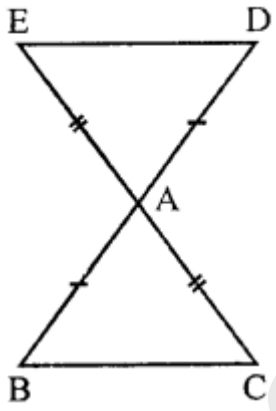
RD Sharma Class 9 Solution Chapter 12 Heron's Formula

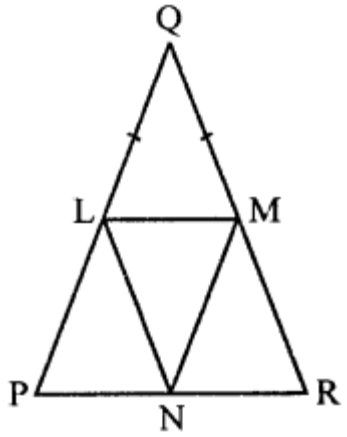
Question 1.
In the figure, the sides BA and CA have been produced such that BA = AD and CA =



AE. Prove the segment DE || BC.
Solution:
Given : Sides BA and CA of ∆ABC are produced such that BA = AD are CA = AE. ED is joined.
To prove : DE || BC
Proof: In ∆ABC and ∆DAE AB=AD (Given)
AC = AE (Given)
∠BAC = ∠DAE (Vertically opposite angles)
∴ ∆ABC ≅ ∆DAE (SAS axiom)
∴ ∠ABC = ∠ADE (c.p.c.t.)
But there are alternate angles
∴ DE || BC

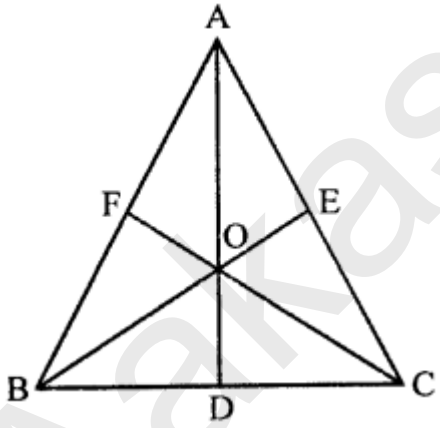
Question 2.
In a ∆PQR, if PQ = QR and L, M and N are the mid-points of the sides PQ, QR and RP respectively. Prove that LN = MN.
Solution:
Given : In ∆PQR, PQ = QR
L, M and N are the mid points of the sides PQ, QR and PR respectively

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To prove : LM = MN
Proof : In ∆LPN and ∆MRH
PN = RN (∵ M is mid point of PR)
LP = MR (Half of equal sides)
∠P = ∠R (Angles opposite to equal sides)
∴ ALPN ≅ AMRH (SAS axiom)
∴ LN = MN (c.p.c.t.)

Question 3.
Prove that the medians of an equilateral triangle are equal.
Solution:
Given : In ∆ABC, AD, BE and CF are the medians of triangle and AB = BC = CA

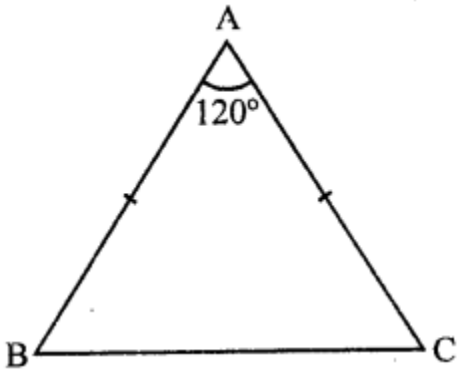


To prove : AD = BE = CF
Proof : In ∆BCE and ∆BCF,
BC = BC (Common side)
CE = BF (Half of equal sides)
∠C = ∠B (Angles opposite to equal sides)
∴ ABCE ≅ ABCF (SAS axiom)
∴ BE = CF (c.p.c.t.) …(i)
Similarly, we can prove that
∴ ∆CAD ≅ ∆CAF

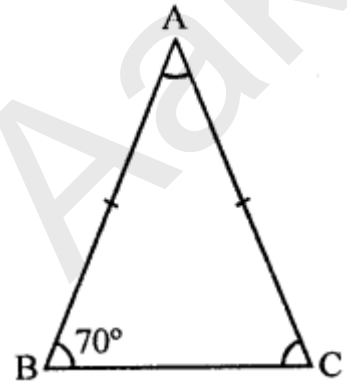
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∴ AD = CF …(ii)
From (i) and (ii)
BE = CF = AD
⇒ AD = BE = CF

Question 4.
In a ∆ABC, if ∠A = 120° and AB = AC. Find ∠B and ∠C.
Solution:
In ∆ABC, ∠A = 120° and AB = AC
∴ ∠B = ∠C (Angles opposite to equal sides)
But ∠A + ∠B + ∠C = 180° (Sum of angles of a triangle)



⇒ 120° + ∠B + ∠B = 180°
⇒ 2∠B = 180° – 120° = 60°
∴ ∠B = $60^{\circ}2$ = 30°
and ∠C = ∠B = 30°
Hence ∠B = 30° and ∠C = 30°
Question 5.
In a ∆ABC, if AB = AC and ∠B = 70°, find ∠A.
Solution:
In ∆ABC, ∠B = 70°
AB =AC
∴ ∠B = ∠C (Angles opposite to equal sides)

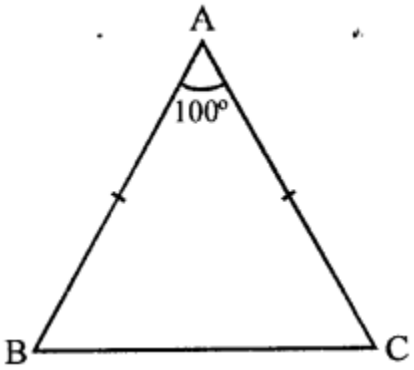


But ∠B = 70°
∴ ∠C = 70°

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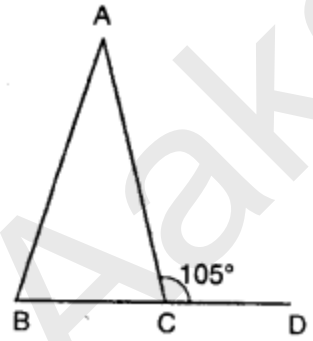
But ∠A + ∠B + ∠C = 180° (Sum of angles of a triangle)
⇒ ∠A + 70° + 70° = 180°
⇒ ∠A + 140°= 180°
∴∠A = 180°- 140° = 40°

Question 6.
The vertical angle of an isosceles triangle is 100°. Find its base angles.
Solution:
In ∆ABC, AB = AC and ∠A = 100°
But AB = AC (In isosceles triangle)



∴ ∠C = ∠B (Angles opposite to equal sides)
∠A + ∠B + ∠C = 180° (Sum of angles of a triangle)
⇒ 100° + ∠B + ∠B = 180° (∵ ∠C = ∠B)
⇒ 2∠B = 180° – 100° = 80°
∴ ∠C = ∠B = 40°
Hence ∠B = 40°, ∠C = 40°

Question 7.
In the figure, AB = AC and ∠ACD = 105°, find ∠BAC.

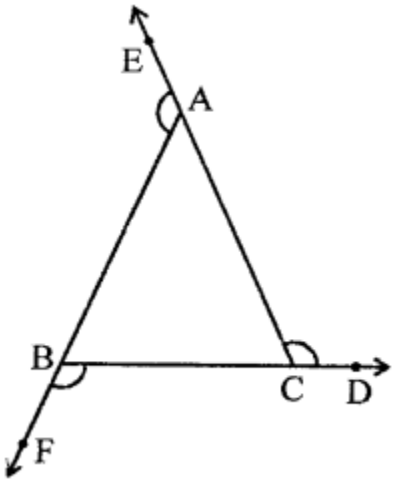


Solution:
In ∆ABC, AB = AC
∴ ∠B = ∠C (Angles opposite to equal sides)
But ∠ACB + ∠ACD = 180° (Linear pair)
⇒ ∠ACB + 105°= 180°
⇒ ∠ACB = 180°-105° = 75°

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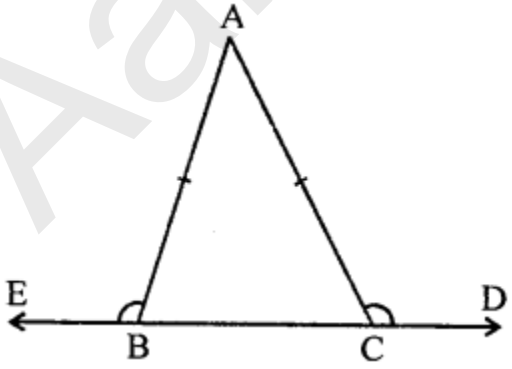
∴ ∠ABC = ∠ACB = 75°
But ∠A + ∠B + ∠C = 180° (Sum of angles of a triangle)
⇒ ∠A + 75° + 75° = 180°
⇒ ∠A + 150°= 180°
⇒ ∠A= 180°- 150° = 30°
∴ ∠BAC = 30°

Question 8.
Find the measure of each exterior angle of an equilateral triangle.
Solution:
In an equilateral triangle, each interior angle is 60°



But interior angle + exterior angle at each vertex = 180°
∴ Each exterior angle = 180° – 60° = 120°

Question 9.
If the base of an isosceles triangle is produced on both sides, prove that the exterior angles so formed are equal to each other.
Solution:
Given : In an isosceles ∆ABC, AB = AC
and base BC is produced both ways

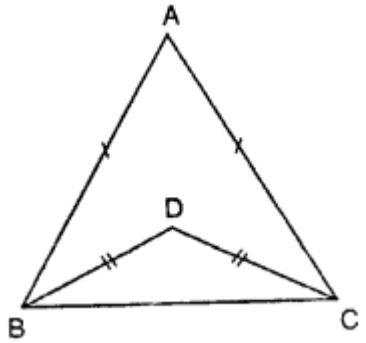


To prove : ∠ACD = ∠ABE

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Proof: In ∆ABC,
∵ AB = AC
∴∠C = ∠B (Angles opposite to equal sides)
⇒ ∠ACB = ∠ABC
But ∠ACD + ∠ACB = 180° (Linear pair)
and ∠ABE + ∠ABC = 180°
∴ ∠ACD + ∠ACB = ∠ABE + ∠ABC
But ∠ACB = ∠ABC (Proved)
∴ ∠ACD = ∠ABE
Hence proved.

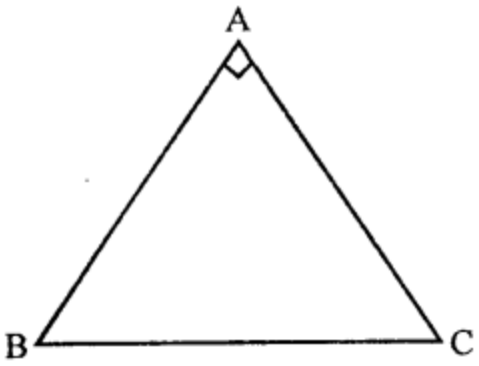
Question 10.
In the figure, AB = AC and DB = DC, find the ratio ∠ABD : ∠ACD.



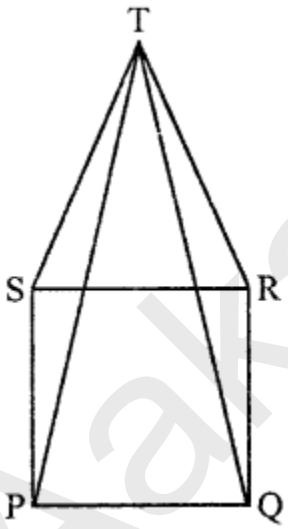
Solution:
In the given figure,
In ∆ABC,
AB = AC and DB = DC
In ∆ABC,
∵ AB = AC
∴ ∠ACD = ∠ABE …(i) (Angles opposite to equal sides)
Similarly, in ∆DBC,
DB = DC
∴ ∠DCB = ∠DBC .. (ii)
Subtracting (ii) from (i)
∠ACB – ∠DCB = ∠ABC – ∠DBC
⇒ ∠ACD = ∠ABD
∴ Ratio ∠ABD : ∠ACD = 1 : 1

Question 11.
Determine the measure of each of the equal angles of a rightangled isosceles triangle.
OR
ABC is a rightangled triangle in which ∠A = 90° and AB = AC. Find ∠B and ∠C.
Solution:
Given : In a right angled isosceles ∆ABC, ∠A = 90° and AB = AC
To determine, each equal angle of the triangle

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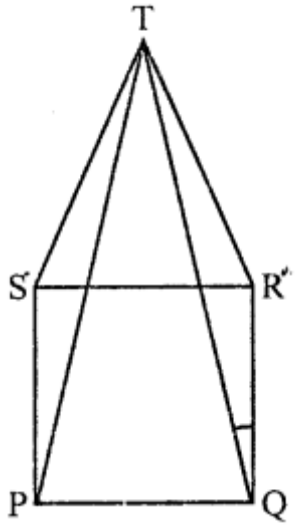


∵ ∠A = 90°
∴ ∠B + ∠C = 90°
But ∠B = ∠C
∴ ∠B + ∠B = 90°
⇒ 2∠B = 90°
90°
⇒ ∠B = $90^\circ 2$ = 45°
and ∠C = ∠B = 45°
Hence ∠B = ∠C = 45°
Question 12.
In the figure, PQRS is a square and SRT is an equilateral triangle. Prove that
(i) PT = QT
(ii) ∠TQR = 15°



Solution:
Given : PQRS is a square and SRT is an equilateral triangle. PT and QT are joined.

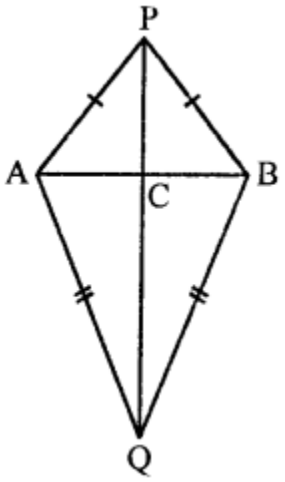
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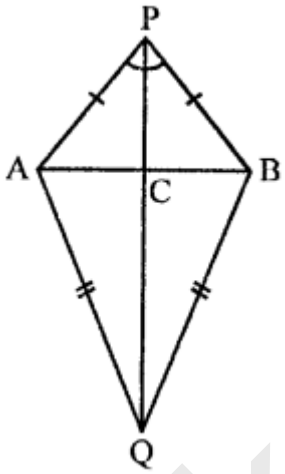
To prove : (i) PT = QT; (ii) ∠TQR = 15°
Proof : In ∆TSP and ∆TQR
ST = RT (Sides of equilateral triangle)
SP = PQ (Sides of square)
and ∠TSP = ∠TRQ (Each = 60° + 90°)
∴ ∆TSP ≅ ∆TQR (SAS axiom)
∴ PT = QT (c.p.c.t.)
In ∆TQR,
∵ RT = RQ (Square sides)
∠RTQ = ∠RQT
But ∠TRQ = 60° + 90° = 150°
∴ ∠RTQ + ∠RQT = 180° – 150° = 30°
∵ ∠PTQ = ∠RQT (Proved)
∠RQT = $30^\circ 2$ = 15°
⇒ ∠TQR = 15°

Question 13.
AB is a line segment. P and Q are points on opposite sides of AB such that each of them is equidistant from the ponits A and B (see figure). Show that the line PQ is perpendicular bisector of AB.

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Solution:
Given : AB is a line segment.
P and Q are points such that they are equidistant from A and B
i.e. PA = PB and QA = QB AP, PB, QA, QB, PQ are joined
To prove : PQ is perpendicular bisector of AB



Proof : In ∆PAQ and ∆PBQ,
PA = PB (Given)
QA = QB (Given)
PQ = PQ (Common)
∴ ∆PAQ ≅ ∆PBQ (SSS axiom)
∴ ∠APQ = ∠BPQ (c.p.c.t.)
Now in ∆APC = ∆BPC
PA = PB (Given)
∆APC ≅ ∆BPC (Proved)
PC = PC (Common)
∴ ∆APC = ∆BPC (SAS axiom)
∴ AC = BC (c.p.c.t.)
and ∠PCA = ∠PCB (c.p.c.t.)
But ∠PCA + ∠PCB = 180° (Linear pair)

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∴ ∠PCA = ∠PCB = 90°
∴ PC or PQ is perpendicular bisector of AB

RD Sharma Class 9 Chapter 12 Heron's Formula Ex 12.2

Question 1.
BD and CE are bisectors of ∠B and ∠C of an isosceles ∠ABC with AB = AC. Prove that BD = CE.
Solution:
Given : In ∆ABC, AB = AC
BD and CE are the bisectors of ∠B and ∠C respectively
To prove : BD = CE
Proof: In ∆ABC, AB = AC
∴ ∠B = ∠C (Angles opposite to equal sides)
∴ $\frac{1}{2}$ ∠B = $\frac{1}{2}$ ∠C
RD Sharma Class 9 Solutions Chapter 12 Heron's Formula Ex 12.2 – 1
∠DBC = ∠ECB
Now, in ∆DBC and ∆EBC,
BC = BC (Common)
∠C = ∠B (Equal angles)
∠DBC = ∠ECB (Proved)
∴ ∆DBC ≅ ∆EBC (ASA axiom)
∴ BD = CE
Question 2.
In the figure, it is given that RT = TS, ∠1 = 2∠2 and ∠4 = 2∠3. Prove that: ∆RBT = ∆SAT.
RD Sharma Class 9 Solutions Chapter 12 Heron's Formula Ex 12.2 – 2
Solution:
Given : In the figure, RT = TS
∠1 = 2∠2 and ∠4 = 2∠3
To prove : ∆RBT ≅ ∆SAT
Proof : ∵ ∠1 = ∠4 (Vertically opposite angles)
But ∠1 = 2∠2 and 4 = 2∠3
∴ 2∠2 = 2∠3 ⇒ ∠2 = ∠3
∵ RT = ST (Given)
∴∠R = ∠S (Angles opposite to equal sides)
∴ ∠R – ∠2 = ∠S – ∠3
⇒ ∠TRB = ∠AST
Now in ∆RBT and ∆SAT
∠TRB = ∠SAT (prove)
RT = ST (Given)
∠T = ∠T (Common)
∴ ∆RBT ≅ ∆SAT (SAS axiom)

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Question 3.
Two lines AB and CD intersect at O such that BC is equal and parallel to AD. Prove that the lines AB and CD bisect at O.
Solution:
Given : Two lines AB and CD intersect each other at O such that AD = BC and AD ‖ BC
RD Sharma Class 9 Solutions Chapter 12 Heron's Formula Ex 12.2 – 3
To prove : AB and CD bisect each other
i. e. AO = OB and CO = OD
Proof: In ∆AOD and ∆BOC,
AD = BC (Given)
∠A = ∠B (Alternate angles)
∠D = ∠C (Alternate angles)
∴ ∆AOD ≅ ∆BOC (ASA axiom)
AO = OB and AO = OC (c.p.c.t.)
Hence AB and CD bisect each other.

RD Sharma Class 9 Solutions Chapter 12 Heron's Formula Ex 12.3

Question 1.
In two right triangles one side an acute angle of one are equal to the corresponding side and angle of the other. Prove that the triangles are congruent.
Solution:
Given : In ∆ABC and ∆DEF,
∠B = ∠E = 90°
∠C = ∠F
AB = DE
RD Sharma Class 9 Solutions Chapter 12 Heron's Formula Ex 12.3 – 1
To prove : ∆ABC = ∆DEF
Proof : In ∆ABC and ∆DEF,
∠B = ∠E (Each = 90°)
∠C = ∠F (Given)
AB = DE (Given)
∆ABC = ∆DEF (AAS axiom)

Question 2.
If the bisector of the exterior vertical angle of a triangle be parallel to the base. Show that the triangle is isosceles.
Solution:
Given : In ∆ABC, AE is the bisector of vertical exterior ∠A and AE ‖ BC
RD Sharma Class 9 Solutions Chapter 12 Heron's Formula Ex 12.3 – 2
To prove : ∆ABC is an isosceles
Proof: ∵ AE ‖ BC
∴ ∠1 = ∠B (Corresponding angles)

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∠2 = ∠C (Alternate angle)
But ∠1 = ∠2 (∵ AE is the bisector of ∠CAD)
∴ ∠B = ∠C
∴ AB = AC (Sides opposite to equal angles)
∴ ∆ABC is an isosceles triangle
Question 3.
In an isosceles triangle, if the vertex angle is twice the sum of the base angles, calculate the angles of the triangle.
Solution:
Given : In ∆ABC, AB = AC
∠A = 2(∠B + ∠C)
RD Sharma Class 9 Solutions Chapter 12 Heron's Formula Ex 12.3 – 3
To calculate: Base angles,
Let ∠B = ∠C = x
Then ∠A = 2(∠B + ∠C)
= 2(x + x) = 2 x 2x = 4x
∵ Sum of angles of a triangle = 180°
∴ 4x + x + x – 180° ⇒ 6x = 180°
⇒ x= $180^{\circ}6$ = 30° o
∴ ∠B = ∠C = 30 and ∠A = 4 x 30° = 120
Question 4.
Prove that each angle of an equilateral triangle is 60°. [NCERT]
Solution:
Given : ∆ABC is an equilateral triangle
RD Sharma Class 9 Solutions Chapter 12 Heron's Formula Ex 12.3 – 4
Proof: In ∆ABC,
AB = AC (Sides of an equilateral triangle)
∴ ∠C = ∠B …(i)
(Angles opposite to equal angles)
Similarly, AB = BC
∴ ∠C = ∠A …(ii)
From (i) and (ii),
∠A = ∠B = ∠C
But ∠A + ∠B + ∠C = 180° (Sum of angles of a triangle)
∴ ∠A = ∠B = ∠C = $180^{\circ}3$= 60°
Question 5.
Angles A, B, C of a triangle ABC are equal to each other. Prove that ∆ABC is equilateral.
Solution:
Given : In ∆ABC, ∠A = ∠B = ∠C
RD Sharma Class 9 Solutions Chapter 12 Heron's Formula Ex 12.3 – 5
To prove : ∆ABC is an equilateral
Proof: In ∆ABC,
∴ ∠B = ∠C (Given)
∴ AC = AB …(i) (Sides opposite to equal angles)
Similarly, ∠C = ∠A

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∴ BC =AB …(ii)
From (i) and (ii)
AB = BC = CA
Hence ∆ABC is an equilateral triangle

Question 6.
ABC is a right angled triangle in which ∠A = 90° and AB = AC. Find ∠B and ∠C.
Solution:
In ∆ABC, ∠A = 90°
RD Sharma Class 9 Solutions Chapter 12 Heron's Formula Ex 12.3 – 6
AB =AC (Given)
∴ ∠C = ∠B (Angles opposite to equal sides)
But ∠B + ∠C = 90° (∵ ∠B = 90°)
∴ ∠B = ∠C = $90^\circ 2$ = 45°
Hence ∠B = ∠C = 45°
Question 7.
PQR is a triangle in which PQ = PR and S is any point on the side PQ. Through S, a line is drawn parallel to QR and intersecting PR at T. Prove that PS = PT.
Solution:
Given : In ∆PQR, PQ = PR
S is a point on PQ and PT || QR
RD Sharma Class 9 Solutions Chapter 12 Heron's Formula Ex 12.3 – 7
To prove : PS = PT
Proof : ∵ST || QR
∴ ∠S = ∠Q and ∠T = ∠R (Corresponding angles)
But ∠Q = ∠R (∵ PQ = PR)
∴ PS = PT (Sides opposite to equal angles)

Question 8.
In a ∆ABC, it is given that AB = AC and the bisectors of ∠B and ∠C intersect at O. If M is a point on BO produced, prove that ∠MOC = ∠ABC.
Solution:
Given : In ∆ABC, AB = AC the bisectors of ∠B and ∠C intersect at O. M is any point on BO produced.
RD Sharma Class 9 Solutions Chapter 12 Heron's Formula Ex 12.3 – 8
To prove : ∠MOC = ∠ABC
Proof: In ∆ABC, AB = BC
∴ ∠C = ∠B
∵ OB and OC are the bisectors of ∠B and ∠C
∴ ∠1 =∠2 = $12\angle B$
Now in ∠OBC,
Ext. ∠MOC = Interior opposite angles ∠1 + ∠2
= ∠1 + ∠1 = 2∠1 = ∠B
Hence ∠MOC = ∠ABC

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Question 9.
P is a point on the bisector of an angle ∠ABC. If the line through P parallel to AB meets BC at Q, prove that triangle BPQ is isosceles.
Solution:
Given : In ∆ABC, P is a point on the bisector of ∠B and from P, RPQ || AB is draw which meets BC in Q
RD Sharma Class 9 Solutions Chapter 12 Heron's Formula Ex 12.3 – 9
To prove : ∆BPQ is an isosceles
Proof : ∵ BD is the bisectors of CB
∴ ∠1 = ∠2
∵ RPQ || AB
∴ ∠1 = ∠3 (Alternate angles)
But ∠1 == ∠2 (Proved)
∴ ∠2 = ∠3
∴ PQ = BQ (sides opposite to equal angles)
∴ ∆BPQ is an isosceles

Question 10.
ABC is a triangle in which ∠B = 2∠C, D is a point on BC such that AD bisects ∠BAC = 72°.
Solution:
Given: In ∆ABC,
∠B = 2∠C, AD is the bisector of ∠BAC AB = CD
To prove : ∠BAC = 72°
Construction : Draw bisector of ∠B which meets AD at O

RD Sharma Solutions Class 9 Chapter 12 Heron's Formula 12.4

Question 1.
In the figure, it is given that AB = CD and AD = BC. Prove that ∆ADC ≅ ∆CBA.
RD Sharma Class 9 Solutions Chapter 12 Heron's Formula Ex 12.4 – 1
Solution:
Given : In the figure, AB = CD, AD = BC
RD Sharma Class 9 Solutions Chapter 12 Heron's Formula Ex 12.4 – 2
To prove : ∆ADC = ∆CBA
Proof : In ∆ADC and ∆CBA
CD = AB (Given)
AD = BC (Given)
CA = CA (Common)
∴ ∆ADC ≅ ∆CBA (SSS axiom)

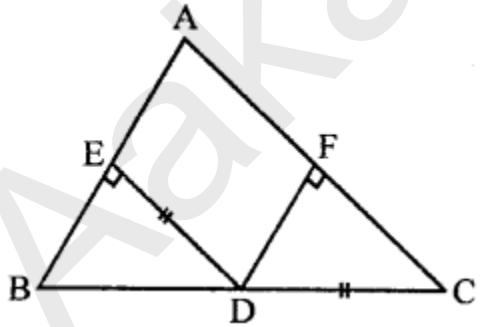
Question 2.
In a APQR, if PQ = QR and L, M and N are the mid-points of the sides PQ, QR and RP

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respectively. Prove that LN = MN.
Solution:
Given : In ∆PQR, PQ = QR
L, M and N are the mid-points of sides PQ, QR and RP respectively. Join LM, MN and LN
RD Sharma Class 9 Solutions Chapter 12 Heron's Formula Ex 12.4 – 2A
To prove : ∠PNM = ∠PLM
Proof : In ∆PQR,
∵ M and N are the mid points of sides PR and QR respectively
∴ MN || PQ and MN = $\frac{1}{2}$ PQ …(i)
∴ MN = PL
Similarly, we can prove that
LM = PN
Now in ∆NML and ∆LPN
MN = PL (Proved)
LM = PN (Proved)
LN = LN (Common)
∴ ∆NML = ∆LPN (SSS axiom)
∴ ∠MNL = ∠PLN (c.p.c.t.)
and ∠MLN = ∠LNP (c.p.c.t.)
⇒ ∠MNL = ∠LNP = ∠PLM = ∠MLN
⇒ ∠PNM = ∠PLM

Class 9 RD Sharma Solutions Chapter 12 Heron's Formula ex 12.5

Question 1.
ABC is a triangle and D is the mid-point of BC. The perpendiculars from D to AB and AC are equal. Prove that the triangle is isosceles.
Solution:
Given : In ∆ABC, D is mid-point of BC and DE ⊥ AB, DF ⊥ AC and DE = DF

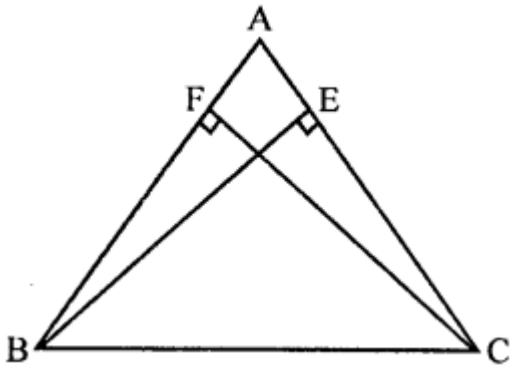


To Prove : ∆ABC is an isosceles triangle
Proof : In right ∆BDE and ∆CDF,
Side DE = DF
Hyp. BD = CD
∴ ∆BDE ≅ ∆CDF (RHS axiom)

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∴ ∠B = ∠C (c.p.c.t.)
Now in ∆ABC,
∠B = ∠C (Prove)
∴ AC = AB (Sides opposite to equal angles)
∴ AABC is an isosceles triangle

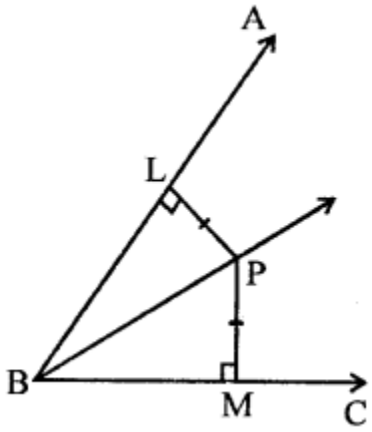
Question 2.
ABC is a triangle in which BE and CF are, respectively, the perpendiculars to the sides AC and AB. If BE = CF, prove that ∆ABC is an isosceles.
Solution:
Given : In ∆ABC,
BE ⊥ AC and CF ⊥ AB
BE = CF



To prove : AABC is an isosceles triangle
Proof : In right ABCE and ABCF Side
BE = CF (Given)
Hyp. BC = BC (Common)
∴ ∆BCE ≅ ∆BCF (RHS axiom)
∴ ∠BCE = ∠CBF (c.p.c.t.)
∴ AB = AC (Sides opposite to equal angles)
∴ ∆ABC is an isosceles triangle

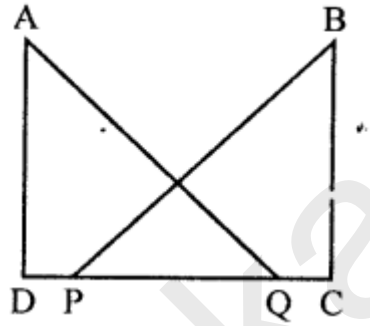
Question 3.
If perpendiculars from any point within an angle on its arms are congruent, prove that it lies on the bisector of that angle.
Solution:
Given : A point P lies in the angle ABC and PL ⊥ BA and PM ⊥ BC and PL = PM. PB is joined

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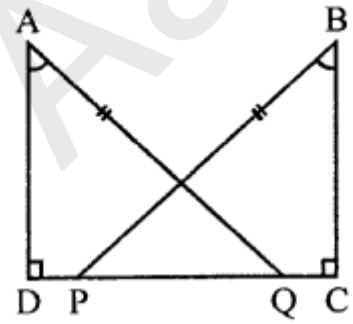


To prove : PB is the bisector ∠ABC,
Proof : In right ∆PLB and ∆PMB
Side PL = PM (Given)
Hyp. PB = PB (Common)
∴ ∆PLB ≅ ∆PMB (RHS axiom)
∴ ∆PBL = ∆PBM (c.p.c.t.)
∴ PB is the bisector of ∠ABC

Question 4.
In the figure, AD ⊥ CD and CB ⊥ CD. If AQ = BP and DP = CQ, prove that ∠DAQ = ∠CBP.



Solution:
Given : In the figure,
AD ⊥ CD and CB ⊥ CD, AQ = BP and DP = CQ



To prove : ∠DAQ = ∠CBP

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Proof : ∵ DP = CQ
∴ DP + PQ = PQ + QC
⇒ DQ = PC
Now in right ∆ADQ and ∆BCP
Side DQ = PC (Proved)
Hyp. AQ = BP
∴ ∆ADQ ≅ ∆BCP (RHS axiom)
∴ ∠DAQ = ∠CBP (c.p.c.t.)

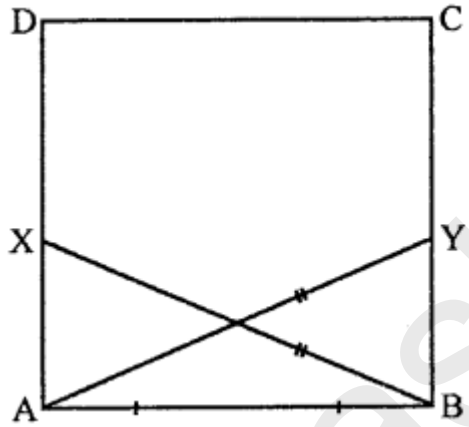
Question 5.
Which of the following statements are true (T) and which are false (F):
(i) Sides opposite to equal angles of a triangle may be unequal.
(ii) Angles opposite to equal sides of a triangle are equal.
(iii) The measure of each angle of an equilateral triangle is 60°.
(iv) If the altitude from one vertex of a triangle bisects the opposite side, then the triangle may be isosceles.
(v) The bisectors of two equal angles of a triangle are equal.
(vi) If the bisector of the vertical angle of a triangle bisects the base, then the triangle may be isosceles.
(vii) The two altitudes corresponding to two equal sides of a triangle need not be equal.
(viii)If any two sides of a right triangle are respectively equal to two sides of other right triangle, then the two triangles are congruent.
(ix) Two right triangles are congruent if hypotenuse and a side of one triangle are respectively equal to the hypotenuse and a side of the other triangle.
Solution:
(i) False : Sides opposite to equal angles of a triangle are equal.
(ii) True.
(iii) True.
(iv) False : The triangle is an isosceles triangle.
(v) True.
(vi) False : The triangle is an isosceles.
(vii) False : The altitude an equal.
(viii) False : If one side and hypotenuse of one right triangle on one side and hypotenuse of the other right triangle are equal, then triangles are congruent.
(ix) True.

Question 6.
Fill in the blanks in the following so that each of the following statements is true.
(i) Sides opposite to equal angles of a triangle are …….
(ii) Angle opposite to equal sides of a triangle are …….
(iii) In an equilateral triangle all angles are …….
(iv) In a ∆ABC if ∠A = ∠C, then AB = …….
(v) If altitudes CE and BF of a triangle ABC are equal, then AB = ……..
(vi) In an isosceles triangle ABC with AB = AC, if BD and CE are its altitudes, then BD is …… CE.
(vii) In right triangles ABC and DEF, if hypotenuse AB = EF and side AC = DE, then

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$\Delta ABC \cong \Delta$……
Solution:
(i) Sides opposite to equal angles of a triangle are equal.
(ii) Angle opposite to equal sides of a triangle are equal.
(iii) In an equilateral triangle all angles are equal.
(iv) In a ΔABC, if $\angle A = \angle C$, then AB = BC.
(v) If altitudes CE and BF of a triangle ABC are equal, then AB = AC.
(vi) In an isosceles triangle ABC with AB = AC, if BD and CE are its altitudes, then BD is equal to CE.
(vii) In right triangles ABC and DEF, it hypotenuse AB = EF and side AC = DE, then $\Delta ABC \cong \Delta EFD$.

Question 7.
ABCD is a square, X and Y are points on sides AD and BC respectively such that AY = BX. Prove that BY = AX and $\angle BAY = \angle ABX$.
Solution:
Given : In square ABCD, X and Y are points on side AD and BC respectively and AY = BX

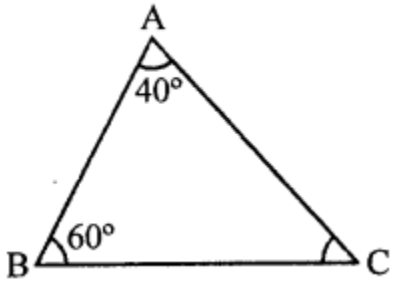


To prove : BY = AX
$\angle BAY = \angle ABX$
Proof: In right ΔBAX and ΔABY
AB =AB (Common)
Hyp. BX = AY (Given)
$\therefore \Delta BAX \cong \Delta ABY$ (RHS axiom)
$\therefore$ AX = BY (c.p.c.t.)
$\angle ABX = \angle BAY$ (c.p.c.t.)
Hence, BY = AX and $\angle BAY = \angle ABX$.

Class 9 RD Sharma Solutions Chapter 12 Heron's Formula 12.6

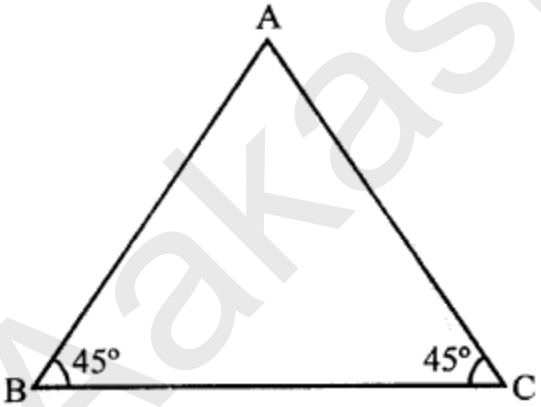
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Question 1.
In ∆ABC, if ∠A = 40° and ∠B = 60°. Determine the longest and shortest sides of the triangle.
Solution:
In ∆ABC, ∠A = 40°, ∠B = 60°
But ∠A + ∠B + ∠C = 180°



⇒ 40° + 60° + ∠C = 180°
⇒ ∠C = 180° = (40° + 60°)
= 180° – 100° = 80°
∵ ∠C = 80°, which is the greatest angle and
∠A = 40° is the smallest angle
∴ Side AB which is opposite to the greatest angle is the longest and side BC which is opposite to the smallest angle is the shortest.

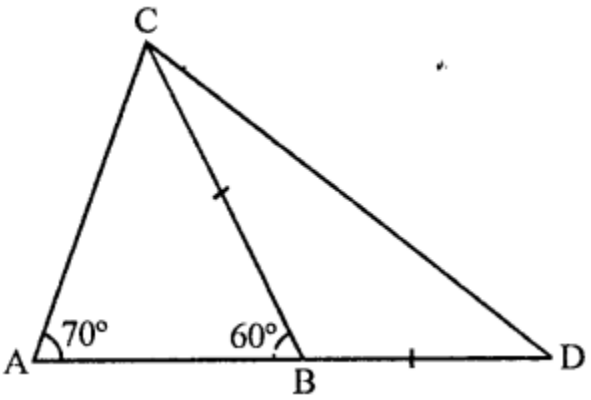
Question 2.
In a ∆ABC, if ∠B = ∠C = 45°. which is the longest side?
Solution:
In ∆ABC, ∠B = ∠C = 45°
But ∠A + ∠B + ∠C = 180°



⇒ ∠A + 45° + 45° = 180°
⇒ ∠A + 90° = 180°
∴ ∠A = 180°-90° = 90°
∴∠A is the greatest
∴ Side BC opposite to it is the longest

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Question 3.
In ∆ABC, side AB is produced to D so that BD = BC. If ∠B = 60° and ∠A = 70°, prove that :
(i) AD > CD
(ii) AD > AC
Solution:
Given : In AABC, side BC is produced to D such that BD = BC
∠A = 70° and ∠B = 60°

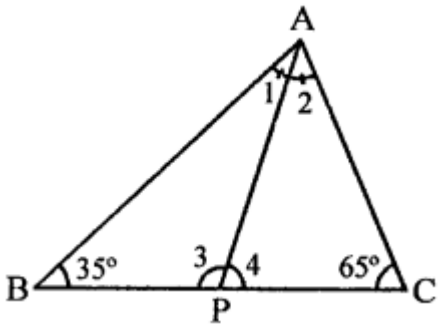


To prove :
(i) AD > CD (ii) AD > AC
Proof: In ∆ABC,
∠A = 70°, ∠B = 60°
But Ext. ∠CBD + ∠CBA = 180° (Linear pair)
∠CBD + 60° = 180° 3
⇒ ∠CBD = 180° – 60° = 120°
But in ∆BCD,
BD = BC
∴ ∠D = ∠BCD
But ∠D + ∠BCD = 180° – 120° = 60°
∴∠D = ∠BCD = $60^\circ 2$ = 30°
and in ∆ABC,
∠A + ∠B + ∠C = 180°
⇒ 70° + 60° + ∠C = 180°
⇒ 130° + ∠C = 180°
∴ ∠C =180°- 130° = 50°
Now ∠ACD = ∠ACB + ∠BCD = 50° + 30° = 80°
(i) Now in ∆ACB,
∠ACD = 80° and ∠A = 70°
∴ Side AD > CD
(Greater angle has greatest side opposite to it)
(ii) ∵ ∠ACD = 80° and ∠D = 30°
∴ AD > AC
Question 4.
Is it possible to draw a triangle with sides of length 2 cm, 3 cm and 7 cm?
Solution:

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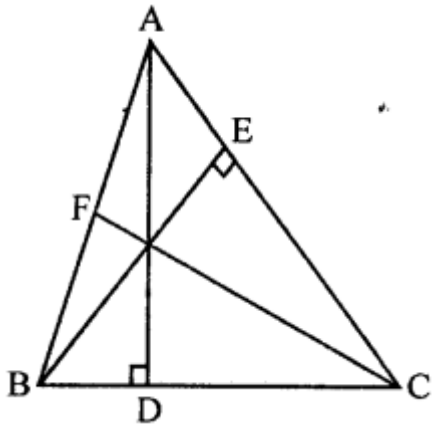
We know that in a triangle, sum of any two sides is greater than the third side and 2 cm + 3 cm = 5 cm and 5 cm < 7 cm
∴ This triangle is not possible to draw

Question 5.
In ∆ABC, ∠B = 35°, ∠C = 65° and the bisector of ∠BAC meets BC in P. Arrange AP, BP and CP in descending order.
Solution:
In ∆ABC, ∠B = 35°, ∠C = 65° and AP is the bisector of ∠BAC which meets BC in P.
Arrange PA, PB and PC in descending order In ∆ABC,
∠A + ∠B + ∠C = 180° (Sum of angles of a triangle)



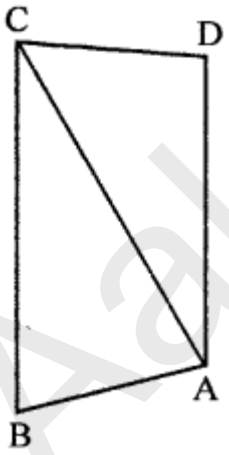
⇒ ∠A + 35° + 65° = 180°
∠A + 100°= 180°
∴ ∠A =180°- 100° = 80°
∵ PA is a bisector of ∠BAC
∴ ∠1 = ∠2 = $\frac{80^\circ}{2}$ = 40°
Now in ∆ACP, ∠ACP > ∠CAP
⇒ ∠C > ∠2
∴ AP > CP …(i)
Similarly, in ∆ABP,
∠BAP > ∠ABP ⇒ ∠1 > ∠B
∴ BP > AP …(ii)
From (i) and (ii)
BP > AP > CP
Question 6.
Prove that the perimeter of a triangle is greater than the sum of its altitudes
Solution:
Given : In ∆ABC,
AD, BE and CF are altitudes

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To prove : AB + BC + CA > AD + BC + CF
Proof : We know that side opposite to greater angle is greater.
In ∆ABD, ∠D = 90°
∴ ∠D > ∠B
∴ AB >AD …(i)
Similarly, we can prove that
BC > BE and
CA > CF
Adding we get,
AB + BC + CA > AD + BE + CF

Question 7.
In the figure, prove that:
(i) CD + DA + AB + BC > 2AC
(ii) CD + DA + AB > BC



Solution:
Given : In the figure, ABCD is a quadrilateral and AC is joined
To prove :
(i) CD + DA + AB + BC > 2AC
(ii) CD + DA + AB > BC
Proof:

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(i) In $\triangle ABC$,
$AB + BC > AC$ …(i)
(Sum of two sides of a triangle is greater than its third side)
Similarly in $\triangle ADC$,
$CD + DA > AC$ …(ii)
Adding (i) and (ii)
$CD + DA + AB + BC > AC + AC$
$\Rightarrow CD + DA + AB + BC > 2AC$
(ii) In $\triangle ACD$,
$CD + DA > CA$
(Sum of two sides of a triangle is greater than its third side)
Adding AB to both sides,
$CD + DA + AB > CA + AB$
But $CA + AB > BC$ (in $\triangle ABC$)
$\therefore CD + DA + AD > BC$

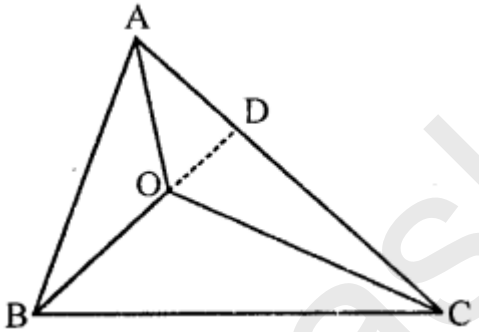
Question 8.
Which of the following statements are true (T) and which are false (F)?
(i) Sum of the three sides of a triangle is less than the sum of its three altitudes.
(ii) Sum of any two sides of a triangle is greater than twice the median drawn to the third side.
(iii) Sum of any two sides of a triangle is greater than the third side.
(iv) Difference of any two sides of a triangle is equal to the third side.
(v) If two angles of a triangle are unequal, then the greater angle has the larger side opposite to it.
(vi) Of all the line segments that can be drawn from a point to a line not containing it, the perpendicular line segment is the shortest one.
Solution:
(i) False. Sum of three sides of a triangle is greater than the sum of its altitudes.
(ii) True.
(iii) True.
(iv) False. Difference of any two sides is less than the third side.
(v) True.
(vi) True.

Question 9.
Fill in the blanks to make the following statements true.
(i) In a right triangle, the hypotenuse is the ……. side.
(ii) The sum of three altitudes of a triangle is ……. than its perimeter.
(iii) The sum of any two sides of a triangle is …….. than the third side.
(iv) If two angles of a triangle are unequal, then the smaller angle has the ….. side opposite to it.
(v) Difference of any two sides of a triangle is……. than the third side.
(vi) If two sides of a triangle are unequal, then the larger side has …… angle opposite to it.
Solution:

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(i) In a right triangle, the hypotenuse is the longest side.
(ii) The sum of three altitudes of a triangle is less than its perimeter.
(iii) The sum of any two sides of a triangle is greater than the third side.
(iv) If two angles of a triangle are unequal, then the smaller angle has the smaller side opposite to it.
(v) Difference of any two sides of a triangle is less than the third side.
(vi) If two sides of a triangle are unequal, then the larger side has greater angle opposite to it.

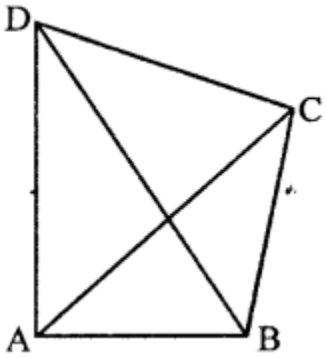
Question 10.
O is any point in the interior of ∆ABC. Prove that
(i) AB + AC > OB + OC
(ii) AB + BC + CA > OA + OB + OC
(iii) OA + OB + OC > $\frac{1}{2}$ (AB + BC + CA)
Solution:
Given : In ∆ABC, O is any point in the interior of the ∆ABC, OA, OB and OC are joined
To prove :
(i) AB + AC > OB + OC
(ii) AB + BC + CA > OA + OB + OC
(iii) OA + OB + OC > $\frac{1}{2}$ (AB + BC + CA)
Construction : Produce BO to meet AC in D.



Proof: In ∆ABD,
(i) AB + AD > BD (Sum of any two sides of a triangle is greater than third)
⇒ AB + AD > BO + OD …(i)
Similarly, in ∆ODC,
OD + DC > OC …(ii)
Adding (i) and (ii)
AB + AD + OD + DC > OB + OD + OC
⇒ AB + AD + DC > OB + OC
⇒ AB + AC > OB + OC
(ii) Similarly, we can prove that
BC + AB > OA + OC
and CA + BC > OA + OB
(iii) In ∆OAB, AOBC and ∆OCA,
OA + OB > AB
OB + OC > BC

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and OC + OA > CA
Adding, we get
2(OA + OB + OC) > AB + BC + CA
∴ OA + OB + OO > 12 (AB + BC + CA)
Question 11.
Prove that in a quadrilateral the sum of all the sides is greater than the sum of its diagonals.
Solution:
Given : In quadrilateral ABCD, AC and BD are its diagonals,



To prove : AB + BC + CD + DA > AC + BD
Proof: In ∆ABC,
AB + BC > AC …(i)
(Sum of any two sides of a triangle is greater than its third side)
Similarly, in ∆ADC,
DA + CD > AC …(ii)
In ∆ABD,
AB + DA > BD …(iii)
In ∆BCD,
BC + CD > BD …(iv)
Adding (i), (ii), (iii) and (iv)
2(AB + BC + CD + DA) > 2AC + 2BD
⇒ 2(AB + BC + CD + DA) > 2(AC + BD)
∴ AB + BC + CD + DA > AC + BD

RD Sharma Solutions Class 9 Chapter 12 Heron's Formula VSAQS

Question 1.
Solution:
In two congruent triangles ABC and DEF, if AB = DE and BC = EF. Name the pairs of equal angles.

In AABC and ADEF,
∆ABC ≅ ∆DEF

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and AB = DE, BC = EF
∴ ∠A = ∠D, ∠B = ∠E and ∠C = ∠F
RD Sharma Class 9 Solutions Chapter 12 Heron's Formula VSAQS – 1

Question 2.Solution:
In two triangles ABC and DEF, it is given that ∠A = ∠D, ∠B = ∠E and ∠C = ∠F. Are the two triangles necessarily congruent?

No, as the triangles are equiangular, so similar.

Question 3.Solution:
If ABC and DEF are two triangles such that AC = 2.5 cm, BC = 5 cm, ∠C = 75°, DE = 2.5 cm, DF = 5 cm and ∠D = 75°. Are two triangles congruent?

Yes, triangles are congruent (SAS axiom)
RD Sharma Class 9 Solutions Chapter 12 Heron's Formula VSAQS – 3

Question 4.Solution:
In two triangles ABC and ADC, if AB = AD and BC = CD. Are they congruent?

Yes, these are congruent
In two triangles ABC are ADC,
AB = AD (Given)
BC = CD (Given)
and AC = AC (Common)
∴ ∆sABC ≅ AADC (SSS axiom)
RD Sharma Class 9 Solutions Chapter 12 Heron's Formula VSAQS – 4

Question 5.Solution:
In triangles ABC and CDE, if AC = CE, BC = CD, ∠A = 60°, ∠C – 30° and ∠D = 90°. Are two triangles congruent?

Yes, triangles are congruent because,
In ∆ABC, and ∆CDE,
AC = CE
BC = CD ∠C = 30°
∴ ∆ABC ≅ ∆CDE (SAS axiom)
RD Sharma Class 9 Solutions Chapter 12 Heron's Formula VSAQS – 5

Question 6.Solution:
ABC is an isosceles triangle in which AB = AC. BE and CF are its two medians. Show that BE = CF.

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Given : In ∆ABC, AB = AC
BE and CF are two medians
RD Sharma Class 9 Solutions Chapter 12 Heron's Formula VSAQS – 6
To prove : BE = CF
Proof: In ∆ABE and ∆ACF.
AB = AC (Given)
∠A = ∠A (Common)
AE = AF (Half of equal sides)
∴ ∆ABE ≅ ∆ACF (SAS axiom)
∴ BE = CF (c.p.c.t.)

Question 7.Solution:
Find the measure of each angle of an equilateral triangle.

In ∆ABC,
AB = AC = BC
RD Sharma Class 9 Solutions Chapter 12 Heron's Formula VSAQS – 7
∵ AB = AC
∴ ∠C = ∠B …(i)
(Angles opposite to equal sides)
Similarly,
AC = BC
∴ ∠B = ∠A …(ii)
From (i) and (ii),
∠A = ∠B = ∠C
But ∠A + ∠B + ∠C = 180°
(Sum of angles of a triangle)
∴ ∠A + ∠B + ∠C = $180^\circ 3$ = 60°
Question 8.Solution:
CDE is an equilateral triangle formed on a side CD of a square ABCD. Show that ∆ADE ≅ ∆BCE.

Given : An equilateral ACDE is formed on the side of square ABCD. AE and BE are joined
RD Sharma Class 9 Solutions Chapter 12 Heron's Formula VSAQS – 8
To prove : ∆ADE ≅ ∆BCE
Proof : In ∆ADE and ∆BCE,
AD = BC (Sides of a square)
DE = CE (Sides of equilateral triangle)
∠ADE = ∠BCE(Each = 90° + 60° = 150°)
∴ AADE ≅ ABCE (SAS axiom)

Question 9.Solution:
Prove that the sum of three altitude of a triangle is less than the sum of its sides.

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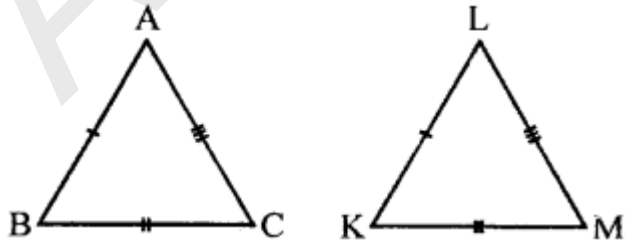
Given : In ∆ABC, AD, BE and CF are the altitude of ∆ABC
RD Sharma Class 9 Solutions Chapter 12 Heron's Formula VSAQS – 9
To prove : AD + BE + CF < AB + BC + CA
Proof : In right ∆ABD, ∠D = 90°
Then other two angles are acute
∵ ∠B < ∠D
∴ AD < AB …(i)
Similarly, in ∆BEC and ∆ABE we can prove thatBE and CF < CA …(iii)
Adding (i), (ii), (iii)
AD + BE -t CF < AB + BC + CA

Question 10.Solution:
In the figure, if AB = AC and ∠B = ∠C. Prove that BQ = CP.
RD Sharma Class 9 Solutions Chapter 12 Heron's Formula VSAQS – 10

Given : In the figure, AB = AC, ∠B = ∠C
To prove : BQ = CP
Proof : In ∆ABQ and ∆ACP
AB = AC (Given)
∠A = ∠A (Common)
∠B = ∠C (Given)
∴ ∆ABQ ≅ ∆ACP (ASA axiom)
∴ BQ = CP (c.p.c.t.)

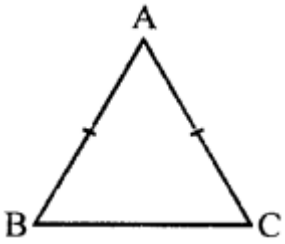
Class 9 RD Sharma Solutions Chapter 12 Heron's Formula MCQS

Mark the correct alternative in each of the following:
Question 1.
In ∆ABC ≅ ∆LKM, then side of ∆LKM equal to side AC of ∆ABC is
(a) LX
(b) KM
(c) LM
(d) None of these
Solution:
Side AC of ∆ABC = LM of ∆LKM (c)



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Question 2.
In $\Delta ABC \cong \Delta ACB$, then ΔABC is isosceles with
(a) AB=AC
(b) AB = BC
(c) AC = BC
(d) None of these
Solution:
$\because \Delta ABC \cong \Delta ACB$
$\therefore$ AB = AC (a)

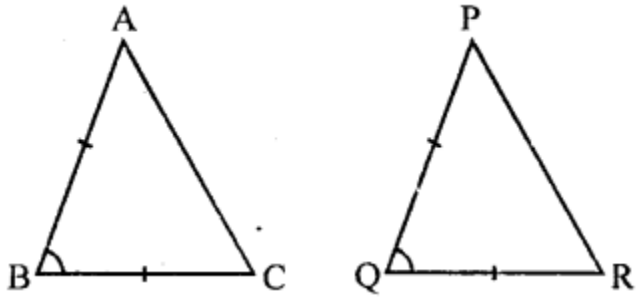


Question 3.
In $\Delta ABC \cong \Delta PQR$, then ΔABC is congruent to ΔRPQ, then which of the following is not true:
(a) BC = PQ
(b) AC = PR
(c) AB = PQ
(d) QR = BC
Solution:
$\because \Delta ABC = \Delta PQR$
$\therefore$ AB = PQ, BC = QR and AC = PR
$\therefore$ BC = PQ is not true (a)

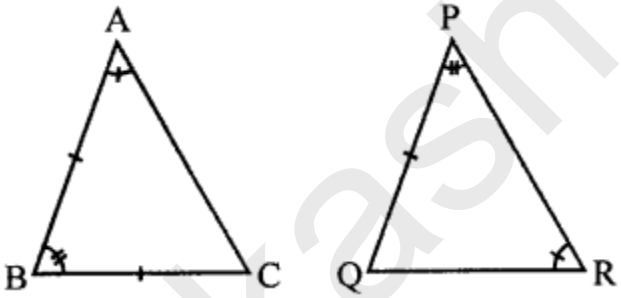
Question 4.
In triangles ABC and PQR three equality relations between some parts are as follows:
AB = QP, $\angle B = \angle P$ and BC = PR State which of the congruence conditions applies:
(a) SAS
(b) ASA
(c) SSS
(d) RHS
Solution:
In two triangles ΔABC and ΔPQR,
AB = QP, $\angle B = \angle P$ and BC = PR

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The condition apply : SAS (a)



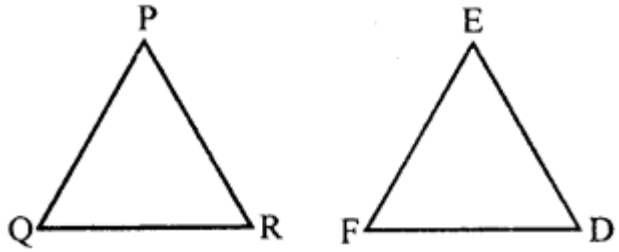
Question 5.
In triangles ABC and PQR, if ∠A = ∠R, ∠B = ∠P and AB = RP, then which one of the following congruence conditions applies:
(a) SAS
(b) ASA
(c) SSS
(d) RHS
Solution:
In ∆ABC and ∆PQR,
∠A = ∠R
∠B = ∠P
AB = RP
∴ ∆ABC ≅ ∆PQR (ASA axiom) (b)



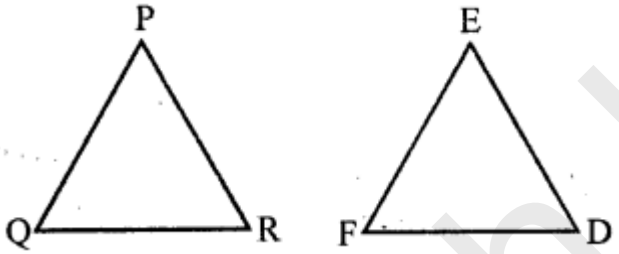
Question 6.
If ∆PQR ≅ ∆EFD, then ED =
(a) PQ
(b) QR
(c) PR
(d) None of these
Solution:
∵ ∆PQR = ∆EFD

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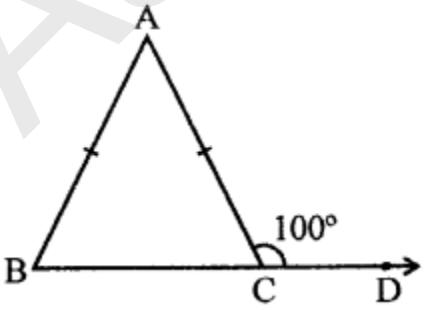
∴ ED = PR (c)



Question 7.
If ΔPQR ≅ ΔEFD, then ∠E =
(a) ∠P
(b) ∠Q
(c) ∠R
(d) None of these
Solution:
∵ ΔPQR ≅ ΔEFD
∴ ∠E = ∠P (a)



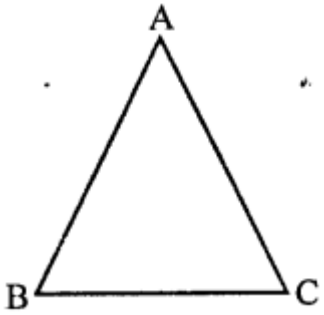
Question 8.
In a ΔABC, if AB = AC and BC is produced to D such that ∠ACD = 100°, then ∠A =
(a) 20°
(b) 40°
(c) 60°
(d) 80°
Solution:
In ΔABC, AB = AC
∴ ∠B = ∠C
But Ext. ∠ACD = ∠A + ∠B



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∠ACB + ∠ACD = 180° (Linear pair)
∴ ∠ACB + 100° = 180°
⇒ ∠ACB = 180°-100° = 80°
∴ ∠B = ∠ACD = 80°
But ∠A + ∠B 4- ∠C = 180°
∴ ∠A + 80° + 80° = 180°
⇒∠A+ 160°= 180°
∴ ∠A= 180°- 160° = 20° (a)

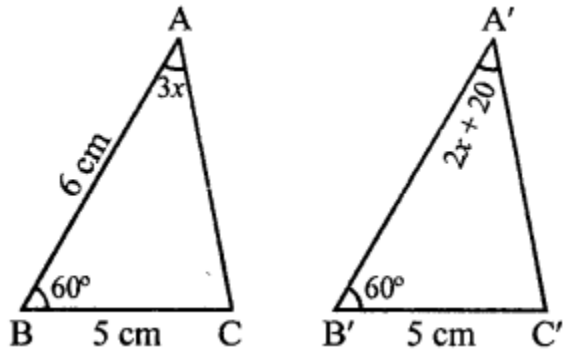
Question 9.
In an isosceles triangle, if the vertex angle is twice the sum of the base angles, then the measure of vertex angle of the triangle is
(a) 100°
(b) 120°
(c) 110°
(d) 130°
Solution:
In ∆ABC,
∠A = 2(∠B + ∠C)
= 2∠B + 2∠C



Adding 2∠A to both sides,
∠A + 2∠A = 2∠A + 2∠B + 2∠C
⇒ 3∠A = 2(∠A + ∠B + ∠C)
⇒ 3∠A = 2 x 180° (∵∠A + ∠B + ∠C = 180°)
⇒ 3∠A = 360°
⇒∠A = $\frac{360°}{3}$ = 120°
∴ ∠A = 120° (b)
Question 10.
Which of the following is not a criterion for congruence of triangles?
(a) SAS
(b) SSA
(c) ASA
(d) SSS
Solution:
SSA is not the criterion of congruence of triangles. (b)

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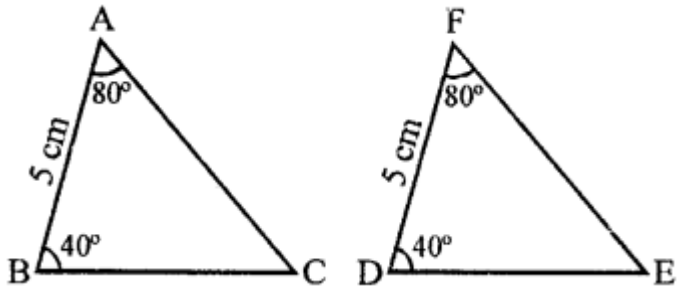
Question 11.
In the figure, the measure of ∠B'A'C' is
(a) 50°
(b) 60°
(c) 70°
(d) 80°



Solution:
In the figure,
ΔABC ≅ ΔA'B'C'
∴ ∠A = ∠A
⇒3x = 2x- + 20
⇒ 3x – 2x = 20
⇒ x = 20
∠B'A'C' = 2x + 20 = 2 x 20 + 20
= 40 + 20 = 60° (b)

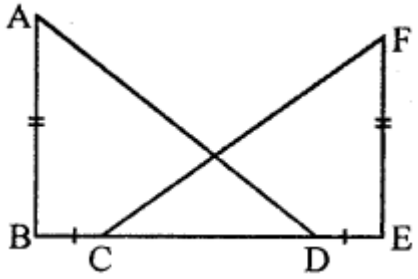
Question 12.
If ABC and DEF are two triangles such that ΔABC ≅ ΔFDE and AB = 5 cm, ∠B = 40° and ∠A = 80°. Then, which of the following is true?
(a) DF = 5 cm, ∠F = 60°
(b) DE = 5 cm, ∠E = 60°
(c) DF = 5 cm, ∠E = 60°
(d) DE = 5 cm, ∠D = 40°
Solution:
∵ ΔABC ≅ ΔFDE,
AB = 5 cm, ∠A = 80°, ∠B = 40°
∴ DF = 5 cm, ∠F = 80°, ∠D = 40°
∴ ∠C =180°- (80° + 40°) = 180° – 120° = 60°

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∴ ∠E = ∠C = 60°
∴ DF = 5 cm, ∠E = 60° (c)

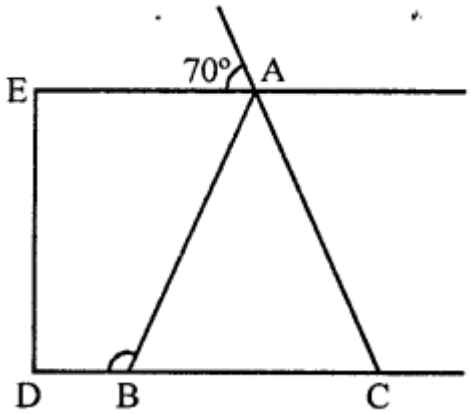
Question 13.
In the figure, AB ⊥ BE and FE ⊥ BE. If BC = DE and AB = EF, then ∆ABD is congruent to
(a) ∆EFC
(b) ∆ECF
(c) ∆CEF
(d) ∆FEC



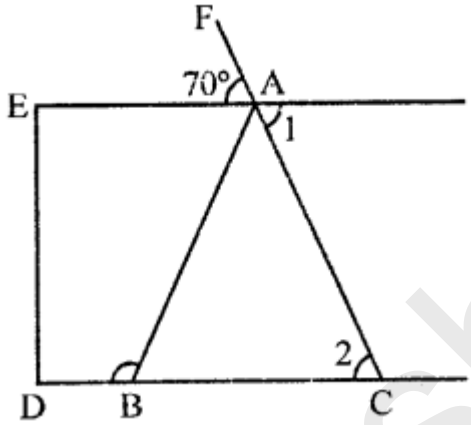
Solution:
In the figure, AB ⊥ BE, FE ⊥ BE
BC = DE, AB = EF,
then CD + BC = CD + DE BD = CE
In ∆ABD and ∆CEF,
BD = CE (Prove)
AB = FE (Given)
∠B = ∠E (Each 90°)
∴ ∆ABD ≅ ∆FCE (b)

Question 14.
In the figure, if AE || DC and AB = AC, the value of ∠ABD is
(a) 70°
(b) 110°
(c) 120°
(d) 130°

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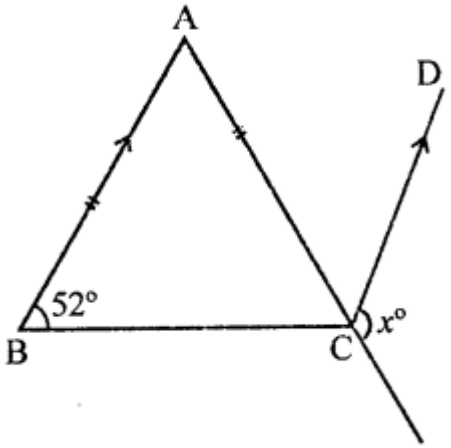
Solution:
In the figure, AE || DC
∴ ∠1 = 70° (Vertically opposite angles)
∴ ∠1 = ∠2 (Alternate angles)
∠2 = ∠ABC (Base angles of isosceles triangle)



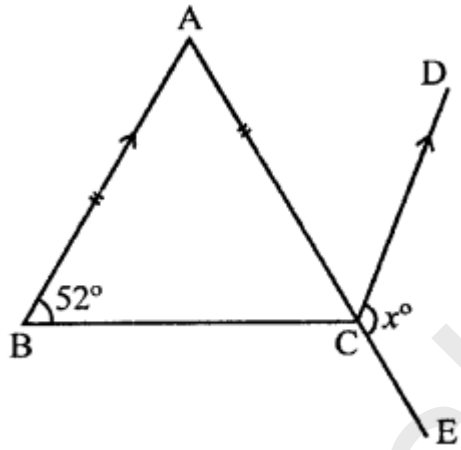
∴ ABC = 90°
But ∠ABC + ∠ABD = 180° (Linear pair)
⇒ 70° +∠ABD = 180°
⇒∠ABD = 180°-70°= 110°
∴ ∠ABD =110° (b)

Question 15.
In the figure, ABC is an isosceles triangle whose side AC is produced to E. Through C, CD is drawn parallel to BA. The value of x is
(a) 52°
(b) 76°
(c) 156°
(d) 104°

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Solution:
In ∆ABC, AB = AC
AC is produced to E

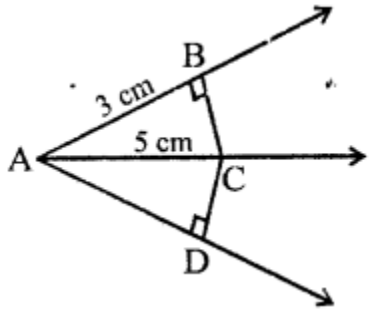


CD || BA is drawn
∠ABC = 52°
∴ ∠ACB = 52° (∵ AB = AC)
∴ ∠BAC = 180°-(52° +52°)
= 180°-104° = 76°
∵ AB || CD
∴ ∠ACD = ∠BAC (Alternate angles)
= 76°
and ∠BCE + ∠DCB = 180° (Linear pair)
∠BCE + 52° = 180°
⇒∠BCE = 180°-52°= 128°
∠x + ∠ACD = 380°
⇒ x + 76° = 180°
∴ x= 180°-76°= 104° (d)

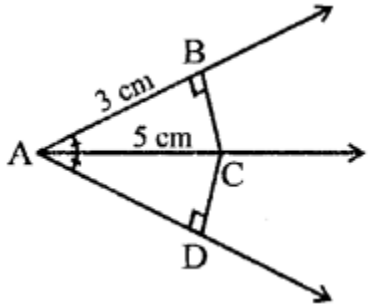
Question 16.
In the figure, if AC is bisector of ∠BAD such that AB = 3 cm and AC = 5 cm, then CD =

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(a) 2 cm
(b) 3 cm
(c) 4 cm
(d) 5 cm



Solution:
In the figure, AC is the bisector of ∠BAD, AB = 3 cm, AC = 5 cm

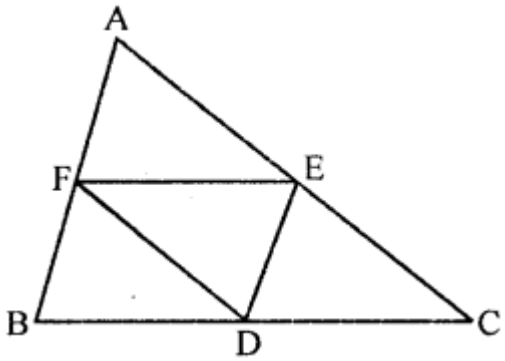


In ∆ABC and ∆ADC,
AC = AC (Common)
∠B = ∠D (Each 90°)
∠BAC = ∠DAC (∵ AC is the bisector of ∠A)
∴ ∆ABC ≅ ∆ADC (AAS axiom)
∴ BC = CD and AB = AD (c.p.c.t.)
Now in right ∆ABC,
$AC^2 = AB^2 + BC^2$
$\Rightarrow (5)^2 = (3)^2 + BC^2$
$\Rightarrow 25 = 9 + BC^2$
$\Rightarrow BC^2 = 25 - 9 = 16 = (4)^2$
∴ BC = 4 cm
But CD = BC
∴ CD = 4 cm (c)

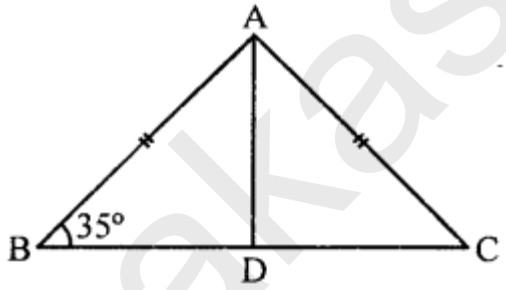
Question 17.
D, E, F are the mid-point of the sides BC, CA and AB respectively of ∆ABC. Then ∆DEF is congruent to triangle
(a) ABC
(b) AEF
(c) BFD, CDE
(d) AFE, BFD, CDE

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Solution:
In ∆ABC, D, E, F are the mid-points of the sides BC, CA, AB respectively
DE, EF and FD are joined

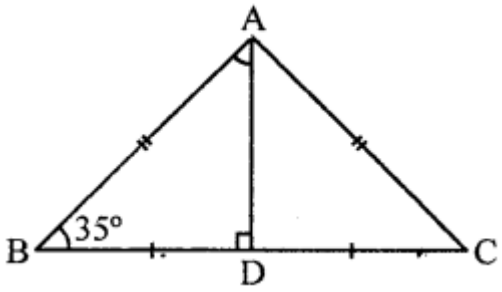


∵ E and F are the mid-points
AC and AB,
∴ EF = 12 BC and EF || BC
Similarly,
DE = 12 AB and DE || AB
DF = 12 AC and DF || AC
∴ ∆DEF is congruent to each of the triangles so formed
∴ ∆DEF is congruent to triangle AFE, BFD, CDE (d)
Question 18.
ABC is an isosceles triangle such that AB = AC and AD is the median to base BC.
Then, ∠BAD =
(a) 55°
(b) 70°
(c) 35°
(d) 110°



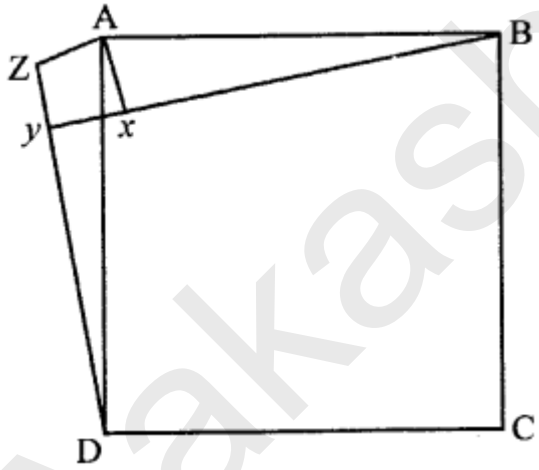
Solution:
In ∆ABC, AB = AC
AD is median to BC

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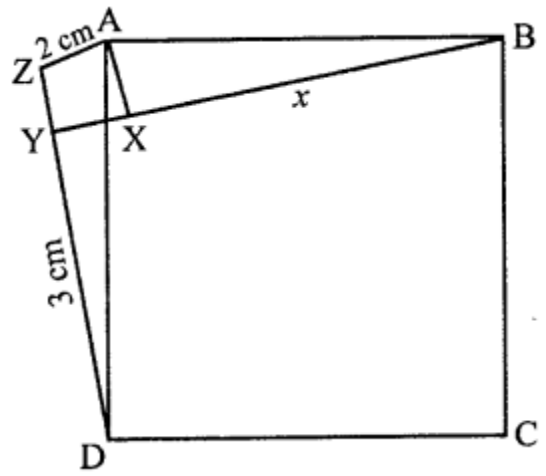
∴ BD = DC
In ∆ADB, ∠D = 90°, ∠B = 35°
But ∠B + BAD + ∠D = 180° (Sum of angles of a triangle)
⇒ 35° + ∠BAD + 90° = 180°
⇒∠BAD + 125°= 180°
⇒ ∠BAD = 180°- 125°
⇒∠BAD = 55° (a)

Question 19.
In the figure, X is a point in the interior of square ABCD. AXYZ is also a square. If DY = 3 cm and AZ = 2 cm, then BY =
(a) 5 cm
(b) 6 cm
(c) 7 cm
(d) 8 cm



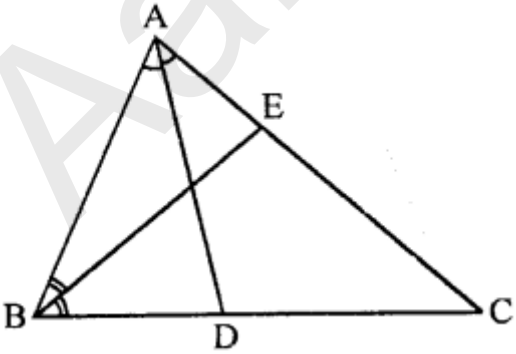
Solution:
In the figure, ABCD and AXYZ are squares
DY = 3 cm, AZ = 2 cm

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DZ = DY + YZ
= DY + Z = 3 + 2 = 5 cm
In ∆ADZ, ∠2 = 90°
$AD^2 + AZ^2 + DZ^2 = 2^2 + 5^2$ cm
= 4 + 25 = 29
In ∠ABX, ∠X = 90°
$AB^2 = AX^2 + BX^2$
$AD^2 = AZ^2 + BX^2$
(∵ AB = AD, AX = AZ sides of square)
$29 = 2^2 + BX^2$
$\Rightarrow 29 = 4 + BX^2$
$\Rightarrow BX^2 = 29 - 4 = 25 = (5)^2$
∴ BX = 5 cm (a)

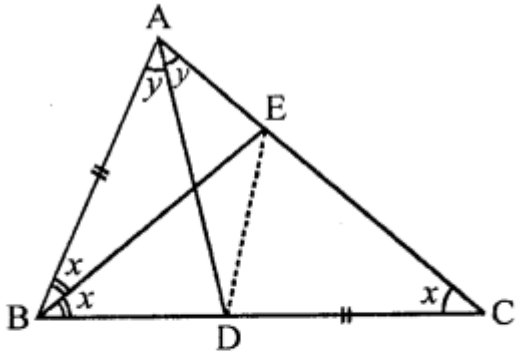
Question 20.
In the figure, ABC is a triangle in which ∠B = 2∠C. D is a point on side BC such that AD bisects ∠BAC and AB = CD. BE is the bisector of ∠B. The measure of ∠BAC is
(a) 72°
(b) 73°
(c) 74°
(d) 95°



Solution:
In the figure, ∠B = 2∠C, AD and BE are the bisectors of ∠A and ∠B respectively,

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AB = CD



Let $\angle C = x$, then $\angle B = 2x$ and

Let $\angle A = 2y$

$\therefore$ $\angle ABC = \angle CBE = x$

$\therefore$ $\angle BAD = \angle CAD = y$

In ΔBCE,

$\therefore$ $\angle EBC = \angle BCE = x$

$\therefore$ $BE = EC$

In ΔABE and ΔDCE,

$AB = DC$	(Given)
$\angle ABE = \angle C$	(Each $= x$)
$BE = EC$	(Proved)

$\therefore$ $\Delta ABE \cong \Delta DCE$ (SAS axiom)

$\therefore$ $\angle BAE = \angle EDC = 2y$

and $AE = ED$

$\therefore$ $\angle EAD = \angle EDA = y$

In ΔABD,

Ext. $\angle ADC = 2x + y = 2y + y$

$\Rightarrow 2x = 2y \Rightarrow x = y$

Now in ΔABC,

$\angle A + \angle B + \angle C = 180°$

$\Rightarrow 2y + 2x + x = 180° \Rightarrow 2x + 2x + x = 180°$

$$\Rightarrow 5x = 180° \Rightarrow x = \frac{180°}{5} = 36°$$

$\therefore$ $\angle BAC = 2y = 2x = 2 \times 36° = 72°$ (a)

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