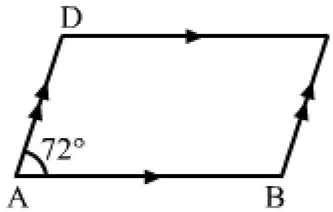
EXERCISE 10B

Answer 1:

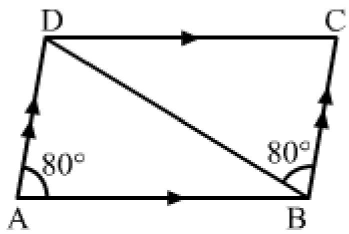


Given, ABCD is parallelogram and $\angle A = 72°$.

Then , as we know that opposite angles are equals.
$\therefore \angle A = \angle C$ and $\angle B = \angle D$
$\therefore \angle C = 72°$
$\angle A$ and $\angle B$ are the adjacent angles.
as, $\angle A + \angle B = 180°$
$\Rightarrow \angle B = 180° - \angle A = 180° - 72° = 108°$

As above, $\angle B = \angle D = 108°$
Hence, $\angle B = \angle D = 108^o$ and $\angle C = 72^o$

Answer 2:



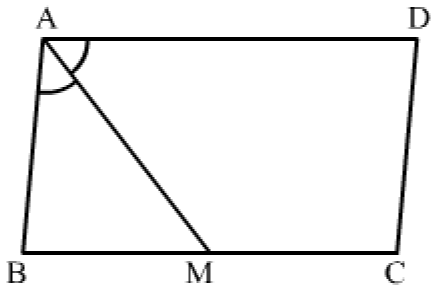
Given: ABCD is parallelogram and $\angle DAB = 80°$ *and* $\angle DBC = 60°$
To find: Measure of $\angle CDB$ and $\angle ADB$
In parallelogram ABCD, AD || BC
$\therefore \angle DBC = \angle ADB = 60°$ (Alternate interior angles) ...(i)
As $\angle DAB$ and $\angle ADC$ are the adjacent angles,

$\angle DAB + \angle ADC = 180°$

$\therefore\ \angle ADC = 180° - \angle DAB = 180° - 80° = 100°$
Also, $\angle ADC = \angle ADB + \angle CDB$
$\therefore\ \angle ADC = 100°$

Then,
$\Rightarrow\ \angle ADB + \angle CDB = 100$ ...(ii)
From (i) and (ii),
$60° + \angle CDB = 100°$
$\Rightarrow\ \angle CDB = 100° - 60° = 40$
Hence, ∠CDB = 40^o and ∠ADB = 60^o

Answer 3:



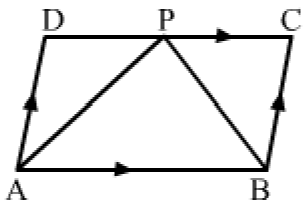
Given: parallelogram ABCD, M is the midpoint of side BC and ∠BAM = ∠DAM.
To prove: AD = 2CD
Proof:
Since, AD∥BC and AM is the transversal.
So, $\angle DAM = \angle AMB$ (Alternate interior angles)
But, $\angle DAM = \angle BAM$ (Given)
Thus, $\angle AMB = \angle BAM$
$\Rightarrow AB = BM$

As we know angles opposite to equals sides are equal and opposite sides of parallelogram are equal
Now, $AB = CD$
$\Rightarrow 2AB = 2CD$

So, $\Rightarrow (AB + AB) = 2CD$
$\Rightarrow BM + MC = 2CD$ (AB = BM and MC = BM)
$\Rightarrow BC = 2CD$

$\therefore AD = 2CD$ (AD=BC)hence proved

Answer 4:



ABCD is a parallelogram.
$\therefore \angle A = \angle C$ and $\angle B = \angle D$ (Opposite angles)
And $\angle A + \angle B = 180^{o}$ (Adjacent angles are supplementary)
$\therefore \angle B = 180^{o} - \angle A$
$\Rightarrow 180^{o} - 60^{o} = 120^{o}$ ($\angle A = 60^{o}$)
$\therefore \angle A = \angle C = 60^{o}$ and $\angle B = \angle D = 120^{o}$

(i) In Δ APB, $\angle PAB = \frac{60}{2} = 30°$

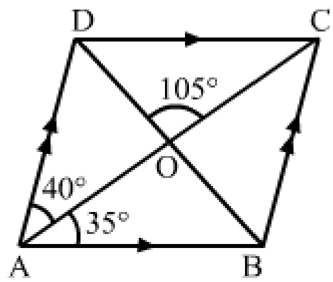
and $\angle PBA = \frac{120}{2} = 60°$
$\therefore \angle APB = 180^{o} - (30^{o} + 60^{o}) = 90^{o}$

(ii) In Δ ADP, $\angle PAD = 30^{o}$ and $\angle ADP = 120^{o}$
$\therefore \angle APB = 180^{o} - (30^{o} + 120^{o}) = 30^{o}$
Thus, $\angle PAD = \angle APB = 30^{o}$
Hence, ΔADP is an isosceles triangle and AD = DP.
In Δ PBC, $\angle PBC = 60^{o}$, $\angle BPC = 180^{o} - (90^{o} + 30^{o}) = 60^{o}$ and $\angle BCP = 60^{o}$ (Opposite angle of $\angle A$)
$\therefore \angle PBC = \angle BPC = \angle BCP$
Hence, ΔPBC is an equilateral triangle and, therefore, PB = PC = BC.

(iii) DC = DP + PC
From (ii), as ,

DC = AD + BC [AD = BC, opposite sides of a parallelogram]
⇒ DC = AD + AD
⇒ DC = 2 AD

Answer 5:



ABCD is a parallelogram.
∴ AB | | DC and BC | | AD
(i) In ΔAOB, $\angle BAO = 35°$,

As we know that, vertically opposite angles are equals

$\angle AOB = \angle COD = 105°$
$\therefore \angle ABO = 180° - (35° + 105°) = 40°$

(ii) As we know that these angles are ∠ODC and ∠ABO are alternate interior angles.
$\therefore \angle ODC = \angle ABO = 40°$

(iii) These are Alternate interior angles

$\angle ACB = \angle CAD = 40°$
(iv) In ΔABC, we get

$\angle CBD = \angle ABC - \angle ABD$ ...(i)

$\angle ABC = 180° - \angle BAD$ (Adjacent angles are supplementary)

$\Rightarrow \angle ABC = 180° - 75° = 105°$
In ΔCBD , we have
Then, ∠CBD = ∠ABC - ∠ABD

$\Rightarrow \angle CBD = 105° - \angle ABD$ (∠ABD = ∠ABO)
$\Rightarrow \angle CBD = 105° - 40° = 65°$

Answer 6:

ABCD is a parallelogram.
i.e., ∠A = ∠C and ∠B = ∠D (Opposite angles)
Also, $\angle A + \angle B = 180°$ (Adjacent angles are supplementary)
$\therefore (2x + 25)° + (3x - 5)° = 180°$
$\Rightarrow 5x + 20 = 180°$

$\Rightarrow 5x = 180 - 20$

$\Rightarrow 5x = 160°$
$\Rightarrow x = \frac{160}{2} = 32°$

$\therefore \angle A = 2 \times 32 + 25 = 89°$ and $\angle B = 3 \times 32 - 5 = 91°$
Hence, x = 32°, ∠A = ∠C = 89° and ∠B = ∠D = 91°

Answer 7:

Let PQRS be a parallelogram.
∴ ∠P = ∠R and ∠Q = ∠S
Let ∠P = y° and ∠B = $(\frac{4y}{5})°$
Now, ∠P + ∠Q = 180°
⇒y + $(\frac{4y}{5})°$ = 180°⇒$(\frac{9y}{5})°$ = 180°⇒y = 100°

Now, ∠P = 100° and ∠B = $(\frac{4}{5})$×100° = 80°
Hence, ∠P = ∠R = 100°; ∠B = ∠S = 80°

Answer 8:

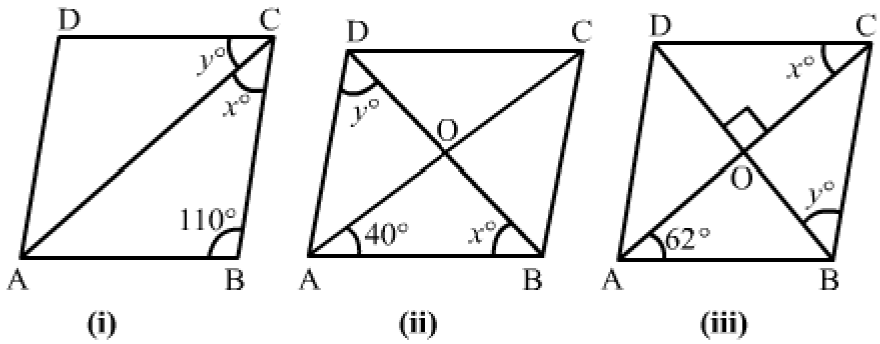
Let PQRS be a parallelogram.
$\therefore \angle P = \angle R$ and $\angle Q = \angle S$ (Opposite angles)
Let $\angle P$ be the smallest angle whose measure is y^o.
$\therefore \angle Q = (2y - 30)°$
$Now, \angle P + \angle Q = 180°$ (Adjacent angles are supplementry)
$\Rightarrow y + 2y - 30° = 180°$
$\Rightarrow 3y = 210°$

$\Rightarrow y = \frac{210}{3} = 70$
$\Rightarrow y = 70°$
$\therefore \angle Q = 2 \times 70° - 30° = 110°$
Hence, $\angle P = \angle R = 70^o$; $\angle Q = \angle S = 110^o$

Answer 9:

ABCD is a parallelogram.
The opposite sides of a parallelogram are parallel and equal.
$\therefore$ AB = DC = 9.5 cm
Let BC = AD = y
$\therefore$ Perimeter of ABCD = $AB + BC + CD + DA = 30\ cm$
$\Rightarrow 9.5 + y + 9.5 + y = 30$
$\Rightarrow 19 + 2y = 30$
$\Rightarrow 2y = 11$
$\Rightarrow y = \frac{11}{2} = 5.5\ cm$
Hence, AB = DC = 9.5 cm and BC = DA = 5.5 cm

Answer 10:



ABCD is a rhombus and a rhombus is also a parallelogram. A rhombus has four equal sides.

(i) In ΔABC,

$$\angle BAC = \angle BCA = \frac{1}{2}(180 - 110)^\circ = 35^\circ$$

i.e., x = 35^o

Now by Adjacent angles are supplementary we get,

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

As, $\angle C = x + y = 70^\circ$

$\Rightarrow y = 70^\circ - x$

$\Rightarrow y = 70^\circ - 35^\circ = 35^\circ$

Hence, x = 35^o; y = 35^o

(ii) The diagonals of a rhombus are perpendicular bisectors of each other.

So, in ΔAOB, ∠OAB = 40^o, ∠AOB = 90^o and

∠ABO + ∠BOA +∠ OAB = 180

$$\angle ABO = 180^\circ - (40^\circ + 90^\circ) = 50^\circ$$

∴ x = 50^o

In ΔABD, AB = AD

So, $\angle ABD = \angle ADB = 50^\circ$

Hence, x = 50^o; y = 50^o

(iii) $\angle BAC = \angle DCA$ (Alternate interior angles)

i.e., $x = 62^o$

In ΔBOC, $\angle BCO = 62^o$

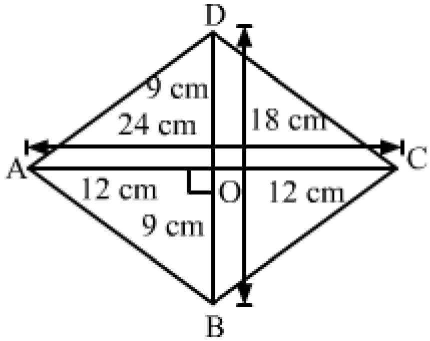
Also, $\angle BOC = 90^o$

$\angle BCO + \angle BOC + \angle OBC = 180$

$\therefore \angle OBC = 180° - (90° + 62°) = 28°$

Hence, $x = 62^o$; $y = 28^o$

Answer 11:



Let PQRS be a rhombus.

$\therefore PQ = QR = RS = SP$

Here, PR and QS are the diagonals of PQRS, where PR = 24 cm and QS = 18 cm.

Let the diagonals intersect each other at M.

$\therefore \Delta PMQ$ is a right angle triangle in which $MP = \frac{AC}{2} = \frac{24}{2} = 12$ cm and $MQ = \frac{QS}{2} = \frac{18}{2} = 9$ cm.

Now, $PQ^2 = MP^2 + MQ^2$ [Pythagoras theorem]

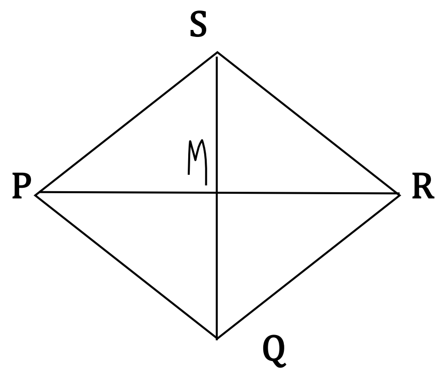
$\Rightarrow PQ^2 = (12)^2 + (9)^2$

$\Rightarrow PQ^2 = 144 + 81 = 225$

$\Rightarrow PQ = 15$ cm

Hence, the side of the rhombus is 15 cm.

Answer 12:



Let PQRS be a rhombus.

∴ PQ = QR = RS = SP = 10 cm

Let PR and QS are the diagonals of PQRS. Let PR = y and QS = 16 cm and M be the intersection point of the diagonals.

∴ ΔPMQ is a right angle triangle, in which

MP = $\frac{PR}{2} = \frac{y}{2}$ and MQ = $\frac{QS}{2} = \frac{16}{2}$ = 8 cm.

Now, $PQ^2 = MP^2 + MQ^2$ [Pythagoras theorem]

$\Rightarrow 10^2 = (\frac{y}{2})^2 + 8^2 \Rightarrow 100 - 64 = \frac{y2}{4} \Rightarrow 36 \times 4 = y^2$

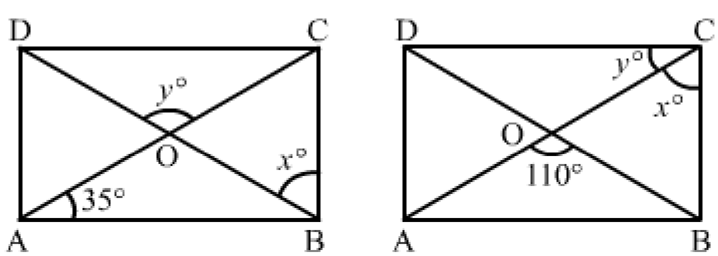
$\Rightarrow y^2 = 144$

∴ y = 12 cm

Hence, the other diagonal of the rhombus is 12 cm.

∴ Area of the rhombus = 12×(12×16) = 96 cm^2

Answer 13:



(i) (ii)

(i) ABCD is a rectangle.
The diagonals of a rectangle are congruent and bisect each other. Therefore, in Δ AOB, as ,
$OA = OB$
$\therefore \angle OAB = \angle OBA = 35^{o}$
$\therefore x = 90^{o} - 35^{o} = 55^{o}$
In ΔAOB

$\angle OAB + \angle OBA + \angle AOB = 180\circ$

And $\angle AOB = 180^{o} - (35^{o} + 35^{o}) = 110^{o}$
$\therefore y = \angle AOB = 110^{o}$ [Vertically opposite angles]
Hence, $x = 55^{o}$ and $y = 110^{o}$

(ii) In ΔAOB, as ,

Given, $\angle AOB = 100\ °$
$OA = OB$
As, $\angle OAB = \angle OBA$

Then, $\angle AOB + \angle OBA + \angle OAB = 180$

$\Rightarrow 2\angle AOB = 180 - \angle AOB$ …………………..($\angle OAB = \angle OBA$)

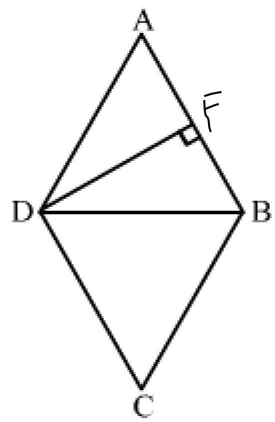
$\Rightarrow 2\angle AOB = 180 - 110 = 70°$

$\Rightarrow \angle AOB = \frac{1}{2} \times 70 = 35°$
so, $\therefore y = \angle BAC = 35^{o}$ [Interior alternate angles]

Here at $\angle C$ is at right angle Δ by fig,

$\Rightarrow 90^{o} = x + y$
$\Rightarrow x = 90^{o} - y$
$\Rightarrow x = 90^{o} - 35^{o} = 55^{o}$
Thus, $x = 55^{o}$ and $y = 35^{o}$

Answer 14:



Given: ABCD is a rhombus, DF is altitude which bisects AB i.e. AF = FB

In ΔAFD and ΔBFD,

DF=DF (Common side)

∠DFA=∠DFB=90° (Given)

AF=FB (Given)

∴ ΔAFD≅ΔBFD (By SAS congruence Criteria)

⇒AD=BD (CPCT)

Also, AD=AB (Sides of rhombus are equal)

⇒AD=AB=BD

Thus, ΔABD is an equilateral triangle.

Therefore, ∠A=60°

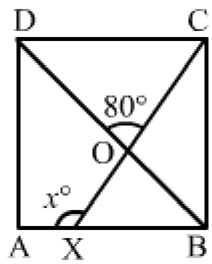
⇒∠C=∠A=60° (Opposite angles of rhombus are equal)

And, ∠ABC+∠BCD=180° (Adjacent angles of rhombus are supplementary.)

⇒∠ABC+60°=180°⇒∠ABC=180°−60°⇒∠ABC=120°⇒∠ADC=∠ABC=120°

Hence, the angles of rhombus are 60°, 120°, 60° and 120°

Answer 15:

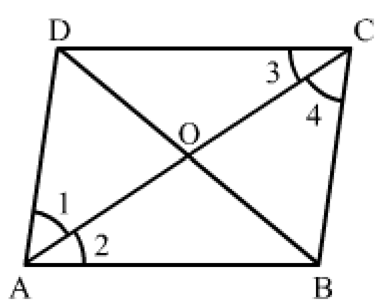


The angles of a square are bisected by the diagonals.

$\angle OBX = \frac{1}{2} \times \angle CBA = \frac{1}{2} \times 90 = 45°$
$\therefore \angle OBX = 45°$
Given, $\angle COD = 80°$

And $\angle BOX = \angle COD = 80°$ [Vertically opposite angles]
$\therefore$ In ΔBOX, as we know that exterior angle is sum of both interior angles.
$\angle AXO = \angle OBX + \angle BOX$
$\Rightarrow \angle AXO = 45° + 80° = 125°$
$\therefore x = 125°$

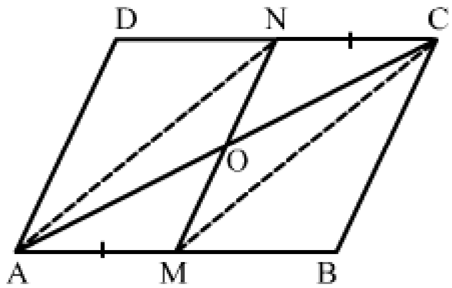
Answer 16:



Given: A rhombus ABCD.
To prove: Diagonal AC bisects ∠A as well as ∠C and diagonal BD bisects ∠B as well as ∠D.
Proof:

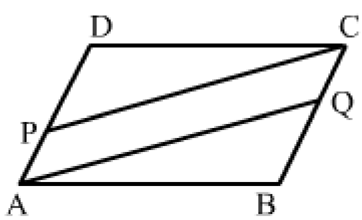
In ΔABC,
$AB = BC$ (Sides of rhombus are equal.)
$\angle ACB = \angle CAB$ (Angles opposite to equal sides are equal.) ...(1)
AD∥BC (Opposite sides of rhombus are parallel.)
AC is transversal.
$\angle DAC = \angle ACB$ (Alternate interior angles) ...(2)
From (1) and (2),
$\angle DAC = \angle CAB$
Thus, AC bisects ∠A.
As, AB∥DC and AC is transversal.
$\angle CAB = \angle DCA$ (Alternate interior angles) ...(3)
From (1) and (3),
$\angle ACB = \angle DCA$
Thus, AC bisects ∠C.
Thus, AC bisects ∠C and ∠A
In ΔDAB,
$AD = AB$ (Sides of rhombus are equal.)
$\angle ADB = \angle ABD$ (Angles opposite to equal sides are equal.) ...(4)
Also,
DC∥AB (Opposite sides of rhombus are parallel.)
BD is transversal.
$\angle CDB = \angle DBA$ (Alternate interior angles) ...(5)
From (4) and (5),
$\angle ADB = \angle CDB$
Therefore, DB bisects ∠D.
As, AD∥BC and BD is transversal.
∠CBD=∠ADB (Alternate interior angles) ...(6)
From (4) and (6)
$\angle CBD = \angle ABD$
Therefore, BD bisects ∠B.
Thus, BD bisects ∠D and ∠B.

Answer 17:



Given: In a parallelogram ABCD, AM = CN.
To prove: AC and MN bisect each other.
Construction: Join AN and MC.
Proof:
As, ABCD is a parallelogram.
$\Rightarrow AB \parallel DC \Rightarrow AM \parallel NC$
And, $AM = CN$ (Given)
Therefore, AMCN is a parallelogram.
As, the diagonals of a parallelogram bisect each other.
Thus, AC and MN also bisect each other.

Answer 18:



As , per by given fig,
$\angle B = \angle D$ [Opposite angles of parallelogram ABCD]
$AD = BC \text{ and } AB = DC$ [Opposite sides of parallelogram ABCD]
Also, AD || BC and AB|| DC

Given, AP = $\frac{1}{3}$AD and CQ = $\frac{1}{3}$BC

So, we get

$\therefore AP = CQ$ [AD = BC]

In ΔDPC and ΔBQA,

$AB = CD, \angle B = \angle D \text{ and } DP = QB$ [DP $= \frac{2}{3}$AD and QB $= \frac{2}{3}$BC]

i.e., $\Delta DPC \cong \Delta BQA$

$\therefore PC = QA$

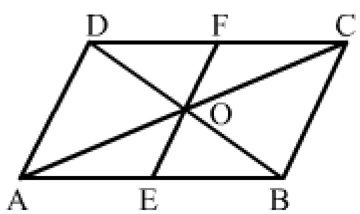
Thus, in quadrilateral AQCP,

$AP = CQ$ ...(i)

$PC = QA$ ...(ii)

∴ AQCP is a parallelogram.

Answer 19:



Given, ABCD is a parallelogram whose diagonals intersect each other at O. A line segment EOF is drawn to meet AB at E and DC at F.

So in ΔODF and ΔOBE,

$OD = OB$ (Diagonals bisects each other)

$\angle DOF = \angle BOE$ (Vertically opposite angles)

$\angle FDO = \angle OBE$ (Alternate interior angles)

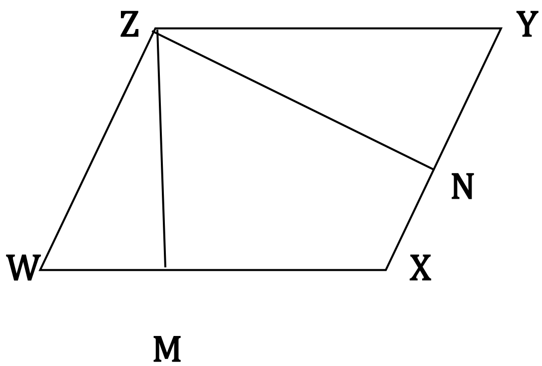
By parallelogram theorem

$\Delta ODF \cong \Delta OBE$

$\therefore OF = OE$

Hence, proved.

Answer 20:



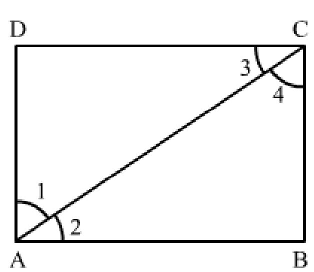
Given: parallelogram WXYZ, ZM⊥ WX, WN ⊥ XY and ∠MZN = 60°
In quadrilateral ZMXN, by angle sum property,

$$\angle MZN + \angle ZMX + \angle X + \angle XNZ = 360°$$

$\Rightarrow 60° + 90° + \angle X + 90° = 360°$

$\Rightarrow \angle X = 360° - 240° \Rightarrow \angle X = 120° \Rightarrow \angle X = 120°$
Also,
$\angle X = \angle Z = 120°$ (Opposite angles of a parallelogram are equal.)
$\angle W + \angle X = 180°$ (Adjacent angles of a parallelogram are supplementary.)
$\Rightarrow \angle W + 120° = 180° \Rightarrow \angle W = 180° - 120° \Rightarrow \angle W = 60°$
Also,
$\angle W = \angle Y = 60°$ (Opposite angles of a parallelogram are equal.)
Thus, the angles of a parallelogram are 60°, 120°, 60° and 120°.

Answer 21:

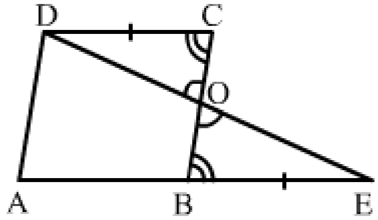


Given: In
rectangle ABCD, AC bisects ∠A, i.e. ∠DAC = ∠CAB and AC bisects ∠C, i.e. ∠DCA = ∠ACB.
To prove:
(i) ABCD is a square,
(ii) diagonal BD bisects ∠B as well as ∠D.
Proof:
(i) Since, AD∥BC (Opposite sides of a rectangle are parallel.)
So, ∠DAC=∠ACB (Alternate interior angles)
But, ∠DAC=∠CAB (Given)

So, ∠CAB = ∠ACB
In ΔABC,
Since, ∠CAB=∠ACB
So, BC=AB (Sides opposite to equal angles are equal.)
But these are adjacent sides of the rectangle ABCD.
Hence, ABCD is a square.

(ii) Since, the diagonals of a square bisects its angles.
So, diagonals BD bisects ∠B as well as ∠D.

Answer 22:



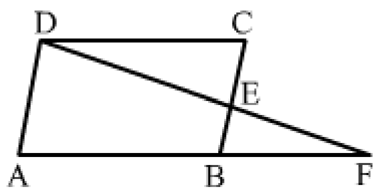
Given, ABCD is parallelogram in which AB is produced to E.

BE = AB (given)

So in ΔODC and ΔOEB, as ,
$DC = BE$ (DC = AB)

$\angle OCD = \angle OBE$ (Alternate interior angles)
$\angle COD = \angle BOE$ (Vertically opposite angles)
by parallelogram theorem we get,
$\therefore \Delta ODC \cong \Delta OEB$
$\Rightarrow OC = OB$
Hence , ED bisects BC.

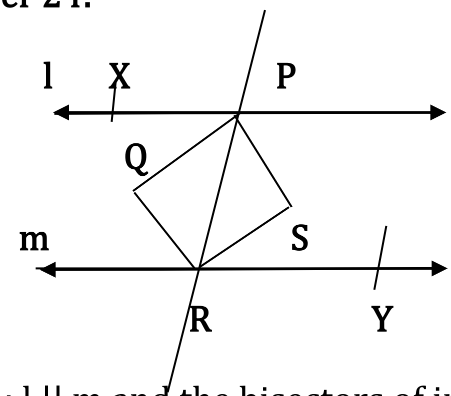
Answer 23:



Given: ABCD is a parallelogram.
BE = CE
DE and AB when produced meet at F.
To prove: AF = 2AB
Proof: In parallelogram ABCD, as ,
$AB \,||\, DC$
$\angle DCE = \angle EBF$ (Alternate interior angles)
In ΔDCE and ΔBFE,
$\angle DCE = \angle EBF$ (Proved above)

$\angle DEC = \angle BEF$ (Vertically opposite angles)
And, $BE = CE$ (Given)
By parallelogram theorem
$\therefore \Delta DCE \cong \Delta BFE$
hence $\therefore DC = BF$
But DC = AB, as ABCD is a parallelogram.
$\therefore DC = AB = BF$ ...(i)
can also be written as , $AF = AB + BF$ ...(ii)
$AF = AB + AB = 2AB$ ………….from(i)
Hence, proved. AF = 2AB.

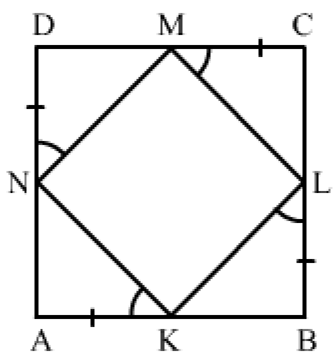
Answer 24:

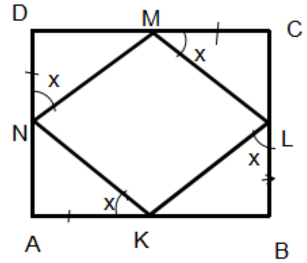


Given: l || m and the bisectors of interior angles intersect at X and Y.
To prove: PQRS is a rectangle.
Proof:
Since, l || m (Given)
So, $\angle XPR = \angle PRY$ (Alternate interior angles)
$\Rightarrow \frac{1}{2}\angle XPR = \frac{1}{2}\angle PRY$
$\Rightarrow \angle QPR = \angle PRS$ but, these are a pair of alternate interior angles for PQ and RS.
$\Rightarrow PQ \parallel SR$
Similarly, $PR \parallel QS$
So, PQRS is a parallelogram.
Also,`
$\angle XPR + \angle RPZ = 180°$ (Linear pair)
$\Rightarrow \frac{1}{2}\angle XPR + \frac{1}{2}\angle PRY = 90° \Rightarrow \angle QPR + \angle RPS = 90° \Rightarrow \angle QPS = 90°$

But, this an angle of the parallelogram PQRS
Hence, PQRS is a rectangle.

Answer 25:



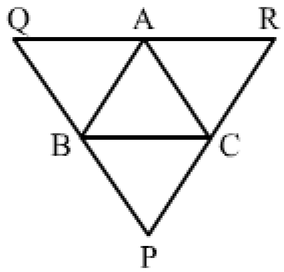


Given: In square ABCD, AK = BL = CM = DN.
To prove: KLMN is a square.
Proof:
In square ABCD,
$AB = BC = CD = DA$ (All sides of a square are equal.)
And, $AK = BL = CM = DN$ (Given)
So, $AB - AK = BC - BL = CD - CM = DA - DN$
$\Rightarrow KB = CL = DM = AN$ ...(1)
In ΔNAK and ΔKBL,
$\angle NAK = \angle KBL = 90°$ (Each angle of a square is a right angle.)
$AK = BL$ (Given)
$AN = KB$ [From (1)]
So, by parallelogram theorem ,
$\Delta NAK \cong \Delta KBL$
$\Rightarrow NK = KL$ (CPCT) ...(2)
Similarly,
$\Delta MDN \cong \Delta NAK\ \Delta DNM \cong CML \Delta MCL \cong LBK$
$\Rightarrow MN = NK\ and\ \angle DNM = \angle KNA$ (CPCT) ...(3)
$MN = JM\ and\ \angle DNM = \angle CML$ (CPCT) ...(4)
$ML = LK\ and\ \angle CML = \angle BLK$ (CPCT) ...(5)

From (2), (3), (4) and (5),
$NK = KL = MN = ML$ ...(6)
And, $\angle DNM = \angle AKN = \angle KLB = LMC$
Now,
In ΔNAK,
$\angle NAK = 90°$
Let ∠AKN = y°
So, $\angle DNK = 90° + y°$
$\Rightarrow \angle DNM + \angle MNK = 90° + y° \Rightarrow y° + \angle MNK = 90° + y° \Rightarrow \angle MNK = 90°$
Similarly,
$\angle NKL = \angle KLM = \angle LMN = 90°$ ...(7)
Using (6) and (7),
All sides of quadrilateral KLMN are equal and all angles are 90°

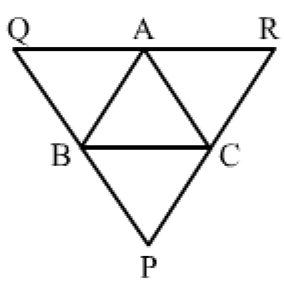
So, KLMN is a square.

Answer 26:



Δ ABC , if lines are drawn through A, B, C parallel respectively to the sides BC, CA and AB. So, we get, BC || QA and CA || QB
i.e., BCQA is a parallelogram.
$\therefore BC = QA$ ...(i)
Similarly, BC || AR and AB || CR.
i.e., BCRA is a parallelogram.
$\therefore BC = AR$ ...(ii)
As $QR = QA + AR$
From (i) and (ii),
$QR = BC + BC$
$\Rightarrow QR = 2BC$
$\therefore$ BC $= \frac{1}{2}$QR

Answer 27:



In ΔABC A, B, C lines drawn, parallel respectively to BC, CA and AB intersecting at P , Q and R. Acc to question,

$Perimeter\ of\ \Delta ABC = AB + BC + CA$ ...(i)
$Perimeter\ of\ \Delta PQR = PQ + QR + PR$ ...(ii)
By given figure,

BC || QA and CA || QB

i.e., BCQA is a parallelogram.

$\therefore BC = QA$ ...(iii)

Similarly, BC || AR and AB || CR

i.e., BCRA is a parallelogram.

$\therefore BC = AR$ ...(iv)

But, $QR = QA + AR$

From (iii) and (iv),

$\Rightarrow QR = BC + BC$

$\Rightarrow QR = 2BC$

$\therefore$ BC $= \frac{1}{2}$QR

Similarly, CA $= \frac{1}{2}$PQ and AB $= \frac{1}{2}$PR

From (i) and (ii),

Perimeter of ΔABC $= \frac{1}{2}QR + \frac{1}{2}PQ + \frac{1}{2}PR$

$= \frac{1}{2}(PR + QR + PQ)$

i.e., Perimeter of ΔABC $= \frac{1}{2}$(Perimeter of ΔPQR)

$\therefore Perimeter\ of\ \Delta PQR = 2 \times Perimeter\ of\ \Delta ABC$