







MATHS

BOOKS - NAND LAL PUBLICATION

UNDERSTANDING QUADRILATERALS

Try These

1. Match the following (caution !A figure may match to more than one type)

	Figure	Type
1.		(a) Simple closed curve
2.		(b) A closed curve that is not simple
3.		(c) Simple curve that is not closed
4.		(d) Not a simple curve.

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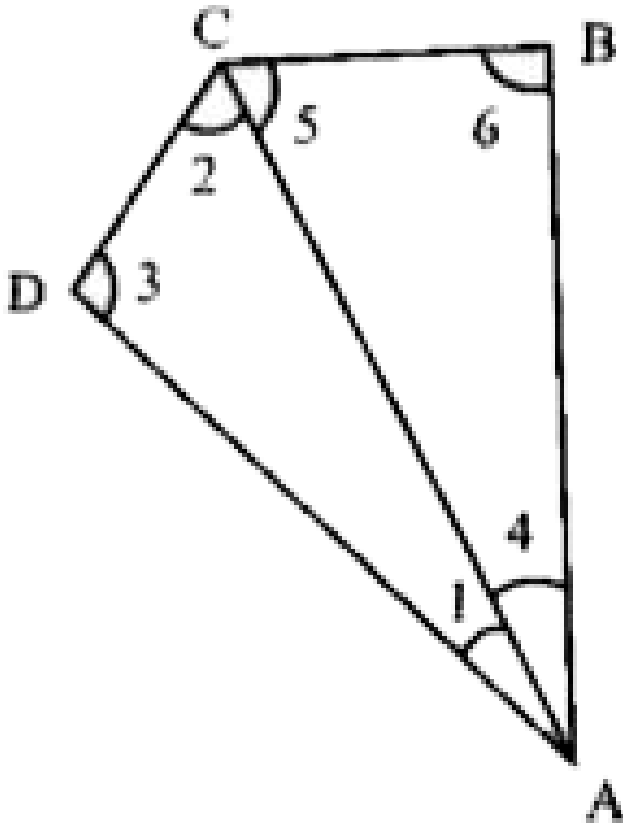
2. Try to give few more examples and non -example for a polygon .

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3. Take any quadrilateral , say ABCD .Divide it into two triangles by drawing a diagonal . You get six angles 1,2,3 ,4,5 and 6 . Use the angles sum property of a triangle and argue

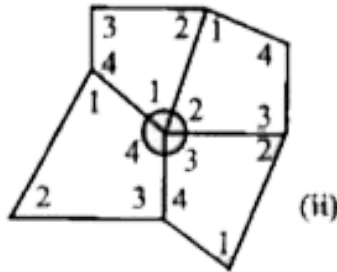
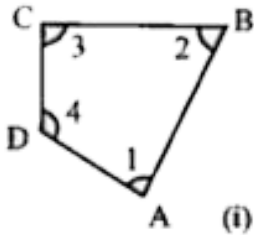
how the sum of the measures of $\angle A$, $\angle B$, $\angle C$ $\angle D$ amounts

to $180^\circ + 180^\circ = 360^\circ$.



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4. Take four congruent card board copies of any quadrilateral ABCD , with angles as shown (fig i) Arrange the copies as shown in the figure , where angles $\angle 1, \angle 2, \angle 3, \angle 4$,meet at a point (fig .ii)



What can you say about the sum of the angles $\angle 1, \angle 2, \angle 3, \angle 4$?

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5. As before consider quadrilateral ABCD Let P . Be any point in its interior . Join P to vertices A,B,C and D . In the figure

,consider $\triangle PAB$.

From this we see $x = 180^\circ - m\angle 2 - m\angle 3$.

Similarly from $\triangle PBC$, $y = 180^\circ - m\angle 4 - m\angle 5$, from $\triangle PCD$

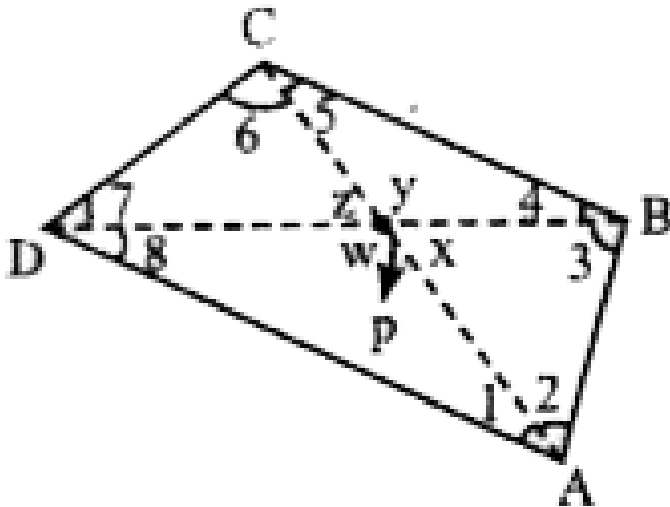
$z = 180^\circ - m\angle 6 - m\angle 7$ and from $\triangle PDA$

$w = 180^\circ - m\angle 8 - m\angle 1$

Use this to find the total measure $m\angle 1 + \angle 2 + \dots\dots m\angle 8$,

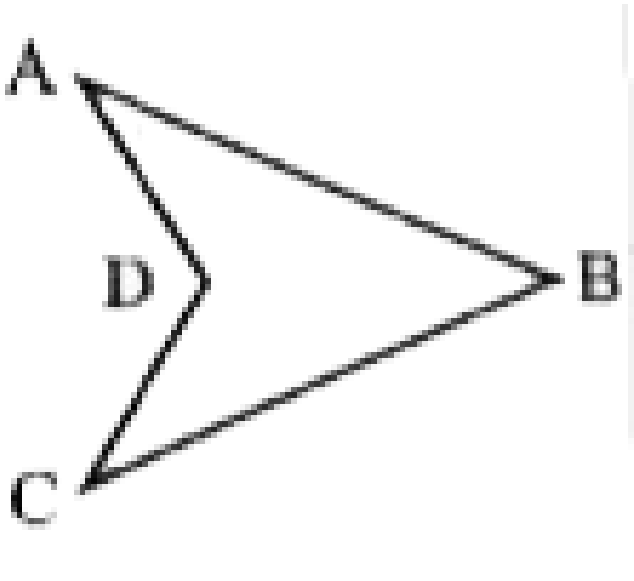
does it help you to arrive at the result ?

Remember $\angle x + \angle y + \angle z + \angle w = 360^\circ$



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6. Consider quadrilateral ABCD .Split it into two triangles to find the sum of the interior angles of quadrilateral ABCD

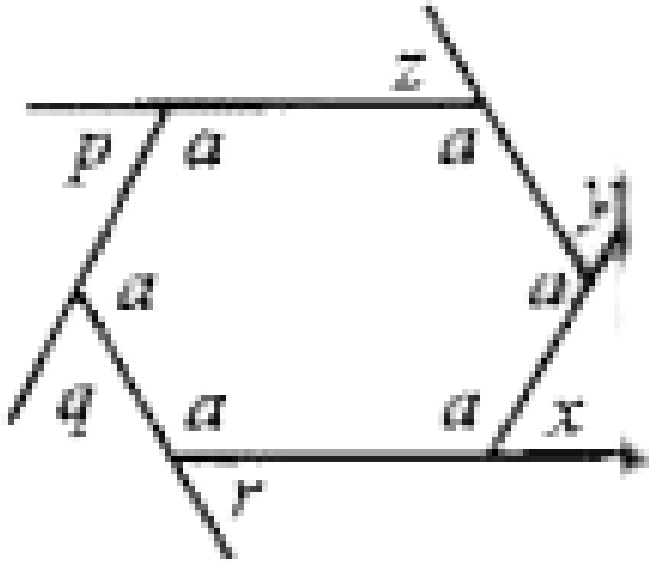


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7. In a regular hexagon.

What is the sum of the measures of its exterior angles x

$y, z, p, q, r?$



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8. If $x^p \cdot y^q = (x + y)^{p+q}$, show that $\frac{dy}{dx} = \frac{y}{x}$;

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9. What is the measure of each ?

(i) exterior angle

(ii) Interior angle.



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10. Take a regular hexagon. Repeat this activity for the cases of octagon



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11. What is the sum of the measure of its exterior angles a ,b,c,d,e,f,g,h.



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12. Is $a = b = c = d = e = f = g = h$? why ? . where
a,b,c,d,e,f,g,h are the sides of octagon

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13. What is the measure of each

(i) exterior angle

(ii) interior angle

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14. What is the sum of the measures of its exterior angles?

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15. Is

$$a = b = c = d = e = f = g = h = , m = n = o = p = q = r$$

? Why ? where a,b,c,d,e,f,g and h are the sides of octagon and

m,n,o,p,q,r are the sides of hexagon .



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16. What is the measure of each

(i) exterior angle

(ii) interior angle



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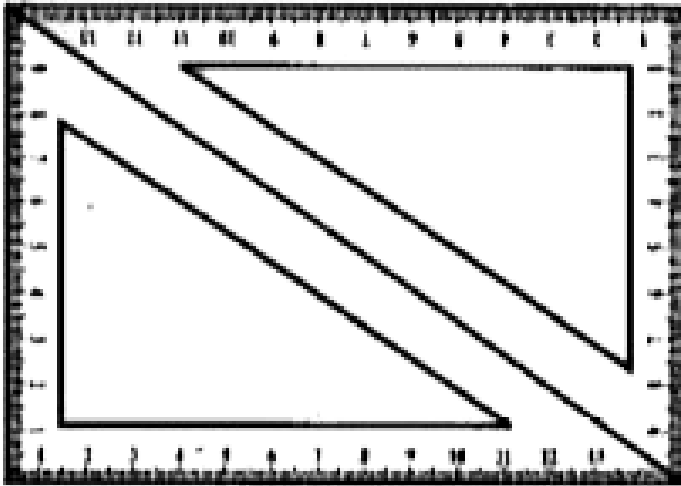
17. Take two identical set squares with angles

$30^\circ - 60^\circ - 90^\circ$ and place these adjacently to form a

parallelogram as shown in the fig .

Does this help you to verify the above property

property: The opposite sides of a parallelogram are of equal length.



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18. Find $x+y+z$

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Think Discuss And Write

1. a, b, c and d are the angle of any quadrilateral .if $\angle a = 45, \angle b = 60, \angle c = 100$. Find $\angle d$

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2. A mason has made a concrete slab .He needs it to be rectangular . In what different ways can he make sure that it is rectangular ?

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3. A square was defined as a rectangle with all sides equal . Can we define it as rhombus with equal angles ? Explain this

idea .



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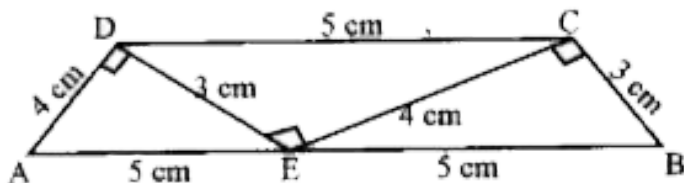
4. Can a trapezium have all angles equal ? Can it have all sides equal ? Explain .



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Do This

1. Take identical cut outs of congruent triangles of sides 3 cm ,4cm , 5cm Arrange them as shown .



You get a trapezium (check if) which are the parallel sides here ?

should the non -parallel sides be equal ?

You can get two more trapeziums using the same set of triangles. Find them out and discuss their shapes.

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Exercise 3 1

1. Give here are some figures .



(1)



(2)



(3)



(4)



(5)



(6)



(7)



(8)

Classify each of them on the basis of the following

(a) Simple curve

(b) Simple closed curve ,

(c) Polygon

(d) Convex polygon

(e) Concave polygon



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2. How many diagonals does each of the following have ?

A convex quadrilateral



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3. How many diagonals does each of the following have ?

A Triangle





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4. How many diagonals does each of the following have ?

A Triangle







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5. What is the sum of the measures of the angles of a convex quadrilateral? Will this property hold if the quadrilateral is not convex? (Make a non-convex quadrilateral and try!)



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6. Examine the table .(Each figure is divided into triangles and the angles deduced from that.)

Figure				
Side	3	4	5	6
Angle sum	180°	$2 \times 180^\circ$ $= (4 - 2) \times 180^\circ$	$3 \times 180^\circ$ $= (5 - 2) \times 180^\circ$	$4 \times 180^\circ$ $= (6 - 2) \times 180^\circ$

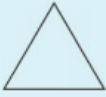



What can you say about the angle sum of a convex polygon with number of sides ?

7 Sides



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7. Examine the table. (Each figure is divided into triangles and the sum of the angles deduced from that.)





Figure				
Side	3	4	5	6
Angle sum	180°	$2 \times 180^\circ$ $= (4 - 2) \times 180^\circ$	$3 \times 180^\circ$ $= (5 - 2) \times 180^\circ$	$4 \times 180^\circ$ $= (6 - 2) \times 180^\circ$

What can

you say about the angle sum of a convex polygon with number of sides? 8

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8. Examine the table .(Each figure is divided into triangles and the angles deduced from that.)





Figure				
Side	3	4	5	6
Angle sum	180°	$2 \times 180^\circ$ $= (4 - 2) \times 180^\circ$	$3 \times 180^\circ$ $= (5 - 2) \times 180^\circ$	$4 \times 180^\circ$ $= (6 - 2) \times 180^\circ$

What can you say about the angle sum of a convex polygon with number of sides ?

10 sides

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9. Examine the table .(Each figure is divided into triangles and the angles deduced from that.)

Figure				
Side	3	4	5	6
Angle sum	180°	$2 \times 180^\circ$ $= (4 - 2) \times 180^\circ$	$3 \times 180^\circ$ $= (5 - 2) \times 180^\circ$	$4 \times 180^\circ$ $= (6 - 2) \times 180^\circ$

What can you say about the angle sum of a convex polygon with number of sides ?

n sides

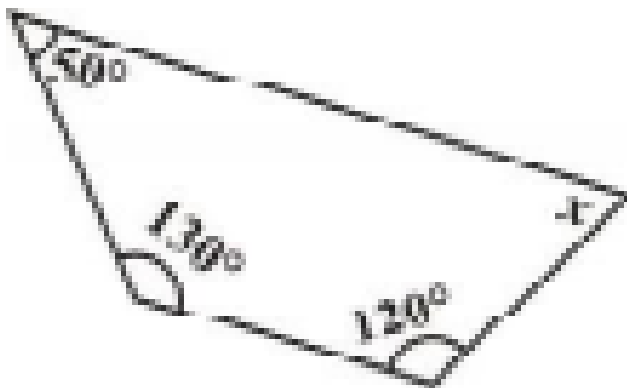
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10. What is a regular polygon ? State the name of regular polygon of

(i) 3 sides , (ii) 4 sides , (iii) 6 sides

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11. Find the angle measure x in the following figures.



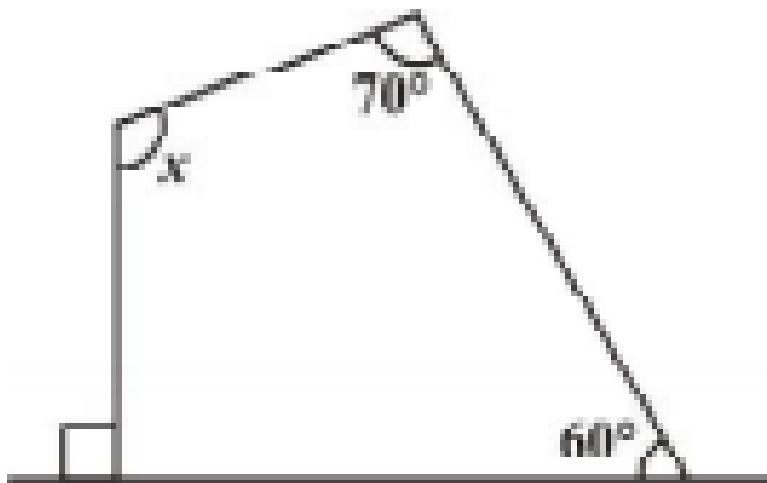
(a)



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12. Find the angle measure x in the following figures.

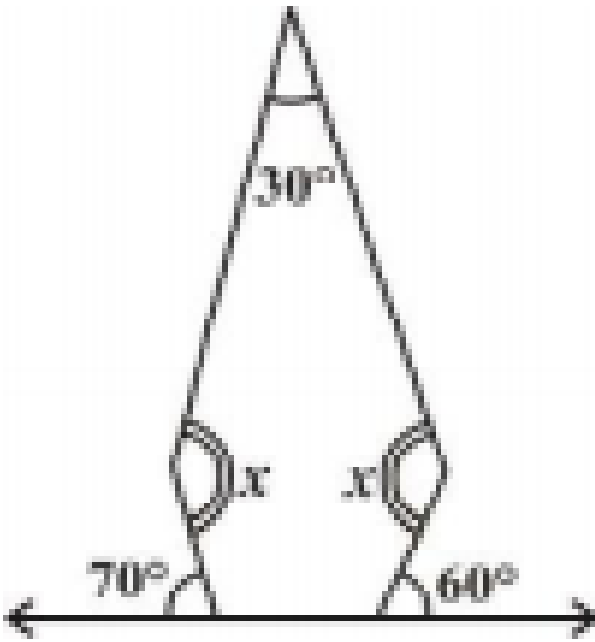
HCS.



(b)

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13. Find the angle measure x in the following figures.

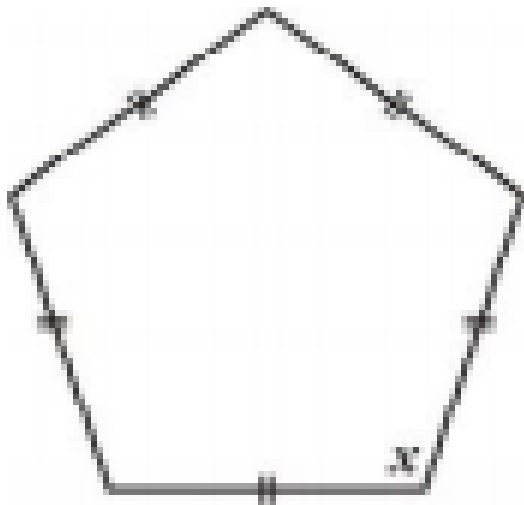


(c)



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14. Find the angle measure x in the following figures.



(d)



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15. Find $x+y+z$



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16.

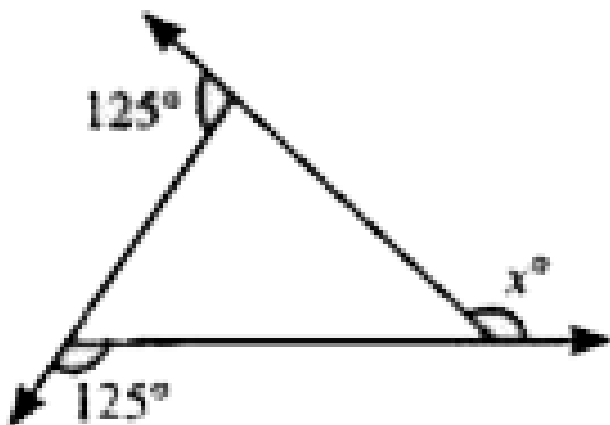


Find $x+y+z+w$.

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Exercise 3 2

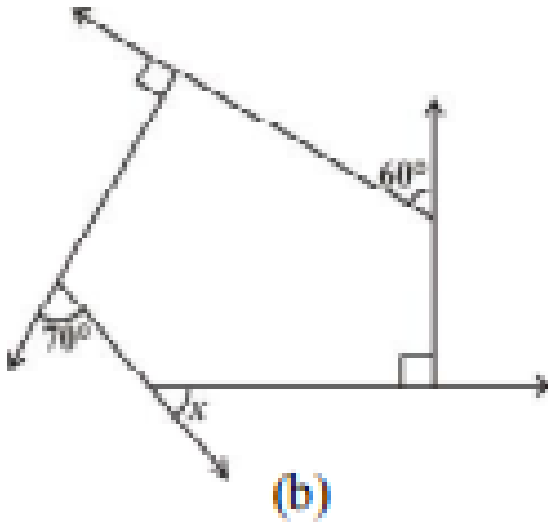
1. Find x in the following figures .





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2. Find x in the following figures.



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3. Find the measure of each exterior angle of a regular polygon of

9 sides



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4. Find the measure of each exterior angle of a regular polygon of

15 sides



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5. How many sides does a regular polygon have if the measure of an exterior angle is 24° ?



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6. How many sides does a regular polygon have if each of its interior angles is 165° ?

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7. Is it possible to have a regular polygon with measure of each exterior angle as 22° ?

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8. Can 22° be an interior angle of a regular polygon ? Why ?

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9. What is the minimum interior angle possible for a regular polygon? Why?

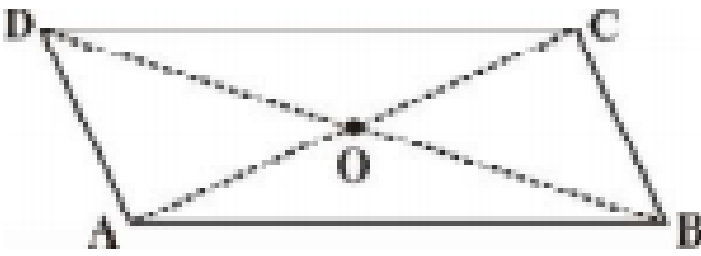
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10. What is the maximum exterior angle possible for a regular polygon?

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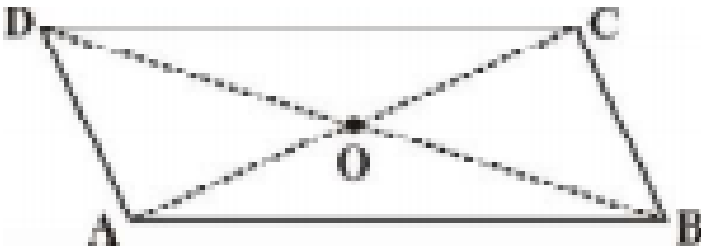
Exercise 3 3

1. Given a parallelogram ABCD. Complete each statement along with the definition or property used AD =



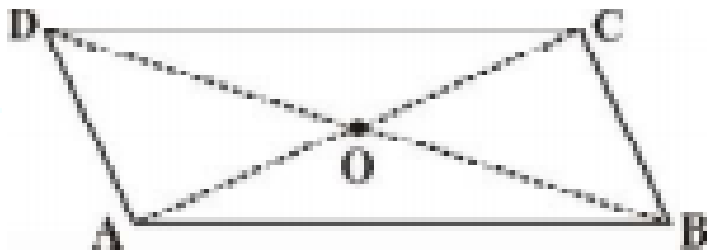
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2. Given a parallelogram ABCD. Complete each statement along with the definition or property used $OC = \dots$



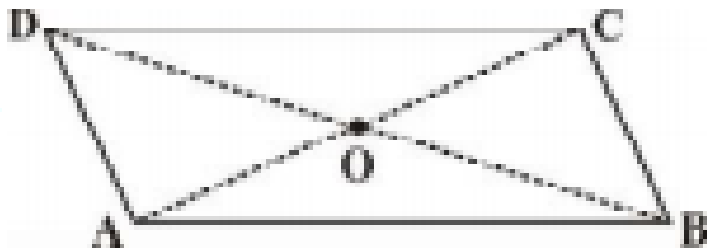
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3. Given a parallelogram ABCD. Complete each statement along with the definition or property used $OC = \dots$



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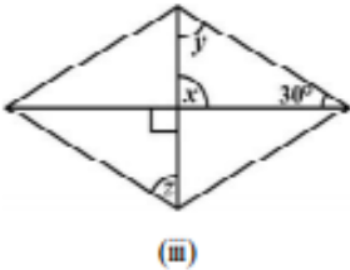
4. Given a parallelogram ABCD. Complete each statement along with the definition or property used $OC = \dots$



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5. Consider the following parallelograms. Find the values of the unknowns x , y , z .



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6. Can a quadrilateral $ABCD$ be a parallelogram if :
 $\angle D + \angle B = 180^\circ$?

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7. Can a quadrilateral ABCD be a parallelogram if

: $AB=DC=8\text{cm}$, $AD=4\text{cm}$ and $BC =4.4\text{cm}$?

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8. Can a quadrilateral ABCD be a parallelogram if : $\angle A = 70^\circ$

and $\angle C = 65^\circ$?

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9. Draw a rough figure of a quadrilateral that is not a parallelogram but has exactly two opposite angles of equal measure.

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10. The measures of two adjacent angles of a parallelogram are in the ratio 3 : 2. Find the measure of each of the angles of the parallelogram.

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11. Two adjacent angles of a parallelogram have equal measure. Find the measure of each of the angles of the parallelogram.

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12. The adjacent figure HOPE is a parallelogram. Find the angle measures x , y and z . State the properties you use to find

them.

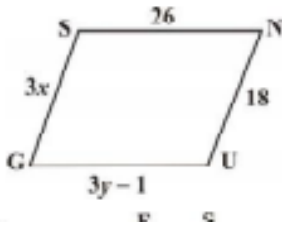


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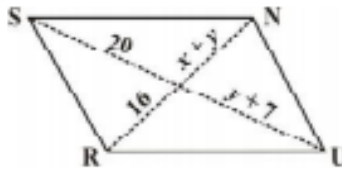
13. The following figures GUNS and RUNS are parallelograms.

Find x and y . (Lengths are in cm)

(i)

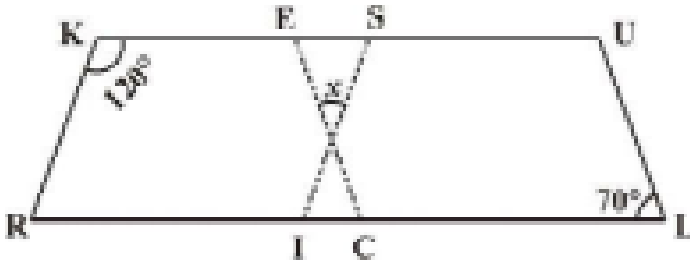


(ii)



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14.



In the

above figure both RISK and CLUE are parallelograms. Find the value of x .

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15. Explain how this figure is a trapezium. Which of its two sides are parallel? (Fig 3.32)

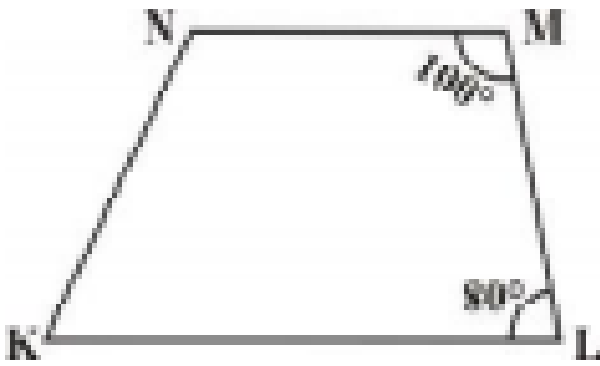
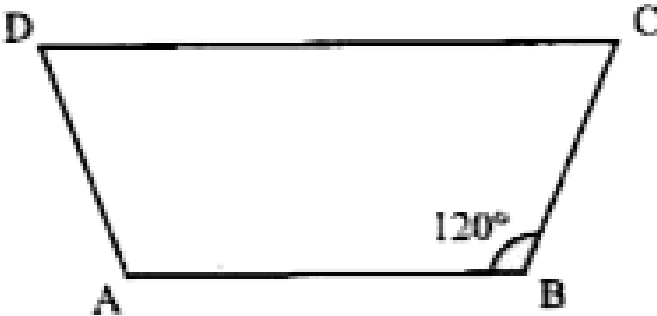


Fig 3.32

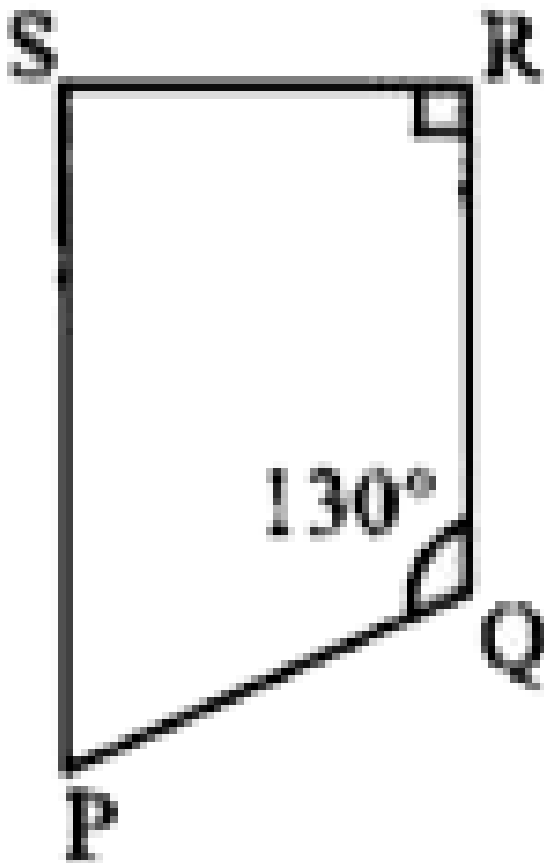
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16. Find $m\angle C$ in the figure if $\overline{AB} \parallel \overline{DC}$



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17. Find the measure of $\angle P$ and $\angle S$ if $\overline{SP} \parallel \overline{RQ}$



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Exercise 3 4

1. State whether True or False. All rectangles are squares

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2. State whether True or False. All rhombuses are parallelograms

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3. State whether True or False. All squares are rhombuses and also rectangles

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4. State whether True or False. All squares are not parallelograms.

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5. State whether True or False. All kites are rhombuses.

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6. State whether True or False. All parallelograms are trapeziums.

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7. State whether True or False. All squares are trapeziums.

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8. Identify all the quadrilaterals that have. four sides of equal length

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9. Identify all the quadrilaterals that have. four right angles

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10. Explain how a square is. a quadrilateral



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11. Explain how a square is a rhombus

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12. Explain how a square is a rhombus

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13. Explain how a square is a rhombus

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14. Name the quadrilaterals whose diagonals bisect each other

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15. Name the quadrilaterals whose diagonals are perpendicular bisectors of each other

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16. Name the quadrilaterals whose diagonals

(i) bisect each other .

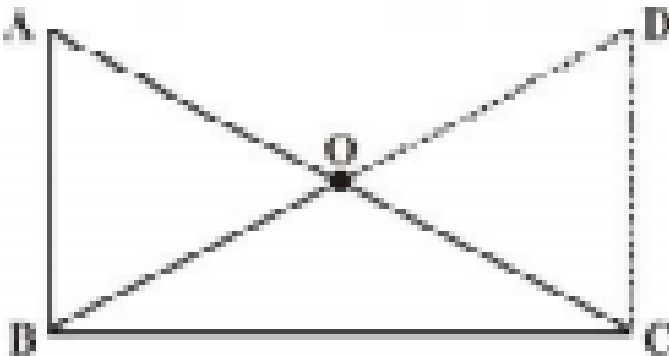
(ii) are equal

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17. Explain why a rectangle is a convex quadrilateral.

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18. ABC is a right-angled triangle and O is the mid point of the side opposite to the right angle. Explain why O is equidistant from A, B and C. (The dotted lines are drawn additionally to help you).



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Additional Questions For Practice Objective Type Questions

1. Diagonals of which figure bisect each other at right angles

.

(i) parallelogram

(ii) rectangle

(iii) rhombus



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2. The four angles quadrilaterals add upto

180°

(ii) 360°

(iii) 54



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3. Number of diagonals in a hexagon are

(i) 6

(ii) 5

(iii) 9



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4. Sum of all the interior angles of a pentagon are

(i) 540°

(ii) 720°

(iii) 360°



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5. Which of the following cannot be the angles of a quadrilateral ?

$70^\circ, 80^\circ, 90^\circ, 120^\circ$

(ii) $102^\circ, 88^\circ, 92^\circ, 78^\circ$

(iii) $80^\circ, 85^\circ, 90^\circ, 78^\circ$



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6. Adjacent sides of the polygon are

(i) Any 2 sides of the polygon

(ii) Any 2 sides with common vertex

(iii) any two sides connecting non - consecutive vertices



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7. Which is not correct ?

(i) Equilateral Δ is a regular polygon

(ii) Square is a regular polygon

(iii) Rhombus is a regular polygon

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8. Fill in the blanks .

Every _ is a rectangle .

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9. Isosceles trapezium is a trapezium in which base angles are _____

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10. Adjacent angles of a parallelogram are supplementary .

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11. Sum of interior angles of a 9 sided polygon are

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12. Number of diagonals in a octagen are 20.

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13. If an angle of a parallelogram is a right angle then it is called a _____

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14. If two adjacent sides of a rectangle are equal then it is called a _____.

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15. State whether True or False .

Diagonals bisect in a trapezium .

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16. At least one angle of a concave quadrilateral is greater than 180° .



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17. state true or false:

Diagonals of a rhombus are equal in length .



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18. Isosceles triangle is a regular polygon .



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19. Every curve is a closed curve .



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20. Diagonal joins any two adjacent vertices of a polygon .



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21. Non - parallel sides of an isosceles trapezium are equal .



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Additional Questions For Practice Short Answer Type Questions

1. Which of the following figure is a regular polygon?

A. (a) Any triangle

B. (b) Right angle triangle

C. (c) Equilateral triangle

D. (d) none of these

Answer:



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Additional Questions For Practice Long Answer Type Questions

1. Ratio between the exterior angle and interior angle of a regular polygon is $2:7$. Find the number of sides of the polygon .



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2. Angles of the quadrilateral are $(2x + 1)^\circ$, $(2x + 9)^\circ$, $(3x - 4)^\circ$, $(x + 10)^\circ$. Find the measure of each of the angles of the quadrilateral.

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3. ABCDEF is a regular hexagon with line l passing through side AF. Find the measure of $\angle x$ and $\angle y$.

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4. Find the measure of each angle of the parallelogram if the larger angle is 60° less than twice of smaller angles.

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5. PQRS is a rhombus . $\angle QRP = 55^\circ$. Find $\angle PSR$



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6. Sum of all the interior angles of a regular polygon is twice sum of its exterior angles .Find the number of sides of the polygon .



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7. One of the sides of the parallelogram is 6 cm more than the other . If its perimeted is 36 cm . Find the sides of the parallelogram .



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Additional Questions For Practice Hots High Order Thinking Skill

1. If the length of the side of a rhombus is equal to the length of one diagonal Find the angles of the rhombus .

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Sample Paper For Practice

1. Correct the statements given below .

Parallel sides of the isosceles trapezium are equal .

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2. Sum of all the interior angles of a quadrilateral is 180° ?.

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3. Diagonals of the parallelogram bisect each other at right angles .

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4. Minimum number of sides in a polygon is 2.

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5. Fill in the blank spaces .

A regular polygon each of whose angle is _____ a regular polygon at 5 sides .

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6. Measure of each interior angle of a polygon is equal to 8 times the measure of each exterior angle . Then the number of sides of polygon has _____

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7. Diagonals of the rhombus bisect each other at _____ .

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8. Sum of all interior angles of a n sided polygon is _____ .



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9. Number of diagonals in a hexagon are

(i) 6

(ii) 5

(iii) 9



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10. Which letter of English alphabet form simple closed curve?



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11. Maximum exterior angle possible for a regular polygon

(i) 60°

(ii) 120°

(iii) 180°



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12. Quadrilateral in which measure of each angle is less than

180° is a

(i) Concave quadrilateral

(ii) Convex quadrilateral

(iii) Both



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13. Identify the type of quadrilateral in the following .

A quadrilateral which is equiangular but not equilateral .

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14. Identify the type of quadrilateral in the following .

A quadrilateral which is equilateral but not equiangular .

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15. Identify the type of quadrilateral in the following .

A quadrilateral which is equiangular but not equilateral .

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16. Identify the type of quadrilateral in the following .

A quadrilateral whose diagonals bisect each other at right - angles .

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17. One side of the square is 36 cm and the side opposite to it is $5x-4$. Find the value of x .

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18. Each interior angle of a polygon is double the exterior angle . Find the number of sides of the polygon .

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19. One of angles of a parallelogram is 26° more than its adjacent angle . What is the measure of each angle ?

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20. PQRS is a parallelogram and O is the point of intersection of the diagonals . $OR = 4$ cm and QS is 3 more than PR . Find OS .

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21. ABCD is a quadrilateral such that $\angle A = \angle B, \angle C = \angle D$.
If $\angle A = 2\angle C$. Find the angles of the quadrilateral .

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