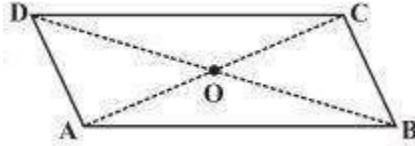


Exercise 3.3

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



- (i) $AD = \dots\dots$ (ii) $\angle DCB = \dots\dots$
 (iii) $OC = \dots\dots$ (iv) $m\angle DAB + m\angle CDA = \dots\dots$

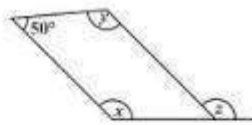
Solution:

- (i) $AD = BC$ (Opposite sides of a parallelogram are equal)
 (ii) $\angle DCB = \angle DAB$ (Opposite angles of a parallelogram are equal)
 (iii) $OC = OA$ (Diagonals of a parallelogram are equal)
 (iv) $m\angle DAB + m\angle CDA = 180^\circ$

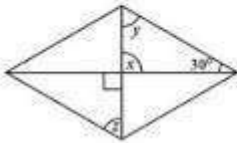
2. Consider the following parallelograms. Find the values of the unknown x, y, z



(i)



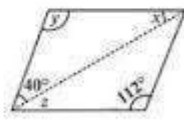
(ii)



(iii)



(iv)



(v)

Solution:

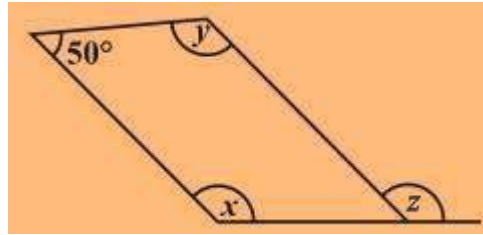
(i)



- $y = 100^\circ$ (opposite angles of a parallelogram)
 $x + 100^\circ = 180^\circ$ (Adjacent angles of a parallelogram)
 $\Rightarrow x = 180^\circ - 100^\circ = 80^\circ$
 $x = z = 80^\circ$ (opposite angles of a parallelogram)
 $\therefore, x = 80^\circ, y = 100^\circ$ and $z = 80^\circ$

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(ii)

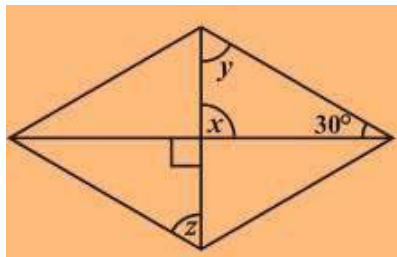


$$50^\circ + x = 180^\circ \Rightarrow x = 180^\circ - 50^\circ = 130^\circ \text{ (Adjacent angles of a parallelogram)}$$

$$x = y = 130^\circ \text{ (opposite angles of a parallelogram)}$$

$$x = z = 130^\circ \text{ (corresponding angle)}$$

(iii)



$$x = 90^\circ \text{ (vertical opposite angles)}$$

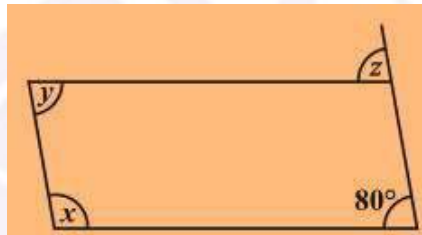
$$x + y + 30^\circ = 180^\circ \text{ (angle sum property of a triangle)}$$

$$\Rightarrow 90^\circ + y + 30^\circ = 180^\circ$$

$$\Rightarrow y = 180^\circ - 120^\circ = 60^\circ$$

$$\text{also, } y = z = 60^\circ \text{ (alternate angles)}$$

(iv)



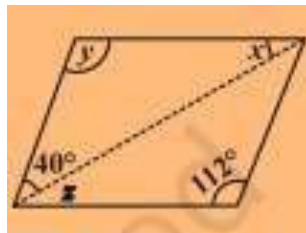
$$z = 80^\circ \text{ (corresponding angle) } z$$

$$= y = 80^\circ \text{ (alternate angles) } x$$

$$+ y = 180^\circ \text{ (adjacent angles)}$$

$$\Rightarrow x + 80^\circ = 180^\circ \Rightarrow x = 180^\circ - 80^\circ = 100^\circ$$

(v)



$$x = 28^\circ$$

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$$y = 112^\circ$$

$$z = 28^\circ$$

3. Can a quadrilateral ABCD be a parallelogram if

(i) $\angle D + \angle B = 180^\circ$?

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

(iii) $\angle A = 70^\circ$ and $\angle C = 65^\circ$?

Solution:

(i) Yes, a quadrilateral ABCD be a parallelogram if $\angle D + \angle B = 180^\circ$ but it should also fulfilled some conditions which are:

(a) The sum of the adjacent angles should be 180° .

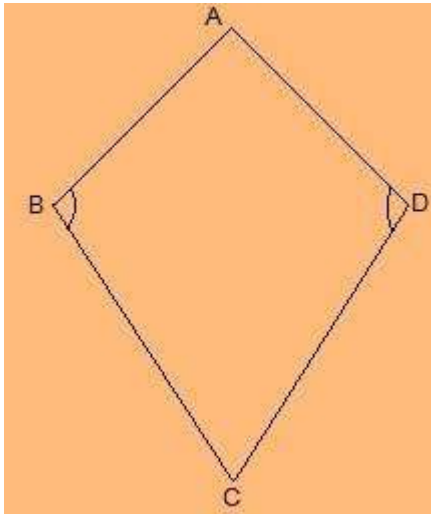
(b) Opposite angles must be equal.

(ii) No, opposite sides should be of same length. Here, $AD \neq BC$

(iii) No, opposite angles should be of same measures. $\angle A \neq \angle C$

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

Solution:



ABCD is a figure of quadrilateral that is not a parallelogram but has exactly two opposite angles that is $\angle B = \angle D$ of equal measure. It is not a parallelogram because $\angle A \neq \angle C$.

5. 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.

Solution:

Let the measures of two adjacent angles $\angle A$ and $\angle B$ be $3x$ and $2x$ respectively in parallelogram ABCD.

$$\angle A + \angle B = 180^\circ$$

$$\Rightarrow 3x + 2x = 180^\circ$$

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$$\Rightarrow 5x = 180^\circ$$

$$\Rightarrow x = 36^\circ$$

We know that opposite sides of a parallelogram are equal.

$$\angle A = \angle C = 3x = 3 \times 36^\circ = 108^\circ$$

$$\angle B = \angle D = 2x = 2 \times 36^\circ = 72^\circ$$

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

Solution:

Let ABCD be a parallelogram.

Sum of adjacent angles of a parallelogram = 180°

$$\angle A + \angle B = 180^\circ$$

$$\Rightarrow 2\angle A = 180^\circ$$

$$\Rightarrow \angle A = 90^\circ$$

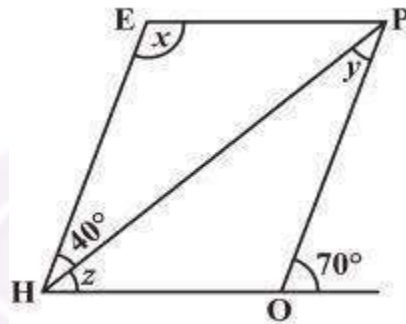
$$\text{also, } 90^\circ + \angle B = 180^\circ$$

$$\Rightarrow \angle B = 180^\circ - 90^\circ = 90^\circ$$

$$\angle A = \angle C = 90^\circ$$

$$\angle B = \angle D = 90^\circ$$

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



Solution:

$$y = 40^\circ \text{ (alternate interior angle)}$$

$$\angle P = 70^\circ \text{ (alternate interior angle)}$$

$$\angle P = \angle H = 70^\circ \text{ (opposite angles of a parallelogram)}$$

$$z = \angle H - 40^\circ = 70^\circ - 40^\circ = 30^\circ$$

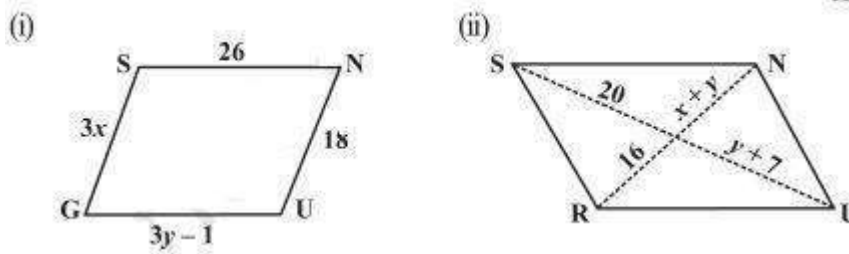
$$\angle H + x = 180^\circ$$

$$\Rightarrow 70^\circ + x = 180^\circ$$

$$\Rightarrow x = 180^\circ - 70^\circ = 110^\circ$$

8. The following figures GUNS and RUNS are parallelograms. Find x and y. (Lengths are in cm)

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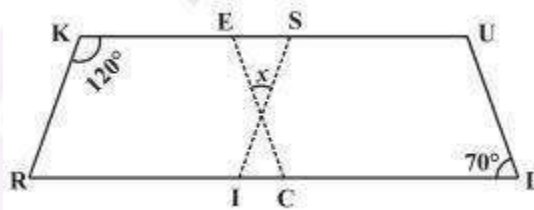
Solution:

(i) $SG = NU$ and $SN = GU$ (opposite sides of a parallelogram are equal)
 $3x = 18$
 $x = 18/3$
 $\Rightarrow x = 6$

$3y - 1 = 26$ and,
 $\Rightarrow 3y = 26 + 1$
 $\Rightarrow y = 27/3 = 9$
 $x = 6$ and $y = 9$

(ii) $20 = y + 7$ and $16 = x + y$ (diagonals of a parallelogram bisect each other)
 $y + 7 = 20$
 $\Rightarrow y = 20 - 7 = 13$ and,
 $x + y = 16$
 $\Rightarrow x + 13 = 16$
 $\Rightarrow x = 16 - 13 = 3$
 $x = 3$ and $y = 13$

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



Solution:

$\angle K + \angle R = 180^\circ$ (adjacent angles of a parallelogram are supplementary)
 $\Rightarrow 120^\circ + \angle R = 180^\circ$
 $\Rightarrow \angle R = 180^\circ - 120^\circ = 60^\circ$
 also, $\angle R = \angle SIL$ (corresponding angles)
 $\Rightarrow \angle SIL = 60^\circ$
 also, $\angle ECR = \angle L = 70^\circ$ (corresponding angles)
 $x + 60^\circ + 70^\circ = 180^\circ$ (angle sum of a triangle)
 $\Rightarrow x + 130^\circ = 180^\circ$
 $\Rightarrow x = 180^\circ - 130^\circ = 50^\circ$

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

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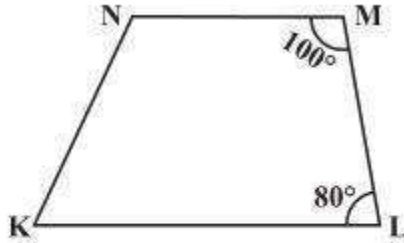


Fig 3.32

Solution:

When a transversal line intersects two lines in such a way that the sum of the adjacent angles on the same side of transversal is 180° then the lines are parallel to each other.
 Here, $\angle M + \angle L = 100^\circ + 80^\circ = 180^\circ$
 Thus, $MN \parallel LK$
 As the quadrilateral KLMN has one pair of parallel line therefore it is a trapezium.
 MN and LK are parallel lines.

11. Find $m\angle C$ in Fig 3.33 if $AB \parallel DC$?

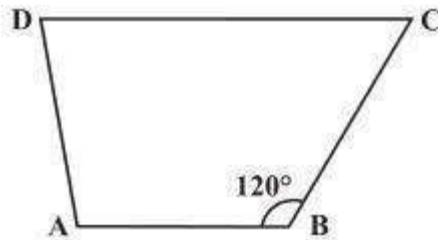


Fig 3.33

Solution:

$$m\angle C + m\angle B = 180^\circ \text{ (angles on the same side of transversal)}$$

$$\Rightarrow m\angle C + 120^\circ = 180^\circ$$

$$\Rightarrow m\angle C = 180^\circ - 120^\circ = 60^\circ$$

12. Find the measure of $\angle P$ and $\angle S$ if $SP \parallel RQ$? in Fig 3.34. (If you find $m\angle R$, is there more than one method to find $m\angle P$?)

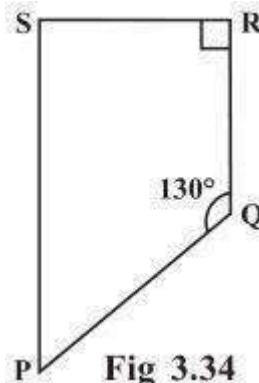


Fig 3.34

Solution:

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$\angle P + \angle Q = 180^\circ$ (angles on the same side of transversal)
 $\Rightarrow \angle P + 130^\circ = 180^\circ$
 $\Rightarrow \angle P = 180^\circ - 130^\circ = 50^\circ$
also, $\angle R + \angle S = 180^\circ$ (angles on the same side of transversal)
 $\Rightarrow 90^\circ + \angle S = 180^\circ$
 $\Rightarrow \angle S = 180^\circ - 90^\circ = 90^\circ$
Thus, $\angle P = 50^\circ$ and $\angle S = 90^\circ$

Yes, there are more than one method to find $m\angle P$.
PQRS is a quadrilateral. Sum of measures of all angles is 360° .
Since, we know the measurement of $\angle Q$, $\angle R$ and $\angle S$.
 $\angle Q = 130^\circ$, $\angle R = 90^\circ$ and $\angle S = 90^\circ$
 $\angle P + 130^\circ + 90^\circ + 90^\circ = 360^\circ$
 $\Rightarrow \angle P + 310^\circ = 360^\circ$
 $\Rightarrow \angle P = 360^\circ - 310^\circ = 50^\circ$

