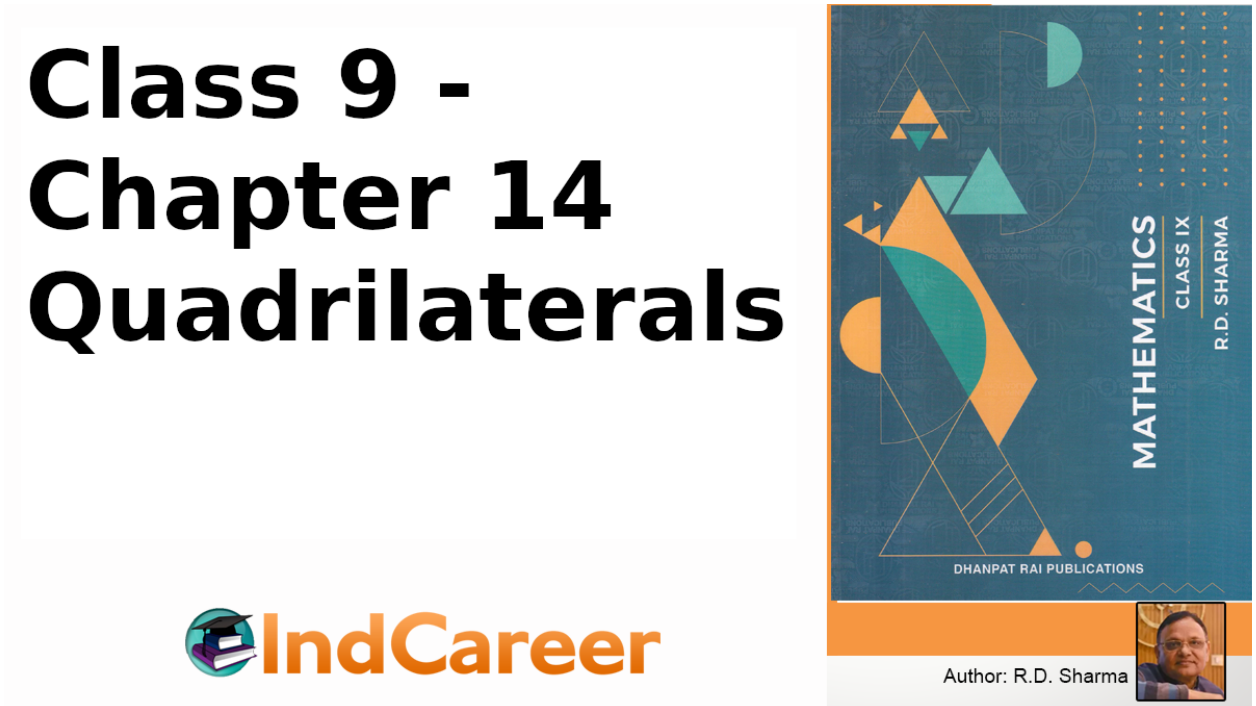

RD Sharma Solutions for Class 9 Maths Chapter 14–Quadrilaterals

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Question 1: Three angles of a quadrilateral are respectively equal to 110^0, 50^0 and 40^0. Find its fourth angle.

Solution:

Three angles of a quadrilateral are 110^0, 50^0 and 40^0

Let the fourth angle be ‘x’

We know, sum of all angles of a quadrilateral = 360^0

$110^0 + 50^0 + 40^0 + x^0 = 360^0$

$\Rightarrow x = 360^0 – 200^0$

$\Rightarrow x = 160^0$

Therefore, the required fourth angle is 160^0.

Question 2: In a quadrilateral ABCD, the angles A, B, C and D are in the ratio of 1:2:4:5. Find the measure of each angles of the quadrilateral.

Solution:

Let the angles of the quadrilaterals are A = x, B = 2x, C = 4x and D = 5x

We know, sum of all angles of a quadrilateral = 360^0

$A + B + C + D = 360^0$

$x + 2x + 4x + 5x = 360^0$

$12x = 360^0$

$x = 360^0/12 = 30^0$

Therefore,

$A = x = 30^0$

$B = 2x = 60^0$

$C = 4x = 120^0$

$D = 5x = 150^0$

Question 3: In a quadrilateral ABCD, CO and DO are the bisectors of ∠C and ∠D respectively. Prove that ∠COD = 1/2 (∠A + ∠B).

Solution:

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In ΔDOC,

$\angle CDO + \angle COD + \angle DCO = 180^0$ [Angle sum property of a triangle]

or $1/2\angle CDA + \angle COD + 1/2\angle DCB = 180^0$

$\angle COD = 180^0 - 1/2(\angle CDA + \angle DCB)$ …..(i)

Also

We know, sum of all angles of a quadrilateral = 360^0

$\angle CDA + \angle DCB = 360^0 - (\angle DAB + \angle CBA)$ ……(ii)

Substituting (ii) in (i)

$\angle COD = 180^0 - 1/2\{360^0 - (\angle DAB + \angle CBA)\}$

We can also write, $\angle DAB = \angle A$ and $\angle CBA = \angle B$

$\angle COD = 180^0 - 180^0 + 1/2(\angle A + \angle B))$

$\angle COD = 1/2(\angle A + \angle B)$

Hence Proved.

Question 4: The angles of a quadrilateral are in the ratio 3:5:9:13. Find all the angles of the quadrilateral.

Solution:

The angles of a quadrilateral are 3x, 5x, 9x and 13x respectively.

We know, sum of all interior angles of a quadrilateral = 360^0

Therefore, $3x + 5x + 9x + 13x = 360^0$

$30x = 360^0$

or $x = 12^0$

Hence, angles measures are

$3x = 3(12) = 36^0$

$5x = 5(12) = 60^0$

$9x = 9(12) = 108^0$

$13x = 13(12) = 156^0$

Exercise 14.2

Question 1: Two opposite angles of a parallelogram are $(3x – 2)^0$ and $(50 – x)^0$. Find the measure of each angle of the parallelogram.

Solution:

Given**:** Two opposite angles of a parallelogram are $(3x – 2)^0$ and $(50 – x)^0$.

We know, opposite sides of a parallelogram are equal.

$(3x – 2)^0 = (50 – x)^0$

$3x + x = 50 + 2$

$4x = 52$

$x = 13$

Angle x is 13^0

Therefore,

$(3x-2)^0 = (3(13) – 2) = 37^0$

$(50-x)^0 = (50 – 13) = 37^0$

Adjacent angles of a parallelogram are supplementary.

$x + 37 = 180^0$

$x = 180^0 - 37^0 = 143^0$

Therefore, required angles are : 37^0, 143^0, 37^0 and 143^0.

Question 2: If an angle of a parallelogram is two-third of its adjacent angle, find the angles of the parallelogram.

Solution:

Let the measure of the angle be x. Therefore, measure of the adjacent angle is 2x/3.

We know, adjacent angle of a parallelogram is supplementary.

$x + 2x/3 = 180^0$

$3x + 2x = 540^0$

$5x = 540^0$

or $x = 108^0$

Measure of second angle is $2x/3 = 2(108^0)/3 = 72^0$

Similarly measure of 3rd and 4th angles are 108^0 and 72^0

Hence, four angles are 108^0, 72^0, 108^0, 72^0

Question 3: Find the measure of all the angles of a parallelogram, if one angle is 24^0 less than twice the smallest angle.

Solution:

Given: One angle of a parallelogram is 24^0 less than twice the smallest angle.

Let x be the smallest angle, then

$x + 2x – 24^0 = 180^0$

$3x – 24^0 = 180^0$

$3x = 108^0 + 24^0$

$3x = 204^0$

$x = 204^0/3 = 68^0$

So, $x = 68^0$

Another angle $= 2x – 24^0 = 2(68^0) – 24^0 = 112^0$

Hence, four angles are 68^0, 112^0, 68^0, 112^0.

Question 4: The perimeter of a parallelogram is 22cm. If the longer side measures 6.5cm what is the measure of the shorter side?

Solution:

Let x be the shorter side of a parallelogram.

Perimeter = 22 cm

Longer side = 6.5 cm

Perimeter = Sum of all sides = x + 6.5 + 6.5 + x

22 = 2 (x + 6.5)

11 = x + 6.5

or x = 11 – 6.5 = 4.5

Therefore, shorter side of a parallelogram is 4.5 cm

Exercise 14.3

Question 1: In a parallelogram ABCD, determine the sum of angles ∠C and ∠D.

Solution:

In a parallelogram ABCD , ∠C and ∠D are consecutive interior angles on the same side of the transversal CD.

So, $\angle C + \angle D = 180^0$

Question 2: In a parallelogram ABCD, if ∠B = 135^0, determine the measures of its other angles.

Solution:

Given: In a parallelogram ABCD, if $\angle B = 135^0$

Here, $\angle A = \angle C$, $\angle B = \angle D$ and $\angle A + \angle B = 180^0$

$\angle A + 135^0 = 180^0$

$\angle A = 45^0$

Answer:

$\angle A = \angle C = 45^0$

$\angle B = \angle D = 135^0$

Question 3: ABCD is a square. AC and BD intersect at O. State the measure of ∠AOB.

Solution:

We know, diagonals of a square bisect each other at right angle.

So, $\angle AOB = 90^0$

Question 4: ABCD is a rectangle with ∠ABD = 40^0. Determine ∠DBC.

Solution:

Each angle of a rectangle = 90°

So, $\angle ABC = 90^0$

$\angle ABD = 40^0$ (given)

Now, $\angle ABD + \angle DBC = 90^0$

$40^0 + \angle DBC = 90^0$

or $\angle DBC = 50^0$.

Exercise 14.4

Question 1: In a ΔABC, D, E and F are, respectively, the mid points of BC, CA and AB. If the lengths of sides AB, BC and CA are 7 cm, 8 cm and 9 cm, respectively, find the perimeter of ΔDEF.

Solution:

Given: AB = 7 cm, BC = 8 cm, AC = 9 cm

In ΔABC,

In a ΔABC, D, E and F are, respectively, the mid points of BC, CA and AB.

According to Midpoint Theorem:

EF = 1/2BC, DF = 1/2 AC and DE = 1/2 AB

Now, Perimeter of ΔDEF = DE + EF + DF

= 1/2 (AB + BC + AC)

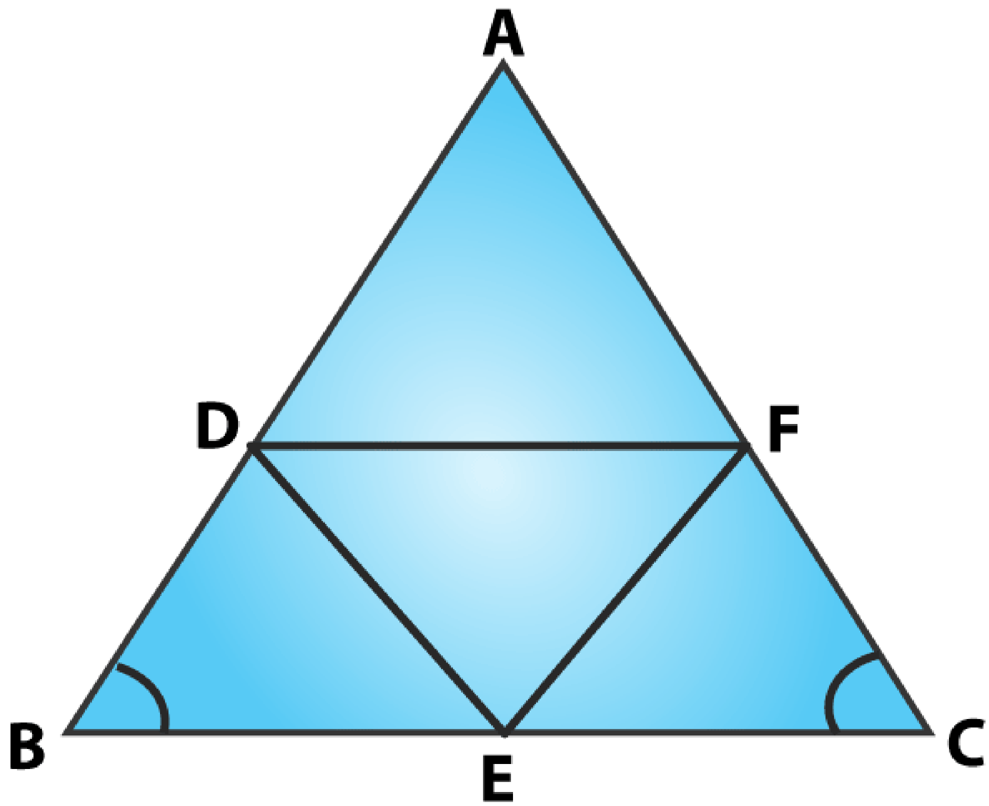
= 1/2 (7 + 8 + 9)

= 12

Perimeter of ΔDEF = 12cm

Question 2: In a ΔABC, $\angle A = 50^0$, $\angle B = 60^0$ and $\angle C = 70^0$. Find the measures of the angles of the triangle formed by joining the mid-points of the sides of this triangle.

Solution:



In ΔABC,

D, E and F are mid points of AB,BC and AC respectively.

In a Quadrilateral DECF:

By Mid-point theorem,

DE // AC ⇒ DE = AC/2

And CF = AC/2

⇒ DE = CF

Therefore, DECF is a parallelogram.

∠C = ∠D = 70^0[Opposite sides of a parallelogram]

Similarly,

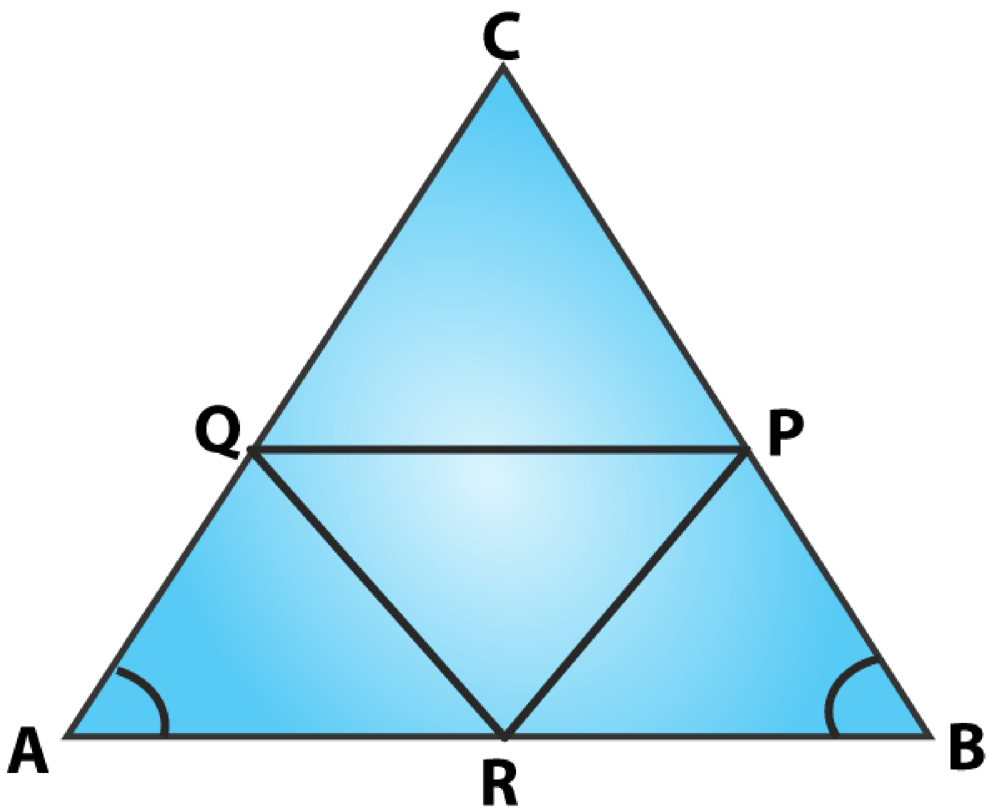
ADEF is a parallelogram, $\angle A = \angle E = 50^0$

BEFD is a parallelogram, $\angle B = \angle F = 60^0$

Hence, Angles of ΔDEF are: $\angle D = 70^0$, $\angle E = 50^0$, $\angle F = 60^0$.

Question 3: In a triangle, P, Q and R are the mid points of sides BC, CA and AB respectively. If AC = 21 cm, BC = 29 cm and AB = 30 cm, find the perimeter of the quadrilateral ARPQ.

Solution:



In ΔABC,

R and P are mid points of AB and BC

By Mid-point Theorem

RP // AC ⇒ RP = AC/2

In a quadrilateral, ARPQ

RP // AQ ⇒ RP = AQ[A pair of side is parallel and equal]

Therefore, ARPQ is a parallelogram.

Now, AR = AB/2 = 30/2 = 15 cm[AB = 30 cm (Given)]

AR = QP = 15 cm[Opposite sides are equal]

And RP = AC/2 = 21/2 = 10.5 cm[AC = 21 cm (Given)]

RP = AQ = 10.5cm[Opposite sides are equal]

Now,

Perimeter of ARPQ = AR + QP + RP +AQ

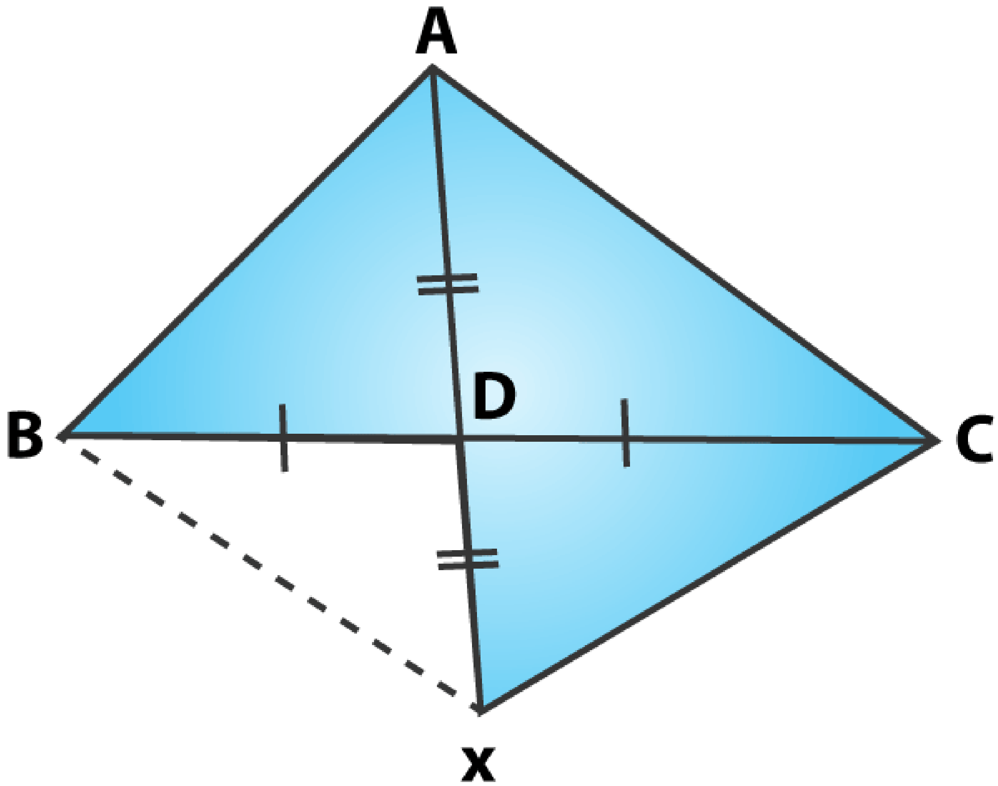
= 15 +15 +10.5 +10.5

= 51

Perimeter of quadrilateral ARPQ is 51 cm.

Question 4: In a ΔABC median AD is produced to X such that AD = DX. Prove that ABXC is a parallelogram.

Solution:



In a quadrilateral ABXC,

AD = DX [Given]

BD = DC [Given]

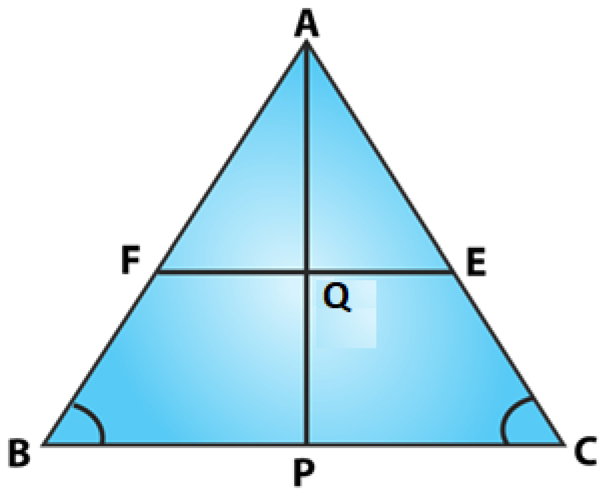
From figure, Diagonals AX and BC bisect each other.

ABXC is a parallelogram.

Hence Proved.

Question 5: In a ΔABC, E and F are the mid-points of AC and AB respectively. The altitude AP to BC intersects FE at Q. Prove that AQ = QP.

Solution:



In a ΔABC

E and F are mid points of AC and AB (Given)

EF ∥ BC ⇒ EF = BC/2 and[By mid-point theorem]

In ΔABP

F is the mid-point of AB, again by mid-point theorem

FQ ∥ BP

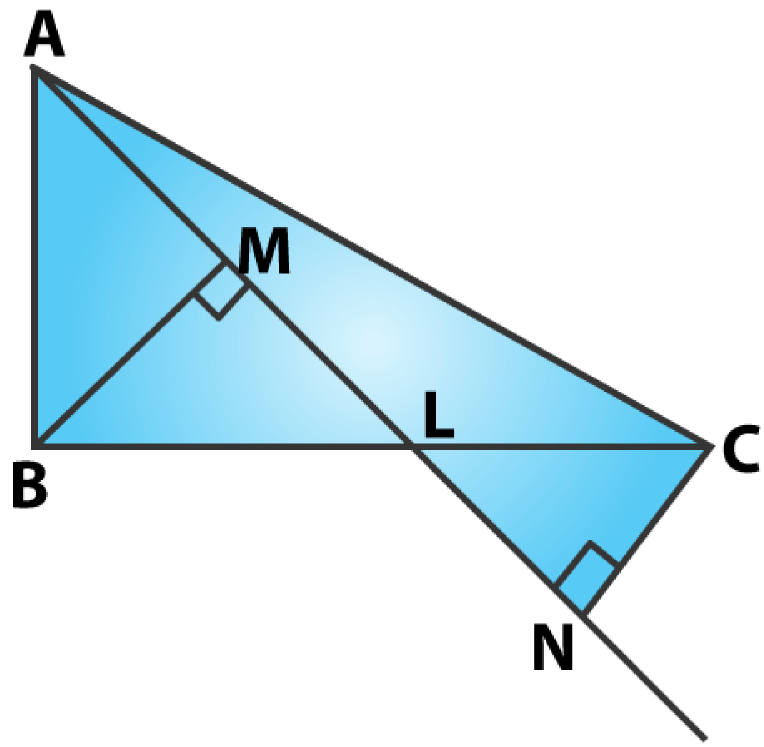
Q is the mid-point of AP

AQ = QP

Hence Proved.

Question 6: In a ΔABC, BM and CN are perpendiculars from B and C respectively on any line passing through A. If L is the mid-point of BC, prove that ML = NL.

Solution:



Given that,

In ΔBLM and ΔCLN

∠BML = ∠CNL = 90^0

BL = CL [L is the mid-point of BC]

∠MLB = ∠NLC [Vertically opposite angle]

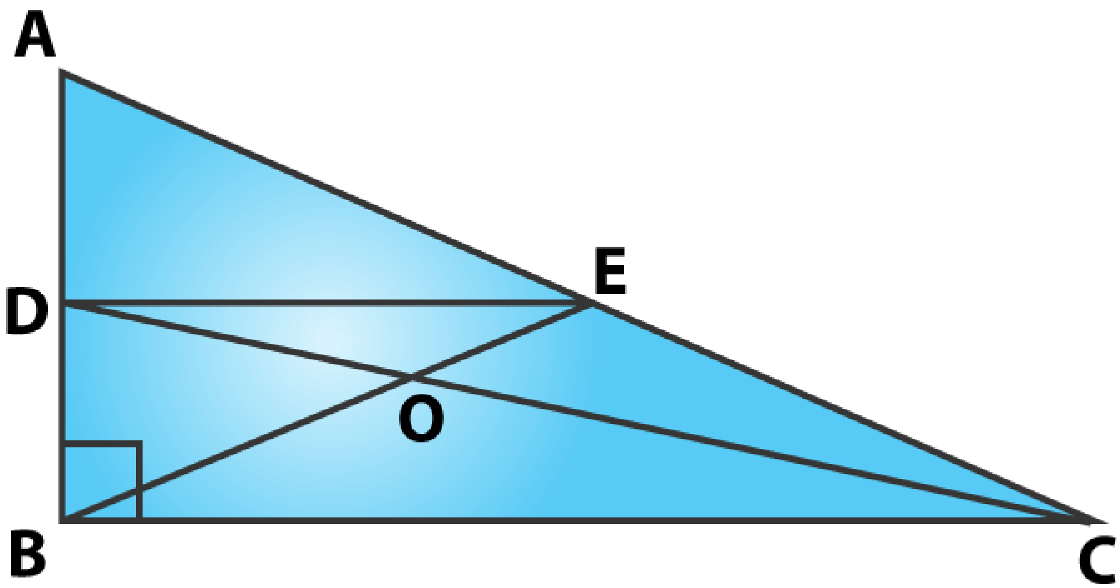
By ASA criterion:

ΔBLM ≅ ΔCLN

So, LM = LN [By CPCT]

Question 7: In figure, triangle ABC is a right-angled triangle at B. Given that AB = 9 cm, AC = 15 cm and D, E are the mid-points of the sides AB and AC respectively, calculate

(i) The length of BC (ii) The area of ΔADE.



Solution:

In ΔABC,

$\angle B = 90^0$ (Given)

AB = 9 cm, AC = 15 cm (Given)

By using Pythagoras theorem

$AC^2 = AB^2 + BC^2$

$\Rightarrow 15^2 = 9^2 + BC^2$

$\Rightarrow BC^2 = 225 – 81 = 144$

or BC = 12

Again,

AD = DB = AB/2 = 9/2 = 4.5 cm [D is the mid−point of AB

D and E are mid-points of AB and AC

DE // BC ⇒ DE = BC/2 [By mid−point theorem]

Now,

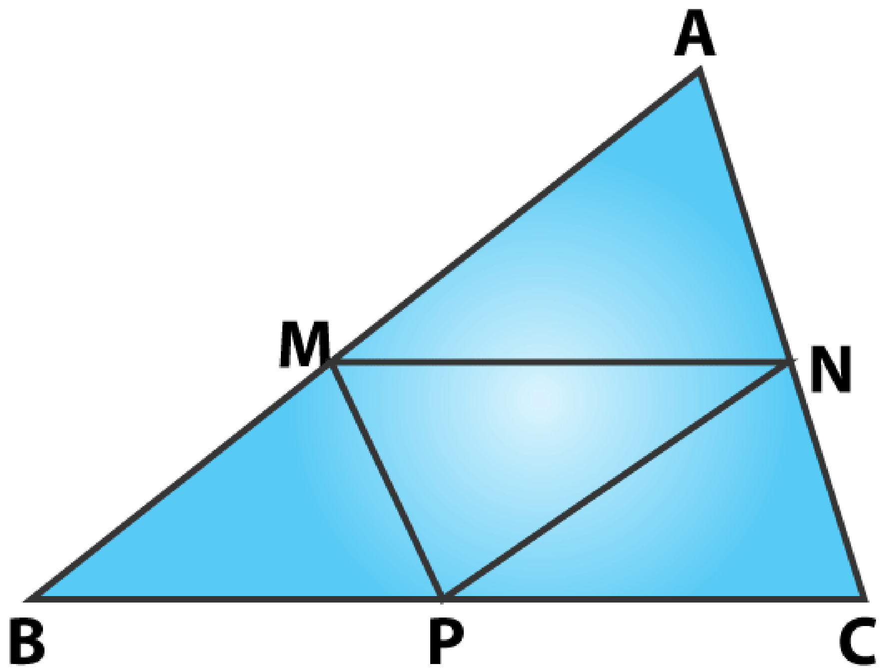
Area of ΔADE = 1/2 x AD x DE

= 1/2 x 4.5 x 6

=13.5

Area of ΔADE is 13.5 cm^2

Question 8: In figure, M, N and P are mid-points of AB, AC and BC respectively. If MN = 3 cm, NP = 3.5 cm and MP = 2.5 cm, calculate BC, AB and AC.



Solution:

Given: MN = 3 cm, NP = 3.5 cm and MP = 2.5 cm.

M and N are mid-points of AB and AC

By mid−point theorem, we have

MN // BC ⇒ MN = BC/2

or BC = 2MN

BC = 6 cm[MN = 3 cm given)

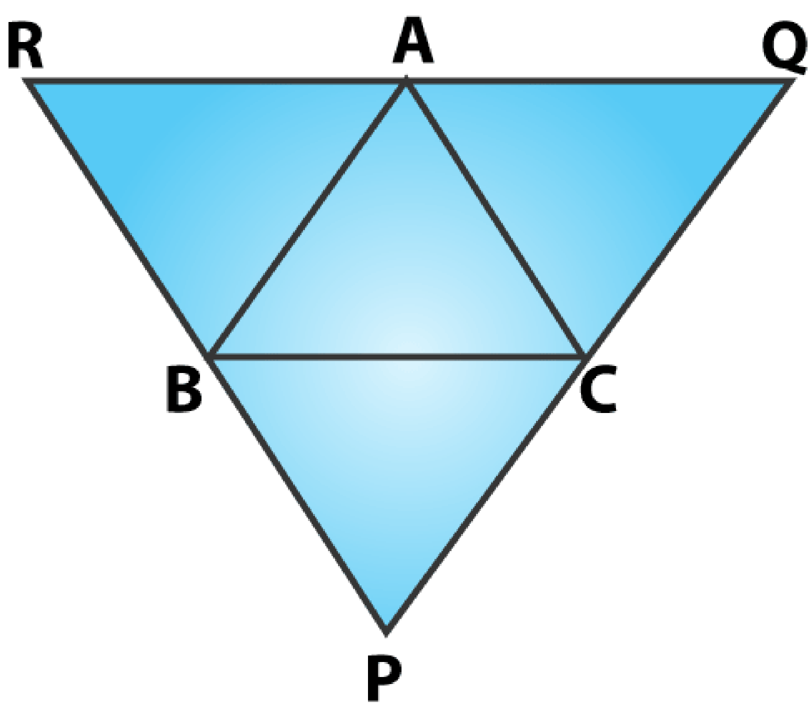
Similarly,

AC = 2MP = 2 (2.5) = 5 cm

AB = 2 NP = 2 (3.5) = 7 cm

Question 9: ABC is a triangle and through A, B, C lines are drawn parallel to BC, CA and AB respectively intersecting at P, Q and R. Prove that the perimeter of ΔPQR is double the perimeter of ΔABC.

Solution:



ABCQ and ARBC are parallelograms.

Therefore, BC = AQ and BC = AR

⇒AQ = AR

⇒A is the mid-point of QR

Similarly B and C are the mid points of PR and PQ respectively.

By mid−point theorem, we have

AB = PQ/2, BC = QR/2 and CA = PR/2

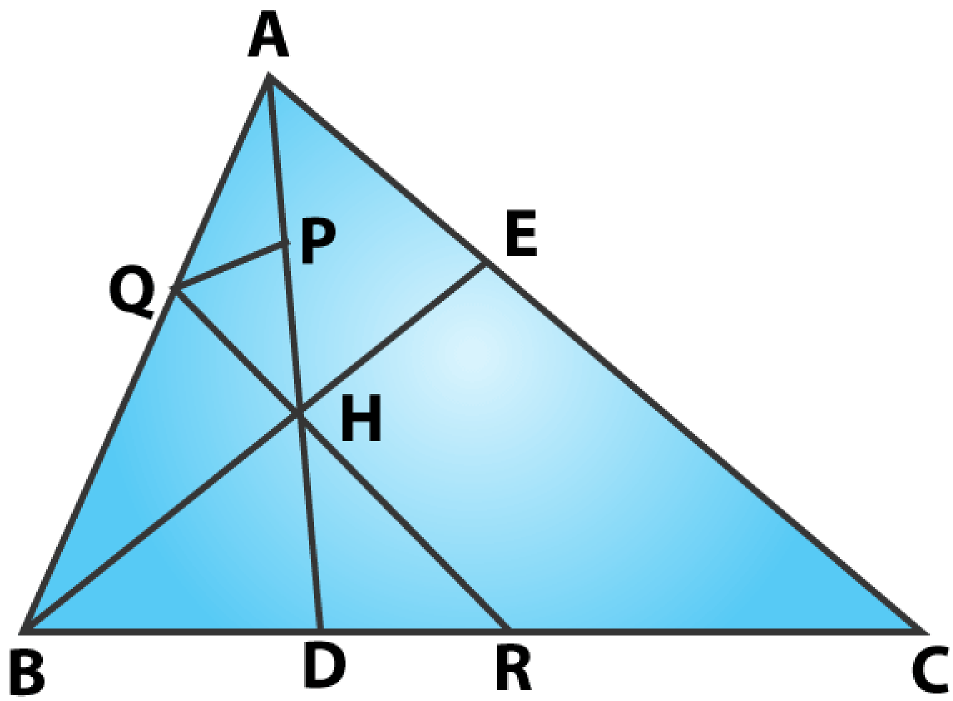
or PQ = 2AB, QR = 2BC and PR = 2CA

⇒PQ + QR + RP = 2 (AB + BC + CA)

⇒ Perimeter of ΔPQR = 2 (Perimeter of ΔABC)

Hence proved.

Question 10: In figure, BE ⊥ AC, AD is any line from A to BC intersecting BE in H. P, Q and R are respectively the mid-points of AH, AB and BC. Prove that ∠PQR = 90^0.



Solution:

BE$\perp$AC and P, Q and R are respectively mid-point of AH, AB and BC. (Given)

In ΔABC, Q and R are mid-points of AB and BC respectively.

By Mid-point theorem:

QR // AC …..(i)

In ΔABH, Q and P are the mid-points of AB and AH respectively

QP // BH ….(ii)

But, BE$\perp$AC

From (i) and (ii) we have,

QP$\perp$QR

$\Rightarrow \angle PQR = 90^0$

Hence Proved.

Exercise VSAQs

Question 1: In a parallelogram ABCD, write the sum of angles A and B.

Solution:

In parallelogram ABCD, Adjacent angles of a parallelogram are supplementary.

Therefore, $\angle A + \angle B = 180^0$

Question 2: In a parallelogram ABCD, if $\angle D = 115^0$, then write the measure of $\angle A$.

Solution:

In a parallelogram ABCD,

$\angle D = 115^0$ (Given)

Since, $\angle A$ and $\angle D$ are adjacent angles of parallelogram.

We know, Adjacent angles of a parallelogram are supplementary.

$\angle A + \angle D = 180^0$

$\angle A = 180^0 – 115^0 = 65^0$

Measure of $\angle A$ is 65^0.

Question 3: PQRS is a square such that PR and SQ intersect at O. State the measure of $\angle POQ$.

Solution:

PQRS is a square such that PR and SQ intersect at O. (Given)

We know, diagonals of a square bisects each other at 90 degrees.

So, $\angle POQ = 90^0$

Question 4: In a quadrilateral ABCD, bisectors of angles A and B intersect at O such that ∠AOB = 75°, then write the value of ∠C + ∠D.

Solution:

∠AOB = 75° (given)

In a quadrilateral ABCD, bisectors of angles A and B intersect at O, then

∠AOB = 1/2 (∠ADC + ∠ABC)

or ∠AOB = 1/2 (∠D + ∠C)

By substituting given values, we get

75° = 1/2 (∠D + ∠C)

or ∠C + ∠D = 150°

Question 5: The diagonals of a rectangle ABCD meet at O. If ∠BOC = 44°, find ∠OAD.

Solution:

ABCD is a rectangle and ∠BOC = 44° (given)

∠AOD = ∠BOC (vertically opposite angles)

∠AOD = ∠BOC = 44°

∠OAD = ∠ODA (Angles facing same side)

and OD = OA

Since sum of all the angles of a triangle is 180°, then

So, ∠OAD = 1/2 (180° – 44°) = 68°

Question 6: If PQRS is a square, then write the measure of ∠SRP.

Solution:

PQRS is a square.

⇒ All side are equal, and each angle is 90° degrees and diagonals bisect the angles.

So, ∠SRP = 1/2 (90°) = 45°

Question 7: If ABCD is a rectangle with ∠BAC = 32°, find the measure of ∠DBC.

Solution:

ABCD is a rectangle and ∠BAC=32° (given)

We know, diagonals of a rectangle bisects each other.

AO = BO

∠DBA = ∠BAC = 32° (Angles facing same side)

Each angle of a rectangle = 90 degrees

So, ∠DBC + ∠DBA = 90°

or ∠DBC + 32° = 90°

or ∠DBC = 58°

Question 8: If ABCD is a rhombus with ∠ABC = 56°, find the measure of ∠ACD.

Solution:

In a rhombus ABCD,

<ABC = 56°

So, <BCD = 2 (<ACD) (Diagonals of a rhombus bisect the interior angles)

or <ACD = 1/2 (<BCD) …..(1)

We know, consecutive angles of a rhombus are supplementary.

∠BCD + ∠ABC = 180°

∠BCD = 180° – 56° = 124°

Equation (1) ⇒ <ACD = 1/2 x 124° = 62°

Question 9: The perimeter of a parallelogram is 22 cm. If the longer side measure 6.5 cm, what is the measure of shorter side?

Solution:

Perimeter of a parallelogram = 22 cm. (Given)

Longer side = 6.5 cm

Let x be the shorter side.

Perimeter = $2x + 2\times6.5$

$22 = 2x + 13$

$2x = 22 – 13 = 9$

or $x = 4.5$

Measure of shorter side is 4.5 cm.

Question 10: If the angles of a quadrilateral are in the ratio 3:5:9:13, then find the measure of the smallest angle.

Solution:

Angles of a quadrilateral are in the ratio 3 : 5 : 9 : 13 (Given)

Let the sides are 3x, 5x, 9x, 13x

We know, sum of all the angles of a quadrilateral = 360°

$3x + 5x + 9x + 13x = 360°$

$30 x = 360°$

$x = 12°$

Measure of smallest angle = $3x = 3(12) = 36°$.

Chapterwise RD Sharma Solutions for Class 9 Maths :

About RD Sharma

RD Sharma i*sn't the kind of author you'd bump into at lit fests. But his bestselling books have helped many* CBSE *students lose their dread of* maths. *Sunday Times profiles the tutor turned internet star*

He dreams of algorithms that would give most people nightmares. And, spends every waking hour thinking of ways to explain concepts like 'series solution of linear differential equations'. Meet Dr Ravi Dutt Sharma — mathematics teacher and author of 25 reference books — whose name evokes as much awe as the subject he teaches. And though students have used his thick tomes for the last 31 years to ace the dreaded maths exam, it's only recently that a spoof video turned the tutor into a YouTube star.

R D Sharma had a good laugh but said he shared little with his on-screen persona except for the love for maths. "I like to spend all my time thinking and writing about maths problems. I find it relaxing," he says. When he is not writing books explaining mathematical concepts for classes 6 to 12 and engineering students, Sharma is busy dispensing his duty as vice-principal and head of department of science and humanities at Delhi government's Guru Nanak Dev Institute of Technology.