NCERT Solutions for Class 10 Maths Chapter 6 Exercise 6.5: Chapter 6 of Class 10 Maths, "Triangles," concludes with Exercise 6.5, which focuses on applying the concepts of similarity and the Pythagoras Theorem to solve higher-order problems. This exercise involves practical questions that test a student's ability to prove geometric properties, calculate unknown lengths, and apply proportionality principles in various scenarios.

It strengthens understanding of key theorems, such as the Basic Proportionality Theorem and similarity criteria, in real-world contexts. Exercise 6.5 challenges students to think critically and apply learned concepts creatively, making it an essential part of mastering geometry and preparing for both board exams and competitive tests.

NCERT Solutions for Class 10 Maths Chapter 6 Exercise 6.5 Overview

NCERT Solutions for Class 10 Maths Chapter 6 Exercise 6.5, "Triangles," emphasize the application of similarity principles and the Pythagoras Theorem in solving advanced geometric problems. This exercise is important as it deepens students' understanding of triangle properties, helping them apply these concepts to real-world and mathematical scenarios.

By tackling these problems, students enhance their logical reasoning, analytical thinking, and problem-solving skills. These solutions play a crucial role in board exam preparation and lay the groundwork for higher studies in mathematics and fields like engineering, physics, and architecture, making them indispensable for both academic and practical learning.

NCERT Solutions for Class 10 Maths Chapter 6 Exercise 6.5 Triangles

Below is the NCERT Solutions for Class 10 Maths Chapter 6 Exercise 6.5 Triangles -

1. Sides of 4 triangles are given below. Determine which of them are right triangles. In the case of a right triangle, write the length of its hypotenuse.

(i) 7 cm, 24 cm, 25 cm
(ii) 3 cm, 8 cm, 6 cm
(iii) 50 cm, 80 cm, 100 cm
(iv) 13 cm, 12 cm, 5 cm

Solution:

(i) Given, the sides of the triangle are 7 cm, 24 cm, and 25 cm.

Squaring the lengths of the sides of the, we will get 49, 576, and 625.

49 + 576 = 625

$(7)^2 + (24)^2 = (25)^2$

Therefore, the above equation satisfies Pythagoras theorem. Hence, it is a right-angled triangle.

Length of Hypotenuse = 25 cm

(ii) Given, the sides of the triangle are 3 cm, 8 cm, and 6 cm.

Squaring the lengths of these sides, we will get 9, 64, and 36.

Clearly, 9 + 36 ≠ 64

Or, $3^2 + 6^2 \neq 8^2$

Therefore, the sum of the squares of the lengths of two sides is not equal to the square of the length of the hypotenuse.

Hence, the given triangle does not satisfy Pythagoras theorem.

(iii) Given, the sides of triangle's are 50 cm, 80 cm, and 100 cm.

Squaring the lengths of these sides, we will get 2500, 6400, and 10000.

However, 2500 + 6400 ≠ 10000

Or, $50^2 + 80^2 \neq 100^2$

As you can see, the sum of the squares of the lengths of two sides is not equal to the square of the length of the third side.

Therefore, the given triangle does not satisfy Pythagoras theorem.

Hence, it is not a right triangle.

(iv) Given, the sides are 13 cm, 12 cm, and 5 cm.

Squaring the lengths of these sides, we will get 169, 144, and 25.

Thus, 144 +25 = 169

Or, $12^2 + 5^2 = 13^2$

The sides of the given triangle satisfy Pythagoras theorem.

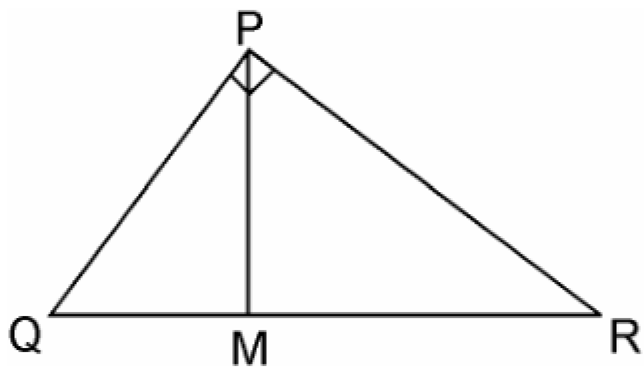
Therefore, it is a right triangle.

Hence, the length of the hypotenuse of this triangle is 13 cm.

2. PQR is a triangle right angled at P, and M is a point on QR such that PM ⊥ QR. Show that $PM^2 = QM \times MR$.

Solution:

Given, ΔPQR is right angled at P is a point on QR such that PM ⊥QR



We have to prove, $PM^2 = QM \times MR$

In ΔPQM, by Pythagoras theorem

$PQ^2 = PM^2 + QM^2$

Or, $PM^2 = PQ^2 – QM^2$ ……………………………..**(i)**

In ΔPMR, by Pythagoras theorem

$PR^2 = PM^2 + MR^2$

Or, $PM^2 = PR^2 – MR^2$ ………………………………………..**(ii)**

Adding equations **(i)** and **(ii)**, we get,

$2PM^2 = (PQ^2 + PM^2) – (QM^2 + MR^2)$

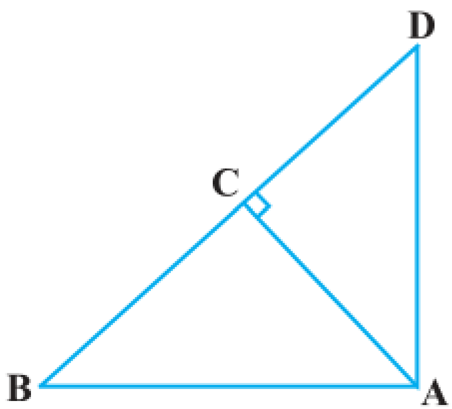
$= QR^2 – QM^2 – MR^2$ [$\because QR^2 = PQ^2 + PR^2$]

$= (QM + MR)^2 – QM^2 – MR^2$

$= 2QM \times MR$

∴ $PM^2 = QM \times MR$

3. In Figure, ABD is a triangle right angled at A and AC ⊥ BD. Show that
(i) $AB^2 = BC \times BD$
(ii) $AC^2 = BC \times DC$
(iii) $AD^2 = BD \times CD$



Solution:

(i) In ΔADB and ΔCAB,

∠DAB = ∠ACB (Each 90°)

∠ABD = ∠CBA (Common angles)

∴ ΔADB ~ ΔCAB [AA similarity criterion]

⇒ AB/CB = BD/AB

⇒ $AB^2 = CB \times BD$

(ii) Let ∠CAB = x

In ΔCBA,

∠CBA = 180° – 90° – x

∠CBA = 90° – x

Similarly, in ΔCAD

∠CAD = 90° – ∠CBA

= 90° – x

∠CDA = 180° – 90° – (90° – x)

∠CDA = x

In ΔCBA and ΔCAD, we have

∠CBA = ∠CAD

∠CAB = ∠CDA

∠ACB = ∠DCA (Each 90°)

∴ ΔCBA ~ ΔCAD [AAA similarity criterion]

⇒ AC/DC = BC/AC

⇒ AC^2 = DC × BC

(iii) In ΔDCA and ΔDAB,

∠DCA = ∠DAB (Each 90°)

∠CDA = ∠ADB (common angles)

∴ ΔDCA ~ ΔDAB [AA similarity criterion]

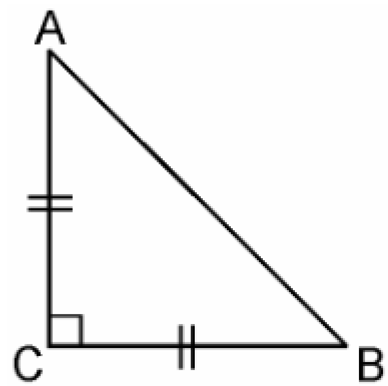
⇒ DC/DA = DA/DA

⇒ AD^2 = BD × CD

4. ABC is an isosceles triangle right angled at C. Prove that $AB^2 = 2AC^2$.

Solution:

Given, ΔABC is an isosceles triangle right angled at C.



In ΔACB, ∠C = 90°

AC = BC (By isosceles triangle property)

$AB^2 = AC^2 + BC^2$ [By Pythagoras theorem]

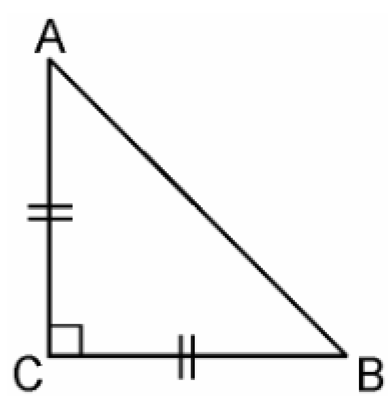
$= AC^2 + AC^2$ [Since, AC = BC]

$AB^2 = 2AC^2$

5. ABC is an isosceles triangle with AC = BC. If $AB^2 = 2AC^2$, prove that ABC is a right triangle.

Solution:

Given, ΔABC is an isosceles triangle having AC = BC and $AB^2 = 2AC^2$



In ΔACB,

AC = BC

$AB^2 = 2AC^2$

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

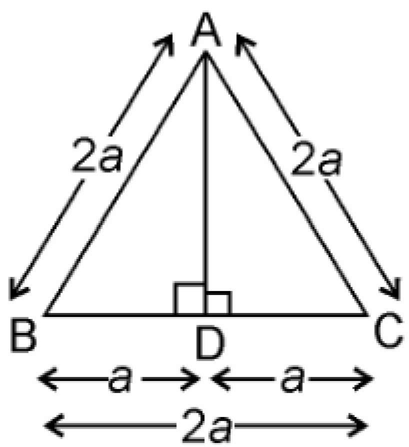
$= AC^2 + BC^2$ [Since, AC = BC]

Hence, by Pythagoras theorem, ΔABC is a right angle triangle.

6. ABC is an equilateral triangle of side 2a. Find each of its altitudes.

Solution:

Given, ABC is an equilateral triangle of side 2a.



Draw, AD ⊥ BC

In ΔADB and ΔADC,

AB = AC

AD = AD

∠ADB = ∠ADC [Both are 90°]

Therefore, ΔADB ≅ ΔADC by RHS congruence.

Hence, BD = DC [by CPCT]

In the right angled ΔADB,

$AB^2 = AD^2 + BD^2$

$(2a)^2 = AD^2 + a^2$

$\Rightarrow AD^2 = 4a^2 - a^2$

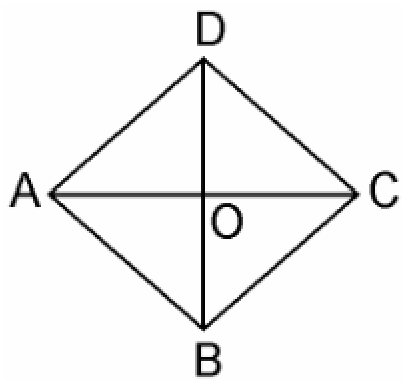
$\Rightarrow AD^2 = 3a^2$

⇒ AD = √3a

7. Prove that the sum of the squares of the sides of the rhombus is equal to the sum of the squares of its diagonals.

Solution:

Given, ABCD is a rhombus whose diagonals AC and BD intersect at O.



We have to prove, as per the question,

$AB^2 + BC^2 + CD^2 + AD^2 = AC^2 + BD^2$

Since the diagonals of a rhombus bisect each other at right angles.

Therefore, AO = CO and BO = DO

In ΔAOB,

∠AOB = 90°

$AB^2 = AO^2 + BO^2$ …………………….. **(i)** [By Pythagoras theorem]

Similarly,

$AD^2 = AO^2 + DO^2$ …………………….. **(ii)**

$DC^2 = DO^2 + CO^2$ …………………….. **(iii)**

$BC^2 = CO^2 + BO^2$ …………………….. **(iv)**

Adding equations **(i) + (ii) + (iii) + (iv)**, we get,

$AB^2 + AD^2 + DC^2 + BC^2 = 2(AO^2 + BO^2 + DO^2 + CO^2)$

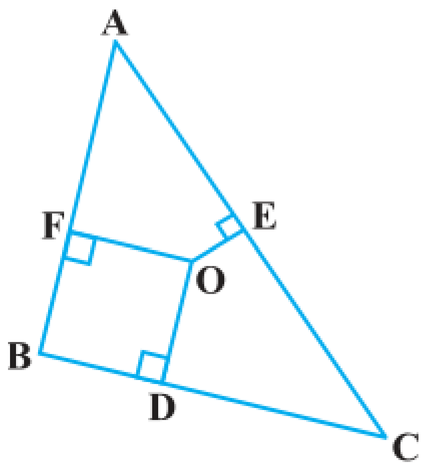
$= 4AO^2 + 4BO^2$ [Since, AO = CO and BO =DO]

$= (2AO)^2 + (2BO)^2 = AC^2 + BD^2$

$AB^2 + AD^2 + DC^2 + BC^2 = AC^2 + BD^2$

Hence, proved.

8. In Fig. 6.54, O is a point in the interior of a triangle.



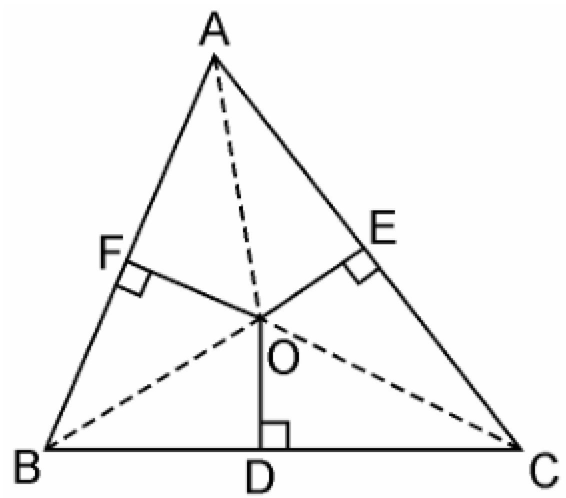
ABC, OD ⊥ BC, OE ⊥ AC and OF ⊥ AB. Show that:
(i) $OA^2 + OB^2 + OC^2 – OD^2 – OE^2 – OF^2 = AF^2 + BD^2 + CE^2$,
(ii) $AF^2 + BD^2 + CE^2 = AE^2 + CD^2 + BF^2$.

Solution:

Given, in ΔABC, O is a point in the interior of a triangle.

And OD ⊥ BC, OE ⊥ AC and OF ⊥ AB.

Join OA, OB and OC



(i) By Pythagoras theorem in ΔAOF, we have

$OA^2 = OF^2 + AF^2$

Similarly, in ΔBOD

$OB^2 = OD^2 + BD^2$

Similarly, in ΔCOE

$OC^2 = OE^2 + EC^2$

Adding these equations,

$OA^2 + OB^2 + OC^2 = OF^2 + AF^2 + OD^2 + BD^2 + OE^2 + EC^2$

$OA^2 + OB^2 + OC^2 – OD^2 – OE^2 – OF^2 = AF^2 + BD^2 + CE^2$.

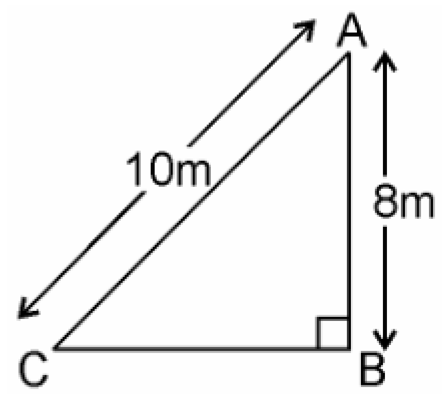
(ii) $AF^2 + BD^2 + EC^2 = (OA^2 – OE^2) + (OC^2 – OD^2) + (OB^2 – OF^2)$

$\therefore AF^2 + BD^2 + CE^2 = AE^2 + CD^2 + BF^2$.

9. A ladder 10 m long reaches a window 8 m above the ground. Find the distance between the foot of the ladder from the base of the wall.

Solution:

Given, a ladder 10 m long reaches a window 8 m above the ground.



Let BA be the wall and AC be the ladder,

Therefore, by Pythagoras theorem,

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

$10^2 = 8^2 + BC^2$

$BC^2 = 100 – 64$

$BC^2 = 36$

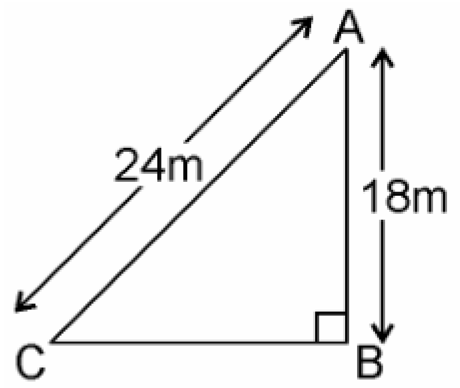
BC = 6m

Therefore, the distance between the foot of the ladder from the base of the wall is 6 m.

10. A guy-wire attached to a vertical pole of height 18 m is 24 m long and has a stake attached to the other end. How far from the base of the pole should the stake be driven so that the wire will be taut?

Solution:

Given, a guy-wire attached to a vertical pole of height 18 m is 24 m long and has a stake attached to the other end.



Let AB be the pole and AC be the wire.

By Pythagoras theorem,

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

$24^2 = 18^2 + BC^2$

$BC^2 = 576 – 324$

$BC^2 = 252$

BC = 6√7m

Therefore, the distance from the base is 6√7m.

11. An aeroplane leaves an airport and flies due north at a speed of 1,000 km per hour. At the same time, another aeroplane leaves the same airport and flies due west at a speed of 1,200 km per hour. How far apart will be the two planes after $1\frac{1}{2}$ hours?

Solution:

Given,

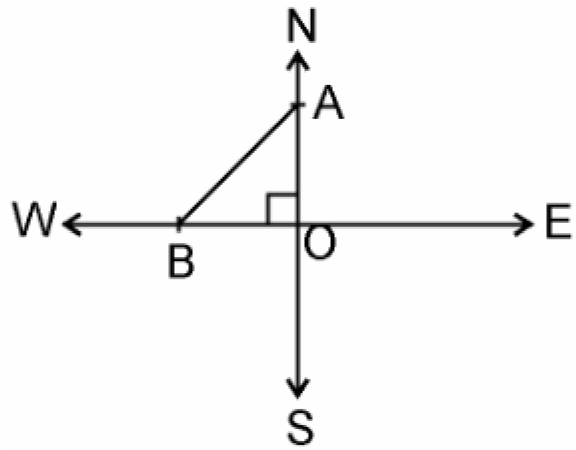
Speed of first aeroplane = 1000 km/hr

Distance covered by the first aeroplane flying due north in $1\frac{1}{2}$ hours (OA) = 1000 × 3/2 km = 1500 km

Speed of second aeroplane = 1200 km/hr

Distance covered by the second aeroplane flying due west in

$1\frac{1}{2}$ hours (OB) = 1200 × 3/2 km = 1800 km



In right angle ΔAOB, by Pythagoras Theorem,

$AB^2 = AO^2 + OB^2$

$\Rightarrow AB^2 = (1500)^2 + (1800)^2$

$\Rightarrow AB = \sqrt{(2250000 + 3240000)}$

$= \sqrt{5490000}$

$\Rightarrow AB = 300\sqrt{61}$ km

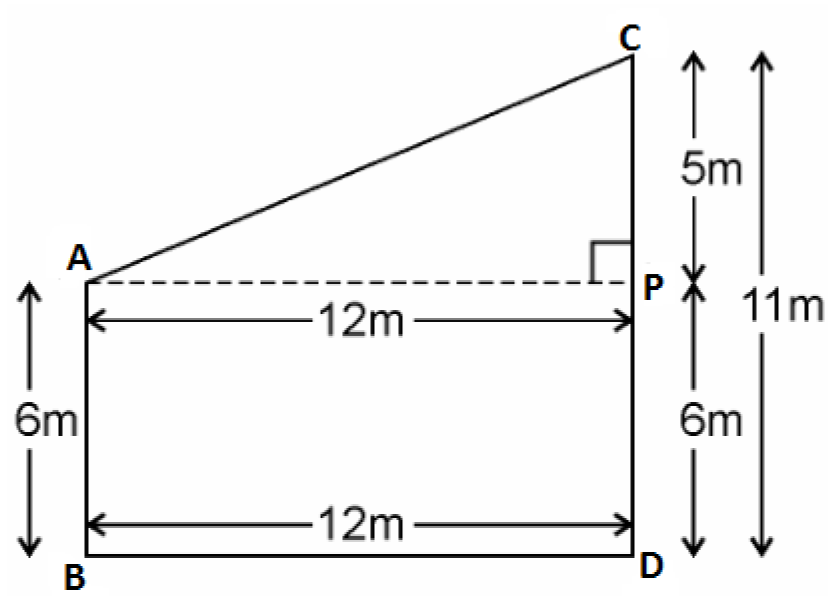
Hence, the distance between two aeroplanes will be $300\sqrt{61}$ km.

12. Two poles of heights 6 m and 11 m stand on a plane ground. If the distance between the feet of the poles is 12 m, find the distance between their tops.

Solution:

Given, Two poles of heights 6 m and 11 m stand on a plane ground.

And the distance between the feet of the poles is 12 m.



Let AB and CD be the poles of height 6m and 11m.

Therefore, CP = 11 – 6 = 5m

From the figure, it can be observed that AP = 12m

By Pythagoras theorem for ΔAPC, we get,

$AP^2 = PC^2 + AC^2$

$(12m)^2 + (5m)^2 = (AC)^2$

$AC^2 = (144+25)\ m^2 = 169\ m^2$

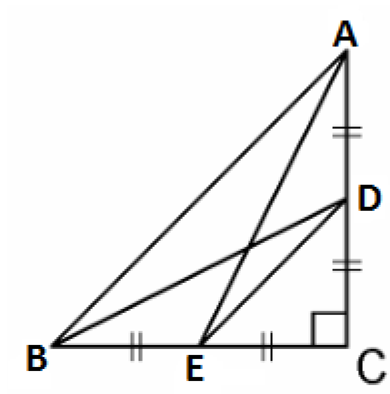
AC = 13m

Therefore, the distance between their tops is 13 m.

13. D and E are points on the sides CA and CB, respectively, of a triangle ABC right angled at C. Prove that $AE^2 + BD^2 = AB^2 + DE^2$.

Solution:

Given, D and E are points on the sides CA and CB, respectively, of a triangle ABC right angled at C.



By Pythagoras theorem in ΔACE, we get

$AC^2 + CE^2 = AE^2$ ………………………………………….**(i)**

In ΔBCD, by Pythagoras theorem, we get

$BC^2 + CD^2 = BD^2$ ………………………………..**(ii)**

From equations **(i)** and **(ii)**, we get

$AC^2 + CE^2 + BC^2 + CD^2 = AE^2 + BD^2$ …………..**(iii)**

In ΔCDE, by Pythagoras theorem, we get

$DE^2 = CD^2 + CE^2$

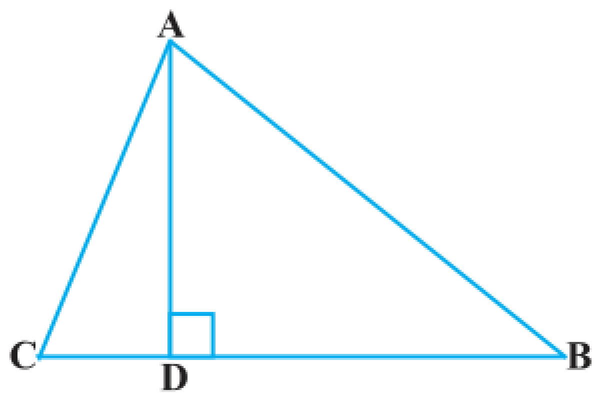
In ΔABC, by Pythagoras theorem, we get

$AB^2 = AC^2 + CB^2$

Putting the above two values in equation **(iii)**, we get

$DE^2 + AB^2 = AE^2 + BD^2$.

14. The perpendicular from A on side BC of a Δ ABC intersects BC at D such that DB = 3CD (see figure). Prove that $2AB^2 = 2AC^2 + BC^2$.



Solution:

Given, the perpendicular from A on side BC of a Δ ABC intersects BC at D such that;

DB = 3CD.

In Δ ABC,

AD ⊥ BC and BD = 3CD

In right angle triangle, ADB and ADC, by Pythagoras theorem,

$AB^2 = AD^2 + BD^2$ ……………………….**(i)**

$AC^2 = AD^2 + DC^2$ …………………………….**(ii)**

Subtracting equation **(ii)** from equation **(i)**, we get

$AB^2 – AC^2 = BD^2 – DC^2$

$= 9CD^2 – CD^2$ [Since, BD = 3CD]

$= 8CD^2$

$= 8(BC/4)^2$ [Since, BC = DB + CD = 3CD + CD = 4CD]

Therefore, $AB^2 – AC^2 = BC^2/2$

$\Rightarrow 2(AB^2 – AC^2) = BC^2$

$\Rightarrow 2AB^2 – 2AC^2 = BC^2$

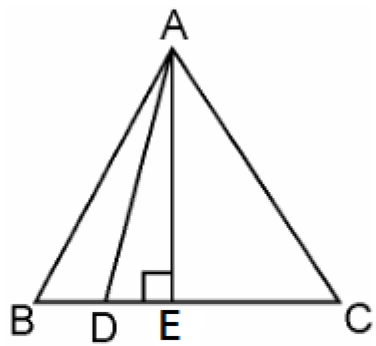
$\therefore 2AB^2 = 2AC^2 + BC^2$.

15. In an equilateral triangle, ABC, D is a point on side BC such that BD = 1/3BC. Prove that $9AD^2 = 7AB^2$.

Solution:

Given, ABC is an equilateral triangle.

And D is a point on side BC such that BD = 1/3BC.



Let the side of the equilateral triangle be *a*, and AE be the altitude of ΔABC.

∴ BE = EC = BC/2 = a/2

And, AE = a√3/2

Given, BD = 1/3BC

∴ BD = a/3

DE = BE – BD = a/2 – a/3 = a/6

In ΔADE, by Pythagoras theorem,

$AD^2 = AE^2 + DE^2$

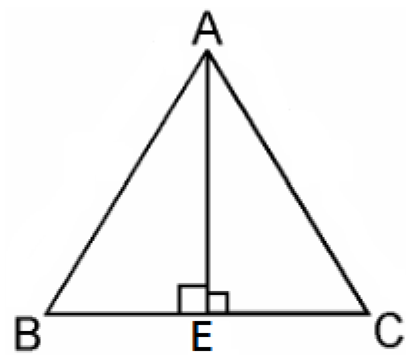
$$
\begin{aligned}
AD^2 &= \left(\frac{a\sqrt{3}}{2}\right)^2 + \left(\frac{a}{6}\right)^2 \\
&= \left(\frac{3a^2}{4}\right) + \left(\frac{a^2}{36}\right) \\
&= \frac{28a^2}{36} \\
&= \frac{7}{9}AB^2
\end{aligned}
$$

⇒ $9\ AD^2 = 7\ AB^2$

16. In an equilateral triangle, prove that three times the square of one side is equal to four times the square of one of its altitudes.

Solution:

Given, an equilateral triangle, say ABC,



Let the sides of the equilateral triangle be of length a, and AE be the altitude of ΔABC.

∴ BE = EC = BC/2 = a/2

In ΔABE, by Pythagoras Theorem, we get

$AB^2 = AE^2 + BE^2$

$$a^2 = AE^2 + \left(\frac{a}{2}\right)^2$$

$$AE^2 = a^2 - \frac{a^2}{4}$$

$$AE^2 = \frac{3a^2}{4}$$

$4AE^2 = 3a^2$

⇒ 4 × (Square of altitude) = 3 × (Square of one side)

Hence, proved.

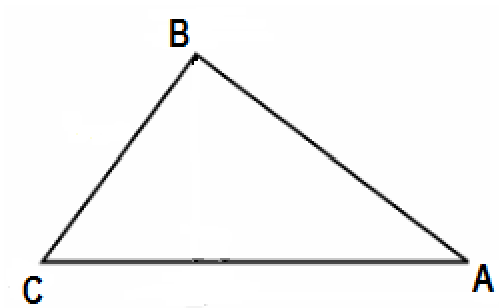
17. Tick the correct answer and justify: In ΔABC, AB = 6√3 cm, AC = 12 cm and BC = 6 cm.
The angle B is:
(A) 120°

(B) 60°
(C) 90°

(D) 45°

Solution:

Given, in ΔABC, AB = 6√3 cm, AC = 12 cm and BC = 6 cm.



We can observe that,

$AB^2 = 108$

$AC^2 = 144$

And, $BC^2 = 36$

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

The given triangle, ΔABC, satisfies Pythagoras theorem.

Therefore, the triangle is a right triangle, right-angled at B.

∴ $\angle B = 90°$

Hence, the correct answer is (C).

Benefits of Using NCERT Solutions for Class 10 Maths Chapter 6 Exercise 6.5 Triangles

Conceptual Understanding: Simplifies complex topics like triangle similarity and Pythagoras Theorem with detailed explanations.

Step-by-Step Solutions: Provides clear, logical solutions, making it easier for students to follow and learn problem-solving techniques.

Exam-Oriented: Focuses on key concepts frequently asked in board exams, boosting preparation and confidence.

Critical Thinking: Enhances logical reasoning and analytical skills through challenging problems.

Competitive Exam Ready: Builds a solid foundation for higher studies and exams.

Time-Saving: Offers structured solutions, saving students time during revisions.