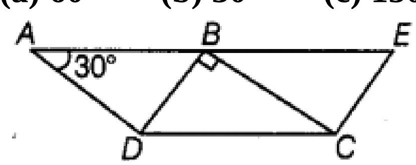
Let $\angle EDC = x = \angle FBC$
So, $\angle ECD = 90° - x$ and $\angle BCF = 90° - x$

Now, in parallelogram ABCD,

$$\angle ADC + \angle DCB = 180°$$
$$\angle ADC + (\angle ECD + \angle ECF + \angle BCF) = 180°$$
$$x + 90° - x + 30° + 90° - x = 180°$$
$$-x = 180° - 210° = -30°$$
$$x = 30°$$

Therefore, $\angle DCB = 30° + 60° + 60° = 150°$
Hence, the correct option is (B).

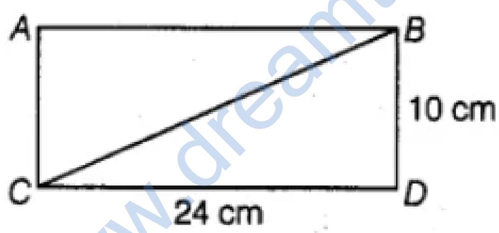
35. In the given figure, ABCD and BDCE are parallelograms with common base DC. If BC ⊥ BD, then ∠BEC =
(a) 60°   (b) 30°   (c) 150°   (d) 120°



Solution:
Given:
$\angle BAD = 30°$
So, $\angle BCD = 30°$ [Opposite angles of a parallelogram are equal]
Now, in triangle CBD:
$\angle DBC + \angle BCD + \angle CDB = 180°$ [Sum of all the angles of a triangle is equal to $180°$]
$90° + 30° + \angle CDB = 180°$
$\angle CDB = 180° - 90° - 30°$
$\angle CDB = 180° - 120°$
$\angle CDB = 60°$
Therefore, $\angle BEC = 60°$ [Opposite angles of a parallelogram are equal]
Hence, the correct option is (A).

36. Length of one of the diagonals of a rectangle whose sides are 10 cm and 24 cm is
(a) 25 cm (b) 20 cm (c) 26 cm (d) 3.5 cm

Solution:
In triangle BCD,



$\angle BDC = 90°$
So, $BC^2 = BD^2 + CD^2$ [By using Pythagoras theorem]
$BC^2 = 10^2 + 24^2$
$BC^2 = 100 + 576$
$BC^2 = 676$
$BC = \sqrt{676}$
$BC = 26\text{cm}$
Hence, the correct option is (a).

37. If the adjacent angles of a parallelogram are equal, then the parallelogram is a
(a) rectangle (b) trapezium (c) rhombus (d) any of the three

Solution:
As we know that sum of the adjacent angles of parallelogram is equal to $180°$.
Now, according to the question, both angles are same. So, each angle will be measure 90°.

Since, the parallelogram is a rectangle.
Hence, the correct option is (a).

38. Which of the following can be four interior angles of a quadrilateral?
(a) 140°, 40°, 20°, 160° (b) 270°, 150°, 30°, 20°
(c) 40°, 70°, 90°, 60° (d) 110°, 40°, 30°, 180°

Solution:
As we know that, the sum of interior angles of a quadrilateral is 360°.
In option (d) has one angle is $180°$ if it is considered then the quadrilateral be a triangle.
Hence, the correct option is (a).

39. The sum of angles of a concave quadrilateral is
(a) more than 360° (b) less than 360° (c) equal to 360° (d) twice of 360°

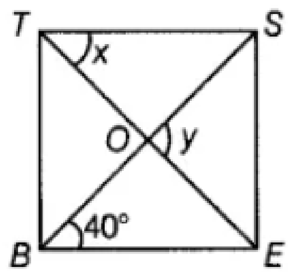
Solution:
As we know that, sum of angles concave and convex of a quadrilateral is equal to $360°$.
Hence, the correct option is (C).

40. Which of the following can never be the measure of exterior angle of a regular polygon?
(a) 22° (b) 36° (c) 45° (d) 30°

Solution:
The formula of the each exterior angle of a polygon $= \dfrac{360°}{n}$, where n is the number of sides of polygon.
Now, when we divide $360°$ by number of sides of polygon then it must be a whole number.
Therefore, $22°$ can never be the measure of exterior angle of a regular polygon.
Hence, the correct option is (a).

41. In the figure, BEST is a rhombus, Then the value of y – x is
(a) 40° (b) 50° (c) 20° (d) 10°

Solution:
Given: BEST is a rhombus.

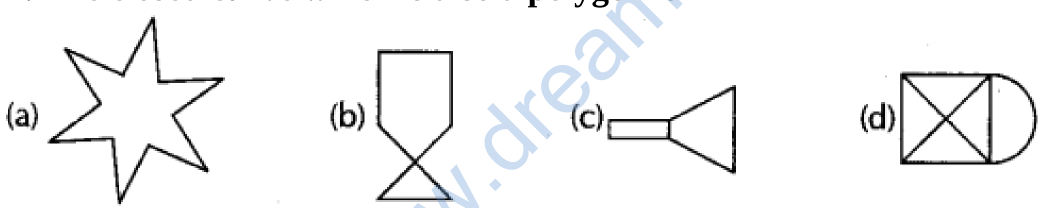


TS||BE and BS is transversal.
So, $\angle SBE = \angle TSB = 40°$ [Alternate interior angles]
Also, $\angle y = 90°$ [Diagonals bisect at $90°$]
In triangle TSO,
$\angle STO + \angle TSO = \angle SOE$

$$x + 40° = 90°$$
$$x = 90° - 40°$$
$$x = 40°$$

Hence, the correct option is (a).

42. The closed curve which is also a polygon is



Solution:
The closed curve which is also a polygon, is option (a).
Hence, the correct option is (a).

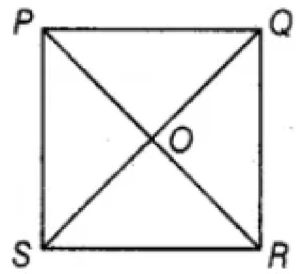
43. Which of the following is not true for an exterior angle of a regular polygon with n sides?
(a) Each exterior angle = 360°/n
(b) Exterior angle = 180° – interior angle
(c) n = 360°/ exterior angle
(d) Each exterior angle = ((n – 2) x 180°)/n

Solution:
The formula of the each exterior angle is = $\frac{360°}{n}$
Since, the formula given in option (d) is incorrect.
Hence, the correct option is (d).

44. PQRS is a square. PR and SQ intersect at O. Then ∠POQ is a

(a) Right angle (b) Straight angle (c) Reflex angle (d) Complete angle

Solution:



As we know that the diagonal of a square intersect each other at right angle.
So, $\angle POQ = 90°$
Hence, the correct option is (a).

45. Two adjacent angles of a parallelogram are in the ratio 1:5. Then all the angles of the parallelogram are
(a) 30°, 150°, 30°, 150° (b) 85°, 95°, 85°, 95°
(c) 45°, 135°, 45°, 135° (d) 30°, 180°, 30°, 180°

Solution:
Let the adjacent angles of a parallelogram be x and 5x. So,
$x + 5x = 180°$ [Sum of adjacent angles of a parallelogram is $180°$]
$6x = 180°$
$x = 30°$

Therefore, the two adjacent angles of a parallelogram are:
$x = 30°$
$5x = 5 \times 30° = 150°$
So, all the angles of the parallelogram are $30°$, $150°$ $30°$ and $150°$.
Hence, the correct option is (a).

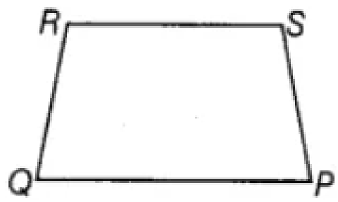
46. A parallelogram PQRS is constructed with sides QR = 6 cm, PQ = 4 cm and ∠PQR = 90°. Then PQRS is a
(a) square (b) rectangle (c) rhombus (d) trapezium

Solution:
Given: one angle of a parallelogram is 90°
As we know that, if one angle of a parallelogram is of 90°, then all the other also be 90°. So, a parallelogram with all angles equal to 90° is called a rectangle.

Hence, the correct option is (b).

47. The angles P, Q, R and S of a quadrilateral are in the ratio 1:3:7:9. Then PQRS is a
(a) parallelogram (b) trapezium with PQ || RS (c) trapezium with QR||PS (d) kite

Solution:



Let the angles of quadrilateral be x, 3x, 7x and 9x. So,
$x+3x+7x+9x=360°$ [Sum of angles in any quadrilateral is $360°$]
$20x=360°$
$x=18°$

So, the angles P, Q, R and S are:
$x=18°$
$3x=3\times 18°=54°$
$7x=7\times 18°=126°$
$9x=9\times 18°=162°$
Since,
$\angle P+\angle S=18°+162°=180°$
And:$\angle Q+\angle R=54°+126°=180°$
Therefore, the quadrialteral PQRS is a trapezium with PQ||RS
Hence, the correct option is (b).

48. PQRS is a trapezium in which PQ||SR and ∠P=130°, ∠Q=110°. Then ∠R is equal to:
(a) 70° (b) 50° (c) 65° (d) 55°

Solution:
Given: PQRS is a trapezium and PQ||SR. So,
$\angle Q+\angle R=180°$ [Angles between the pair of parallel sides are supplementary]
$110°+\angle R=180°$
$\angle R=180°-110°$
$\angle R=70°$
Hence, the correct option is (a).

49. The number of sides of a regular polygon whose each interior angle is of 135° is
(a) 6 (b) 7 (c) 8 (d) 9

Solution:
The formula of each angle of a polygon having n sides = $\frac{360°}{n}$
As we know that, exterior angle + interior angle = $180°$
So,
$$135° + \text{Exterior angle} = 180°$$
$$\text{Exterior angle} = 180° - 135°$$
$$\text{Exterior angle} = 45°$$
Now, number of sides (n) in polygon $= \frac{360°}{\text{Exterior angle}}$
$$= \frac{360°}{45°}$$
$$= 8$$
Hence, the correct option is (c).

50. If a diagonal of a quadrilateral bisects both the angles, then it is a
(a) kite (b) parallelogram (c) rhombus (d) rectangle

Solution:
As we know that if diagonal of a quadrilateral bisects both the angles, then it is a rhombus.
Hence, the correct option is (c).

51. To construct a unique parallelogram, the minimum number of measurements required is
(a) 2 (b) 3 (c) 4 (d) 5

Solution:
To construct a unique parallelogram, the minimum number of measurements required is 3 that are two adjacent sides of the parallelogram and the angle between them.
Hence, the correct option is (b).

52. To construct a unique rectangle, the minimum number of measurements required is
(a) 4 (b) 3 (c) 2 (d) 1

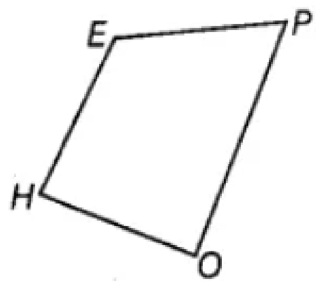
Solution:
To construct a unique rectangle, the minimum number of measurements required is 2 that are length and breadth of a rectangle.

Hence, the correct option is (c).

In questions 53 to 91, fill in the blanks to make the statements true.

53. In quadrilateral HOPE, the pairs of opposite sides are __________.

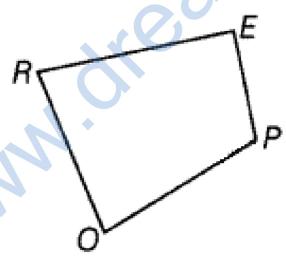
Solution:
Let HOPE is a quadrilateral.



In quadrilateral HOPE, the pairs of opposite sides are EH, PO and HO, EP.

54. In quadrilateral ROPE, the pairs of adjacent angles are __________.

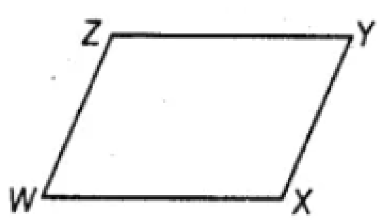
Solution:



In quadrilateral ROPE, the pairs of adjacent angles are $\angle R, \angle O; \angle O, \angle P; \angle P, \angle E; \angle E, \angle R$.

55. In quadrilateral WXYZ, the pairs of opposite angles are __________.

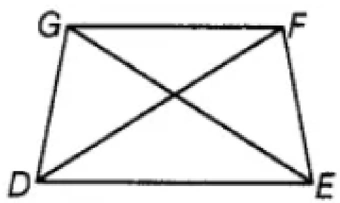
Solution:



In quadrilateral WXYZ, the pairs of opposite angles are $\angle W$ and $\angle Y; \angle X$ and $\angle Z$.

56. The diagonals of the quadrilateral DEFG are __________ and __________.

Solution:
Let DEFG is a quadrilateral.



The diagonals of the quadrilateral DEFG are GE and FD.

57. The sum of all __________ of a quadrilateral is 360°.

Solution:
As we know that the sum of all angles of a quadrilateral is 360°.

58. The measure of each exterior angle of a regular pentagon is __________.

Solution:
The formula of exterior angle having side's n is = $\frac{360°}{n}$

In pentagon, n = 5:

So, exterior angle = $\frac{360°}{5} = 72°$

Hence, the measure of each exterior angle of a regular pentagon is $\underline{72°}$.

59. Sum of the angles of a hexagon is __________.

Solution:
The formula of the sum of angle of an n-gon = $(n-2)\times 180°$
In hexagon, n = 6:
So, sum of the angles of hexagon = $(6 - 2)\times 180° = 4\times 180° = 720°$.
Hence, sum of the angles of a hexagon is $\underline{720°}$.

60. The measure of each exterior angle of a regular polygon of 18 sides is __________.

Solution:

Given:
Number of sides (n) =18

The formula of exterior angle having n sides is = $\frac{360°}{n}$

$= \frac{360°}{18}$

$= 20°$

Hence, the measure of each exterior angle of a regular polygon of 18 sides $\underline{20°}$.

61. The number of sides of a regular polygon, where each exterior angle has a measure of 36°, is __________.

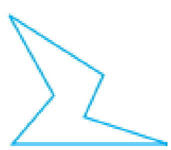
Solution:
Given:
Exterior angle = 36°
As we know that, the sum of exterior angles of a regular polygon is $360°$.
Now, the number of sides is calculated as follows:

Number of sides $= \frac{360°}{\text{Exterior angle}}$

$= \frac{360°}{36°}$

$= 10$

Hence, the number of sides of a regular polygon, where each exterior angle has a measure of 36°, is 10.

62.  **is a closed curve entirely made up of line segments. The another name for this shape is __________.**

Solution:
The another name for this shape is concave polygon.

63. A quadrilateral that is not a parallelogram but has exactly two opposite angles of equal measure is __________.

Solution:
A quadrilateral that is not a parallelogram but has exactly two opposite angles of equal measure is kite.

64. The measure of each angle of a regular pentagon is __________.

Solution:

The formula of the sum of interior angles of a polygon = $(n-2)\times 180°$

In reqular pentagon, n = 5

So, the sum of interior angles of a polygon = $(n-2)\times 180°$

$$=(5-2)\times 180°$$
$$=3\times 180°$$
$$=540°$$

So, measure of each angle of a regular pentagon = $\frac{540°}{5}$

$$=\frac{540°}{5}$$
$$=108°$$

Hence, the measure of each angle of a regular pentagon is $108°$.

65. The name of three-sided regular polygon is __________.

Solution:

As we know that the name of three-sided regular polygon is an equilateral triangle.

66. The number of diagonals in a hexagon is __________.

Solution:

The formula of the number diagonals in a hexagon is = $\frac{n(n-3)}{2}$

We know that in hexagon, n = 6

Then,

The number diagonals in a hexagon is = $\frac{n(n-3)}{2}=\frac{6(6-3)}{2}=\frac{18}{2}=9$

Hence, the number of diagonals in a hexagon is 9.

67. A polygon is a simple closed curve made up of only __________.

Solution:

A polygon is a simple closed curve made up of only line segment.

68. A regular polygon is a polygon whose all sides are equal and all __________ are equal.

Solution:

A regular polygon is a polygon whose all sides are equal and all angles are equal.

69. The sum of interior angles of a polygon of n sides is __________right angles.

Solution:
The sum of interior angles of a polygon of n sides is 2n-4 right angles.

70. The sum of all exterior angles of a polygon is __________.

Solution:
The sum of all exterior angles of a polygon is $360°$.

71. __________ is a regular quadrilateral.

Solution:
As we know that square is a regular quadrilateral.

72. A quadrilateral in which a pair of opposite sides is parallel is __________.

Solution:
A quadrilateral in which a pair of opposite sides is parallel is trapezium.

73. If all sides of a quadrilateral are equal, it is a __________.

Solution:
If all sides of a quadrilateral are equal, it is a rhombus, square.

74. In a rhombus diagonals intersect at __________ angles.

Solution:
In a rhombus diagonals intersect at right angles.

75. __________ measurements can determine a quadrilateral uniquely.

Solution:
To construct a unique quadrilateral, 5 measurement are required that are four sides and one angle or three sides and two angles.
Hence, 5 measurements can determine a quadrilateral uniquely.

76. A quadrilateral can be constructed uniquely if its three sides and __________ angles are given.

Solution:
A quadrilateral can be constructed uniquely if its three sides and two included angles are given.

77. A rhombus is a parallelogram in which __________ sides are equal.

Solution:
A rhombus is a parallelogram in which all sides are equal.

78. The measure of __________ angle of concave quadrilateral is more than 180°.

Solution:
The measure of 1 angle of concave quadrilateral is more than 180°.

79. A diagonal of a quadrilateral is a line segment that joins two __________ vertices of the quadrilateral.

Solution:
A diagonal of a quadrilateral is a line segment that joins two opposite vertices of the quadrilateral.

80. The number of sides in a regular polygon having measure of an exterior angle as 72° is __________.

Solution:
Given: exterior angle $= 72°$

$$\text{Number of sides} = \frac{360°}{\text{Exterior angle}}$$

$$= \frac{360°}{72°}$$

$$= 5$$

The number of sides in a regular polygon having measure of an exterior angle as 72° is 5.

81. If the diagonals of a quadrilateral bisect each other, it is a __________.

Solution:
If the diagonals of a quadrilateral bisect each other, it is a Parallelogram.

82. The adjacent sides of a parallelogram are 5 cm and 9 cm. Its perimeter is __________.

Solution:

As we know that, perimeter of Parallelogram = 2$\times$(Sum of length of adjacent sides)

$= 2\times(5+9)$

$= 2\times 14$

$= 28cm$

The adjacent sides of a parallelogram are 5 cm and 9 cm. Its perimeter is 28 cm.

83. A nonagon has __________ sides.

Solution:
A nonagon has 9 sides.

84. Diagonals of a rectangle are __________.

Solution:
Diagonals of a rectangle are equal.

85. A polygon having 10 sides is known as __________.

Solution:
A polygon having 10 sides is known as square.

86. A rectangle whose adjacent sides are equal becomes a __________.

Solution:
A rectangle whose adjacent sides are equal becomes a square.

87. If one diagonal of a rectangle is 6 cm long, length of the other diagonal is __________.

Solution:
As we know that diagonal of a rectangle are equal.
So, if one diagonal of a rectangle is 6 cm long, length of the other diagonal is 6cm.

88. Adjacent angles of a parallelogram are __________.

Solution:
Adjacent angles of a parallelogram are supplementary.

89. If only one diagonal of a quadrilateral bisects the other, then the quadrilateral is known as __________.

Solution:

If only one diagonal of a quadrilateral bisects the other, then the quadrilateral is known as kite.

90. In trapezium ABCD with AB||CD, if ∠A = 100°, then ∠D = __________.

Solution:

Given: ABCD is a trapezium and AB||CD.

∠A = 100°

So, $\angle A + \angle D = 180°$ [Supplementary angle is equal to $180°$]

$100° + \angle D = 180°$

$\angle D = 180° - 100°$

$\angle D = 80°$

Hence, in trapezium ABCD with AB||CD, if ∠A = 100°, then ∠D = $80°$.

91. The polygon in which sum of all exterior angles is equal to the sum of interior angles is called __________.

Solution:

The polygon in which sum of all exterior angles is equal to the sum of interior angles is called Quadrilateral.

In questions 92 to 131 state whether the statements are true (T) or (F) false.

92. All angles of a trapezium are equal.

Solution:

As we know that all angles of a trapezium are not equal.

Hence, the given statement is false.

93. All squares are rectangles.

Solution:

As we know that all the angles of square are right angle.

So, all squares are rectangles.

Hence, the given statement is true.

94. All kites are squares.

Solution:

In square, all the angles are of 90° but in kite, it is not the case.

Hence, the given statement is false.

95. All rectangles are parallelograms.

Solution:
As we know that all the properties of parallelogram are satisfied by the rectangle.
Hence, the given statement is true.

96. All rhombuses are squares.

Solution:
As we know that the angle of rhombus are not equal to $90°$. So, all the rhombuses are not square.
Hence, the given statement is false.

97. Sum of all the angles of a quadrilateral is 180°.

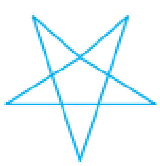
Solution:
As we know that sum of all the angles of a quadrilateral is $360°$.
Hence, the given statement is false.

98. A quadrilateral has two diagonals.

Solution:
As we know that a quadrilateral has two diagonal.
Hence, the given statement is false.

99. Triangle is a polygon whose sum of exterior angles is double the sum of interior angles.

Solution:
As we know that the sum of exterior angle is $360°$ and the sum of interior angles of a triangle is $180°$ that is double the sum of interior angle.
Hence, the given statement is true.

100.  **is a polygon.**

Solution:
The given figure is not a simple closed curve as it intersect with itself more than once.
Hence, the given statement id false.

101. A kite is not a convex quadrilateral.

Solution:
We know that a kite is a convex quadrilateral as the line segment joining any two opposite vertices inside it lies completely inside it.
Hence, the given statement is false.

102. The sum of interior angles and the sum of exterior angles taken in an order are equal in case of quadrilaterals only.

Solution:
We know that:
Interior angle + Exterior angle = $360°$
Hence, the given statement is false.

103. If the sum of interior angles is double the sum of exterior angles taken in an order of a polygon, then it is a hexagon.

Solution:
We know that the sum of interior angles of a hexagon is 720° and the sum of exterior angles of a hexagon is 360° that is double the sum of exterior angles.
Hence, the given statement is true.

104. A polygon is regular if all of its sides are equal.

Solution:
According to the definition of a regular polygon, a polygon is regular, if all sides and all angles are equal.
Hence, the given statement is false.

105. Rectangle is a regular quadrilateral.

Solution:
All the sides are not equal of rectangle. Since rectangle is not a regular polygon.
Hence, the given statement is false.

106. If diagonals of a quadrilateral are equal, it must be a rectangle.

Solution:
We know that diagonal of rectangle are equal. So, it is definitely a rectangle.
Hence, the given statement is true.

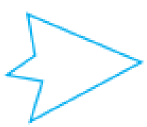
107. If opposite angles of a quadrilateral are equal, it must be a parallelogram.

Solution:
If opposite angles are equal, it has to be a parallelogram.
Hence, the given statement is true.

108. The interior angles of a triangle are in the ratio 1:2:3, then the ratio of its exterior angles is 3:2:1.

Solution:
Let the interior angle be x, 2x, and 3x. So,
$x+2x+3x=180°$ [Angle sum property of triangle]
$6x=180°$
$x=\frac{180°}{6}$
$x=30°$
So, the interior angles are $30°, 60°$ and $90°$.
Therefore, the exterior angles will be $(180°-30°),(180°-60°)$ and $(180°-90°)$ that is $150°,120°$ and $90°$.

So, the ratio of exterior angle $=150°:120°:90°=5:4:3$.
Hence, the given statement is false.

109.  **is a concave pentagon.**

Solution:
Total number of sides are 6. So, it is a concave hexagon.
Hence, the given statement is false.

110. Diagonals of a rhombus are equal and perpendicular to each other.

Solution:
We know that diagonals of a rhombus are perpendicular to each other but not equal.
Hence, the given statement is false.

111. Diagonals of a rectangle are equal.

Solution:
The diagonals of a rectangle are equal.
Hence, the given statement is true.

112. Diagonals of rectangle bisect each other at right angles.

Solution:
We know that diagonals of a rectangle does not bisect each other.
Hence, the given statement is false.

113. Every kite is a parallelogram.

Solution:
Kite is a parallelogram because its opposite sides are not equal and parallel
Hence, the given statement is false.

114. Every trapezium is a parallelogram.

Solution:
In a trapezium, only one pair of sides is parallel.
Hence, the given statement is false.

115. Every parallelogram is a rectangle.

Solution:
As in rectangle all angles are right angle but not in parallelogram.
So, every parallelogram is a rectangle.
Hence, the given statement is false.

116. Every trapezium is a rectangle.

Solution:
As we know that in a rectangle, opposite sides are equal and parallel but in a trapezium, it is not so. Therefore, every trapezium is a rectangle.
Hence, the given statement is false.

117. Every rectangle is a trapezium.

Solution:
A rectangle satisfies all the properties of a trapezium but it is not true vice-versa.
Hence, the given statement is true.

118. Every square is a rhombus.

Solution:
A square satisfies all the properties of a rhombus but it is not true vice-versa.
Hence, the given statement is true.

119. Every square is a parallelogram.

Solution:
A square satisfies all the properties of a parallelogram but it is not true vice-versa.
Hence, the given statement is true.

120. Every square is a trapezium.

Solution:
A square satisfies all the properties of a trapezium but it is not true vice-versa.
Hence, the given statement is true.

121. Every rhombus is a trapezium.

Solution:
A rhombus satisfies all the properties of a trapezium but it is not true vice-versa.
Hence, the given statement is true.

122. A quadrilateral can be drawn if only measures of four sides are given.

Solution:
As we know that at least five measurement is required to determine a quadrilateral uniquely.
Hence, the given statement is false.

123. A quadrilateral can have all four angles as obtuse.

Solution:
It is not possible to be a quadrilateral can have all four angles as obtuse because their sum will exceed 360°.
Hence, the given statement is false.

124. A quadrilateral can be drawn if all four sides and one diagonal is known.

Solution:
A quadrilateral can be drawn if all four sides and one diagonal is known.
Hence, the given statement is true.

125. A quadrilateral can be drawn when all the four angles and one side is given.

Solution:
A quadrilateral can’t be drawn when all the four angles and one side is given.
Hence, the given statement is false.

126. A quadrilateral can be drawn if all four sides and one angle is known.

Solution:
A quadrilateral can be drawn if all four sides and one angle is known.
Hence, the given statement is true.

127. A quadrilateral can be drawn if three sides and two diagonals are given.

Solution:
A quadrilateral can be drawn if three sides and two diagonals are given.
Hence, the given statement is true.

128. If diagonals of a quadrilateral bisect each other, it must be a parallelogram.

Solution:
Yes, if diagonals of a quadrilateral bisect each other, it must be a parallelogram.
Hence, the given statement is true.

129. A quadrilateral can be constructed uniquely if three angles and any two sides are given.

Solution:
Yes, a quadrilateral can be constructed uniquely if three angles and any two sides are given.
Hence, the given statement is true.

130. A parallelogram can be constructed uniquely if both diagonals and the angle between them is given.

Solution:
Yes, a parallelogram can be constructed uniquely if both diagonals and the angle between them is given.
Hence, the given statement is true.

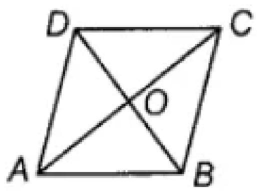
131. A rhombus can be constructed uniquely if both diagonals are given.

Solution:
Yes, A rhombus can be constructed uniquely if both diagonals are given.
Hence, the given statement is true.

Solve the following:

132. The diagonals of a rhombus are 8 cm and 15 cm. Find its side.

Solution:
Let ABCD is a rhombus.



Given: AC = 15 cm and BD = 8 cm
We know that the diagonals of a rhombus bisect each other at $90°$. So, in triangle AOB,

$$AB^2 = OA^2 + OB^2$$

$$AB^2 = \left(\frac{15}{2}\right)^2 + \left(\frac{8}{2}\right)^2$$

$$AB^2 = (7.5)^2 + 4^2$$

$$AB^2 = 56.25 + 16$$

$$AB^2 = 72.25$$

$$AB = \sqrt{72.25}$$

$$AB = 8.5\text{cm}$$

Hence, the length of each side is 8.5 cm.

133. Two adjacent angles of a parallelogram are in the ratio 1:3. Find its angles.

Solution:
Let the adjacent angles of a parallelogram be x and 3x.
Now, x + 3x = 180° [adjacent angles of parallelogram are supplementary]
4x = 180°
x = 45°
So, the angles are 45°, 135°.
Hence, the angles are 45°, 135, 45°, 135°. [Opposite angles in a parallelogram are equal]

134. Of the four quadrilaterals— square, rectangle, rhombus and trapezium— one is somewhat different from the others because of its design. Find it and give justification.

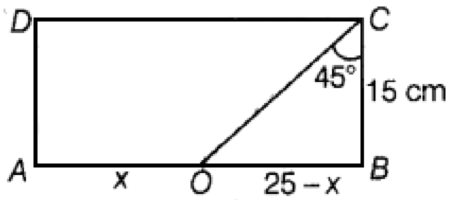
Solution:
Opposite sides of rectangle, rhombus and square are equal and parallel. Also, opposite angles are equal. So, they are parallelograms.

Now, in trapezium only one pair of sides are parallel. So, it is not a parallelogram.
Hence, trapezium has different design.

135. In a rectangle ABCD, AB = 25 cm and BC = 15. In what ratio does the bisector of ∠C divide AB?

Solution:

Given: In triangle ABCD:
AB = 25 cm and BC = 15 cm



According to the question, CO is the bisector of $\angle C$ and it divides AB.
So, $\angle OCB = \angle OCD = 45°$

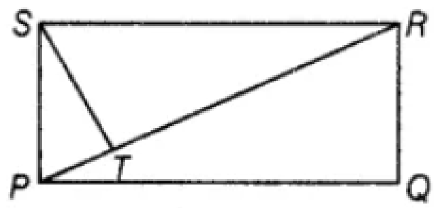
Now, in triangle OCB:
$\angle CBO + \angle OCB + \angle COB = 180°$ [Angle sum property of triangle]
$90° + 45° + \angle COB = 180°$
$\angle COB = 180° - (90° + 45°)$
$\angle COB = 180° - 135°$
$\angle COB = 45°$
Again, in triangle OCB:
$\angle OCB = \angle COB$
$OB = BC$
$OB = 15\text{cm}$

CO divides AB in the ratio AO: OB
Let AO be x. So, OB = AB – x = 25 – x
Therefore, AO: OB = x: 25 – x
=10: 15
=2:3
Hence, CO divides AB in the ratio 2:3.

136. PQRS is a rectangle. The perpendicular ST from S on PR divides ∠S in the ratio 2:3. Find ∠TPQ.

Solution:

Given: PQRS is a rectangle. ST$\perp PR$ and ST divides $\angle S$ in the ratio 2:3.
So, sum of ratio = 2+3=5



Now,

$\angle TSP = \frac{2}{5} \times 90° = 36°$

$\angle TSR = \frac{3}{5} \times 90° = 54°$

Now, by the angle sum property of a triangle.

$$\angle TPS = 180° - (\angle STP + \angle TSP)$$
$$= 180° - (90° + 36°)$$
$$= 54°$$

Also, we know that, $\angle SPQ = 90°$

So, $\angle TPS + \angle TPQ = 90°$

$$54° + \angle TPQ = 90°$$
$$\angle TPQ = 90° - 54°$$
$$\angle TPQ = 36°$$

Hence, ∠TPQ = 36°.

137. A photo frame is in the shape of a quadrilateral. With one diagonal longer than the other. Is it a rectangle? Why or why not?

Solution:

We know that in the rectangle both the diagonal are equal. So, it can't be rectangle.

138. The adjacent angles of a parallelogram are (2x – 4)° and (3x – 1)°. Find the measures of all angles of the parallelogram.

Solution:

We know that the adjacent angles of a parallelogram are supplementary. So,

$$(2x-4)° + (3x-1)° = 180°$$
$$5x - 5° = 180°$$
$$5x = 185°$$
$$x = \frac{185°}{5}$$
$$x = 37°$$

So, the adjacent angles are:
$2x-4=2\times37°-4°=74°-4°=70°$
And: $3x-1=3\times37°-1°=111°-1°=110°$
Hence, the angles are $70°,110°,70°,110°$. [Opposite angles in a parallelogram are equal]

139. The point of intersection of diagonals of a quadrilateral divides one diagonal in the ratio 1:2. Can it be a parallelogram? Why or why not?

Solution:
As we know that the diagonals of a parallelogram intersect each other in the ratio 1 : 1.
Hence, it can never be a parallelogram.

140. The ratio between exterior angle and interior angle of a regular polygon is 1:5. Find the number of sides of the polygon.

Solution:
Let the exterior angle and interior angle be x and 5x. So,
$x+5x=180°$ [Exterior angle and corresponding interior angle are supplementary]
$6x=180°$
$x=\frac{180°}{6}$
$x=30°$
So, the number of sides = $\frac{360°}{\text{Exterior angle}}$
$=\frac{360°}{30°}$
$=12$
Hence, the number of sides in polygon is 12.

141. Two sticks each of length 5 cm are crossing each other such that they bisect each other. What shape is formed by joining their end points? Give reason.

Solution:
Let's take sticks as the diagonal of a quadrilateral.
According to the question, they are bisecting each other. So, the shape formed by joining their end points will be parallelogram.
Hence, the shape formed by joining the vertex is, it may be a rectangle or a square depending on the angle between the sticks.

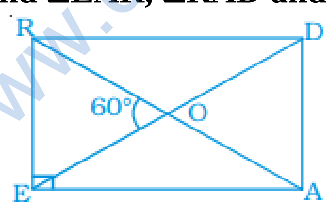
142. Two sticks each of length 7 cm are crossing each other such that they bisect each other at right angles. What shape is formed by joining their end points? Give reason.

Solution:
Let's take sticks as the diagonal of a quadrilateral.
According to the question, they are bisecting each other at right angle. So, the shape formed joining their end points will be a rhombus.

143. A playground in the town is in the form of a kite. The perimeter is 106 metres. If one of its sides is 23 metres, what are the lengths of other three sides?

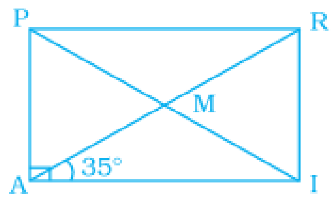
Solution:
Suppose the length of other non-consecutive side be x cm.
So, perimeter of playground = 23 + 23+ x + x
106 = 2 (23+ x)
46 + 2x = 106 2x = 106 – 46
2x = 60
x = 30 m
Therefore, the lengths of other three sides are 23m, 30m and 30m. we know that a kite has two pairs of equal consecutive sides.

144. In rectangle READ, find ∠EAR, ∠RAD and ∠ROD



Solution:
Given: READ is a rectangle and $\angle ROE = 60°$.
So, $\angle EOA = 180° - 60° = 120°$
Now, in triangle EOA,
$\angle OEA = \angle OAE = 30°$ [OE = OA and equal sides make equal angles]
So, $\angle EAR = 30°$
Now, $\angle RAD = 90° - \angle EAR = 60°$
And: $\angle ROD = \angle EOA = 120°$

145. In rectangle PAIR, find ∠ARI, ∠RMI and ∠PMA.



Solution:

Given:

$\angle RAI = 35°$

So, $\angle PRA = 35°$ [PR||AI and AR is transversal]

$\angle ARI = 90° - \angle PRA = 90° - 35° = 55°$

Since, AM = IM, $\angle MAI + \angle MIA = 35°$

Now, in triangle AMI,

$\angle RMI = \angle MAI + \angle MIA = 70°$ [Exterior angle]

Hence, $\angle RMI = \angle PMA = 70°$ [Vertical opposite angle]

146. In parallelogram ABCD, find ∠B, ∠C and ∠D.

Solution:

Given: ABCD is a parallelogram.

So, $\angle A = \angle C = 80°$

Similarly, $\angle A + \angle B = 180°$

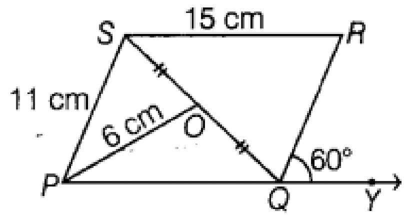
$80° + \angle B = 180°$

$\angle B = 180° - 80°$

$\angle B = 100°$

Hence, $\angle B = \angle D = 100°$. [Opposite angles are equal]

147. In parallelogram PQRS, O is the mid-point of SQ. Find ∠S, ∠R, PQ, QR and diagonal PR.



Solution:

Given: PQRS is a parallelogram and $\angle RQY = 60°$.

So,

$\angle RQP = 180° - \angle RQY$

$= 180° - 60°$

$= 120°$

Since, $\angle S = 120°$. [Opposite angles are equal in a parallelogram]

Now, $\angle P + \angle R + \angle S + \angle Q = 360°$ [Angle sum property of a quadrilateral]

$\angle P + \angle R + 120° + 120° = 360°$

$\angle P + \angle R = 360° - (120° + 120°)$

$\angle P + \angle P = 360° - 240°$ [opposite angles are equal; $\angle P = \angle R$]

$2\angle P = 120°$

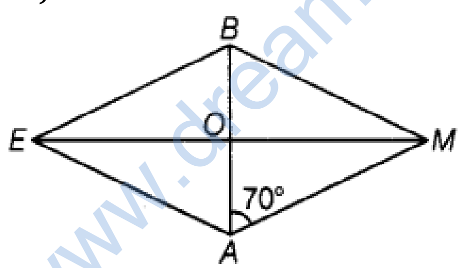
$\angle P = 60°$

Also, SR = PQ = 15 cm [Opposite sides of a parallelogram are equal]

Similarly, PQ = PS = 11 cm

And; PR = $2 \times PO = 2 \times 6 = 12$ [Diagonals of a parallelogram bisect each other]

148. In rhombus BEAM, find ∠AME and ∠AEM.



Solution:

Given: $\angle BAM = 70°$

As diagonal of rhombus are bisect each other at right angle. So,

$\angle BOM = \angle BOE = \angle AOM = \angle AOE = 90°$

Now, in triangle AOM,

$\angle AOM + \angle AMO + \angle OAM = 180°$ [Angle sum property of triangle]

$90° + \angle AMO + 70° = 180°$

$\angle AMO = 180° - 90° - 70°$

$\angle AMO = 20°$

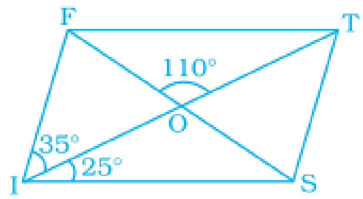
Also, AM = BM = BE = EA

In triangle AME;

AM = EA

And: $\angle AME = \angle AEM = 20°$ [Equal sides make equal angles]

149. In parallelogram FIST, find ∠SFT, ∠OST and ∠STO.



Solution:

Given: $\angle FIS = 60°$

So, $\angle FTS = \angle FIS = 60°$ [Opposite angles of a parallelogram are equal]

Now, FT||IS and TI is a transversal. So, $\angle FTO = \angle SIO = 25°$ [Alternate angles]

So, $\angle STO = \angle FTS - \angle FTO = 60° - 25° = 35°$

Also, $\angle FOT + \angle SOT = 180°$ [Linear pair]

$110° + \angle SOT = 180°$

$\angle SOT = 180° - 110°$

$\angle SOT = 70°$

Again, in triangle TOS,

$\angle TSO + \angle OTS + \angle TOS = 180°$ [Angle sum property of triangle]

So, $\angle OST = 180° - (70° + 35°) = 75°$

In triangle FOT,

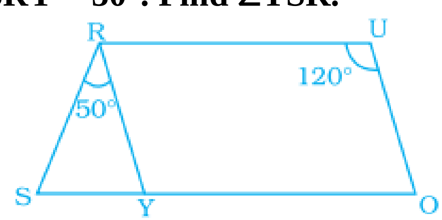
$\angle FOT + \angle FTO + \angle OFT = 180°$

$\angle SFT = \angle OFT = 180° - (\angle FOT + \angle FTO)$

$= 180° - (110° + 25°)$

$= 45°$

150. In the given parallelogram YOUR, ∠RUO = 120° and OY is extended to point S such that ∠SRY = 50°. Find ∠YSR.



Solution:

Given: $\angle RUO = 120°$ and $\angle SRY = 50°$

$\angle RYO = \angle RUO = 120°$ [Opposite angles of a parallelogram]

Now, $\angle SYR = 180° - \angle RYO$ [linear pair]

$= 180° - 120°$

$= 60°$

In triangle SRY,

$\angle SRY + \angle RYS + \angle YSR = 180°$ [By the angle sum property of a triangle]

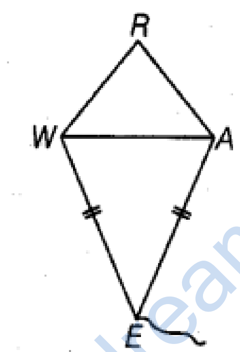
$50° + 60° + \angle YSR = 180°$

$\angle YSR = 180° - (50° + 60°)$

$\angle YSR = 180° - 110°$

$\angle YSR = 70°$

151. In kite WEAR, ∠WEA = 70° and ∠ARW = 80°. Find the remaining two angles.



Solution:

Given: $\angle WEA = 70°$ and $\angle ARW = 80°$

In a kite WEAR,

$\angle RWA + \angle WEA + \angle EAR + \angle ARW = 360°$ [The interior angle sum property of a quadrilateral]

$\angle RWE + 70° + \angle EAR + 80° = 360°$

$\angle RWE + \angle EAR = 360° - 150°$

$\angle RWE + \angle EAR = 210°$ …(I)

Now, $\angle RWA = \angle RAW$ [RW = RA]…(II)

And $\angle AWE = \angle WAE$ [WE = AE]…(III)

Now, adding equation (II) and (III), get:

$\angle RWA + \angle AWE = \angle RAW + \angle WAE$

$\angle RWE = \angle RAE$

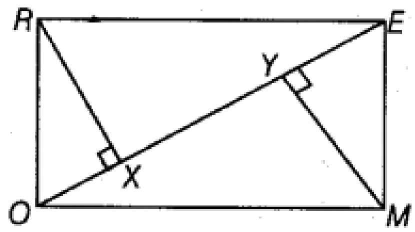
Now, from equation (I),

$2\angle RWE = 210°$

$\angle RWE = 105°$

$\angle RWE = \angle RAE = 105°$

152. A rectangular MORE is shown below:



Answer the following questions by giving appropriate reason.
(i) Is RE = OM? (ii) Is ∠MYO = ∠RXE?
(iii) Is ∠MOY = ∠REX? (iv) Is ΔMYO ≅ ΔRXE? (v) Is MY = RX?

Solution:

(i) Given: MORE is a rectangle.
Yes, RE = OM [because opposite are equal]

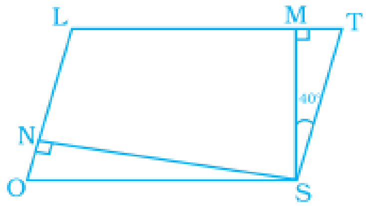
(ii) Yes, ∠MYO = ∠RXE because MY and RX both are perpendicular to OE and it is equal to $90°$.

(iii) Yes, ∠MOY = ∠REX because RE||OM and EO is a transversal.
Since, $\angle MOE = \angle OER$ [Alternate interior angles]
So, $\angle MOY = \angle REX$

(iv) Yes, ΔMYO ≅ ΔRXE
In triangle MYO and triangle RXE.
MO = RE [Proved (i)]
$\angle MOY = \angle REX$ [Proved (iii)]
$\angle MYO = \angle REX$ [Proved (ii)]
So, ΔMYO ≅ ΔRXE [By AAS]

(v) Yes, MY = RX
These are corresponding parts of congruent triangles.

153. In parallelogram LOST, SN⊥OL and SM⊥LT. Find ∠STM, ∠SON and ∠NSM.



Solution:

Given: $\angle MST = 40°$

In triangle MST,

$\angle TMS + \angle MST + \angle STM = 180°$ [By the angle sum property of a triangle]

$\angle STM = 180° - (90° + 40°)$ [SM $\perp$ LT, $\angle TMS = 90°$]

$\angle STM = 180° - 130°$

$= 50°$

So, $\angle SON = \angle STM = 50°$ [opposite angles of a parallelogram are equal]

Now, in triangle ONS,

$\angle ONS + \angle OSN + \angle SON = 180°$ [Angle sum property of triangle]

$\angle OSN = 180° - (90° + 50°)$

$= 180° - 140°$

$= 40°$

Moreover, $\angle SON + \angle TSO = 180°$ [Adjacent angles of a parallelogram are supplementary]

$\angle SON + \angle TSM + \angle NSM + \angle OSN = 180°$

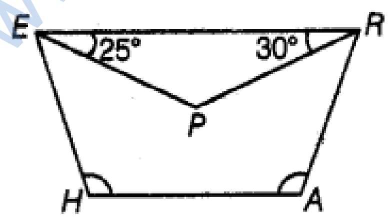
$50° + 40° + \angle NSM + 40° = 180°$

$130° + \angle NSM = 180°$

$\angle NSM = 180° - 130°$

$\angle NSM = 50°$

154. In trapezium HARE, EP and RP are bisectors of ∠E and ∠R respectively. Find ∠HAR and ∠EHA.



Solution:

Given: EP and PR are angle bisectors of $\angle REH$ and $\angle ARE$ respectively.

As HARE is a trapezium,

So, $\angle E + \angle H = 180°$ and $\angle R + \angle A = 180°$

$\angle PER + \angle PEH + \angle H = 180°$ and $\angle ERP + \angle PRA + \angle RAH = 180°$

$25° + 25° + \angle H = 180°$ and $30° + 30° + \angle A = 180°$

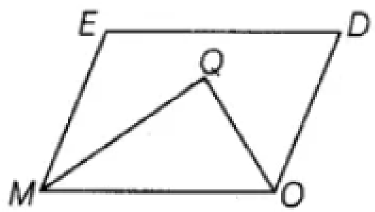
$50° + \angle H = 180°$ and $60° + \angle A = 180°$

$\angle H = 130°$ and $\angle A = 120°$ that is $\angle EHA = 130°$ and $\angle HAR = 120°$

155. In parallelogram MODE, the bisector of ∠M and ∠O meet at Q, find the measure of ∠MQO.

Solution:

Let MODE be a parallelogram and Q be the point of intersection of the bisector of $\angle M$ and $\angle O$.



As MODE is a parallelogram. So,

$\angle EMO + \angle DOM = 180°$ [Adjacent angles are supplementary]

Now, dividing above equation by 2, get:

$\frac{1}{2}\angle EMO + \frac{1}{2}\angle DOM = 90°$

$\angle QMO + \angle QOM = 90°$ …(i)

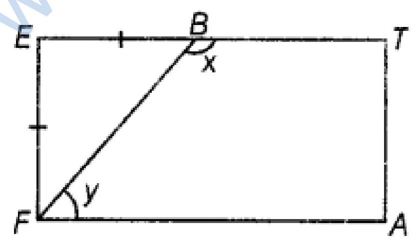
Now, in triangle MOQ,

$\angle QOM + \angle QMO + \angle MQO = 180°$ [Angle sum property of triangle]

$90° + \angle MQO = 180°$ [From equation (i)]

So, $\angle MQO = 180° - 90° = 90°$

156. A playground is in the form of a rectangle ATEF. Two players are standing at the points F and B where EF = EB. Find the values of x and y.



Solution:

Given: a rectangle ATEF in which EF = EB.

Now, triangle FEB is an isosceles triangle. So,

$\angle EFB + \angle EBF + \angle FEB = 180°$ [Angle sum property of triangle]

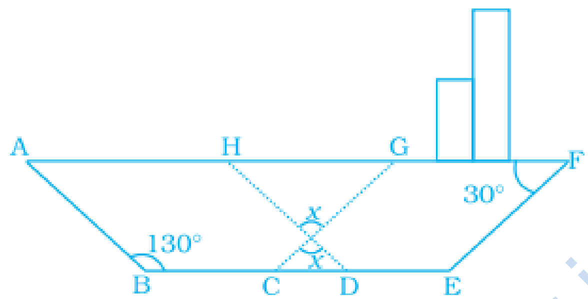
$\angle EFB + \angle EBF + 90° = 180°$ [As $\angle FEB = 90°$]

$2\angle EFB = 90°$ [As $\angle EFB = \angle EBF$]

$\angle EFB = 45°$ and $\angle EBF = 45°$

Now, $\angle x = 180° - 45° = 135°$ [Linear pair]
And: $\angle EFB + \angle y = 90°$
$\angle y = 90° - 45° = 45°$

157. In the following figure of a ship, ABDH and CEFG are two parallelograms. Find the value of x.



Solution:
Given: ABDH and CEFG are a parallelogram.

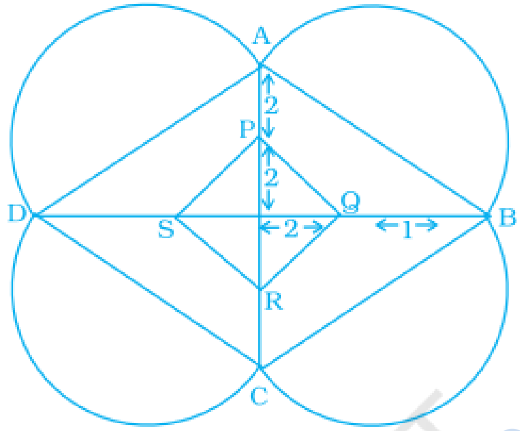
Now, in parallelogram ABDH,
$\angle ABD = \angle AHD = 130°$ [Opposite angles of a parallelogram are equal]
Now, $\angle GHD = 180° - \angle AHD$ [Linear pair]
$= 180° - 130°$
$50° = \angle GHO$

Also, $\angle EFG + \angle FGC = 180°$ [Adjacent angles of a parallelogram are supplementary]
$30° + \angle FGC = 180°$
$\angle FGC = 180° - 30°$
$= 150°$

And $\angle HGC + \angle FGC = 180°$ [Linear pair]
$\angle HGC = 180° - \angle FGC$
$= 180° - 150°$
$\angle HGO = 30°$

Now, in triangle HGO,
$\angle OHG + \angle HGO + \angle HOG = 180°$
$50° + 30° + x = 180°$
$x = 180° - 80°$
$= 100°$

158. A Rangoli has been drawn on a flor of a house. ABCD and PQRS both are in the shape of a rhombus. Find the radius of semicircle drawn on each side of rhombus ABCD.



Solution:

In rhombus ABCD,

AO = OP + PA = 2 + 2units

And: OB = OQ +QB = 2 + 1 = 3 units

As diagonal of rhombus bisect each other at $90°$.

Now, In triangle OAB,

$(AB)^2 = (OA)^2 + (OB)^2$ [By Pythagoras theorem]

$(AB)^2 = (4)^2 + (3)^2$

$(AB)^2 = 16 + 9$

$(AB)^2 = 25$

$AB = \sqrt{25}$

$AB = 5$ units

As, AB is a diameter of semi-circle. So, radius will be:

$$\text{Radius} = \frac{\text{Diameter}}{2}$$

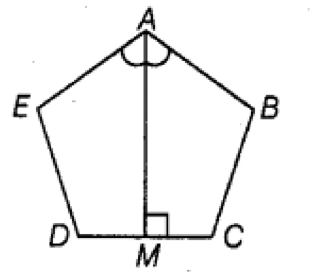
$$= \frac{AB}{2}$$

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

$$= 2.5 \text{ Units}$$

Hence, the radius of the semi-circle is 2.5 units.

159. ABCDE is a regular pentagon. The bisector of angle A meets the side CD at M. Find ∠AMC



Solution:

Given: ABCDE is a pentagon and the line segment AM is the bisector of the $\angle A$.

As, the measure of each interior angle of a regular polygon is $108°$. So,

$$\angle BAM = \frac{1}{2} \times 108° = 54°$$

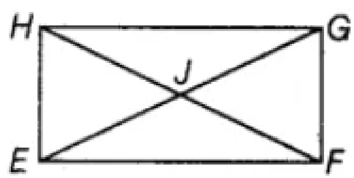
Now, in quadrilateral ABCM,

$$\angle BAM + \angle ABC + \angle BCM + \angle AMC = 360°$$
$$54° + 108° + 108° + \angle AMC = 360°$$
$$\angle AMC = 360° - 270°$$
$$\angle AMC = 90°$$

160. Quadrilateral EFGH is a rectangle in which J is the point of intersection of the diagonals. Find the value of x if JF = 8x + 4 and EG = 24x – 8.

Solution:

Given: EFGH is a rectangle. Where, diagonal are intersecting at the point J.

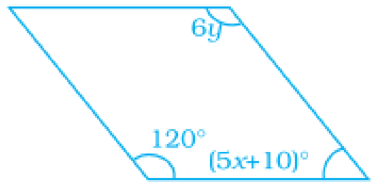


As, diagonal of rectangle bisect each other and are equal. So,

$$EG = 2 \times JF$$
$$24x - 8 = 2(8x + 4)$$
$$24x - 8 = 16x + 8$$
$$24x - 16x = 8 + 8$$
$$8x = 16$$
$$x = 2$$

Hence, the value of x is 2.

161. Find the values of x and y in the following parallelogram.



Solution:

In the given parallelogram,

$120° + (5x + 10)° = 180°$ [Adjacent angles are supplementary]

$120° + 5x + 10° = 180°$

$5x = 180° - 130°$

$5x = 50°$

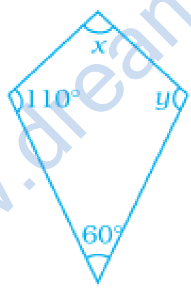
$x = 10°$

Similarly, opposite angles are equal in a parallelogram.

So, 6y = 120°

$y = 20°$

162. Find the values of x and y in the following kite.



Solution:

See the given figure,

$y = 110°$ [opposite angle are equal in kite]

Now, using the angle sum property of quadrilateral:

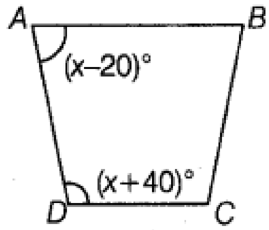
$110° + 60° + 110° x = 360°$

$x = 360° - 280°$

$x = 80°$

Hence, $x = 80°$ and $y = 110°$.

163. Find the value of x in the trapezium ABCD given below.



Solution:

Given: ABCD is a trapezium, and $\angle A = (x-20)^\circ$ and $\angle D = (x+40)^\circ$.

AS we know that in trapezium, the angles on either side of the base are supplementary. So,

$$(x-20)^\circ + (x+40)^\circ = 180^\circ$$
$$x - 20^\circ + x + 40^\circ = 180^\circ$$
$$2x + 20^\circ = 180^\circ$$
$$2x = (180^\circ - 20^\circ)$$
$$2x = 160^\circ$$
$$x = 80^\circ$$

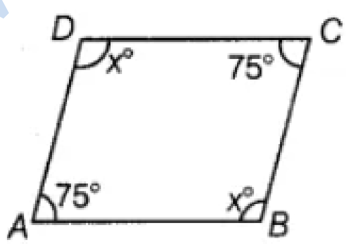
Hence, the value of x is 80°.

164. Two angles of a quadrilateral are each of measure 75° and the other two angles are equal. What is the measure of these two angles? Name the possible figures so formed.

Solution:

Let ABCD be a quadrilateral.

Where, $\angle A = \angle C = 75^\circ$ and $\angle B = \angle D = x$



Now, by the angle sum property of a triangle.

$$\angle A + \angle B + \angle C + \angle D = 360^\circ$$
$$75^\circ + x + 75^\circ + x = 360^\circ$$
$$2x = 360^\circ - 150^\circ$$
$$2x = 210^\circ$$
$$x = 105^\circ$$

Since, the other two angle are 105° each. [Opposite angle are equal]

Hence, the quadrilateral is a parallelogram.

165. In a quadrilateral PQRS, ∠P = 50°, ∠Q = 50°, ∠R = 60°. Find ∠S. Is this quadrilateral convex or concave?

Solution:

Given: PQRS is a quadrilateral and ∠P = 50°, ∠Q = 50°, ∠R = 60°.

Using the angle sum property of a quadrilateral, get:

$$\angle P + \angle Q + \angle R + \angle S = 360°$$

$$50° + 50° + 60° + \angle S = 360°$$

$$160° + \angle S = 360°$$

$$\angle S = 360° - 160°$$

$$\angle S = 200°$$

Therefore, one angle of the quadrilateral PQRS is obtuse. Hence, the quadrilateral is concave.

166. Both the pairs of opposite angles of a quadrilateral are equal and supplementary. Find the measure of each angle.

Solution:

Let ABCD be a quadrilateral. So,

$$\angle A = \angle C$$

$$\angle B = \angle D$$

And: $\angle A + \angle C = 180°,\ \angle B + \angle D = 180°,$

Now, $\angle A + \angle A = 180°$ $\quad [\angle C = \angle A]$

$$2\angle A = 180°$$

$$\angle A = 90°$$

Similarly, $\angle B = 90°$

Hence, each angle is a right angle.

167. Find the measure of each angle of a regular octagon.

Solution:

As we know that number of sides in octagon is 8.

So, the formula of the sum of interior angles of a regular octagon = $(n - 2) \times 180°$

$$= (8 - 2) \times 180°$$

$$= 6 \times 180°$$

$$= 1080°$$

Now, the each angle of regular octagon = $\dfrac{\text{Sum of interior angle}}{n}$

$$= \frac{1080°}{8}$$

$$= 135°$$

Hence, the measure of each angle of a regular octagon is $135°$.

168. Find the measure of an are exterior angle of a regular pentagon and an exterior angle of a regular decagon. What is the ratio between these two angles?

Solution:

As we know that number of sides in pentagon is 5 and decagon is 10. So,

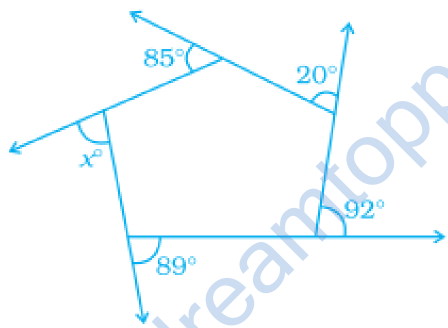
Exterior angle of a regular pentagon = $\frac{360°}{5} = 72°$

Exterior angle of a regular pentagon = $\frac{360°}{10} = 36°$

So, ratio will be = $72° : 36° = 2 : 1$

Hence, the ratio between these two angles is 2: 1.

169. In the figure, find the value of x.



Solution:

As we know that the sum of all the exterior angles of a pentagon is $360°$. So,

$$92° + 20° + 85° + x + 89° = 360°$$
$$286° + x = 360°$$
$$x = 360° - 286°$$
$$x = 74°$$

170. Three angles of a quadrilateral are equal. Fourth angle is of measure 120°. What is the measure of equal angles?

Solution:

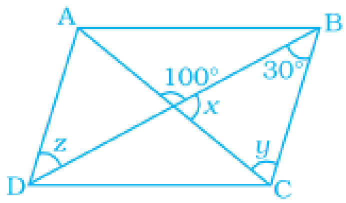
Let the measure of equal angles be x each. So,

$$x + x + x + 120° = 360°$$
$$3x = 360° - 120°$$
$$3x = 240°$$
$$x = 80°$$

171. In a quadrilateral HOPE, PS and ES are bisectors of ∠P and ∠E respectively. Give reason.

Solution:
In the given question data is insufficient.

172. ABCD is a parallelogram. Find the value of x, y and z.

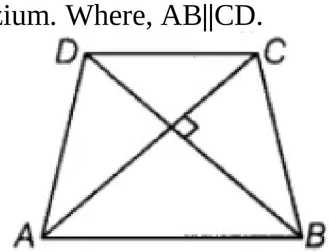


Solution:
Given: ABCD is a parallelogram.
Now, in triangle OBC,
$y + 30° = 100°$ [Exterior angle property of triangle]
$y = 70°$
Now, using the angle sum property of a triangle,
$x + y + 30° = 180°$
$x + 70° + 30° = 180°$
$x = 180° - 100°$
$= 80°$

Since, AD||BC and BD is transversal. So,
$\angle ADO = \angle OBC$ [Alternate interior angles]
$z = 30°$

173. Diagonals of a quadrilateral are perpendicular to each other. Is such a quadrilateral always a rhombus? Give a figure to justify your answer.

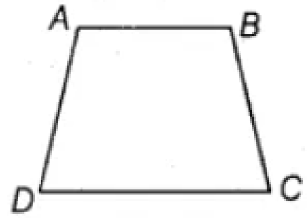
Solution:
The given statement is false because it is not necessary that a quadrilateral having perpendicular diagonals is a rhombus.
For example: ABCD is a trapezium. Where, AB||CD.



174. ABCD is a trapezium such that AB||CD, ∠A : ∠D = 2 :1, ∠B : ∠C = 7 : 5. Find the angles of the trapezium.

Solution:

Let ABCD is a trapezium and AB||CD.



Also, angles A and D be 2x and x respectively. So,

$2x + x = 180°$ [In trapezium, the angles on either side of the base are supplementary]

$3x = 180°$

$x = 60°$

So, $\angle A = 2 \times 60° = 120°$

And $\angle D = 60°$

Again, let the angle B and C be 7x and 5x respectively. So,

$7x + 5x = 180°$

$12x = 180°$

$x = 15°$

Hence, $\angle B = 7 \times 15 = 105°$ and $\angle C = 5 \times 15 = 75°$.

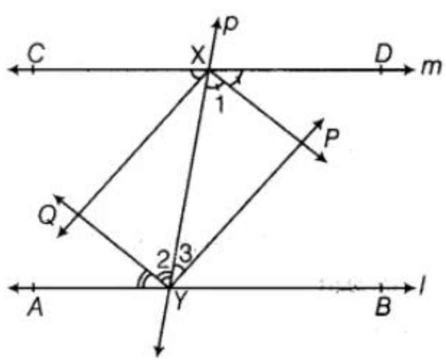
175. A line l is parallel to line m and a transversal p intersects them at X, Y respectively. Bisectors of interior angles at X and Y intersect at P and Q. Is PXQY a rectangle? Given reason.

Solution:

Given: l||m

Now, $\angle DXY = \angle XYA$ [Alternate interior angles]

$\frac{\angle DXY}{2} = \frac{\angle XYA}{2}$ [Dividing both the sides by 2]



Now, $\angle 1 = \angle 2$ [Alternate angle are equal]
XP and YQ are bisectors. So,
XP||QY ... (i)

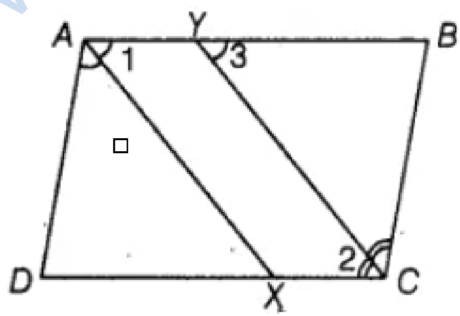
Similarly, XQ||PY ... (ii)
Now, from equation (i) and (ii), get:

In parallelogram PXQY,
$\angle DXY + \angle XYB = 180°$ ... (iii) [Interior angles on the same side of transversal are supplementary]
Now, dividing both the sides by 2, get:
$$\frac{\angle DXY}{2} + \frac{\angle XYB}{2} = \frac{180°}{2}$$
So, $\angle 1 + \angle 3 = 90°$ [Dividing both the sides by 2] ... (iv)

In triangle XYP,
$\angle 1 + \angle 3 + \angle p = 180°$
$90° + \angle P = 180°$ [From equation (iv)]
$\angle P = 180° - 90°$
$\angle P = 90°$ ... (v)
From equation (iii) and (v), PXQY is a rectangle.

176. ABCD is a parallelogram. The bisector of angle A intersects CD at X and bisector of angle C intersects AB at Y. Is AXCY a parallelogram? Give reason.

Solution:
Given: ABCD is a parallelogram.
So, $\angle A = \angle C$ [Opposite angles of a parallelogram are equal]



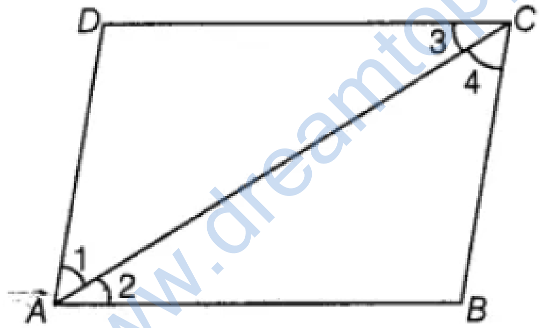
Now, dividing both the sides by 2 in the above equation, get
$$\frac{\angle A}{2} = \frac{\angle C}{2}$$
$\angle 1 = \angle 2$ [Alternate angles]
Also, $\angle 2 = \angle 3$ [AB||CD and CY is the transversal]
$\angle 1 = \angle 3$

But they are pair of corresponding angles.
AX||YC … (i)
AY||XC [AB||DC] … (ii)
From equation (i) and (ii).
Hence, AXCY is a parallelogram.

177. A diagonal of a parallelogram bisects an angle. Will it also bisect the other angle? Give reason.

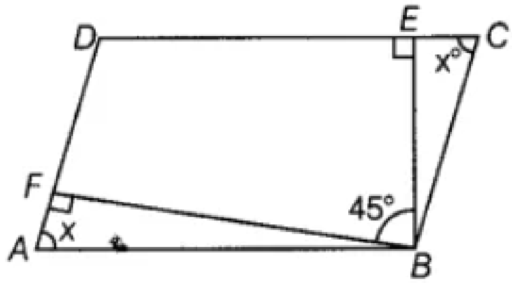
Solution:
Let ABCD is a parallelogram.
Given: $\angle 1 = \angle 2$

Now, ABCD is a parallelogram. So,
$\angle 1 = \angle 4$ [Alternate angles] … (i)
Also, $\angle 2 = \angle 3$ [Alternate angles] … (ii)
Now, $\angle 1 = \angle 2$ [Given]
Hence, $\angle 3 = \angle 4$ [From equation (i) and (ii)]



178. The angle between the two altitudes of a parallelogram through the vertex of an obtuse angle of the parallelogram is 45°. Find the angles of the parallelogram.

Solution:
Let ABCD be a parallelogram, where BE and BF are the perpendiculars through the vertex B to the sides DC and AD, respectively.



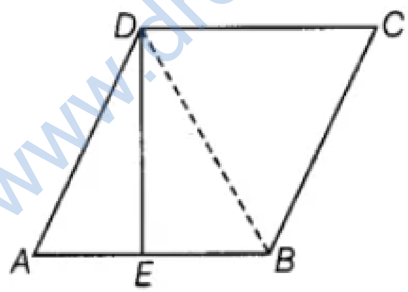
Let $\angle A = \angle C = x, \angle B = \angle D = y$ [Opposite angles are equal in parallelogram]
Now, $\angle A + \angle B = 180°$ [Adjacent sides of a parallelogram are supplementary]

In triangle ABF;
$\angle ABF = 90° - x$
And in triangle BEC,
$\angle EBC = 90° - x$
So, $x + 90° - x + 45° + 90° - x = 180°$
$-x = 180° - 225°$
$x = 45°$

So, $\angle A = \angle C = 45°$
$\angle B = 45° + 45° + 45° = 135°$
$\angle D = 135°$
Hence, the angles are $45°, 135°, 45°$ and $135°$.

179. ABCD is a rhombus such that the perpendicular bisector of AB passes through D. Find the angles of the rhombus. Hint: Join BD. Then Δ ABD is equilateral.

Solution:
Let ABCD be a rhombus where DE is perpendicular bisector of AB.



Construction: Join BD.
Now, in triangle AED and triangle BED:
AE = EB
ED = ED [Common side]
$\angle AED = \angle DEB = 90°$

Now, using SAS rule,
$\Delta AED \cong \Delta BED$
AD = DB = AB [ABCD is a rhombus. So, AD = AB]
Hence, triangle ADB is an equilateral triangle.

So, $\angle DAB = \angle DBA = \angle ADB = 60°$
$\angle DCB = 60°$ [Opposite angles of a rhombus are equal]

Now, $\angle DAB + \angle ABC = 180°$ [Adjacent angles of a rhombus are supplementary]

$60° + \angle ABD + \angle DBC = 180°$

$60° + 60° + \angle DBC = 180°$

$\angle DBC = 60°$

$\angle ABC = \angle ABD + \angle DBC = 60° + 60° = 120°$

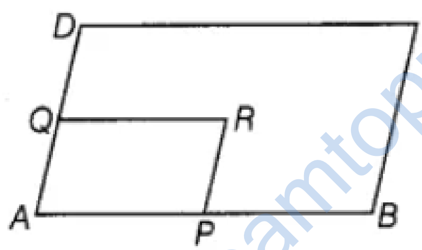
$\angle ADC = 120°$ [Opposite angles of a rhombus are equal]

Hence, the angles of the rhombus are $60°, 120°, 60°, 120°$.

180. ABCD is a parallelogram. Points P and Q are taken on the sides AB and AD respectively and the parallelogram PRQA is formed. If ∠C = 45°, find ∠R.

Solution:

Let ABCD be a parallelogram,



Given: $\angle C = 45°$

In a parallelogram ABCD,

$\angle A = \angle C$ [Opposite angles of parallelogram are equal]

Similarly, in a parallelogram PRQA:

$\angle A = \angle R$ [Opposite angles of parallelogram are equal]

Hence, $\angle R = 45°$

181. In parallelogram ABCD, the angle bisector of ∠A bisects BC. Will angle bisector of B also bisect AD? Give reason.

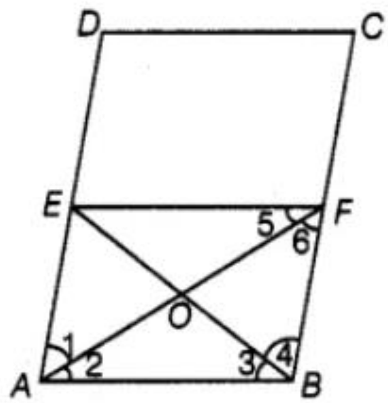
Solution:

Given: ABCD is a parallelogram and $\angle A$ is bisector of BC at F that is $\angle 1 = \angle 2$, CF = FB.

Construction: Draw FE||BA

Now, ABFE is a parallelogram by construction. So,

$\angle 1 = \angle 6$ [Alternate angle]



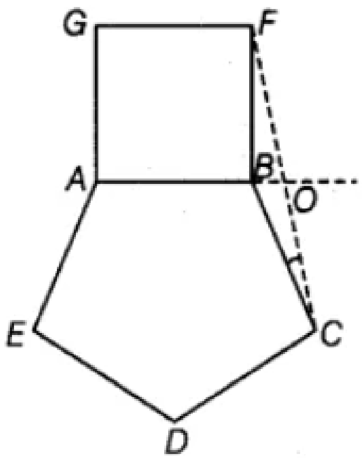
Also, $\angle 1 = \angle 2$ [Given]
$\angle 2 = \angle 6$
AB = FB [Opposite sides to equal angles are equal] …(i)
So, ABFE is rhombus.

Now, in triangle ABO and triangle BOF:
AB = BF [From equation (i)]
BO = BO [Common]
AO = FO [Diagonals of rhombus each other]
$\Delta ABO \cong \Delta BOF$ [By SSS]
$\angle 3 = \angle 4$ [By CPCT]

Now, $BF = \frac{1}{2} BC$ [Given]
$BF = \frac{1}{2} AD$ [BC = AD]
AE = $\frac{1}{2} AD$ [BF = AE]
Hence, E is the mid-point of AD.

182. A regular pentagon ABCDE and a square ABFG are formed on opposite sides of AB. Find ∠BCF.

Solution:



Given: ABCDE is a pentagon.

Now, each interior angle of the regular pentagon = $\dfrac{\text{Sum of interior angles}}{\text{Number of sides}}$

$$= \frac{(x-2)\times 180^\circ}{5}$$

$$= \frac{540^\circ}{5}$$

$$= 108^\circ$$

Construction: Join CF.

Now, $\angle FBC = 360^\circ - (90^\circ + 108^\circ) = 360^\circ - 198^\circ = 162^\circ$

Now, in triangle FBC by the angle sum property, get:

$$\angle FBC + \angle BCF + \angle BFC = 180^\circ$$

$$\angle BCF + \angle BFC = 180^\circ - 162^\circ$$

$$\angle BCF + \angle BFC = 18^\circ$$

So, triangle FBC is an isosceles triangle and BF = BC.

Hence, $\angle BCF = \angle BFC = 9^\circ$.

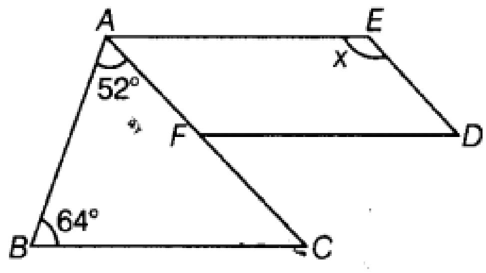
183. Find maximum number of acute angles which a convex, a quadrilateral, a pentagon and a hexagon can have. Observe the pattern and generalise the result for any polygon.

Solution:

In the event that an angle is acute, at that point the comparing exterior angle is greater than 90°. Presently, assume convex polygon has at least four acute angles. Since, the polygon is convex, all the exterior angles are positive, so the entirety of the exterior angle is at any rate the aggregate of the interior angles. Presently, supplementary of the four acute angles, which is greater than 4 x 90° = 360°

Be that as it may, this is impossible. Since, the sum of exterior angle of a polygon must equal to 360° and cannot be greater than it. It follows that the maximum number of acute angle in convex polygon is 3.

184. In the following figure, FD||BC||AE and AC||ED. Find the value of x.

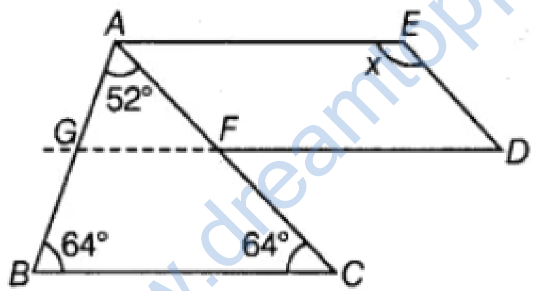


Solution:

Given:

FD||BC||AE and AC||ED.

Construction: Produce DF such that it intersect AB at G.



In triangle ABC,

$\angle A + \angle B + \angle C = 180°$ [Angle sum property of triangle]

$52° + 64° + \angle C = 180°$

$\angle C = 180° - (52° + 64°)$

$\angle C = 180° - 116°$

$\angle C = 64°$

Now, as see that DG||BC and DG||AE,

$\angle ACB = \angle AFG$ [FG||BC and FC is a transversal. So, corresponding angles]

$64° = \angle AFG$

Also, GFD is a straight line.

So, $\angle GFA + \angle AFD = 180°$ [linear pair]

$64° + \angle AFD = 180°$

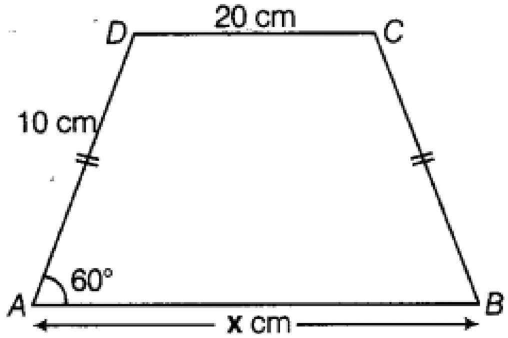
$\angle AFD = 180° - 64°$

$= 116°$

Also, FD||AE and AF||ED

Hence, AEDF is a parallelogram.
Now, $\angle AFD = \angle AEF$ [Opposite angles in a parallelogram are equal]
$\angle AED = x = 116°$

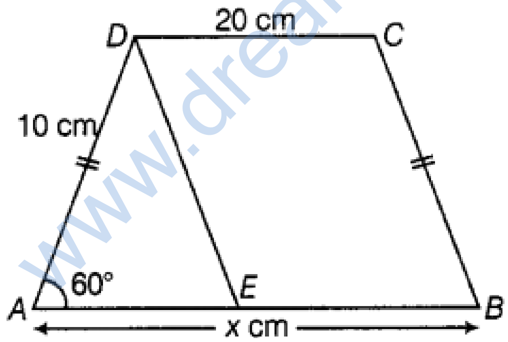
185. In the following figure, AB||DC and AD = BC. Find the value of x.



Solution:

Given: an isosceles trapezium, AB||DC, AD = BC and $\angle A = 60°$.
So, $\angle B = 60°$.

Construction: Draw a line parallel to BC through D.

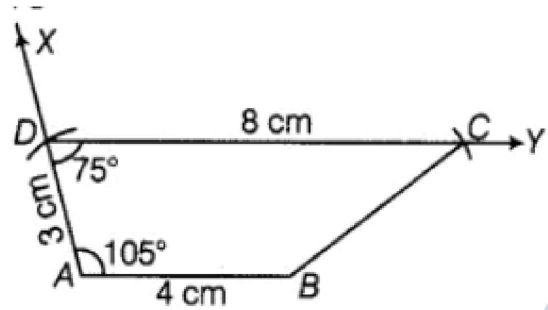


Now, DEBC is a parallelogram, BE = CD = 20 cm and DE = BC = 10 cm.
Now, $\angle DEB + \angle CBE = 180°$ [Adjacent angles are supplementary in parallelogram]
$\angle DEB = 180° - 60°$
$= 120°$

In triangle ADE,
$\angle ADE = 60°$ [Exterior angle]
Also, in triangle ADE is an equilateral triangle.
AE = 10 cm
AB = AE + EB
= 10 + 20
=30 cm
Hence, x = 30 cm.

186. Construct a trapezium ABCD in which AB||DC, ∠A = 105°, AD = 3 cm, AB = 4 cm and CD = 8 cm.

Solution:
We know that;

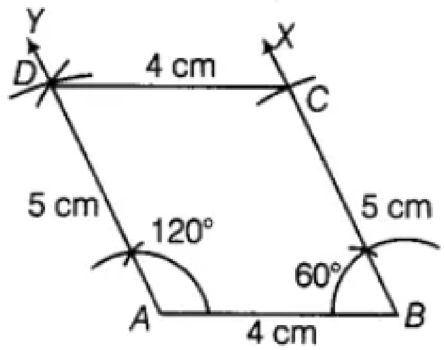


$\angle A+\angle D=180°$ [Sum of adjacent angle of a trapezium is 180°.
$105°+\angle D=180°$
$\angle D=180°-105°$
$\angle D=75°$

Steps of construction;
Step I Draw AB = 4 cm.
Step II Draw $\overline{AX}$ that is $\angle BAX=105°$.
Step III Mark a point D on AX that is AD = 3 cm.
Step IV Draw $\overline{DY}$ that is $\angle ADY=75°$.
Step V Mark a point C that is CD = 8 cm.
Step VI Join BC
Hence, ABCD is the required trapezium.

187. Construct a parallelogram ABCD in which AB = 4 cm, BC = 5 cm and ∠B = 60°.

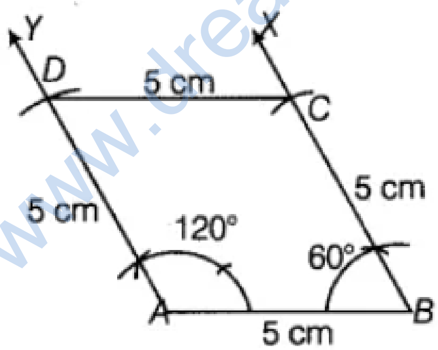
Solution:
As we know that the opposite sides of a parallelogram are equal.
So, $AB=DC=4cm$
$BC=AD=5cm$
$\angle B=60°$
$\angle A+\angle B=180°$ [Sum of cointerior angles]
$\angle A=180°$



Steps of Construction
Step I Draw AB = 4 cm
Step II Draw ray BX that is $\angle ABX = 60°$
Step III Mark a point C that is BC = 5 cm
Step IV Draw a ray AY that is $\angle YAB = 120°$
Step V Mark a point D that is AD = 5 cm
Step Join C and D
Hence, ABCD is required parallelogram.

188. Construct a rhombus whose side is 5 cm and one angle is of 60°.

Solution:



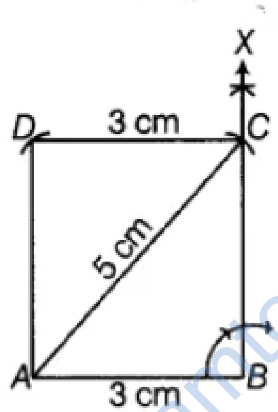
Suppose $\angle B = 60°$
$\angle A + \angle B = 180°$ [Sum of cointerior angles]
$\angle A + 60° = 180°$
$\angle A = 120°$
AB = BC = CD = DA = 5 cm

Steps of Construction
Step I Draw AB = 5 cm.
Step II Mark a point D that is AD = 5 cm.
Step III Mark a point D that is AD = 5 cm.
Step IV Draw a ray BX that is $\angle ABX = 60°$.
Step V mark a point C that is BC = 5 cm.
Step VI Join C and D.

Hence, ABCD is the required rhombus.

189. Construct a rectangle whose one side is 3 cm and a diagonal equal to 5 cm.

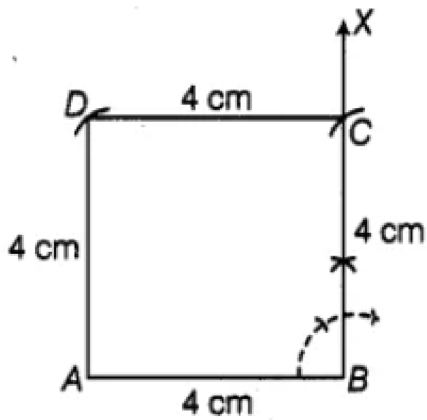
Solution:
As, diagonal of a rectangle and opposite sides are equal and all the angles of rectangle are right angle. So,
AC = 5 cm
AB = 3 cm



Steps of construction;
Step I Draw AB = 3 cm.
Step II Draw a ray that is $\angle ABX = 90°$.
Step III Draw an arc that is AC = 5 cm.
Step IV With B as centre, draw an arc of radius 5 cm. with C as centre, draw an another arc of radius 3 cm which intersect first arc at a point suppose D.
Step V Join CD and AD.
Hence, ABCD is the required rectangle.

190. Construct a square of side 4 cm.

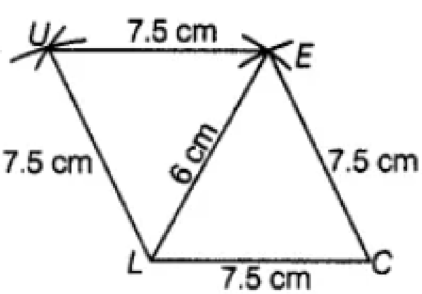
Solution:
As we know that all sides of a square are equal and each side is perpendicular to adjacent side. So,
AB = BC = CD = DA = 4 cm



Steps of Construction
Step I Draw $\overline{AB} = 4$ cm.
Step II At B, draw $\overline{BX}$ that is $\angle ABX = 90°$.
Step III From $\overline{BX}$, cut-off BC = 4 cm.
Step IV With centre C and radius = 4 cm, draw an arc.
Step V With centre A and radius = 4 cm, Draw another arc to interest the previous arc at D.
Step VI Join DA and CD.
Hence, ABCD is the required square.

191. Construct a rhombus CLUE in which CL = 7.5 cm and LE = 6 cm.

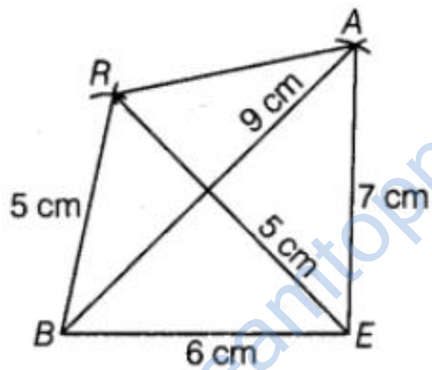
Solution:
As we know that all sides of a rhombus are equal and opposite sides are parallel to each other.
Steps of construction;
Step I Draw a line segment CL = 7.5 cm.
Step II With C as a centre, draw an arc CE = 7.5 cm.
Step III With L as a centre, draw an another arc LU = 7.5 cm.



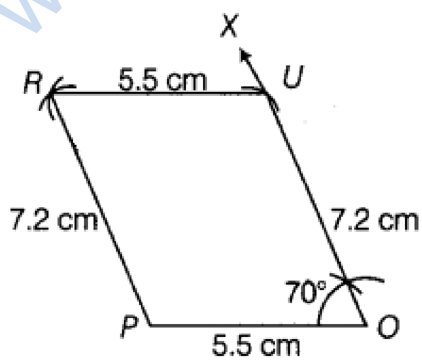
Step IV Now, with centre L, draw an arc LE = 6 cm, that is cut-off previous arc CE.
Step V With E as a centre, draw an arc UE = 7.5 cm that is cut-off previous arc LU.
Step VI Now join UL, CE and EU
Hence, CLUE is a required rhombus.

192. Construct a quadrilateral BEAR in which BE = 6 cm, EA = 7 cm, RB = RE = 5 cm and BA = 9 cm. Measure its fourth side.

Solution:
Steps of construction
Step I Draw a line segment BE = 6 cm.
Step II With B as centre, draw an arc an arc BR = 5 cm and with E as a centre, draw an arc EA = 7 cm.
Step III Now, draw an another arc BA = 9 cm with B as a centre, that is cut-off arc AE.
Step IV Draw an another arc ER = 5 cm with E as a centre, that is cut-off arc BR.
Step V Now join BR, EA and AR.
Hence, BEAR is a required quadrilateral and AR = 5 cm.



193. Construct a parallelogram POUR in which, PO=5.5 cm, OU = 7.2 cm and ∠O = 70°.
Solution:



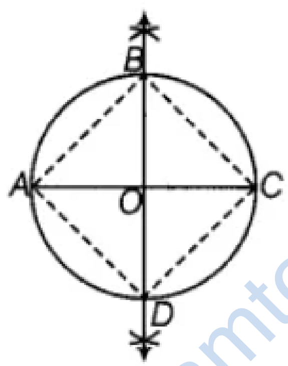
As, opposite side of a parallelogram are equal.
PO = RU = 5.5 cm, OU = RP = 7.2 cm

Steps of construction
Step I Draw PO = 5.5 cm.
Step II Construct $\angle POX = 70°$.

Step III with O as centre and radius OU = 7.2 cm, draw an arc.
Step IV with U as centre and radius UR = 5.5 cm, draw an arc.
Step V with P as centre and radius PR = 7.2 cm, draw an arc to cut the arc draw in step IV.
Step VI Join PR and UR.
Hence, POUR is the required parallelogram.

194. Draw a circle of radius 3 cm and draw its diameter and label it as AC. Construct its perpendicular bisector and let it intersect the circle at B and D. What type of quadrilateral is ABCD? Justify your answer.

Solution:

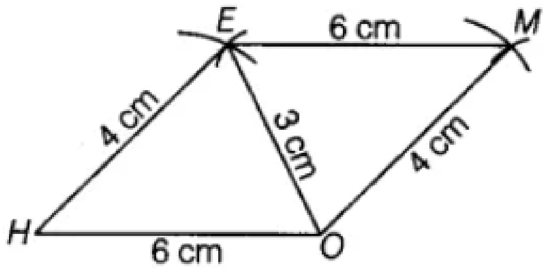


Steps of construction
Step I Taking centre OC = 3 cm, draw a circle.
Step II Join A to C and draw a perpendicular bisector of AC that cut the circumference of circle at B and D.
Step III Join B and D.
Step IV Hence, ABCD is a cyclic quadrilateral.

Justification,
In cyclic quadrilateral,
$\angle B = \angle D = 90°$ [Angle in a semi-circle]
$\angle A = \angle C = 90°$
$\angle B + \angle D = 180°$
And; $\angle A + \angle C = 180°$ [Opposite angles are supplementary]
As opposite angles are supplementary.
Hence, quadrilateral is a cyclic quadrilateral.

195. Construct a parallelogram HOME with HO = 6 cm, HE = 4 cm and OE = 3 cm.

Solution:



Steps of Construction,
Step I Draw HO = 6 cm.
Step II With H as centre and radius HE = 4 cm, draw an arc.
Step III With O as centre and radius OE = 3 cm, draw an arc, intersecting the arc drawn in step II at E.
Step IV With E as centre and radius EM = 6 cm, draw an arc opposite to the side HE.
Step V With O as centre and radius OM = 4 cm, draw an arc, intersecting the arc drawn in step IV at M.
Step VI Join HE, OE, EM and OM
Therefore, HOME is the required parallelogram.

196. Is it possible to construct a quadrilateral ABCD in which AB = 3 cm, BC = 4 cm, CD = 5.4 cm, DA = 5.9 cm and diagonal AC = 8 cm? If not, why?

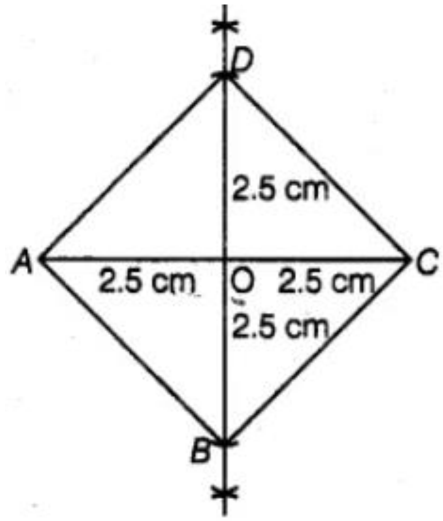
Solution:
Given: AS = 3 cm, SC = 4 cm, and CD = 5.4 cm,
DA = 59 cm and AC = 8 cm
Now, AS + SC = 3 + 4 = 7 cm and AC = 8 cm
As we know that the sum of two sides of a triangle is less than the third side, which is absurd.
Hence, we cannot construct such a quadrilateral.

197. Is it possible to construct a quadrilateral ROAM in which RO=4 cm, OA = 5 cm, ∠O = 120°, ∠R = 105° and ∠A = 135°? If not, why?

Solution:
Given: OA = 5 cm, $\angle O = 120°$, $\angle R = 105°$ and $\angle A = 135°$.
As, $\angle O + \angle R + \angle A = 120° + 105° + 135° = 360°$
As the sum of three angles of a quadrilateral is $360°$.
This is impossible, as the total sum of angles is $360°$ in a quadrilateral.
Hence, the quadrilateral can’t be construct.

198. Construct a square in which each diagonal is 5cm long.

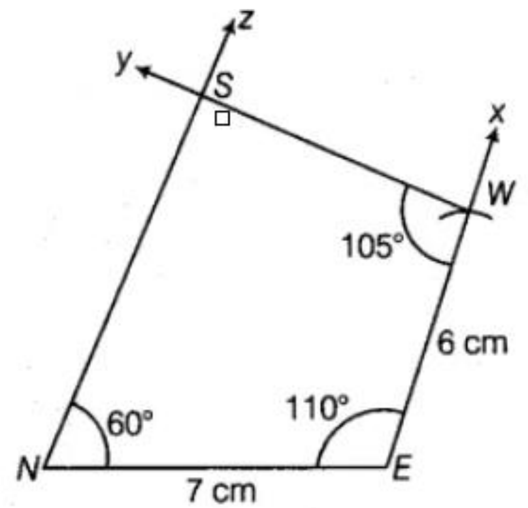
Solution:



Steps of construction;
Step I Draw AC = 5 cm.
Step II with A as centre, draw arc of length slightly greater then $\frac{1}{2}AC$ above and below the line segment AC.
Step III with C as centre, draw an arc of same length as in step II above and below the line segment AC that is intersect the arcs drawn in step II.
Step IV Join both the intersection points obtained in step III by a line segment that is intersect AC at O.
Step V with O as centre cut-off OB = OD = 2.5 cm along the bisector line.
Step VI Join AD, CD, AB and CB.
Hence, ABCD is a required square.

199. Construct a quadrilateral NEWS in which NE = 7cm, EW = 6 cm, ∠N = 60°, ∠E = 110° and ∠S = 85°.

Solution:

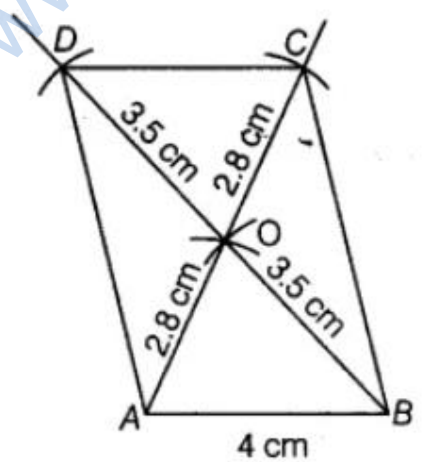


Fourth angle = $360° - (60° + 110° + 85°) = 360° - 255° = 105°$

Steps of construction
Step I Draw NE = 7 cm
Step II Make $\angle NEX = 110°$
Step III With E as centre and radius 6 cm, draw an arc an arc, cutting EX at W.
Step IV Make $\angle EWY = 105°$
Step V Make $\angle ENZ = 60°$, So, that NZ and WY intersect each other at point S.
Hence, NEWS is the required quadrilateral.

200. Construct a parallelogram when one of its side is 4cm and its two diagonals are 5.6 cm and 7cm. Measure the other side.

Solution:



Steps of construction;
Step I Draw AB = 4 cm.
Step II With A as centre and radius 2.8 cm, draw an arc.
Step III With B as centre and radius 3.5 cm, draw another arc cutting the previous arc at O.

Step IV Join OA and OB
Step V Produce AO to C that is OC = AO and produce BO to D that is OD = BD.
Step VI Join AD, BC and CD.
Hence, ABCD is the required parallelogram.

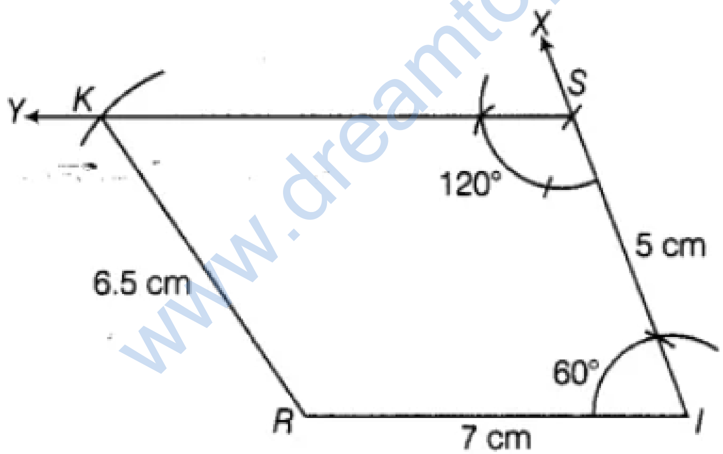
201. Find the measure of each angle of a regular polygon of 20 sides?

Solution:

As we know that the sum of interior angles of an n polygon = $(n - 2)\times 180°$
At n = 20;
Sum = $(20 - 2)\times 180° = 18\times 180° = 3240°$
The measure of each interior angle = $\frac{3240°}{20} = 162°$

202. Construct a trapezium RISK in which RI||KS, RI = 7 cm, IS = 5 cm, RK=6.5 cm and ∠I = 60°.

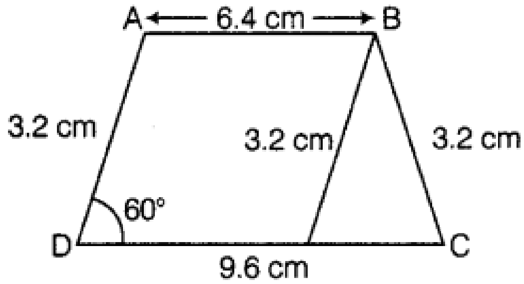
Solution:



$\angle I + \angle S = 180°$
$60° + \angle S = 180°$
$\angle S = 120°$

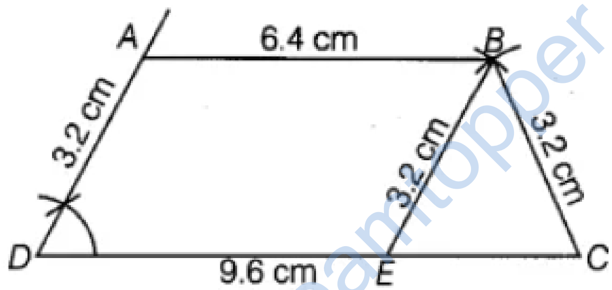
Steps of construction,
Step I Draw an arc RI = 7 cm
Step II Make $\angle RIX = 60°$
Step III With I as centre and radius 5 cm, draw an arc cutting IX at S.
Step IV Make $\angle ISY = 120°$
Step V With R as centre and radius 6.5 cm, draw an arc cutting SY at K.
Step VI Join KR.
Hence, KISK is the required trapezium.

203. Construct a trapezium ABCD where AB||CD, AD = BC = 3.2cm, AB = 6.4 cm and CD = 9.6 cm. Measure ∠B and ∠A.



[Hint: Difference of two parallel sides gives an equilateral triangle.]

Solution:



Steps of construction;
Step I Draw DC = 9.6 cm.
Step II With D as center, draw an angle measure $60°$. Now, cut-off it with an arc 3.2 cm called point A.
Step III Now, draw AB||CD.
Step IV Talking C as center, cut an arc B measure 3.2 cm on previous parallel line.
Step V Draw a line segment BE = 3.2 cm from arc B.
Step VI Join B to E and C.
Hence, ABCD is a required trapezium where $\angle A = 120°$ and $\angle B = 60°$.