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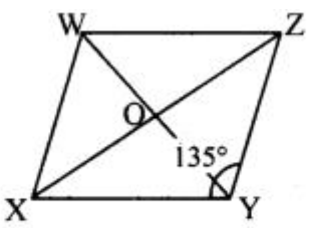
Practice Set 5.1 Geometry 9th Std Maths Part 2 Answers Chapter 5 Quadrilaterals

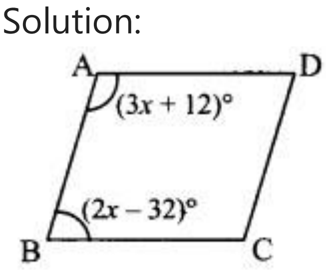
Question 1.
Diagonals of a parallelogram WXYZ intersect each other at point O. If ∠XYZ∠ = 135°, then measure of ∠XWZ and ∠YZW? If l(OY) = 5 cm, then l(WY) = ?
Solution:



i. ∠XYZ = 135°
□WXYZ is a parallelogram.
∠XWZ = ∠XYZ
∴ ∠XWZ = 135° …..(i)

ii. ∠YZW + ∠XYZ = 180° [Adjacent angles of a parallelogram are supplementary]
∴ ∠YZW + 135°= 180° [From (i)]
∴ ∠YZW = 180°- 135°
∴ ∠YZW = 45°

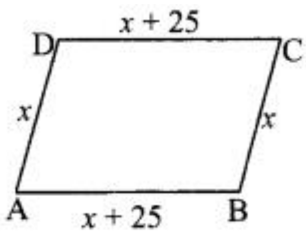
iii. l(OY) = 5 cm [Given]
l(OY) = 12 l(WY) [Diagonals of a parallelogram bisect each other]
∴ l(WY) = 2 x l(OY)
= 2 x 5
∴ l(WY) = 10 cm
∴∠XWZ = 135°, ∠YZW = 45°, l(WY) = 10 cm
Question 2.
In a parallelogram ABCD, if ∠A = (3x + 12)°, ∠B = (2x – 32)°, then liptl the value of x and the measures of ∠C and ∠D.
Solution:



□ABCD is a parallelogram. [Given]
∴ ∠A + ∠B = 180° [Adjacent angles of a parallelogram are supplementary],
∴ (3x + 12)° + (2x-32)° = 180°
∴ 3x + 12 + 2x – 32 = 180
∴ 5x – 20 = 180
∴ 5x= 180 + 20
∴ 5x = 200
∴ x = 2005
∴ x = 40
ii. ∠A = (3x + 12)°
= [3(40) + 12]°
=(120 +12)°= 132°
∠B = (2x – 32)°
= [2(40) – 32]°
= (80 – 32)° = 48°

∴ ∠C = ∠A = 132°
∠D = ∠B = 48° [Opposite angles of a parallelogram]
∴ The value of x is 40, and the measures of ∠C and ∠D are 132° and 48° respectively.

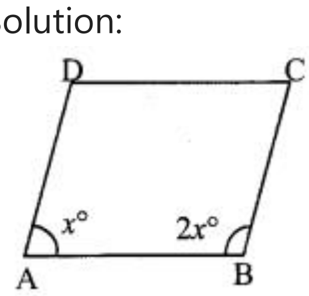
Question 3.
Perimeter of a parallelogram is 150 cm. One of its sides is greater than the other side by 25 cm. Find the lengths of all sides.
Solution:



i. Let □ABCD be the parallelogram and the length of AD be x cm.
One side is greater than the other by 25 cm.
∴ AB = x + 25 cm
AD = BC = x cm
AB = DC = (x + 25) cm [Opposite angles of a parallelogram]

ii. Perimeter of □ABCD = 150 cm [Given]
∴ AB + BC + DC + AD = 150
∴ (x + 25) +x + (x + 25) + x – 150
∴ 4x + 50 = 150
∴ 4x = 150 – 50
∴ 4x = 100
∴ x = 1004
∴ x = 25
iii. AD = BC = x = 25 cm
AB = DC = x + 25 = 25 + 25 = 50 cm
∴ The lengths of the sides of the parallelogram are 25 cm, 50 cm, 25 cm and 50 cm.

Question 4.
If the ratio of measures of two adjacent angles of a parallelogram is 1 : 2, find the measures of all angles of the parallelogram.
Solution:



i. Let □ABCD be the parallelogram.
The ratio of measures of two adjacent angles of a parallelogram is 1 : 2.
Let the common multiple be x.
∴ ∠A = x° and ∠B = 2x°
∠A + ∠B = 180° [Adjacent angles of a parallelogram are supplementary]
∴ x + 2x = 180
∴ 3x = 180
∴ x = 1803
∴ x = 60
ii. ∠A = x° = 60°
∠B = 2x° = 2 x 60° = 120°
∠A = ∠C = 60°
∠B = ∠D= 120° [Opposite angles of a parallelogram]
∴ The measures of the angles of the parallelogram are 60°, 120°, 60° and 120°.

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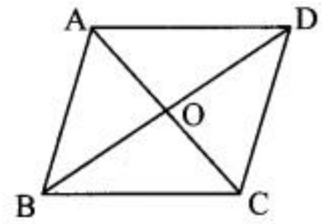
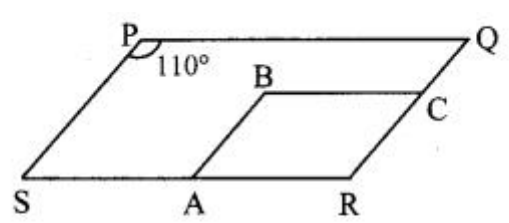
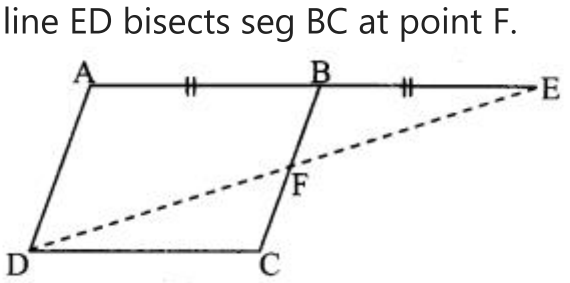
Question 5.
Diagonals of a parallelogram intersect each other at point O. If AO = 5, BO show that □ABCD is a rhombus.


Given: AO = 5, BO = 12 and AB = 13.
To prove: □ABCD is a rhombus.
Solition:
Proof:
AO = 5, BO = 12, AB = 13 [Given]
$AO^2 + BO^2 = 5^2 + 12^2$
= 25 + 144
∴ $AO^2 + BO^2 = 169$ .....(i)
$AB^2 = 13^2 = 169$ ....(ii)
∴ $AB^2 = AO^2 + BO^2$ [From (i) and (ii)]
∴ ΔAOB is a right-angled triangle. [Converse of Pythagoras theorem]
∴ ∠AOB = 90°
∴ seg AC ⊥ seg BD .....(iii) [A-O-C]
∴ In parallelogram ABCD,
∴ seg AC ⊥ seg BD [From (iii)]
∴ □ABCD is a rhombus. [A parallelogram is a rhombus perpendicular to each other]

Question 6.
In the adjoining figure, □PQRS and □ABCR are two parallelograms. If ∠P = 110°, then find the measures of all the angles of □ABCR.
Solution:


□PQRS is a parallelogram. [Given]
∴ ∠R = ∠P [Opposite angles of a parallelogram]
∴ ∠R = 110° .....(iii)
□ABCR is a parallelogram. [Given]
∴ ∠A + ∠R= 180° [Adjacent angles of a parallelogram are supplementary]
∴ ∠A+ 110°= 180° [From (i)]
∴ ∠A= 180°- 110°
∴ ∠A = 70°
∴ ∠C = ∠A = 70°
∴ ∠B = ∠R= 110° [Opposite angles of a parallelogram]
∴ ∠A = 70°, ∠B = 110°,
∴ ∠C = 70°, ∠R = 110°

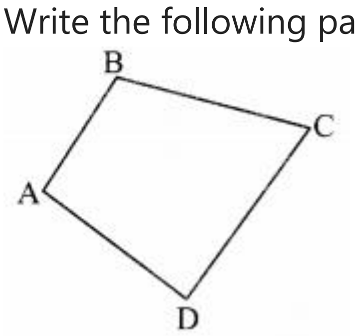
Question 7.
In the adjoining figure, □ABCD is a parallelogram. Point E is on the ray AB such that BE = AB, then prove that line ED bisects seg BC at point F.


Given: □ABCD is a parallelogram.

BE = AB
To prove: Line ED bisects seg BC at point F i.e. FC = FB
Solution:
Proof:
□ABCD is a parallelogram. [Given]
∴ seg AB ≅ seg DC …….(i) [Opposite angles of a parallelogram]
seg AB ≅ seg BE ……..(ii) [Given]
seg DC ≅ seg BE ……..(iii) [From (i) and (ii)]
side DC || side AB [Opposite sides of a parallelogram]
i.e. side DC || seg AE and seg DE is their transversal. [A-B-E]
∴ ∠CDE ≅ ∠AED
∴ ∠CDF ≅ ∠BEF …..(iv) [D-F-E, A-B-E]
In ΔDFC and ΔEFB,
seg DC = seg EB [From (iii)]
∠CDF ≅ ∠BEF [From (iv)]
∠DFC ≅ ∠EFB [Vertically opposite angles]
∴ ΔDFC ≅ ΔEFB [SAA test]
∴ FC ≅ FB [c.s.c.t]
∴ Line ED bisects seg BC at point F.

Maharashtra Board Class 9 Maths Chapter 5 Quadrilaterals Practice Set 5.1 Intext Questions and Activities

Question 1.
Write the following pairs considering □ABCD. (Textbook pg. no 57)



Pairs of adjacent sides:
i. AB, AD
ii. AD, DC
iii. DC, BC
iv. BC, AB

Pairs of adjacent angles:
i. ∠A, ∠B
ii. ∠C, ∠D
iii. ∠B, ∠C
iv. ∠D, ∠A

Pairs of opposite sides:
i. AB, DC
ii. AD, BC

Pairs of opposite angles:
i. ∠A, ∠C
ii. ∠B, ∠D

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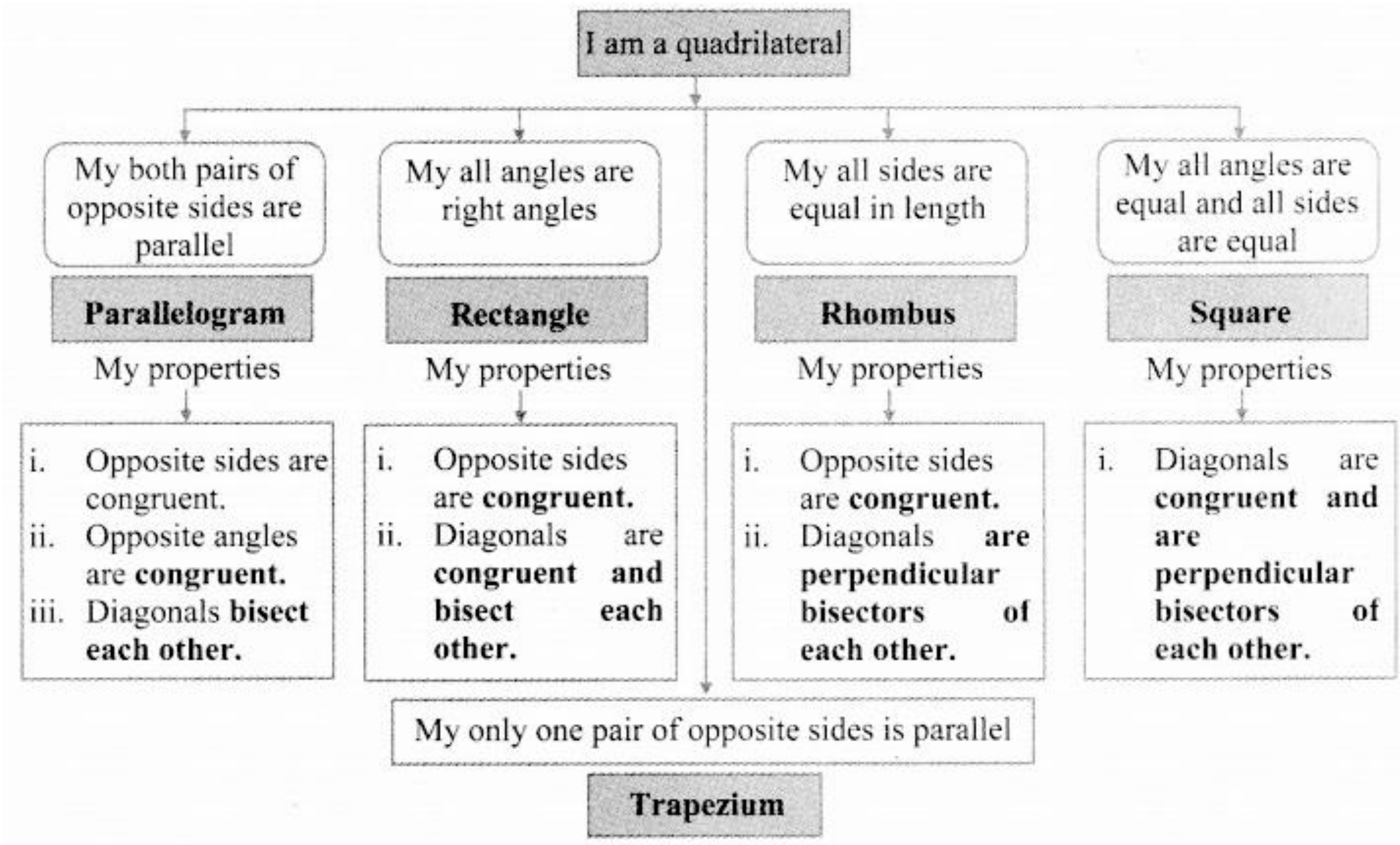
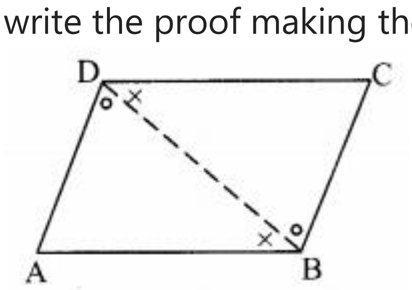
Question 2.

Complete the following tree diagram. (Textbook pg. no 57)



Question 3.

In the above theorem, to prove ∠DAB ≅ ∠BCD, is any change in the construction needed? If so, how will you write the proof making the change? (Textbook pg. no. 60)



Solution:

Yes

Construction: Draw diagonal BD.

Proof:

side AB || side CD and diagonal BD is their transversal. [Given]

∴ ∠ABD ≅ ∠CDB ....(i) [Alternate angles]

side BC || side AD and diagonal BD is their transversal. [Given]

∴ ∠ADB ≅ ∠CBD ....(ii) [Alternate angles]

In ΔDAB and ΔBCD,

∠ABD ≅ ∠CDB [From (i)]

seg BD ≅ seg DB [Common side]

∴ ∠ADB ≅ ∠CBD [From (ii)]

∴ ΔDAB ≅ ΔBCD [ASA test]

∴ ∠DAB ≅ ∠BCD [c.a.c.t.]

Note: ∠DAB s ∠BCD can be proved using the same construction as in the above theorem.

∠BAC ≅ ∠DCA .....(i)

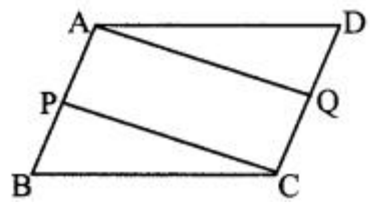
∠DAC ≅ ∠BCA ......(ii)

∴ ∠BAC + ∠DAC ≅ ∠DCA + ∠BCA [Adding (i) and (ii)]

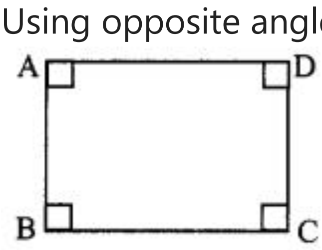
∴ ∠DAB ≅ ∠BCD [Angle addition property]

Practice Set 5.2 Geometry 9th Std Maths Part 2 Answers Chapter 5 Quadrilaterals

Question 1.
In the adjoining figure, □ABCD is a parallelogram, P and Q are midpoints of sides AB and DC respectively, then prove □APCQ is a parallelogram.

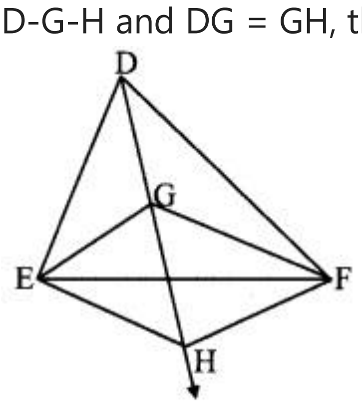


Given: □ABCD is a parallelogram. P and Q are the midpoints of sides AB and DC respectively.
To prove: □APCQ is a parallelogram.
Solution:
Proof:
AP = 12 AB .....(i) [P is the midpoint of side AB]
QC = 12 DC ....(ii) [Q is the midpoint of side CD]
□ABCD is a parallelogram. [Given]
∴ AB = DC [Opposite sides of a parallelogram]
∴ 12 AB = 12 DC [Multiplying both sides by 12]
∴ AP = QC ....(iii) [From (i) and (ii)]
Also, AB || DC [Opposite angles of a parallelogram]
i.e. AP || QC ....(iv) [A – P – B, D – Q – C]
From (iii) and (iv),
□APCQ is a parallelogram. [A quadrilateral is a parallelogram if its opposite sides is parallel and congruent]
Question 2.
Using opposite angles test for parallelogram, prove that every rectangle is a parallelogram.

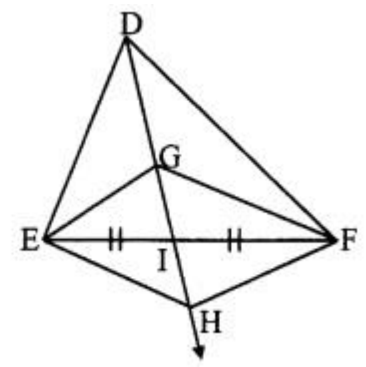


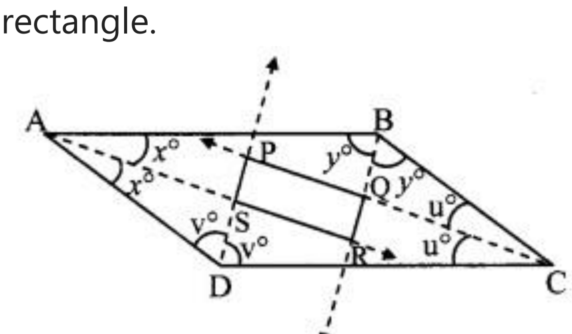
Given:
□ABCD is a rectangle.
To prove: Rectangle ABCD is a parallelogram.
Solution:
Proof:
□ABCD is a rectangle.
∴ ∠A ≅ ∠C = 90° [Given]
∠B ≅ ∠D = 90° [Angles of a rectangle]
∴ Rectangle ABCD is a parallelogram. [A quadrilateral is a parallelogram, if pairs of its opposite angles are congruent]

Question 3.
In the adjoining figure, G is the point of concurrence of medians of ADEF. Take point H on ray DG such that D-G-H and DG = GH, then prove that □GEHF is a parallelogram.



Given: Point G (centroid) is the point of concurrence of the medians of ADEF.

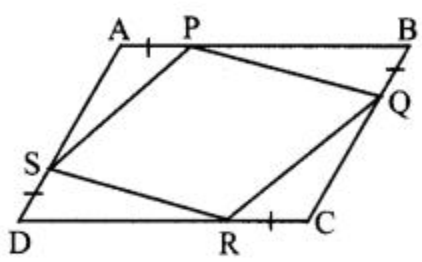
DG = GH
To prove: □GEHF is a parallelogram.
Solution:
Proof:


Let ray DH intersect seg EF at point I such that E-I-F.
∴ seg DI is the median of ΔDEF.
∴ EI = FI ……(i)
Point G is the centroid of ΔDEF.
∴ DGGI = 21 [Centroid divides each median in the ratio 2:1]
∴ DG = 2(GI)
∴ GH = 2(GI) [DG = GH]
∴ GI + HI = 2(GI) [G-I-H]
∴ HI = 2(GI) – GI
∴ HI = GI ….(ii)
From (i) and (ii),
□GEHF is a parallelogram [A quadrilateral is a parallelogram, if its diagonals bisect each other]
Question 4.
Prove that quadrilateral formed by the intersection of angle bisectors of all angles of a parallelogram is a rectangle.


Given: □ABCD is a parallelogram.
Rays AS, BQ, CQ and DS bisect ∠A, ∠B, ∠C and ∠D respectively.
To prove: □PQRS is a rectangle.
Solution:
Proof:
∠BAS = ∠DAS = x° …(i) [ray AS bisects ∠A]
∠ABQ = ∠CBQ =y° ….(ii) [ray BQ bisects ∠B]
∠BCQ = ∠DCQ = u° …..(iii) [ray CQ bisects ∠C]
∠ADS = ∠CDS = v° ….(iv) [ray DS bisects ∠D]
□ABCD is a parallelogram. [Given]
∴ ∠A + ∠B = 180° [Adjacent angles of a parallelogram are supplementary]
∴ ∠BAS + ∠DAS + ∠ABQ + ∠CBQ = 180° [Angle addition property]
∴ x°+x°+ v° + v° = 180 [From (i) and (ii)]
∴ 2x° + 2v° =180
∴ x + y = 90° ……(v) [Dividing both sides by 2]
Also, ∠A + ∠D= 180° [Adjacent angles of a parallelogram are supplementary]
∴ ∠BAS + ∠DAS + ADS + ∠CDS = 180° [Angle addition property]
∴ x° + x° + v° + v° = 180°
∴ 2x° + 2v° = 180°
∴ x° + v° = 90° …..(vi) [Dividing both sides by 2]
In ΔARB,

∠RAB + ∠RBA + ∠ARB = 180° [Sum of the measures of the angles of a triangle is 180°]
∴ x° + y° + ∠SRQ = 180° [A – S – R, B – Q – R]
∴ 90° + ∠SRQ = 180° [From (v)]
∴ ∠SRQ = 180°- 90° = 90° .....(vi)
Similarly, we can prove
∠SPQ = 90° ...(viii)
In ΔASD,
∠ASD + ∠SAD + ∠SDA = 180° [Sum of the measures of angles a triangle is 180°]
∴ ∠ASD + x° + v° = 180° [From (vi)]
∴ ∠ASD + 90° = 180°
∴∠ASD = 180°- 90° = 90°
∴ ∠PSR = ∠ASD [Vertically opposite angles]
∴ ∠PSR = 90° .....(ix)
Similarly we can prove
∠PQR = 90° ..(x)
∴ In □PQRS,
∠SRQ = ∠SPQ = ∠PSR = ∠PQR = 90° [From (vii), (viii), (ix), (x)]
∴ □PQRS is a rectangle. [Each angle is of measure 90°]

Question 5.
In the adjoining figure, if points P, Q, R, S are on the sides of parallelogram such that AP = BQ = CR = DS, then prove that □PQRS is a parallelogram.



Given: □ABCD is a parallelogram.
AP = BQ = CR = DS
To prove: □PQRS is a parallelogram.
Solution:
Proof:
□ABCD is a parallelogram. [Given]
∴ ∠B = ∠D ....(i) [Opposite angles of a parallelogram]
Also, AB = CD [Opposite sides of a parallelogram]
∴ AP + BP = DR + CR [A-P-B, D-R-C]
∴ AP + BP = DR + AP [AP = CR]
∴ BP = DR ....(ii)
In APBQ and ARDS,
seg BP ≅ seg DR [From (ii)]
∠PBQ ≅ ∠RDS [From (i)]
seg BQ ≅ seg DS [Given]
∴ ΔPBQ ≅ ΔRDS [SAS test]
∴ seg PQ ≅ seg RS .....(iii) [c.s.c.t]
Similarly, we can prove that
ΔPAS ≅ ΔRCQ
∴ seg PS ≅ seg RQ ....(iv) [c.s.c.t]
From (iii) and (iv),
□PQRS is a parallelogram. [A quadrilateral is a parallelogram, if pairs of its opposite angles are congruent]

Maharashtra Board Class 9 Maths Chapter 5 Quadrilaterals Practice Set 5.2 Intext Questions and Activities

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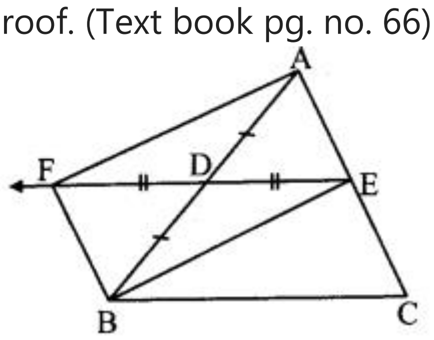
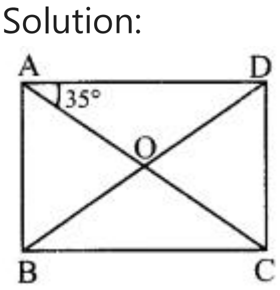
Question 1.
Points D and E are the midpoints of side AB and side AC of ΔABC respectively. Point F is on ray ED such that ED = DF. Prove that □AFBE is a parallelogram. For this example write 'given' and 'to prove' and complete the proof. (Text book pg. no. 66)



Given: D and E are the midpoints of side AB and side AC respectively.
ED = DF
To prove: □AFBE is a parallelogram.
Solution:
Proof:
seg AB and seg EF are the diagonals of □AFBE.
seg AD ≅ seg DB [Given]
seg DE ≅ seg DF [Given]
∴ Diagonals of □AFBE bisect each other.
∴ □AFBE is a parallelogram. [By test of parallelogram]

Practice Set 5.3 Geometry 9th Std Maths Part 2 Answers Chapter 5 Quadrilaterals

Question 1.
Diagonals of a rectangle ABCD intersect at point O. If AC = 8 cm, then find BO and if ∠CAD = 35°, then find ∠ACB.
Solution:



i. AC = 8 cm ...(i) [Given]
□ABCD is a rectangle [Given]
∴ BD = AC [Diagonals of a rectangle are congruent]
∴ BD = 8 cm [From (i)]
BO = 12 BD [Diagonals of a rectangle bisect each other]
∴ BO = 12 x 8
∴ BO = 4 cm
ii. side AD || side BC and seg AC is their transversal. [Opposite sides of a rectangle are parallel]
∴ ∠ACB = ∠CAD [Alternate angles]
∠ACB = 35° [∵∠CAD = 35°]
∴ BO = 4 cm, ∠ACB = 35°

Question 2.
In a rhombus PQRS, if PQ = 7.5 cm, then find QR. If ∠QPS 75°, then find the measures of ∠PQR and ∠SRQ.
Solution:

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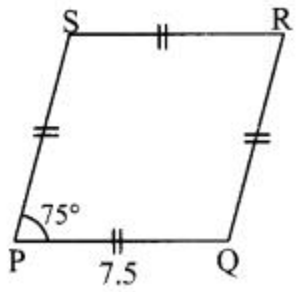
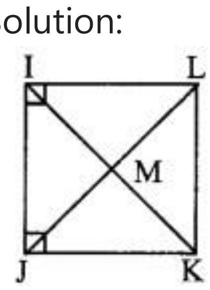


i. PQ = 7.5 cm [Given]
□PQRS is a rhombus. [Given]
∴ QR = PQ [Sides of a rhombus are congruent]
∴ QR = 7.5 cm

ii. ∠QPS = 75° [Given]
∠QPS + ∠PQR = 180° [Adjacent angles of a rhombus are supplementary]
∴ 75° + ∠PQR = 180°
∴ ∠PQR = 180° – 75°
∴ ∠PQR =105°

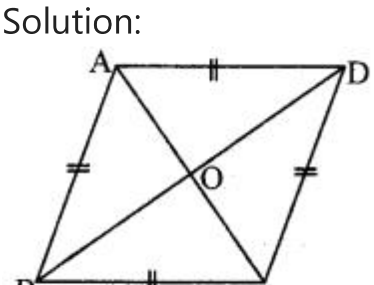
iii. ∠SRQ = ∠QPS [Opposite angles of a rhombus]
∴ ∠SRQ = 75°
∴ QR = 7.5 cm, ∠PQR = 105°,
∠SRQ = 75°

Question 3.
Diagonals of a square IJKL intersects at point M. Find the measures of ∠IMJ, ∠JIK and ∠LJK.
Solution:



□IJKL is a square. [Given]
∴ seg IK ⊥ seg JL [Diagonals of a square are perpendicular to each other]
∠ IMJ=90°
∠ JIL 90° .... (i) [Angle of a square]

ii. ∠JIK = 12∠JIL [Diagonals of a square bisect the opposite angles]
∠JIK = 12 (90°) [From (i)
∴ ∠JIK = 45°
∠IJK = 90° (ii) [Angle of a square]
iii. ∠LJK = 12∠IJK [Diagonals of a square bisect the opposite angles]
∠LJK = 12 (90°) [From (ii)]
∴ ∠LJK = 45°
∴ ∠LJK = 90°, ∠JIK = 45°, ∠LJK=45°
Question 4.
Diagonals of a rhombus are 20 cm and 21 cm respectively, then find the side of rhombus and its Perimeter.
Solution:



i. Let □ABCD be the rhombus.

AC = 20 cm, BD = 21 cm

$AO = \frac{1}{2} AC$ [Diagonals of a rhombus bisect each other]

$= \frac{1}{2} \times 20 = 10$ cm (i)

Also, $BO = \frac{1}{2} BD$ [Diagonals of a rhombus bisect each other]

$= \frac{1}{2} \times 21 = \frac{21}{2}$ cm (ii)

ii. In ΔAOB, ∠AOB = 90° [Diagonals of a rhombus are prependicular to each other]
∴ $AB^2 = AO^2 + BO^2$ [Pythagoras theorem]

$= (10)^2 + \left(\frac{21}{2}\right)^2$ [From (i) and (ii)]

$= 100 + \frac{441}{4}$

$= \frac{400 + 441}{4}$

∴ $AB^2 = \frac{841}{4}$

∴ $AB = \sqrt{\frac{841}{4}}$ [Taking square root of both sides]

$= \frac{29}{2} = 14.5$ cm

iii. Perimeter of □ABCD
= 4 x AB = 4 x 14.5 = 58 cm
∴ The side and perimeter of the rhombus are 14.5 cm and 58 cm respectively.

Question 5.
State with reasons whether the following statements are ‘true' or ‘false'.
i. Every parallelogram is a rhombus.
ii. Every rhombus is a rectangle,
iii. Every rectangle is a parallelogram.
iv. Every square is a rectangle,
v. Every square is a rhombus.
vi. Every parallelogram is a rectangle.
Answer:
i. False.
All the sides of a rhombus are congruent, while the opposite sides of a parallelogram are congruent.
ii. False.
All the angles of a rectangle are congruent, while the opposite angles of a rhombus are congruent.
iii. True.
The opposite sides of a parallelogram are parallel and congruent. Also, its opposite angles are congruent.
The opposite sides of a rectangle are parallel and congruent. Also, all its angles are congruent.
iv. True.
The opposite sides of a rectangle are parallel and congruent. Also, all its angles are congruent.
All the sides of a square are parallel and congruent. Also, all its angles are congruent.
v. True.
All the sides of a rhombus are congruent. Also, its diagonals are perpendicular bisectors of each other.
All the sides of a square are congruent. Also, its diagonals are perpendicular bisectors of each other.
vi. False.
All the angles of a rectangle are congruent, while the opposite angles of a parallelogram are congruent.

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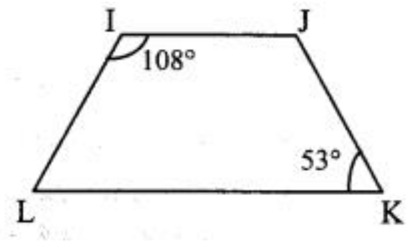
Digvijay
Arjun

Practice Set 5.4 Geometry 9th Std Maths Part 2 Answers Chapter 5 Quadrilaterals

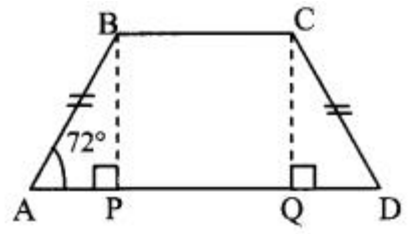
Question 1.
In □IJKL, side IJ || side KL, ∠I = 108° and ∠K = 53°, then find the measures of ∠J and ∠L.
Solution:



i. ∠I = 108° [Given]
side IJ || side KL and side IL is their transveral. [Given]
∴ ∠I + ∠L = 180° [Interior angles]
∴ 108° + ∠L = 180°
∴ ∠L = 180° – 108° = 72°

ii. ∠K = 53° [Given]
side IJ || side KL and side JK is their transveral. [Given]
∴ ∠J + ∠K = 180° [Interior angles]
∴ ∠J + 53° = 180°
∴ ∠J= 180°- 53° = 127°
∴ ∠L = 72°, ∠J = 127°

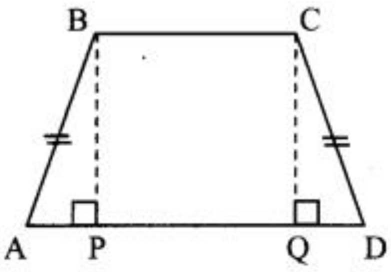
Question 2.
In □ABCD, side BC || side AD, side AB ≅ side DC. If ∠A = 72°, then find the measures of ∠B and ∠D.
Construction: Draw seg BP ⊥ side AD, A – P – D, seg CQ ⊥ side AD, A – Q – D.
Solution:



i. ∠A = 72° [Given]
In □ABCD, side BC || side AD and side AB is their transversal. [Given]
∴ ∠A + ∠B = 180° [Interior angles]
∴ 72° +∠B = 180°
∴ ∠B = 180° – 72° = 108°

ii. In ΔBPA and ΔCQD,
∠BPA ≅ ∠CQD [Each angle is of measure 90°]
Hypotenuse AB ≅ Hypotenuse DC [Given]
seg BP ≅ seg CQ [Perpendicular distance between two parallel lines]
∴ ΔBPA ≅ ΔCQD [Hypotenuse side test]
∴ ∠BAP ≅ ∠CDQ [c. a. c. t.]
∴ ∠A = ∠D
∴ ∠D = 72°
∴ ∠B = 108°, ∠D = 72°

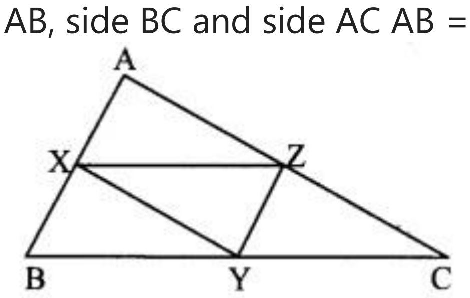
Question 3.
In □ABCD, side BC < side AD, side BC || side AD and if side BA ≅ side CD, then prove that ∠ABC = ∠DCB.



Given: side BC < side AD, side BC || side AD, side BA = side CD
To prove: ∠ABC ≅ ∠DCB
Construction: Draw seg BP ⊥ side AD, A – P – D
seg CQ ⊥ side AD, A – Q – D
Solution:
Proof:
In ΔBPA and ΔCQD,
∠BPA ≅ ∠CQB [Each angle is of measure 90°]
Hypotenuse BA ≅ Hypotenuse CD [Given]
seg BP ≅ seg CQ [Perpendicular distance between two parallel lines]
∴ ΔBPA ≅ ΔCQD [Hypotenuse side test]
∴ ∠BAP ≅ ∠CDQ [c. a. c. t.]
∴ ∠A = ∠D ….(i)
Now, side BC || side AD and side AB is their transversal. [Given]
∴ ∠A + ∠B = 180°…..(ii) [Interior angles]
Also, side BC || side AD and side CD is their transversal. [Given]
∴ ∠C + ∠D = 180° …..(iii) [Interior angles]
∴ ∠A + ∠B = ∠C + ∠D [From (ii) and (iii)]
∴ ∠A + ∠B = ∠C + ∠A [From (i)]
∴ ∠B = ∠C
∴ ∠ABC ≅ ∠DCB

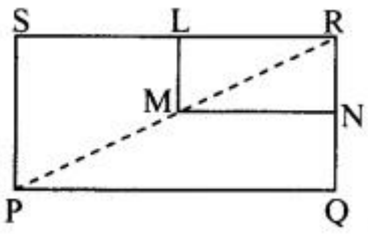
Practice Set 5.5 Geometry 9th Std Maths Part 2 Answers Chapter 5 Quadrilaterals

Question 1.
In the adjoining figure, points X, Y, Z are the midpoints of of ΔABC respectively, cm. Find the lengths of side AB, side BC and side AC AB = 5 cm, AC = 9 cm and BC = 11c.m. Find the lengths of XY, YZ, XZ.

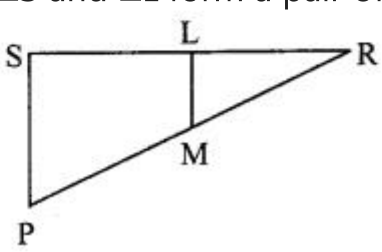


Solution:
i. AC = 9 cm [Given]
Points X and Y are the midpoints of sides AB and BC respectively. [Given]
∴ XY = 12 AC [Midpoint tfyeprem]
= 12 x 9 = 4.5 cm
ii. AB = 5 cm [Given]
Points Y and Z are the midpoints of sides BC and AC respectively. [Given]
∴ YZ = 12 AB [Midpoint theorem]
= 12 x 5 = 2.5 cm
iii. BC = 11 cm [Given]
Points X and Z are the midpoints of sides AB and AC respectively. [Given]
∴ XZ = 12 BC [Midpoint theorem]
= 12 x 11 = 5.5 cm
l(XY) = 4.5 cm, l(YZ) = 2.5 cm, l(XZ) = 5.5 cm

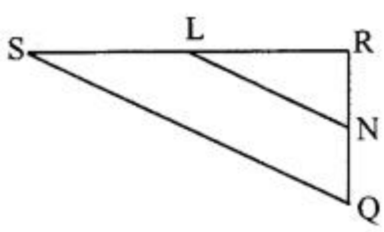
Question 2.
In the adjoining figure, □PQRS and □MNRL are rectangles. If point M is the midpoint of side PR, then prove that,
i. SL = LR
ii. LN = 12 SQ.



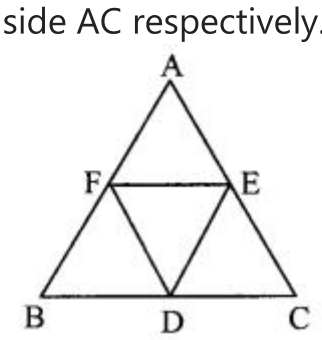
Given: □PQRS and □MNRL are rectangles. M is the midpoint of side PR.
Solution:
Toprove:
i. SL = LR
ii. LN = 12 (SQ)
Proof:
i. □PQRS and □MNRL are rectangles. [Given]
∴ ∠S = ∠L = 90° [Angles of rectangles]
∠S and ∠L form a pair of corresponding angles on sides SP and LM when SR is their transversal.



∴eg ML || seg PS …(i) [Corresponding angles test]
In ∆PRS,
Point M is the midpoint of PR and seg ML || seg PS. [Given] [From (i)]
∴ Point L is the midpoint of seg SR. ……(ii) [Converse of midpoint theorem]
∴ SL = LR
ii. Similarly for ∆PRQ, we can prove that,

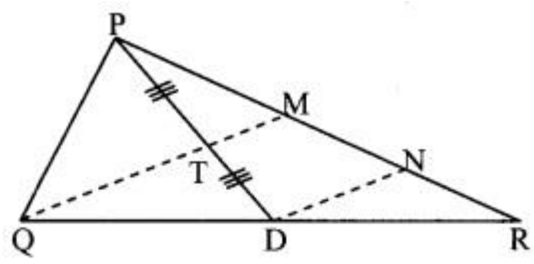


Point N is the midpoint of seg QR. ….(iii)
In ∆RSQ,
Points L and N are the midpoints of seg SR and seg QR respectively. [From (ii) and (iii)]
∴ LN = 12SQ [Midpoint theorem]
Question 3.
In the adjoining figure, ∆ABC is an equilateral triangle. Points F, D and E are midpoints of side AB, side BC, side AC respectively. Show that ∆FED is an equilateral triangle.

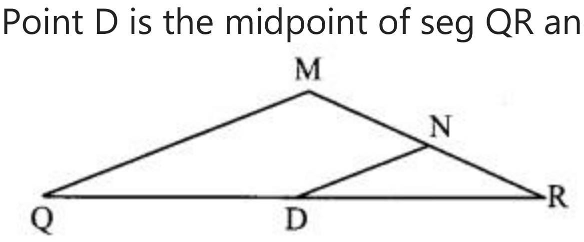


Given: ∆ABC is an equilateral triangle.
Points F, D and E are midpoints of side AB, side BC, side AC respectively.
To prove: ∆FED is an equilateral triangle.
Solution:
Proof:
∆ABC is an equilateral triangle. [Given]
∴ AB = BC = AC ….(i) [Sides of an equilateral triangle]
Points F, D and E are midpoints of side AB and BC respectively.

∴ FD = 12AC …..(ii) [Midpoint theorem]
Points D and E are the midpoints of sides BC and AC respectively.
∴ DE = 12AB …..(iii) [Midpoint theorem]
Points F and E are the midpoints of sides AB and AC respectively.
∴ FE = 12BC
∴ FD = DE = FE [From (i), (ii), (iii) and (iv)]
∴ ΔFED is an equilateral triangle.
Question 4.
In the adjoining figure, seg PD is a median of ΔPQR. Point T is the midpoint of seg PD. Produced QT intersects PR at M. Show that PMPR = 13. [Hint: Draw DN || QM]



Solution:
Given: seg PD is a median of ΔPQR. Point T is the midpoint of seg PD.
To Prove: PMPR = 13
Construction: Draw seg DN ||seg QM such that P-M-N and M-N-R.
Proof:
In ΔPDN,
Point T is the midpoint of seg PD and seg TM || seg DN [Given]
∴ Point M is the midpoint of seg PN. [Construction and Q-T-M]
∴ PM = MN [Converse of midpoint theorem]
In ΔQMR,
Point D is the midpoint of seg QR and seg DN || seg QM [Construction]



∴ Point N is the midpoint of seg MR. [Converse of midpoint theorem]
∴ RN = MN …..(ii)
∴ PM = MN = RN …..(iii) [From (i) and (ii)]
Now, PR = PM + MN + RN [P-M-R-Q-T-M]
∴ PR = PM + PM + PM [From (iii)]
∴ PR = 3PM
PMPR = 13

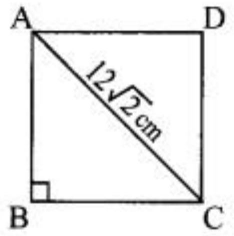
Problem Set 5 Geometry 9th Std Maths Part 2 Answers Chapter 5 Quadrilaterals

Question 1.
Choose the correct alternative answer and fill in the blanks.

i. If all pairs of adjacent sides of a quadrilateral are congruent, then it is called _____.
(A) rectangle
(B) parallelogram
(C) trapezium
(D) rhombus
Answer:
(D) rhombus

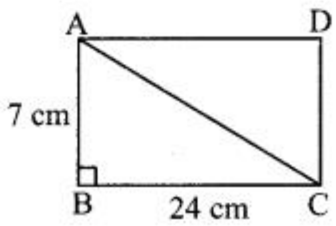
ii. If the diagonal of a square is 22√2 cm, then the perimeter of square is _____.
(A) 24 cm
(B) 24√2 cm
(C) 48 cm
(D) 48√2 cm
Answer:

In ΔABC,
$AC^2 = AB^2 + BC^2$



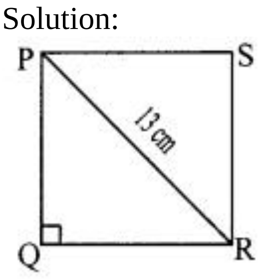
∴ $(12^2 \sqrt{2})^2 = AB^2 + AB^2$
∴ AB2=122×22=122
∴ AB = 12 cm
∴ Perimeter of □ABCD = 4 x 12 = 48 cm
(C) 48 cm
iii. If opposite angles of a rhombus are (2x)° and (3x – 40)°, then the value of x is ____.
(A) 100°
(B) 80°
(C) 160°
(D) 40°
Answer:
2x = 3x – 40 … [Pythagoras theorem]
∴ x = 40°
(D) 40°

Question 2.
Adjacent sides of a rectangle are 7 cm and 24 cm. Find the length of its diagonal.
Solution:



Let □ABCD be the rectangle.
AB = 7 cm, BC = 24 cm
In ΔABC, ∠B = 90° [Angle of a rectangle]
$AC^2 = AB^2 + BC^2$ [Pythagoras theorem]
$= 7^2 + 24^2$
= 49 + 576
= 625
AC = √625 [Taking square root of both sides]
= 25 cm
∴ The length of the diagonal of the rectangle is 25 cm.

Question 3.
If diagonal of a square is 13 cm, then find its side.
Solution:



Let □PQRS be the square of side x cm.
∴ PQ = QR = x cm …..(i) [Sides of a square]
∴ In ΔPQR, ∠Q = 90° [Angle of a square]
∴ $PR^2 = PQ^2 + QR^2$ [Pythagoras theorem]
∴ 13 = x + x [From (i)]
∴ $169 = 2x^2$

$$\therefore \quad x^2 = \frac{169}{2}$$

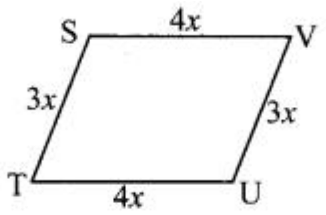
$$\therefore \quad x = \sqrt{\frac{169}{2}} \quad \text{[Taking square root of both sides]}$$

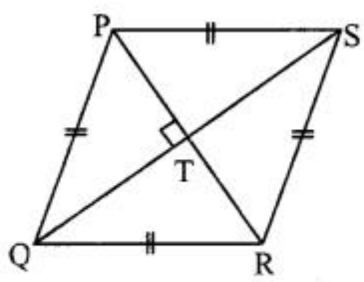
$$\therefore \quad x = \frac{13}{\sqrt{2}}$$

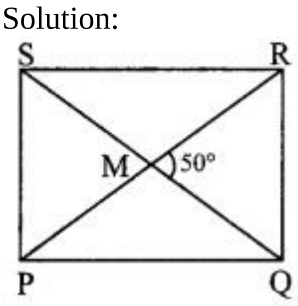
$$= \frac{13}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} \quad \text{[Multiplying the numerator and denominator by } \sqrt{2}\text{]}$$

$$= \frac{13\sqrt{2}}{2} = 6.5\sqrt{2} \text{ cm}$$

The length of the side of the square is 6.5√2 cm.

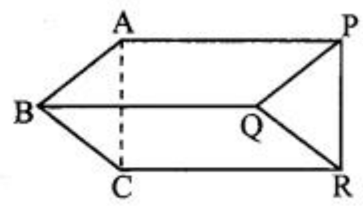
Question 4.
Ratio of two adjacent sides of a parallelogram is 3 : 4, and its perimeter is 112 cm. Find the length of its each side.
Solution:


Let □STUV be the parallelogram.
Ratio of two adjacent sides of a parallelogram is 3 : 4.
Let the common multiple be x.
ST = 3x cm and TU = 4x cm
∴ ST = UV = 3x cm
TU = SV = 4x cm …..(i) [Opposite sides of a parallelogram]
Perimeter of □STUV = 112 [Given]
∴ ST + TU + UV + SV = 112
∴ 3x + 4x + 3x + 4x = 112 [From (i)]
∴ 14x = 112
∴ x = 11214
∴ x = 8
∴ ST = UV = 3x = 3 x 8 = 24 cm
∴ TU = SV = 4x = 4 x 8 = 32 cm [From (i)]
∴ The lengths of the sides of the parallelogram are 24 cm, 32 cm, 24 cm and 32 cm.
Question 5.
Diagonals PR and QS of a rhombus PQRS are 20 cm and 48 cm respectively. Find the length of side PQ.
Solution:


□PQRS is a rhombus. [Given]
PR = 20 cm and QS = 48 cm [Given]
∴ PT = 12 PR [Diagonals of a rhombus bisect each other]
= 12 x 20 = 10 cm
Also, QT = 12 QS [Diagonals of a rhombus bisect each other]
= 12 x 48 = 24 cm
ii. In ∆PQT, ∠PTQ = 90° [Diagonals of a rhombus are perpendicular to each other]
∴ $PQ^2 = PT^2 + QT^2$ [Pythagoras- theorem]
$= 10^2 + 24^2$
= 100 + 576
∴ $PQ^2 = 676$
∴ PQ = $\sqrt{676}$ [Taking square root of both sides]
= 26 cm
∴ The length of side PQ is 26 cm.
Question 6.
Diagonals of a rectangle PQRS are intersecting in point M. If ∠QMR = 50°, then find the measure of ∠MPS.
Solution:


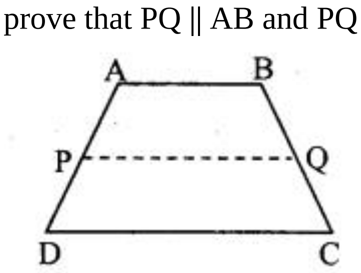
□PQRS is a rectangle.
∴ PM = 12 PR …(i)
MS = 12 QS …(ii) [Diagonals of a rectangle bisect each other]
Also, PR = QS …..(iii) [Diagonals of a rectangle are congruent]
∴ PM = MS ….(iv) [From (i), (ii) and (iii)]
In ∆PMS,
PM = MS [From (iv)]
∴ ∠MSP = ∠MPS = x° …..(v) [Isosceles triangle theorem]
∠PMS = ∠QMR = 50° ……(vi) [Vertically opposite angles]
In ∆MPS,
∠PMS + ∠MPS + ∠MSP = 180° [Sum of the measures of the angles of a triangle is 180°]
∴ 50° +x + x = 180° [From (v) and (vi)]
∴ 50° + 2x= 180
∴ 2x= 180-50
∴ 2x= 130

∴ x = 1302 = 65°
∴ ∠MPS = 65° [From (v)]
Question 7.
In the adjoining figure, if seg AB ∥ seg PQ , seg AB ≅ seg PQ, seg AC ∥ seg PR, seg AC ≅ seg PR, then prove that seg BC ∥ seg QR and seg BC ≅ seg QR.

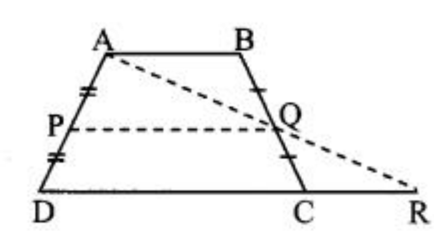


Solution:
Given: seg AB ∥ seg PQ , seg AB ≅ seg PQ,
seg AC ∥ seg PR, seg AC ≅ seg PR
To prove: seg BC ∥ seg QR, seg BC ≅ seg QR
Proof:
Consider □ABQP,
seg AB ∥ seg PQ [Given]
seg AB ≅ seg PQ [Given]
∴ □ABQP is a parallelogram. [A quadrilateral is a parallelogram if a pair of its opposite sides is parallel and congruent]
∴ segAP ∥ segBQ …..(i)
∴ seg AP ≅ seg BQ …..(ii) [Opposite sides of a parallelogram]
Consider □ACRP,
seg AC ∥ seg PR [Given]
seg AC ≅ seg PR [Given]
∴ □ACRP is a parallelogram. [A quadrilateral is a parallelogram if a pair of its opposite sides is parallel and congruent]
∴ seg AP ∥ seg CR …(iii)
∴ seg AP ≅ seg CR …….(iv) [Opposite sides of a parallelogram]
Consider □BCRQ,
seg BQ ∥ seg CR
seg BQ ≅ seg CR
∴ □BCRQ is a parallelogram. [A quadrilateral is a parallelogram if a pair of its opposite sides is parallel and congruent]
∴ seg BC ∥ seg QR
∴ seg BC ≅ seg QR [Opposite sides of a parallelogram]

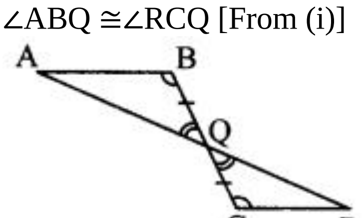
Question 8.
In the adjoining figure, □ABCD is a trapezium. AB ∥ DC. Points P and Q are midpoints of seg AD and seg BC respectively. Then prove that PQ ∥ AB and PQ = 12 (AB + DC).



Given : □ ABCD is a trapezium.
To prove:
Construction: Join points A and Q. Extend seg AQ and let it meet produced DC at R.
Proof:

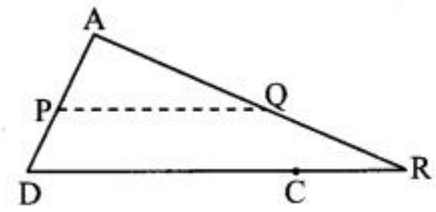


seg AB ∥ seg DC [Given]
and seg BC is their transversal.
∴ ∠ABC ≅ ∠RCB [Alternate angles]
∴ ∠ABQ ≅ ∠RCQ ….(i) [B-Q-C]
In ∆ABQ and ∆RCQ,
∠ABQ ≅∠RCQ [From (i)]



seg BQ ≅ seg CQ [Q is the midpoint of seg BC]
∠BQA ≅ ∠CQR [Vertically opposite angles]
∴ ∆ABQ ≅ ∆RCQ [ASA test]
seg AB ≅ seg CR …(ii) [c. s. c. t.]
seg AQ ≅ seg RQ [c. s. c. t.]
∴ Q is the midpoint of seg AR. ….(iii)

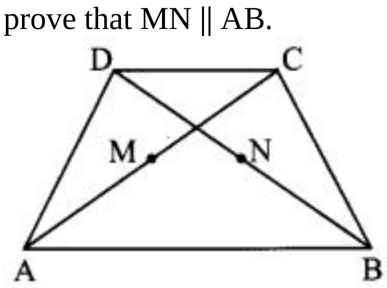
In ΔADR,
Points P and Q are the midpoints of seg AD and seg AR respectively. [Given and from (iii)]



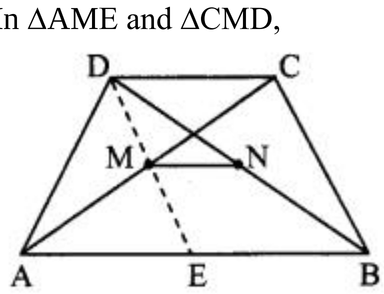
∴ seg PQ || seg DR [Midpoint theorem]
i.e. seg PQ || seg DC ……..(iv) [D-C-R]
But, seg AB || seg DC …….(v) [Given]
∴ seg PQ || seg AB [From (iv) and (v)]
In ΔADR,

$$PQ = \frac{1}{2}\ DR \quad \text{[Midpoint theorem]}$$
$$= \frac{1}{2}\ (DC + CR) \quad \text{[D–C–R]}$$
$$= \frac{1}{2}\ (DC + AB) \quad \text{[From (ii)]}$$
$$\mathbf{PQ = \frac{1}{2}\ (AB + DC)}$$

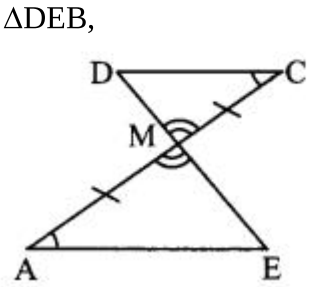
Question 9.
In the adjoining figure, □ABCD is a trapezium. AB || DC. Points M and N are midpoints of diagonals AC and DB respectively, then prove that MN || AB.



Solution:
Given: □ABCD is a trapezium. AB || DC.
Points M and N are midpoints of diagonals AC and DB respectively.
To prove: MN || AB
Construction: Join D and M. Extend seg DM to meet seg AB at point E such that A-E-B.
Proof:
seg AB || seg DC and seg AC is their transversal. [Given]
∴ ∠CAB ≅ ∠ACD [Alternate angles]
∴ ∠MAE ≅ ∠MCD ….(i) [C-M-A, A-E-B]
In ΔAME and ΔCMD,



∠AME ≅ ∠CMD [Vertically opposite angles]
seg AM ≅ seg CM [M is the midpoint of seg AC]
∠MAE ≅∠MCD [From (i)]
∴ ΔAME ≅ ΔCMD [ASA test]
∴ seg ME ≅ seg MD [c.s.c.t]
∴ Point M is the midpoint of seg DE. …(ii)
In ΔDEB,



Points M and N are the midpoints of seg DE and seg DB respectively. [Given and from (ii)]
∴ seg MN || seg EB [Midpoint theorem]
∴ seg MN || seg AB [A-E-B]

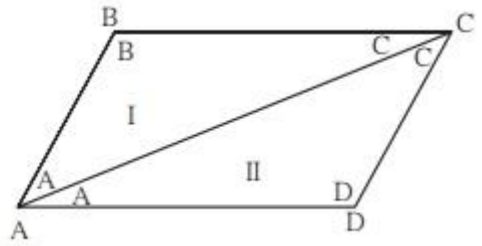
Maharashtra Board Class 9 Maths Chapter 5 Quadrilaterals Problem Set 5 Intext Questions and Activities

AllGuideSite :

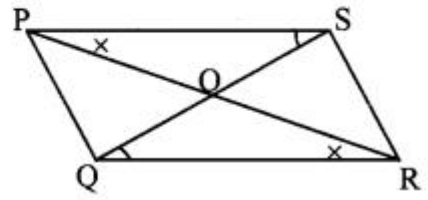
Digvijay

Arjun

Question 1.
Draw five parallelograms by taking various measures of lengths and angles. (Textbook page no. 59)

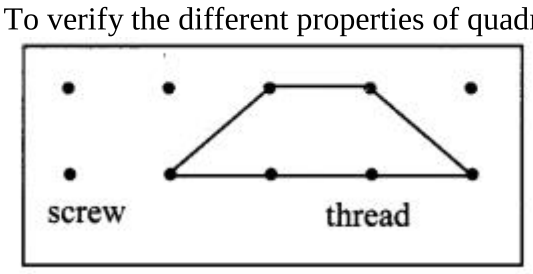


Question 2.
Draw a parallelogram PQRS. Draw diagonals PR and QS. Denote the intersection of diagonals by letter O. Compare the two parts of each diagonal with a divider. What do you find? (Textbook page no. 60)



Answer:
seg OP = seg OR, and seg OQ = seg OS
Thus we can conclude that, point O divides the diagonals PR and QS in two equal parts.

Question 3.
To verify the different properties of quadrilaterals.



Material: A piece of plywood measuring about 15 cm x 10 cm, 15 thin screws, twine, scissor.
Note: On the plywood sheet, fix five screws in a horizontal row keeping a distance of 2 cm between any two adjacent screws. Similarly make two more rows of screws exactly below the first one. Take care that the vertical distance between any two adjacent screws is also 2 cm.
With the help of the screws, make different types of quadrilaterals of twine. Verify the properties of sides and angles of the quadrilaterals. (Textbook page no. 75)