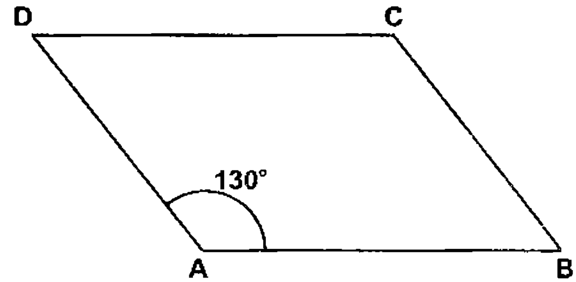
EXERCISE 11.1

(1) One angle of a parallelogram is 130°. Find the measures of its remaining angles.



Given

ABCD is a parallelogram that

$m\angle A = 130^\circ$

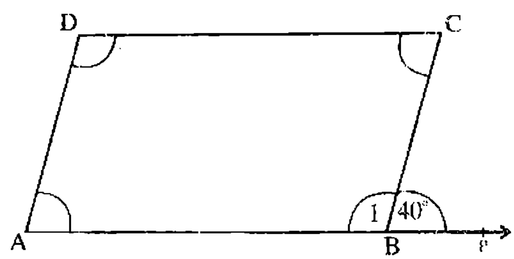
To Prove

(Required) To find the measures of $\angle B$, $\angle C$, $\angle D$

Proof

Statements	Reasons
$m\angle C = m\angle A$	Opposite angles of parallelogram.
$m\angle C = 130^\circ$	Given, $m\angle A = 130^\circ$
$m\angle B + m\angle A = 180^\circ$	$\overline{AD} \parallel \overline{BC}$ and $\overline{AB}$ is transversal. $\therefore$ sum of interior angles.
$m\angle B + 130^\circ = 180^\circ$	Given $m\angle A = 130^\circ$
$m\angle B = 180^\circ - 130^\circ$	
$m\angle B = 50^\circ$	
$m\angle D = m\angle B$	Opp. angles
$m\angle D = 50^\circ$	As $m\angle B = 50^\circ$
$\therefore$ $m\angle B = 50^\circ$, $m\angle C = 130^\circ$, $m\angle D = 50^\circ$	

(2) One exterior angle formed on producing one side of a parallelogram is 40°. Find the measures of its interior angles.



Given

ABCD is a parallelogram, side AB has been produced to p to form exterior angle $m\angle CBP = 40^\circ$ and name the interior angles as $\angle 1$, $\angle C$, $\angle D$, $\angle A$.

Required

To find the degree measures of $\angle 1$, $\angle C$, $\angle D$, $\angle A$

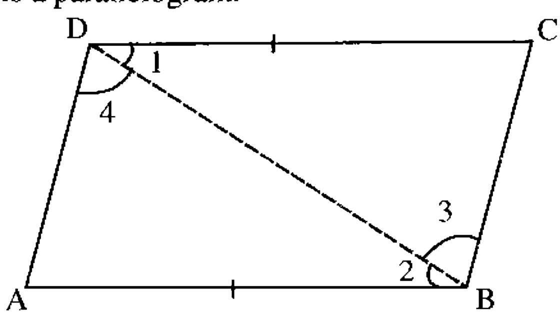
Proof

Statements	Reasons
$m\angle 1 + m\angle CBP = 180^\circ$	Supp.angles.
$m\angle 1 + 40^\circ = 180^\circ$	$m\angle CBP = 40^\circ$ given

$\therefore$ $m\angle 1 = 180^\circ - 40^\circ$	
$m\angle 1 = 140^\circ$ (i)	
$m\angle D = m\angle 1$	Opp.angles of llm
$m\angle D = 140^\circ$.....(ii)	From (i)
$m\angle A + m\angle 1 = 180^\circ$	$\overline{AD} \parallel \overline{BC}$ and $\overline{AB}$ is transversal. (Interior angles)
$m\angle A + 140^\circ = 180^\circ$	From (i)
$m\angle A = 180^\circ - 140^\circ$	
$m\angle A = 40^\circ$..............(iii)	
$m\angle C = m\angle A$	Opp. angles
$m\angle C = 40^\circ$	From (iii)
Thus $m\angle 1 = 140^\circ$, $m\angle C = 40^\circ$	

Theorem

If two opposite sides of a quadrilateral are congruent and parallel, it is a parallelogram.



Given

In a quadrilateral ABCD,

$\overline{AB} \cong \overline{DC}$ and $\overline{AB} \parallel \overline{DC}$

To prove

ABCD is a parallelogram.

Construction

Join the point B to D and in the figure, name the angles as indicated:

$\angle 1$, $\angle 2$, $\angle 3$ and $\angle 4$

Proof

Statements	Reasons
In $\Delta ABD \leftrightarrow \Delta CDB$	
$\overline{AB} \cong \overline{DC}$	Given
$\angle 2 \cong \angle 1$	Alternate angles
$\overline{BD} \cong \overline{BD}$	Common
$\therefore$ $\Delta ABD \cong \Delta CDB$	S.A.S. postulate
Now $\angle 4 \cong \angle 3$ .....(i)	(corresponding angles of congruent triangles)
$\therefore$ $\overline{AD} \parallel \overline{BC}$ .....(ii)	From (i)

and $\overline{AD} \cong \overline{BC}$ ....(iii)	Corresponding sides of congruent Δs
Also $\overline{AB} \parallel \overline{DC}$ ....(iv)	Given
Hence ABCD is a parallelogram	From (ii) – (iv)