CBSE Class 9 Mathematics

NCERT Solutions

CHAPTER 7

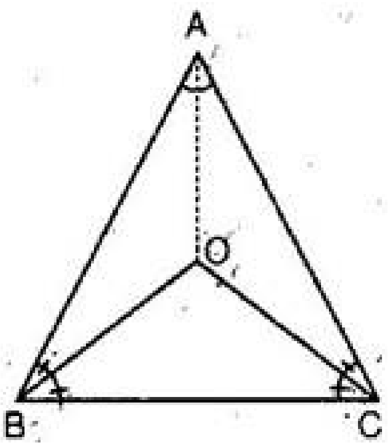
Triangles(Ex. 7.2)

1. In an isosceles triangle ABC, with AB = AC, the bisectors of $\angle$B and $\angle$C intersect each other at O. Join A to O. Show that:

(i) OB = OC

(ii) AO bisects $\angle$A.

Ans. (i) ABC is an isosceles triangle in which AB = AC.



$\therefore$ $\angle$C = $\angle$B [Angles opposite to equal sides]

$\Rightarrow$ $\angle$OCA + $\angle$OCB = $\angle$OBA + $\angle$OBC

$\because$ OB bisects $\angle$B and OC bisects $\angle$C

$\therefore$ $\angle$OBA = $\angle$OBC and $\angle$OCA = $\angle$OCB

$\Rightarrow$ $\angle$OCB + $\angle$OCB = $\angle$OBC + $\angle$OBC

$\Rightarrow$ 2$\angle$OCB = 2$\angle$OBC

$\Rightarrow$ $\angle$OCB = $\angle$OBC

Now in ΔOBC,

$\angle$OCB = $\angle$OBC [Proved above]

$\therefore$ **OB** = **OC** [Sides opposite to equal angles]

(ii) In $\triangle$AOB and $\triangle$AOC,

AB = AC [Given]

OA = OA [Common]

OB = OC [Prove above]

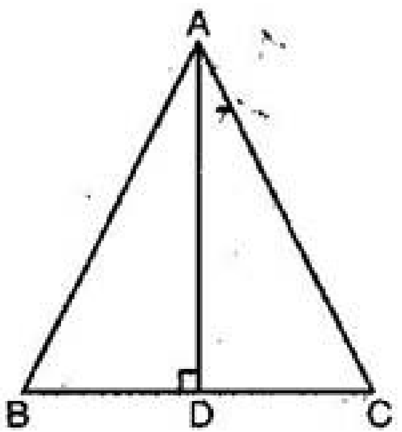
$\therefore$ $\triangle$AOB $\cong$ $\triangle$AOC [By SSS congruency]

$\Rightarrow$ $\angle$OAB = $\angle$OAC [By C.P.C.T.]

Hence AO bisects $\angle$A.

---

2. In $\triangle$ABC, AD is the perpendicular bisector of BC (See figure). Show that $\triangle$ABC is an isosceles triangle in which AB = AC.



Ans. In $\triangle$ADB and $\triangle$ADC,

BD = CD [AD bisects BC]

$\angle$ADB = $\angle$ADC = 90° [AD $\perp$ BC]

AD = AD [Common]

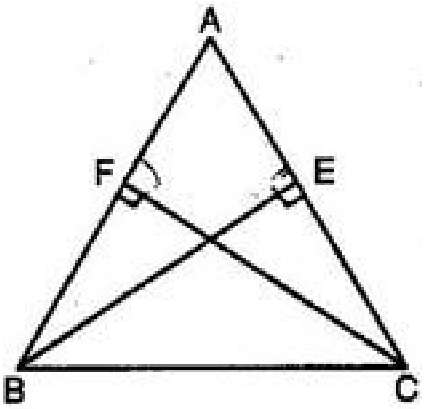
$\therefore$ $\triangle$ABD $\cong$ $\triangle$ACD [By SAS congruency]

$\Rightarrow$ AB = AC [By C.P.C.T.]

Therefore, **ABC is an isosceles triangle with AB = AC. Hence, proved.**

---

3. ABC is an isosceles triangle in which altitudes BE and CF are drawn to equal sides AC and AB respectively (See the given figure). Show that these altitudes are equal.



Ans. In $\triangle$ ABE and $\triangle$ ACF,

$\angle$A= $\angle$A [Common]

$\angle$AEB = $\angle$AFC = 90° [Given]

AB = AC [Given]

$\therefore$ $\triangle$ ABE $\cong$ $\triangle$ ACF [By AAS congruency]

$\Rightarrow$ BE = CF [By C.P.C.T.]

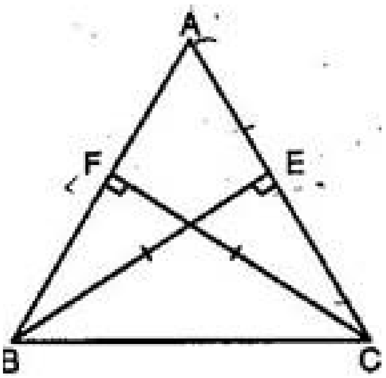
$\Rightarrow$ **Altitudes are equal.**

---

4. ABC is a triangle in which altitudes BE and CF to sides AC and AB are equal (See figure). Show that:

(i) $\triangle$ ABE $\cong$ $\triangle$ ACF

(ii) AB = AC or $\triangle$ ABC is an isosceles triangle.



Ans. (i) In $\triangle$ABE and $\triangle$ACF,

$\angle$A= $\angle$A [Common]

$\angle$AEB = $\angle$AFC = 90° [Given]

BE = CF [Given]

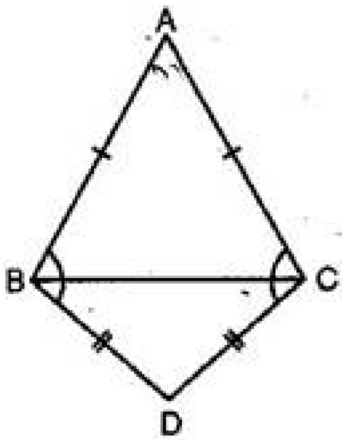
$\therefore$ $\triangle$ABE $\cong$ $\triangle$ ACF [By AAS congruency]

(ii) Since $\triangle$ABE $\cong$ $\triangle$ACF

$\Rightarrow$ BE = CF [By C.P.C.T.]

$\Rightarrow$ ABC is an isosceles triangle.

5. ABC and DBC are two isosceles triangles on the same base BC (See figure). Show that $\angle$ABD = $\angle$ACD.



Ans. In isosceles triangle ABC,

AB = AC [Given]

$\angle$ACB = $\angle$ABC ....(i) [Angles opposite to equal sides]

Also in Isosceles triangle BCD.

BD = DC

$\therefore$ $\angle$BCD = $\angle$CBD ....(ii) [Angles opposite to equal sides]

Adding eq. (i) and (ii),

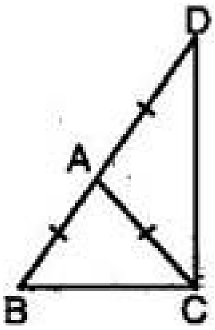
$\angle$ACB + $\angle$BCD = $\angle$ABC + $\angle$CBD

$\Rightarrow$ $\angle$ACD = $\angle$ABD

Or $\angle$ABD = $\angle$ACD

---

6. $\triangle$ ABC is an isosceles triangle in which AB = AC. Side BA is produced to D such that AD = AB. Show that $\angle$BCD is a right angle (See figure).



Ans. In isosceles triangle ABC,

AB = AC [Given]

$\angle$ACB = $\angle$ABC ....(i) [Angles opposite to equal sides]

Now AD = AB [By construction]

But AB = AC [Given]

$\therefore$ AD = AB = AC

$\Rightarrow$ AD = AC

Now in triangle ADC,

AD = AC

$\Rightarrow$ $\angle$ADC = $\angle$ACD ....(ii) [Angles opposite to equal sides]

In triangle BCD,

$\Rightarrow \angle ABC + \angle BCD + \angle CDA = 180^0$ [Angle sum property]

$\Rightarrow \angle ACB + \angle BCD + \angle CDA = 180^0$ [Because $\angle$ACB = $\angle$ABC, see (i)]

$\Rightarrow \angle ACB + \angle ACB + \angle ACD + \angle CDA = 180^0$ [Because $\angle BCD = \angle ACB + \angle ACD$]

$\Rightarrow 2\angle ACB + \angle ACD + \angle CDA = 180^0$

$\Rightarrow 2\angle ACB + \angle ACD + \angle ACD = 180^0$ [Because $\angle$ADC = $\angle$ACD, see (ii)]

$\Rightarrow 2\angle ACB + 2\angle ACD = 180^0$

$\Rightarrow 2(\angle ACB + \angle ACD) = 180^0$ [Taking out 2 common]

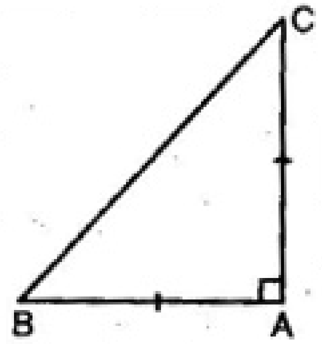
$\Rightarrow 2\angle BCD = 180^0$ [Because, $\angle ACD + \angle ACB = \angle BCD$]

$\Rightarrow$ $\angle$BCD = 90°

Hence $\angle$BCD is a right angle.

7. ABC is a right angled triangle in which $\angle$A = 90° and AB = AC. Find $\angle$B and $\angle$C.

Ans. ABC is a right triangle in which,



$\angle A = 90^\circ$ And AB = AC

In $\triangle ABC$,

AB = AC

$\Rightarrow \angle C = \angle B$ ……….(i)

We know that, in $\triangle ABC$,

$\angle A + \angle B + \angle C = 180^\circ$ [Angle sum property]

$\Rightarrow 90^\circ + \angle B + \angle B = 180^\circ$

[$\angle A = 90^\circ$ (given) and $\angle B = \angle C$ (from eq. (i)]

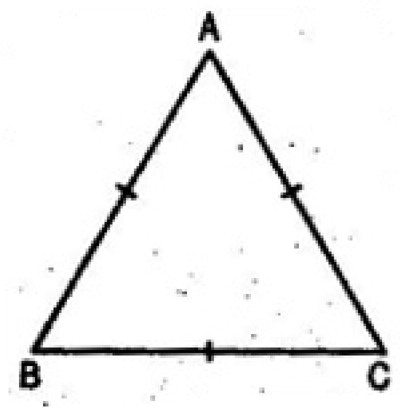
$\Rightarrow 2\angle B = 90^\circ$

$\Rightarrow \angle B = 45^\circ$

Also $\angle C = 45^\circ$ [$\angle B = \angle C$]

8. Show that the angles of an equilateral triangle are 60° each.

Ans. Let ABC be an equilateral triangle.



$\therefore$ AB = BC = AC

$\Rightarrow$ AB = BC

$\Rightarrow$ $\angle$C = $\angle$A ....(i)

Similarly, AB = AC

$\Rightarrow$ $\angle$C = $\angle$B ....(ii)

From eq. (i) and (ii),

$\angle$A = $\angle$B = $\angle$C ....(iii)

Now in ΔABC

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

$\Rightarrow$ $\angle$A + $\angle$A + $\angle$A = 180°

$\Rightarrow$ 3$\angle$A = 180°

$\Rightarrow$ $\angle$A = 60°

Since $\angle$A = $\angle$B = $\angle$C [From eq. (iii)]

$\therefore$ $\angle$A = $\angle$B = $\angle$C = 60°

Hence each angle of equilateral triangle is 60°.