OBJECTIVE Type Questions

[1 mark]

Multiple Choice Questions

1. If x, y, and z are the sides of a triangle and t is the semi-perimeter, then which of the following results is not true?

(a) $t > z$ **(b)** $t < x + z$

(c) $t < x + y$ **(d)** $t > x + y + z$

Ans. *(d)* $t > x + y + z$

Explanation: Let, $x = 3$ cm

$y = 4$ cm

$z = 5$ cm

$x + y = 3$ cm + 4 cm = 7 cm

$x + z = 3$ cm + 5 cm = 8 cm

$x + y + z = 3$ cm + 4 cm + 5 cm = 12 cm

So, semi-perimeter of the triangle,

$$t = \frac{x+y+z}{2} = \frac{3+4+5}{2}$$

$= 6$ cm

Clearly, $t > z$

$t < x + y$

$t < x + z$

$t < x + y + z$

2. If $\Delta ACB \cong \Delta EDF$, then which of the following equations is/are true?

(I) $AC = ED$

(II) $\angle C = \angle F$

(III) $AB = EF$

(a) Only (I) **(b) (I) and (III)**

(c) (II) and (III) **(d) All of these**

Ans. *(b) (I) and (III)*

Explanation: Since, $\Delta ACB \cong \Delta EDF$

$\therefore$ $AC = ED$

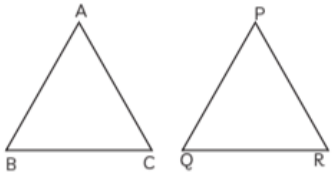
$CB = DF$

$AB = EF$

And $\angle A = \angle E$, $\angle C = \angle D$ and $\angle B = \angle F$

Therefore, equations (I) and (III) are true.

3. If AB = QR, BC = PR and CA = PQ in ΔABC and ΔPQR, then:



(a) $\Delta ABC \cong \Delta PQR$

(b) $\Delta CBA \cong \Delta PRQ$

(c) $\Delta BAC \cong \Delta RPQ$

(d) $\Delta BCA \cong \Delta PQR$

[Delhi Gov. SQP 2022]

Ans. *(b)* $\Delta CBA \cong \Delta PRQ$

Explanation: According to the question

AB = QR, BC = PR and CA = PQ

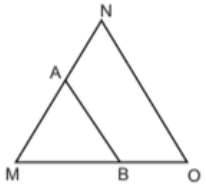
Since, AB = QR, BC = PR and CA = PQ

We can say that,

A corresponds to Q, B corresponds to R, C corresponds to P.

Hence, $\Delta CBA \cong \Delta PRQ$

4. In the given figure, ΔMNO is an isosceles triangle in which MN = MO and AB is parallel to NO. If $\angle N = 75°$, then $\angle NAB$ is:



(a) 105° **(b) 75°**

(c) 65° **(d) 85°**

Ans. *(a) 105°*

Explanation: In ΔMNO,

$MN = MO$ [Given]

$\therefore$ $\angle N = \angle O$

[Angles opposite to equal sides are equal]

$\angle O = 75°$

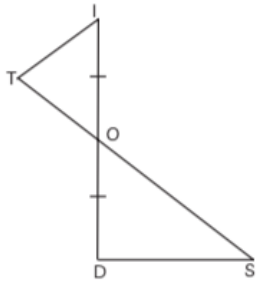
$\angle NAB + \angle ANO = 180°$ [Co-interior angles]

$\angle NAB + 75° = 180°$

$\angle NAB = 180° - 75°$

$\angle NAB = 105°$

5. The triangles made by two intersecting lines as shown in figure. What additional information is required to prove that $\Delta TOI \cong \Delta SOD$?



(a) $\angle DOS = \angle TOI$ **(b)** $\angle OTI = \angle ODI$

(c) $TO = OS$ **(d)** $TI = DS$

[Delhi Gov. SQP 2022]

Ans. *(b)* $\angle OTI = \angle ODI$

Explanation: According to the SAS Congruence criteria, two triangles are congruent if two sides and the included angle of one triangle are equal to the two sides and the included angle of the other triangle.

So, In ΔTOI and ΔSOD,

$OI = OD$ ...(i)

[sides of the triangle]

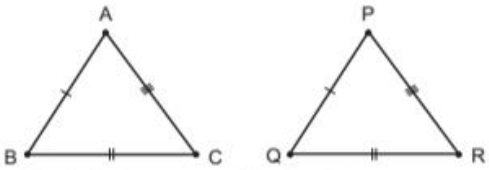
$\angle OTI = \angle ODI$ ...(ii)

[included angles of the triangle]

$OT = DI$

[sides of the triangle so they are equal]

6. If $\Delta ABC \cong \Delta PQR$ and ΔABC is not congruent to ΔRPQ, then which of the following is not true?



(a) BC= PQ **(b) AC = PR**
(c) QR= BC **(d) AB = PQ**

[NCERT Exemplar]

Ans. *(a) BC = PQ*

Explanation:

Given, $\Delta ABC \cong \Delta PQR$

Thus, the corresponding sides are equal

Hence,

$AB = PQ$
$BC = QR$
$AC = PR$

Therefore, BC = PQ is not true for the triangles.

7. Which of the following is not a criterion for congruence of the triangle?

(a) SAS **(b) ASA**
(c) SSA **(d) SSS**

[NCERT Exemplar]

Ans. *(c) SSA*

Explanation:

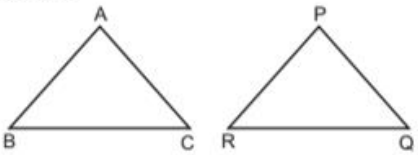
(1) SAS = If two pairs of corresponding sides of two triangles are equal in length and the corresponding included angles are equal in measurement, then the triangles are congruent.

(2) ASA = If two pairs of corresponding angles of two triangles are equal in measurement, and the corresponding included sides are equal in length, then the triangles are congruent.

(3) SSA = The SSA condition (Side-Side Angle) which specifies two sides and a non-included angle (also known as ASS, or Angle-Side-Side) does not prove congruence by itself.

(4) SSS = If three pairs of corresponding sides of two triangles are equal in length, then the triangles are congruent.

8. If in ΔACB and ΔPQR, AC = PQ and BC = RQ, then to show $\Delta ACB \cong \Delta PQR$ by SAS congruence rule which one of the following is needed?



(a) $\angle A = \angle P$ **(b) $\angle A = \angle Q$**
(c) $\angle B = \angle R$ **(d) $\angle C = \angle Q$**

Ans. *(d) $\angle C = \angle Q$*

Explanation: Given, AC = PQ and BC = RQ

For $\Delta ACB \cong PQR$

To follow SAS congruence rule , two sides and the included angle of one triangle should be equal to the two sides and the included angle of the other triangle.

$\therefore \angle C = \angle Q$ is needed

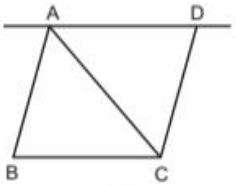
9. If two pairs of angles and one pair of corresponding sides are equal, then which congruence rule is followed?

(a) ASA **(b) AAS**
(c) SAS **(d) SSA**

Ans. *(b) AAS*

Explanation: When two angles and a non-included side of a triangle are equal to the corresponding angles and sides of another triangle, then the triangles are said to be congruent by AAS congruence rule.

10. In a triangle (as shown in fig). AB = CD, AD = BC and AC is the angle bisector of $\angle A$, then which among the following conditions is true for congruence of ΔABC and ΔCDA by SAS rule?



(a) $\angle A = \angle D$ **(b) $\angle B = \angle A$**
(c) $\angle B = \angle D$ **(d) $\angle C = \angle A$**

Ans. *(c) $\angle B = \angle D$*

Explanation: As In ΔABC and ΔCDA,

$AB = CD$
$AD = BC$

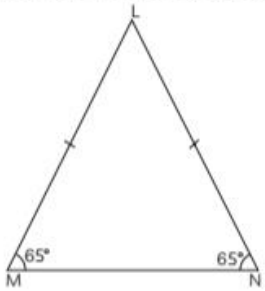
For SAS Rule, if two sides and the included angle of one triangle are equal to the two sides and the included angle of the other triangle, then triangles are congruent.

Therefore,

For $\Delta ABC \cong \Delta CDA$

by SAS, $\angle B$ must be equal to $\angle D$

11. ΔLMN is an isosceles triangle such the LM = LN and $\angle N = 65°$. The value of $\angle L$ is:



(a) $\angle L = 55°$ **(b)** $\angle L = 45°$
(c) $\angle L = 50°$ **(d)** $\angle L = 65°$ **[Diksha]**

Ans. *(c)* $\angle L = 50°$

Explanation: ΔLMN is an isosceles triangle.

$LM = LN$ [Given]

$\angle N = \angle M$

[$\because$ Angles opposite to equal sides are equal]

$\therefore \quad \angle M = 65°$

$\angle L + \angle M + \angle N = 180°$

[$\because$ Angle sum property of a triangle]

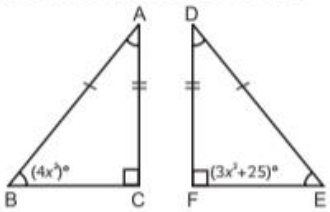
$\angle L + 65° + 65° = 180°$

$\angle L + 130° = 180°$

$\angle L = 180° - 130°$

$\angle L = 50°$

12. In the given figure $\Delta ABC \cong \Delta DEF$ by AAA congruence rule. The value of $\angle x$ is:



(a) 75° **(b) 105°**
(c) 125° **(d) 5°**

Ans. *(d) 5°*

Explanation: In ΔABC and ΔDEF,

$\angle C = \angle F$

$AB = DE$

$\therefore \quad AC = DF$

$\Delta ABC \cong \Delta DEF$ [By RHS rule]

$\angle B = \angle E$ [By CPCT]

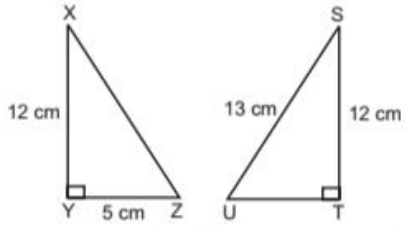
$(4x^2)° = (3x^2 + 25)°$

$x^2 = 25$

$x = \sqrt{25}$

$x = 5°$

13. Consider the triangles shown in the figure. Which of these is not true about the given triangles?



(a) $\Delta XYZ \cong \Delta STU$ (by SSS congruence rule)
(b) $\Delta XYZ \cong \Delta STU$ (by RHS congruence rule)
(c) $\Delta XYZ \cong \Delta STU$ (by ASA congruence rule)
(d) $\Delta XYZ \cong \Delta STU$ (by SAS congruence rule)

Ans. *(c)* $\Delta XYZ \cong \Delta STU$ [By ASA congruence rule]

Explanation: In ΔXYZ,

$XZ^2 = XY^2 + YZ^2$

$XZ^2 = (12)^2 + (5)^2$

$XZ^2 = 144 + 25$

$XZ^2 = 169$

$XZ = 13$ cm

Therefore, $\Delta XYZ \cong \Delta STU$

[By SSS congruence rule]

Now, In ΔXYZ and ΔSTU,

$\angle Y = \angle T$ [Right angles]

Hypotenuse XZ = Hypotenuse SU

Hypotenuse XZ = Hypotenuse XU = 13 cm

$XY = ST = 12$ cm

Therefore, $\Delta XYZ \cong \Delta STU$

[By RHS congruence rule]

Then, $YZ = UT = 5$ cm [By CPCT]

$\therefore \quad XY = ST$

$YZ = UT$

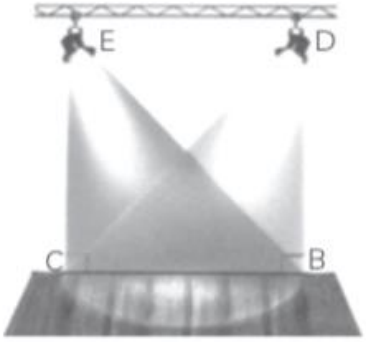
$XZ = SU$

And $\angle Y = \angle T$

Here, $\Delta XYZ \cong \Delta STU$

By SSS, RHS and SAS congruence rules, but as only one angle is known, ASA congruence rule is not applicable here.

14. During the New Year party, the lights shining on a stage appear to form two congruent right triangles. If EC = DB, then by which congruence rule $\Delta ECB \cong \Delta DBC$?



(a) SSS **(b) RHS**
(c) ASA **(d) SAS**

Ans. *(d) SAS*

Explanation: Since $\Delta ECB \cong \Delta DBC$

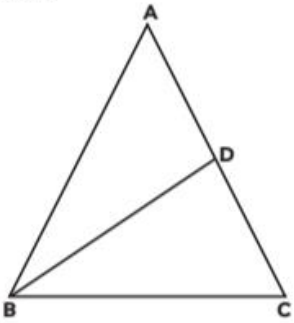
$EC = DB$ [Given]

$\angle C = \angle B$ [Right angled triangle]

$CB = BC$ [Common]

$\Delta ECB \cong \Delta DBC$ [By SAS congruence rule]

15. **In ΔABC, if point D is the mid-point of AC and BA = BC, then**



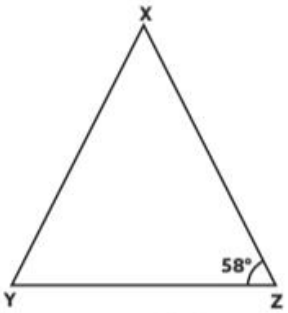
(a) $\Delta DAB \cong \Delta DBC$ **(b)** $\Delta ADB \cong \Delta CBD$
(c) $\Delta DAB \cong \Delta DCB$ **(d)** $\Delta ABD \cong \Delta DBC$
[Diksha]

Ans. *(c)* $\Delta DAB \cong \Delta DCB$

Explanation: In ΔDAB and ΔDCB,

$AD = CD$ [Point D is the mid-point of AC]
$BA = BC$ [Given]
$BD = BD$ [Common side]
Hence, $\Delta DAB \cong \Delta DCB$ [By SSS congruency rule]

16. **ΔXYZ is an isosceles triangle, such that XY = XZ and $\angle Z = 58°$. The value of $\angle X + \angle Y$ is:**



(a) 180° **(b)** 64°
(c) 122° **(d)** 116° **[Diksha]**

Ans. *(c)* 122°

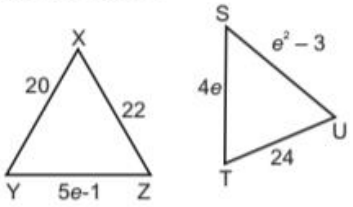
Explanation: In ΔXYZ is an isosceles triangle.

$XY = XZ$ [Given]
$\angle Z = \angle Y$ [Angles opposite to equal sides are equal]
$\therefore \quad \angle Y = \angle 58°$ ...(i)
$\angle X + \angle Y + \angle Z = 180°$ [Angle sum property of triangles]
$\angle X + 58° + 58° = 180°$
$\angle X + 116° = 180°$
$\angle X = 64°$ ...(ii)

Adding eqs. (i) and (ii)

$\angle X + \angle Y = 64° + 58°$
$\angle X + \angle Y = 122°$

17. **In the figure, $\Delta XYZ \cong \Delta STU$ by SSS rule, then the value of *e* will be:**



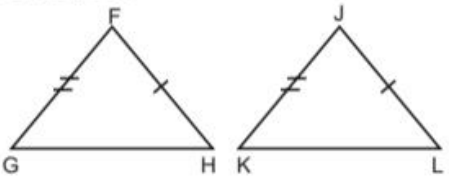
(a) 6 **(b)** 5
(c) 4 **(d)** 3

Ans. *(b)* 5

Explanation: Given, $\Delta XYZ \cong \Delta STU$ [By SSS Congruence rule]

Therefore, $XZ = SU$ [By CPCT]
$22 = e^2 - 3$ [Given]
$e^2 = 25$
$e = \sqrt{25}$
$e = 5$

18. **Shreyansh wants to prove that $\Delta FGH \cong \Delta JKL$ using SAS rule. He knows that FG = JK and FH= JL. What additional piece of information does he need?**

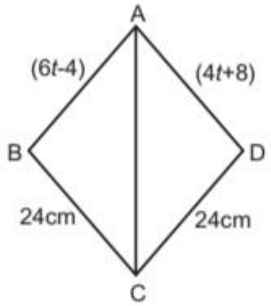


(a) $\angle F = \angle J$ **(b)** $\angle H = \angle L$
(c) $\angle G = \angle K$ **(d)** $\angle F = \angle G$

Ans. *(a)* $\angle F = \angle J$

Explanation: We know for SAS, if two sides and the included angle of one triangle are equal to the two sides and the included angle of the other triangle, then the triangles are congruent.
So, $\angle F = \angle J$

19. **What must be the value of the variable t in order to prove that $\Delta ABC \cong \Delta ADC$ by SSS rule?**



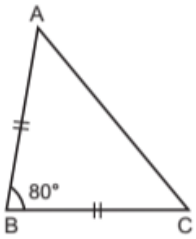
(a) 7.5 **(b)** 6
(c) 4 **(d)** 8

Ans. *(b) 6*

Explanation: Since, ABC ≅ ΔADC

$$AB = AD$$
$$6t - 4 = 4t + 8$$
$$6t - 4t = 8 + 4$$
$$2t = 12$$
$$t = 6$$

20. In ΔABC, BC = AB and ∠B = 80°, then ∠A is equal to:



(a) 80° **(b) 40°**

(c) 50° **(d) 100°**

[NCERT Exemplar]

Ans. *(c) 50°*

Explanation: BC = AB and ∠B = 80°

$$\angle A = \angle C$$

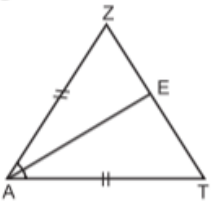
[Angles opposite to equal sides are equal]

Let $\angle A = \angle C = x$

In ΔABC,

$$x + 80° + x = 180° \quad \text{[Angle sum property]}$$
$$2x + 80° = 180°$$
$$2x = 180° - 80°$$
$$2x = 100°$$
$$x = 50°$$

21. In triangle ZAT, AZ = AT and AE bisect ∠ZAT. If the measure of ∠ZAT is 50°, which of the following angles measure 25°?



(a) ∠ZAE **(b) ∠ZTA**

(c) ∠AET **(d) ∠AEZ**

Ans. *(a) ∠ZAE*

Explanation: Given, ∠ZAT = 50°

And $AZ = AT$

Therefore, $\angle T = \angle Z$ ... (i)

[Angles opposite to equal sides are equal]

In ΔZAT,

$$\angle A + \angle Z + \angle T = 180°$$
$$50° + \angle Z + \angle Z = 180° \quad \text{[From eq. (i)]}$$
$$2\angle Z = 180° - 50°$$
$$2\angle Z = 130°$$
$$\angle Z = \frac{130°}{2}$$
$$\angle Z = 65°$$

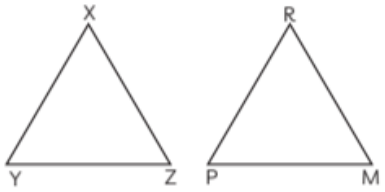
Since, AE is angle bisector.

$$\therefore \angle ZAE = \angle EAT = \frac{\angle ZAT}{2} = \frac{50°}{2} = 25°$$

Hence, $\angle ZAE = 25°$

Fill in the Blanks

22. If ΔXYZ ≅ ΔRPM then XZ = ...



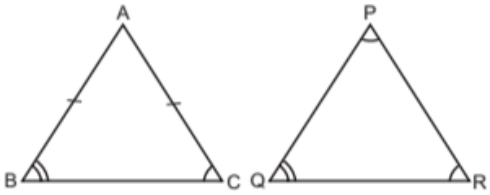
Ans. *RM*

Explanation: Since, If ΔXYZ ≅ ΔRPM

Therefore, X ↔ R, Y ↔ P and Z ↔ M

Thus, XZ = RM

23. In triangles ABC and PQR, AB = AC, ∠C = ∠P, and ∠B = ∠Q. The two triangles are: ..... .



[NCERT Exemplar]

Ans. *isosceles but not congruent*

Explanation: In ΔABC and ΔPQR,

$\angle C = \angle P$ [Given]

$\angle B = \angle Q$ [Given]

Also $AB = AC$

Thus $\angle B = \angle C$

[Isosceles triangle property]

Thus, $\angle B = \angle C = \angle Q = \angle P$

$\therefore$ $PR = QR$

[Sides opposite to equal angles are equal]

Thus, both the triangles are isosceles but not congruent.

True and False

24. If two sides and an angle of one triangle are equal to two sides and an angle of another triangle, then the two triangles must be congruent.

Ans. *False*

Explanation: If two sides and the included angle of one triangle are equal to the corresponding

two sides and the included angle of another triangle then the two triangles must be congruent by SAS congruence rule.

25. If two angles and a side of one triangle are equal to two angles and a side of another triangle, then the two triangles must be congruent.

Ans. *False*

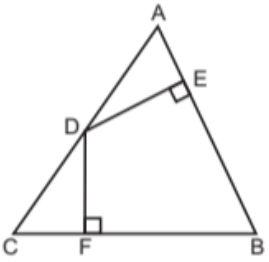
Explanation: If two angles and the corresponding sides of one triangle are equal to the two angles and the corresponding side of another triangle, then the two triangles must be congruent.

26. Equality of three angles is not sufficient for the congruence of triangles.

Ans. *True*

Explanation: Equality of three angles is not sufficient for the congruence of triangles. Therefore, for the congruence of triangles out of three equal parts, one has to be a side.

27. In ΔABC, D is a point on side AC such that DE = DF and AD = CD and DE ⊥ AB at E and DF ⊥ CB at F, then AB = BC.



Ans. *True*

Explanation: In ΔAED and ΔCFD,

$AD = CD$

$DE = DF$

$\Delta AED \cong \Delta CFD$

[By RHS congruence rule]

$\angle A = \angle C$

$\therefore \quad AB = BC$

[Sides opposite to equal angles are equal]

Assertion and Reason (A-R)

Direction for questions 28 to 30: In question number 28 to 30, a statement of Assertion (A) is followed by a statement of Reason (R).

Choose the correct option as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

28. Assertion (A): In ΔABC, if $\angle B = 2\angle C$ and $\angle A = 2\angle B$, then the values of all angles are in an integer number.

Reason (R): The angle sum property says that the sum of all the angles of a triangle is 180°.

Ans. *(d) Assertion (A) is false but reason (R) is true.*

Explanation: We know that, in ΔABC

$\angle A + \angle B + \angle C = 180°$ ... (i)

As $\angle A = 2\angle B$ and $\angle B = 2\angle C$ or $\angle C = \frac{\angle B}{2}$

Putting this value in equation (i), we get

$$2\angle B + \angle B + \frac{\angle B}{2} = 180°$$

$$\frac{4\angle B + 2\angle B + \angle B}{2} = 180°$$

$$7\angle B = 360°$$

$$\angle B = \frac{360°}{7}$$

$$\angle B = 51.4°$$

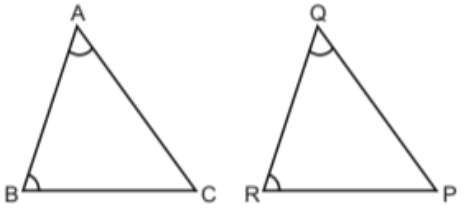
which is not an integer value.

29. Assertion (A): In ΔABC and ΔQRP, $\angle A = \angle Q$ and $\angle B = \angle R$, also AB = QR.

Reason (R): Both the triangles are congruent by the SAS congruence rule.

Ans. *(c) Assertion (A) is true but reason (R) is false.*

Explanation:



We have given, in ΔABC and ΔQRP, $\angle A = \angle Q$ and $\angle B = \angle R$.

Since, in ΔABC and ΔQRP, AB and QR are included between equal angles.

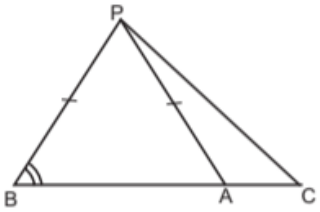
Hence, the side of ΔQRP is QR which should be equal to side AB of ΔABC, so that $\Delta ABC \cong \Delta QRP$ by ASA congruence rule.

30. Assertion (A): In the figure, A is a point on side BC of ΔPBC such that PB = PA, then PC > PB.

Reason (R): In a triangle, the side opposite to the larger angle is longer.

Ans. *(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).*

Explanation:



In ΔPBA,

PB = PA [Given]

So, ∠PBA = ∠PAB = x

[Opposite angle of equal sides are equal]

∠PAC = ∠PBA + ∠PAB

[Exterior angle property]

∠PAC = $x + x$

∠PAC = $2x$

∠PAC > ∠PAB

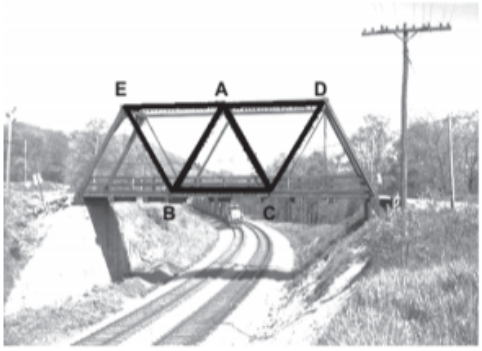
∴ PC > PB [Side opposite to larger angle]

CASE BASED Questions (CBQs)

[**4** & **5** marks]

Read the following passages and answer the questions that follow:

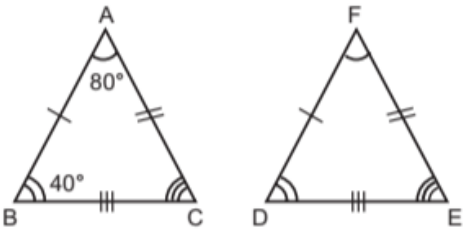
31. *Truss bridges are formed with a structure of connected elements that form triangular structures to make up the bridge. Trusses are the triangles that connect to the top and bottom cord and two endposts. You can see that there are some triangular shapes are shown in the picture given alongside and these are represented as ΔABC, ΔCAD, and ΔBEA.*



(A) If AB = CD and AD = CB, then prove ΔABC ≅ ΔCDA

(B) If AB = 7.5 m, AC = 4.5 m and BC = 5 m. Find the perimeter of ΔACD, if ΔABC ≅ ΔCDA by SSS congruence rule.

(C) If ΔABC ≅ ΔFDE, AB = 5 cm, ∠B = 40° and ∠A = 80°. Then find the length of DF and ∠E.



Ans. (A) In ΔABC and ΔCDA,

AB = CD [Given]

AD = CB [Given]

AC = CA [common]

So by SSS congruence rule

ΔABC ≅ ΔCDA

(B) Given that ΔABC ≅ ΔCDA

[By SSS congruence rule]

So, Perimeter of ΔABC = Perimeter of ΔCDA

(7.5 m + 4.5 m +5 m) = Perimeter of ΔCDA

The required perimeter of ΔCDA=17 m.

(C) Given, ΔABC ≅ ΔFDE and AB = 5cm,

∠B = 40°

∠A = 80°

Since, ΔFDE ≅ ΔABC

DF = AB [By CPCT]

DF = 5cm

and ∠E = ∠C

⇒ ∠E = ∠C = 180°– (∠A + ∠B)

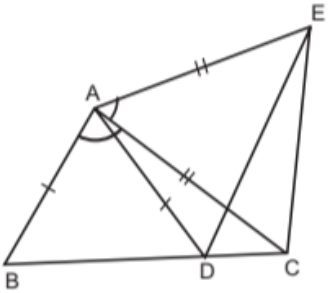
[By Angle Sum Property of a ΔABC]

⇒ ∠E = 180°– (80° + 40°)

∠E = 60°

Hence, DF = 5cm, ∠E = 60°

32. *Ramanuj wants to grow potatoes, so he bought farmland in quadrilateral form. But later on, he decided to grow two types of potatoes and the same mix of both the types so he made several divisions on the land as shown in the figure. Here, AC = AE, AB = AD and ∠BAC = ∠EAC.*



(A) $\Delta ABC \cong \Delta ADE$ by which congruence rule?

(a) AAS **(b) SAS**

(c) ASA **(d) AAA**

(B) Which among the following conditions is required to make $\Delta ABC \cong \Delta ADE$ by SAS rule, if only AB = AD and AC = AE are given?

(a) $\angle ABC = \angle AED$

(b) $\angle CAB = \angle EDA$

(c) $\angle BAC = \angle DAE$

(d) None of these

(C) If $\Delta ABC \cong \Delta ADE$, then BC is equal to which among the following sides?

(a) AB **(b) EC**

(c) AD **(d) DE**

(D) If $\angle BAD + \angle DAC = x + \angle DAC$, then find the value of x will be equal to:

(a) $\angle DAC$ **(b) $\angle BAD$**

(c) $\angle ACE$ **(d) $\angle EAC$**

Ans. (A) *(b) SAS Congruence Rule*

Explanation: In ΔABC and ΔADE

$AB = AD$ [Given]

$\angle BAC = \angle DAE$ [Given]

$AC = AE$ [Given]

$\therefore \quad \Delta ABC \cong \Delta ADE$ [By SAS Rule]

(B) *(c) $\angle BAC = \angle DAE$*

Explanation: In ΔABC and ΔADE

$AB = AD$ [Given]

$AC = AE$ [Given]

So, the required condition is $\angle BAC = \angle DAE$

(C) *(d) DE*

Explanation: $\because \Delta ABC \cong \Delta ADE$ [By SAS congruence rule]

$\therefore \quad BC = DE$ [By CPCT]

(D) *(d) $\angle EAC$*

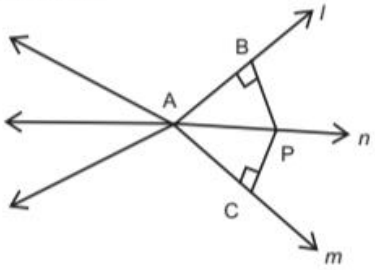
Explanation: $\angle BAD = \angle EAC$ [Given]

Add $\angle DAC$ on both sides, we get

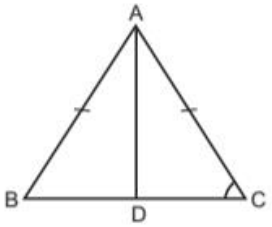
$\angle BAD + \angle DAC = \angle EAC + \angle DAC$.

33. *To check the understanding of the students of the class about IX the triangles, the Mathematics teacher write some questions on the blackboard and ask the students to read them carefully and answer the following question.*

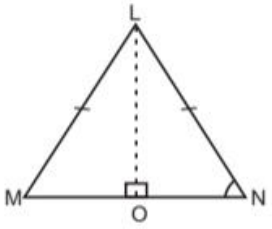
(A) In figure, P is a point equidistant from the lines l and m intersecting at point A, then find $\angle BAP$.



(B) In ΔABC, if AB = AC and BD = DC (see figure), then find $\angle ADC$.



(C) ΔLMN is an isosceles triangle, where LM = LN and LO, is an angle bisector of $\angle MLN$, Prove that point 'O' is the mid-point of side MN.



Ans. (A) Let us consider ΔPAB and ΔPAC (as shown in figure).

Here, we have

$PB = PC$ [Perpedicular distance]

$\angle PBA = \angle PCA$ [Each 90°]

$PA = PA$ [Common]

$\Delta PAB \cong \Delta PAC$ [By RHS congruence rule]

So, $\angle BAP = \angle CAP$ [By CPCT]

(B) We have

$AB = AC$, $BD = CD$ and $AD = AD$

$\therefore \quad \Delta ABD = \Delta ACD$ [By SSS congruence rule]

$\angle ADB = \angle ADC$ [By CPCT]

Since, BDC is a straight line.

$\therefore \angle ADB + \angle ADC = 180°$ [By SSS congruecne rule]

$\Rightarrow \quad 2\angle ADC = 180°$

$\Rightarrow \quad \angle ADC = 90°$

(C) Given: LM = LN and ∠MLO = ∠NLO

To prove: OM = ON

Proof: Since ΔLMN is an isosceles triangle and LM = LN

∴ ∠M = ∠N ...(i)

LO is an angle bisector of ∠MLN

∠MLO = ∠NLO ...(ii)

In ΔMLO and ΔNLO,

∠M = ∠N

i.e., ∠OML = ∠ONL

LM = LN

∠MLO = ∠NLO

∴ ΔMLO ≅ ΔNLO

[By ASA congruence rule]

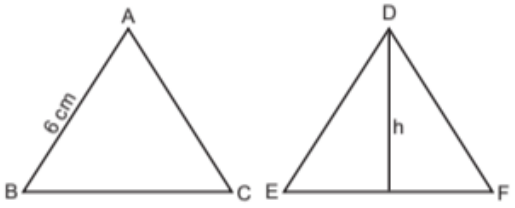
∴ OM = ON [By CPCT]

Hence, proved.

VERY SHORT ANSWER Type Questions (VSA)

[1 mark]

34. Two equilateral triangles, ABC and DEF are congruent. Find the height of ΔDEF, if AB = 6 cm.



Ans. ΔABC ≅ ΔDEF

∴ AB = DE [By CPCT]

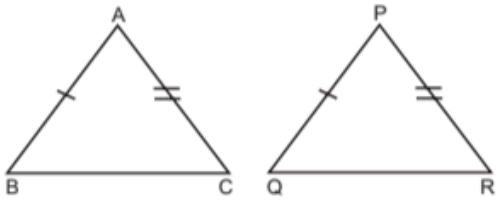
⇒ DE = 6 cm

Height of equilateral triangle = $\frac{\sqrt{3}}{2}$ × side

∴ $= \frac{\sqrt{3}}{2} \times 6$

Height = $3\sqrt{3}$ cm

35. In two congruent triangles ABC and PQR, if AB = PQ and AC = PR. Find the pair of corresponding angles included between corresponding sides.



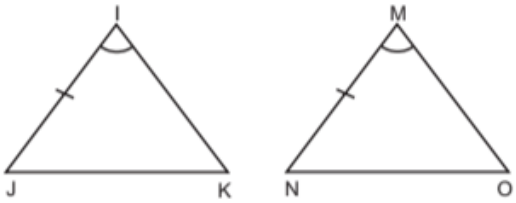
Ans. ΔBAC ≅ ΔQPR [By SAS congruence rule]

Then, ∠A = ∠P.

36. Shreya has 3 equal sides and joins them to make a triangle. Find the value of each angle

Ans. An equilateral triangle has all sides equal and each angle is of 60°.

37. Ritu and Shinu have two congruent triangles with them ΔIJK and ΔMNO, IJ = MN, ∠I = ∠M. What will be the condition in which the two triangles will be congruent by SAS rule?

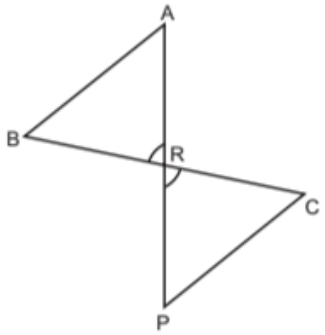


Ans. ΔIJK ≅ ΔMNO

To follow SAS congruence rule

IK = MO

38. In the figure shown below, R is the midpoint of AP and BC. Show that ΔABR ≅ ΔPCR.



Ans. In ΔABR and ΔPCR,

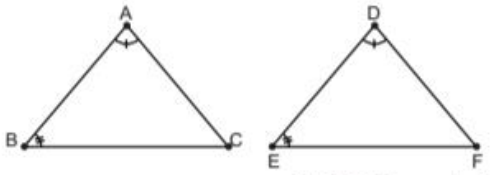
AR = PR [R is the midpoint]

BR = CR [R is the midpoint]

∠R = ∠R [Vertically opposite angles]

∴ ΔABR ≅ ΔPCR [By SAS congruence rule]

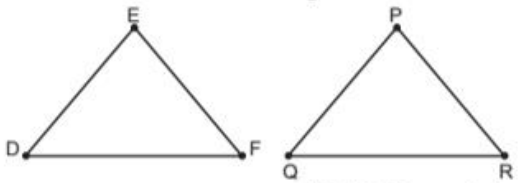
39. **In triangles ABC and DEF, ∠A = ∠D, ∠B = ∠E, and AB = EF, will the two triangles be congruent? Give reasons for your answer.**



[NCERT Exemplar]

Ans. Two triangles need not be congruent because AB and EF are not the corresponding sides in the triangles.

40. **If ΔPQR ≅ ΔEDF, then is it true to say that PR = EF? Give a reason for your answer.**



[NCERT Exemplar]

Ans. Yes, if ΔPQR ≅ ΔEDF, then it means that corresponding angles and their sides are equal because we know that, two triangles are congruent, if the sides and angles of one triangle are equal to the corresponding sides and angles of other triangle.

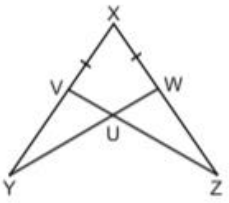
∵ ΔPQR ≅ ΔEDF,

PQ = ED, QR = DF and PR = EF

[These are corresponding sides]

Hence, it is true to say that PR = EF

41. **What additional congruence statement is necessary to prove ΔXWY ≅ ΔXZV by ASA?**



Ans.

ΔXYW ≅ ΔXZV

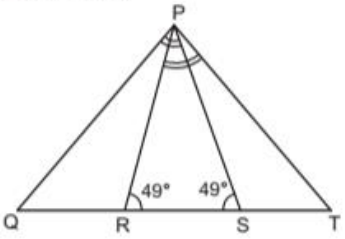
ΔXWY ≅ ΔXVZ

XY = XZ [By CPCT]

∠X = ∠X [Common]

∠XYW = ∠XZV

42. **In the given figure, PQ = PT, PR = PS, show that ΔQPS ≅ ΔTPR.**



Ans. Since, in ΔQPS and ΔTPR,

PR = PS [Given]

PQ = PT [Given]

∠QPS = ∠TPR [Given]

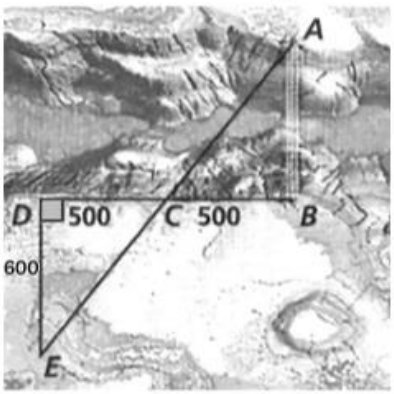
∴ ΔQPS ≅ ∠TPR

[By SAS congruence rule]

SHORT ANSWER Type-I Questions (SA-I)

[2 marks]

43. **Shreya, an architect, wants to design a bridge across a canyon. She needs to find the distance from A to B to locate points C, D, and E as shown in the figure. If DE = 600 m. What is the length of AB?**



Ans.

∠D = ∠B [Both are 90°]

DC = BC = 500 m [Given]

∠DCE = ∠BCA

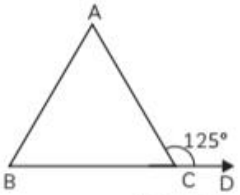
[Vertically opposite angles]

∴ ΔDCE ≅ ΔBCA [By ASA]

ED = AB [By CPCT]

Hence, AB = 600 m [∵ DE = 600m, given]

44. **In the given figure AB = AC and ∠ACD = 125°. Find ∠A.**



[Delhi Gov. QB 2022]

Ans. AB = AC

According to theorem, angles opposite to equal sides of an isosceles triangles are equal.

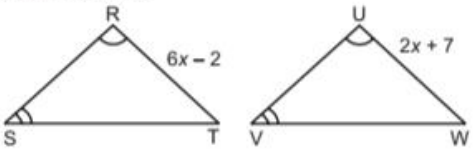
$$\angle B = \angle C$$
$$\angle C = 180° - \angle ACD$$
$$= 180° - 125° = 55°$$
$$\angle B = 55°$$
$$55° + 55° + \angle A = 180°$$

(Angle sum property of triangle)

$$110° + \angle A = 180°$$
$$\angle A = 180° - 110° = 70°$$

Therefore, $\angle A = 70°$

45. In ΔRST, RT = 6x − 2. In ΔUVW, UW = 2x + 7, ∠R = ∠U, and ∠S = ∠V. What must be the value of x in order to prove that ΔRST ≅ ΔUVW?



Ans. Given that $\angle S = \angle V$

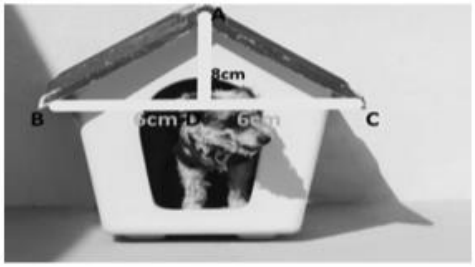
and $\angle R = \angle U$

$\angle T = \angle W$

For $\Delta RST \cong \Delta UVW$

$$RT = UW$$
$$6x - 2 = 2x + 7$$
$$6x - 2x = 9$$
$$4x = 9$$
$$x = \frac{9}{4}$$
$$x = 2.25$$

46. The front of a dog house has the dimensions (as shown in the figure). Prove that ΔADB ≅ ΔADC also find the perimeter of ΔABC.



Ans. In ΔABD and ΔACD,

$\angle ADB = \angle ADC$ [Both 90°]

BD = DC = 6 cm [Given]

AD = AD [Common]

By SAS congruence rule,

$\Delta ABD \cong \Delta ACD$

Now, AB = AC [By CPCT]

In ΔABD,

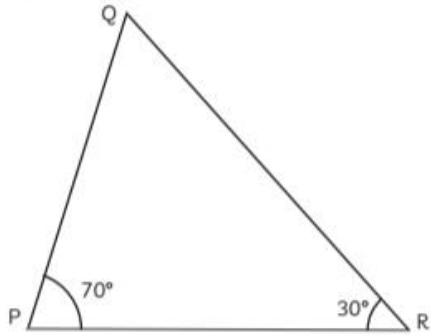
$$AB^2 = AD^2 + BD^2$$
$$AB^2 = (8)^2 + (6)^2$$
$$= 64 + 36$$
$$AB^2 = 100$$
$$AB = 10 \text{ cm}$$
$$AB = AC = 10 \text{ cm}$$

Therefore,

Perimeter of ABC = AB + AC + BC

$$= (10 + 10 + 12) \text{ cm}$$
$$= 32 \text{ cm}$$

47. In ΔPQR, ∠P = 70°, ∠R = 30°. Which side of the triangle is the longest?



[NCERT Exemplar]

Ans. In ΔPQR, ∠P = 70°, ∠R = 30°

But

$\angle P + \angle Q + \angle R = 180°$ [Angle sum property]

$$70° + \angle Q + 30° = 180°$$
$$\angle Q = 180° - 100°$$
$$\angle Q = 80°$$

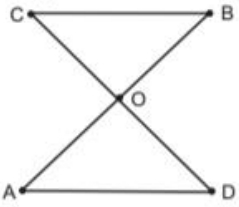
[The greatest angle]

As we know, the side opposite to the greatest angle is the longest.

So, the side opposite to ∠Q is PR.

Hence, PR is the longest side.

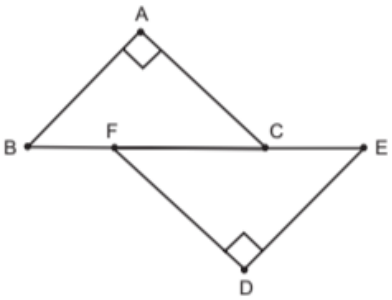
48. In the given figure two lines AB and CD intersect each other at the point O such that BC || AD and BC = DA. Show that O is the midpoint of both the line-segment AB and CD.



[NCERT Exemplar]

Ans. BC || AD [Given]
Therefore ∠CBO = ∠DAO
[Alternate interior angles]
And ∠BCO = ∠ADO [Alternate interior angles]
Also, BC = DA [Given]
So, ΔBOC ≅ ΔAOD [ASA congruence rule]
Therefore, OB = OA and OC = OD, *i.e.*, O is the mid-point of both AB and CD.

49. In figure BA ⊥ AC, DE ⊥ DF. Such that BA = DE and BF = EC. Show that ΔABC ≅ ΔDEF.



[NCERT Exemplar]

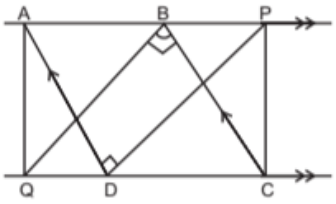
Ans. According to the question,
BA ⊥ AC, DE ⊥ DF
Such that BA = DE and BF = EC.
In, ΔABC and ΔDEF

	BA = ED	[Given]
	BF = EC	[Given]
	∠A = ∠D	[Both 90°]
Now,	BF = EC	[Given]
	BF + FC = EC + FC	
	BC = EF	
∴	ΔABC ≅ ΔDEF	[By RHS]

SHORT ANSWER Type-II Questions (SA-II)

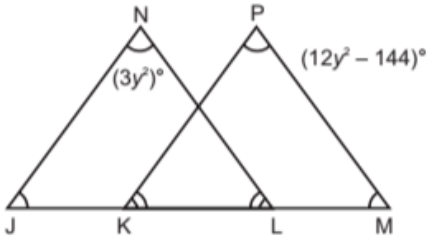
[3 marks]

50. ABCD is a parallelogram where ∠ADP = ∠CBQ = 90° also ABP and QDC are straight lines. Prove that triangle ADP is congruent to CBQ. Also, explain why AQ is parallel to PC.



Ans. In ΔADP and ΔCBQ,
∠ADP = ∠CBQ = 90° [Given]
AD = CB
[Opposite sides of parallelogram are equal]
∠DAB = ∠BCD
[Opposite angles of parallelogram are equal]
So, by ASA Congruence Rule,
ΔADP ≅ ΔCBQ,
Since ΔADP and ΔCBQ are congruent
AP = CQ and also parallel
∴ APCQ is a parallelogram, so AQ = PC

51. Find the measure of ∠N and ∠P if ∠J = ∠M and ∠K = ∠L.



Ans. In ΔNJL and ΔPMK,

	∠NJL = ∠PMK	[Given]
	∠NLJ = ∠PKM	[Given]
∴	∠N = ∠P	
	$(3y^2)° = (12y^2 - 144)°$	
	$144 = 12y^2 - 3y^2$	
	$144 = 9y^2$	
	$y^2 = \frac{144}{9}$	
	$y^2 = 16$	
	$y = \sqrt{16}$	
	$y = 4°$	
Now,	$\angle JNL = 3y^2 = 3(4)^2$	
	$= 3 \times 16 = 48°$	

Also, $\angle MPK = (12y^2 - 144)^\circ$

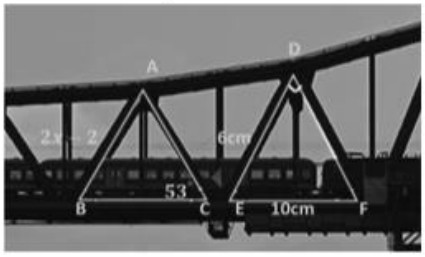
$= 12(4)^2 - 144^\circ$

$= 192^\circ - 144^\circ$

$\angle MPK = 48^\circ$

Hence, $\angle JNL = \angle MPK$

52. If $\Delta ABC \cong \Delta DFE$, find the value of x.



Ans. Since, $\Delta ABC \cong \Delta DFE$ [Given]

$\therefore$ $\angle C = \angle E$

Since, $\angle C = 53^\circ$ [Given]

Therefore, $\angle E = 53^\circ$

In ΔDEF, $\angle D = 90^\circ$

$EF^2 = DE^2 + DF^2$

$10^2 = 6^2 + DF^2$

$DF^2 = 100 - 36$

$DF^2 = 64$

$DF = \sqrt{64}$

$DF = 8$ cm

Also, $\angle C = \angle E$

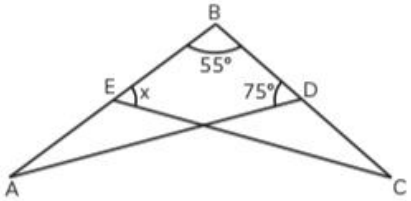
$\therefore$ $AB = DF$ [$\Delta ABC \cong \Delta DFE$]

$2x - 2 = 8$

$2x = 10$

$x = 5$

53. In the given figure, if AB = BC and $\angle A = \angle C$, then find the value of x.



Ans. In ΔBEC,

$\angle EBC + \angle BEC + \angle BCE = 180^\circ$

$\Rightarrow$ $55^\circ + x + \angle BCE = 180^\circ$

$\Rightarrow$ $\angle BCE = 125^\circ - x$ ...(i)

In ΔBDA,

$\Rightarrow 55^\circ + 75^\circ + \angle BAD = 180^\circ$

$\Rightarrow$ $\angle BAD = 50^\circ$

$\because$ $\angle A = \angle C$

$\Rightarrow$ $\angle BAD = \angle BCE$

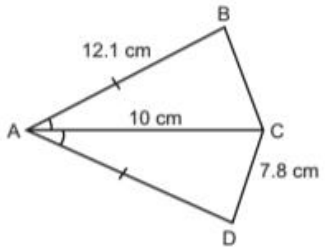
$\Rightarrow$ $\angle BCE = 50^\circ$

Putting in eq. (i)

$\Rightarrow$ $50^\circ = 125^\circ - x$

$\Rightarrow$ $x = 75^\circ$

54. Find the perimeter of the quadrilateral ABCD (as shown in the figure), if $\angle CAB = \angle CAD$ and also AB = AD.



Ans. Since $AB = AD$ [Given]

$\therefore$ $AD = 12.1$ cm [AB = 12.1cm]

Now,

In ΔABC and ΔADC

$AB = AD$ [Given]

$\angle BAC = \angle DAC$ [Given]

$AC = AC$ [Given]

$\therefore$ $\Delta ABC \cong \Delta ADC$

[By SAS congruence rule]

Hence $BC = DC$ [By CPCT]

$BC = 7.8$ cm

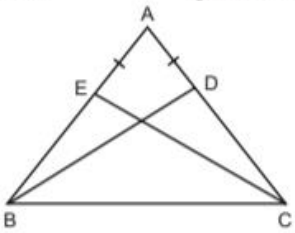
Now, we have to calculate the perimeter of quadrilateral.

Perimeter $= AB + BC + CD + AD$

$= 12.1 + 7.8 + 7.8 + 12.1$

$= 39.8$ cm

55. ABC is an isosceles triangle with AB = AC and BD and CE are its two medians. Show that BD = CE. [NCERT Exemplar]



Ans. Given: AB = AC

Also, BD and CE are two medians

$\therefore$ E is the mid-point of AB

D is the mid-point of AC

Hence $\frac{1}{2} AB = \frac{1}{2} AC$

$BE = CD$

In ΔBEC and ΔCDB

$BE = DC$ [Given]

$\angle EBC = \angle DCB$

[Angles opposite to equal sides are equal]

$BC = BC$ [Common]

Hence,

$\Delta BEC \cong \Delta CDB$

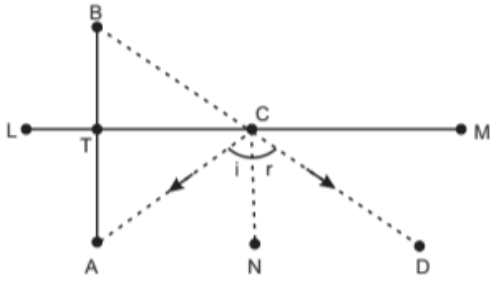
[By SAS congruence rule]

$BD = CE$ [By CPCT]

LONG ANSWER Type Questions (LA)

[4 & 5 marks]

56. The image of an object placed at a point A before a plane mirror, LM is seen at the point B by an observer at D as shown in figure. Prove that the image is as far behind the mirror as the object is in front of the mirror.



[Hint: CN is normal to the mirror, also, angle of incidence = angle of reflection].

Ans. According to the figure we need to prove that

$$AT = BT$$

According to the given question,

The angle of incidence = Angle of reflection

Therefore,

$$\angle ACN = \angle DCN \quad \text{... (i)}$$

Since, AB ||CN and AC is the transversal,

From the figure, we know that $\angle TAC$ and $\angle ACN$ are alternate angles.

$$\angle TAC = \angle ACN \quad \text{... (ii)}$$

We know that AB || CN and BD are the transversals.

From the figure, we know that $\angle TBC$ and $\angle DCN$ are corresponding angles.

$$\angle TBC = \angle DCN \quad \text{.... (iii)}$$

By considering the equation (i), (ii), and (iii)

We get,

$$\angle TAC = \angle TBC \quad \text{... (iv)}$$

Now, In ΔACT and ΔBCT

$$\angle ATC = \angle BTC = 90^\circ$$

CT is common *i.e.*, $CT = CT$

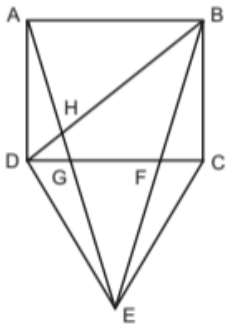
By AAS congruence rule,

$$\Delta ACT \cong \Delta BCT$$

$$AT = BT \quad \text{[CPCT]}$$

Therefore, it is proved that the image is as far behind the mirror as the object is in front of the mirror.

57. Ram has a wooden box on which he exactly fitted a triangle and joined with a straight line to prove that AE = BE and also, find $\angle BDE$ and $\angle AHD$.



Ans. Since, ABCD is a square and ΔDCB is an equilateral triangle.

As $\angle BCD = 90^\circ$ and $\angle DCE = 60^\circ$

$$\Rightarrow \quad \angle BCD + \angle DCE = 90^\circ + 60^\circ$$

$$\angle BCE = 150^\circ$$

Similarly, we have $\angle ADE = 150^\circ$

Thus, in ΔADE, we have

$$AD = BC$$

$$\angle BCE = \angle ADE = 150^\circ$$

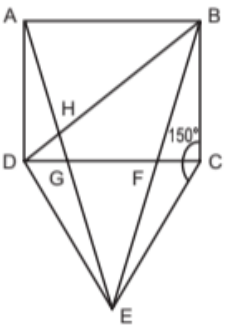
And $EC = DE$

So, by SAS Congruence Rule,

$$\Delta ECB \cong \Delta EDA$$

$$\Rightarrow \quad AE = BE$$

Now,



In ΔBCE,

$$BC = CE$$

[Angles opposite to equal sides are equal]

$$\therefore \quad \angle CBE = \angle CEB = x$$

In ΔBCE,

$$\angle EBC + \angle BEC + \angle BCE = 180^\circ$$

$$x + x + 150^\circ = 180^\circ$$

$$2x = 180^\circ - 150^\circ$$

$$2x = 30^\circ$$

$$x = 15^\circ$$

Also, $\angle FEC = 15^\circ$

$$\angle DEC = \angle DEF + \angle FEC$$

$\angle DEF = \angle DEC - \angle FEC$

$= 60° - 15°$

$\angle DEF = 45°$

Now, $\angle BDE = \angle BDC + \angle CDE$

$= 45° + 60°$

$\angle BDE = 105°$

$\therefore$ In ΔDBE,

$\angle DEB + \angle BDE + \angle DBE = 180°$

[Angle sum property]

$45° + 105° + \angle DBE = 180°$

$\angle DBE = 180° - 45° - 105°$

$= 180° - 150°$

$\angle DBE = 30°$

In ΔADH,

$\angle A + \angle D + \angle H = 180°$

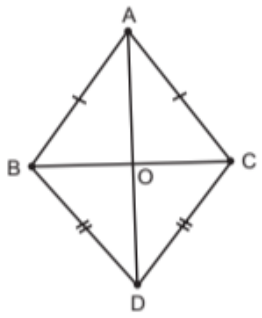
[Angle sum property]

$15° + 45° + \angle H = 180°$

$60° + \angle H = 180°$

$\angle H = 120°$

58. ABC and DBC are two triangles on the same base BC such that A and D lie on the opposite sides of BC, AB = AC and DB = DC. Show that AD is the perpendicular bisector of BC.



[NCERT Exemplar]

Ans. Let AD intersect BC at O.

Then must prove that $\angle AOB = \angle AOC = 90°$ and $BO = OC$

In ΔABD and ΔACD, we have

$AB = AC$ [Given]

$AD = DA$ [Common]

$BD = DC$ [Given]

$\therefore \quad \Delta ABD \cong \Delta ACD$ [By SSS]

$\Rightarrow \quad \angle BAD = \angle CAD$ [By CPCT]

In ΔABC,

$\angle AOB = \angle AOC$

[Angle opposite to equal sides are equal]

But $\angle AOB + \angle AOC = 180°$ [Linear pair]

$\Rightarrow \quad \angle AOB + \angle AOB = 180°$

$\Rightarrow \quad 2\angle AOB = 180°$

$\therefore \quad \angle AOB = 90°$

Hence, AD is perpendicular to BC and AD bisects BC.

$\therefore$ AD is a perpendicular bisector.