Pythagoras Theorem

Objective

To verify Pythagoras theorem by performing an activity.

The area of the square constructed on the hypotenuse of a right-angled triangle is equal to the sum of the areas of squares constructed on the other two sides of a right-angled triangle.

Prerequisite Knowledge

1. In a right-angled triangle the square of hypotenuse is equal to the sum of squares on the other two sides.
2. Concept of a right-angled triangle.
3. Area of square = $(\text{side})^2$
4. Construction of perpendicular lines.

Materials Required

Coloured papers, pair of scissors, fevicol, geometry box, sketch pens, light coloured square sheet.

Procedure

1. Take a coloured paper, draw and cut a right-angled triangle ACB right-angled at C, of sides 3 cm, 4 cm and 5 cm as shown in fig. (i).

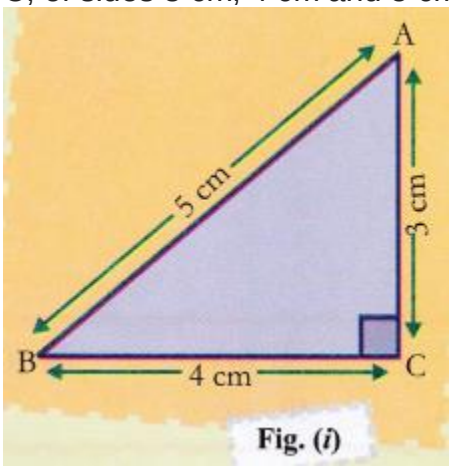


Fig. (*i*)

2. Paste this triangle on white sheet of paper.

3. Draw squares on each side of the triangle on side AB, BC and AC and name them accordingly as shown in fig. (ii).

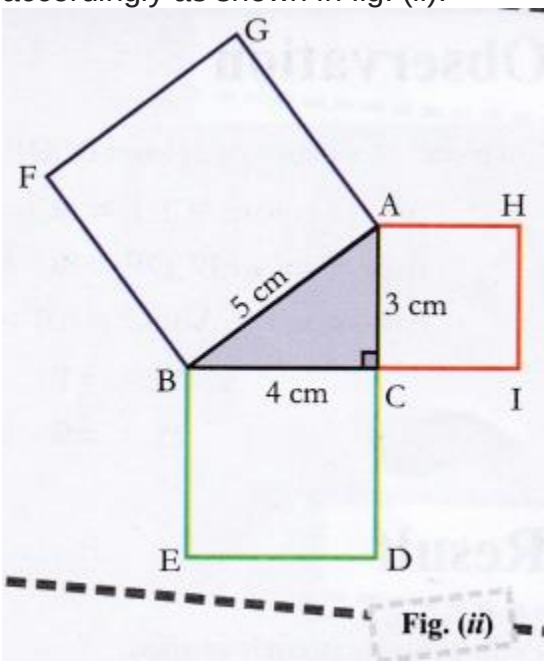


Fig. (*ii*)

4. Extend the sides FB and GA of the square ABFG which meets ED at P and CI at Q respectively, as shown in fig. (iii).

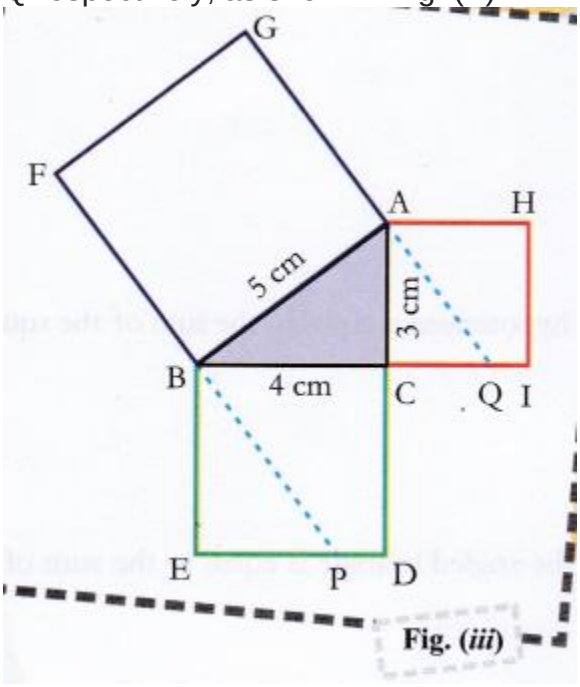


Fig. (*iii*)

5. Draw perpendicular RP on BP which meets CD at R. Mark the parts 1, 2, 3, 4 and 5 of the squares BCDE and ACIH and colour them with five different colours as

shown in fig. (iv).

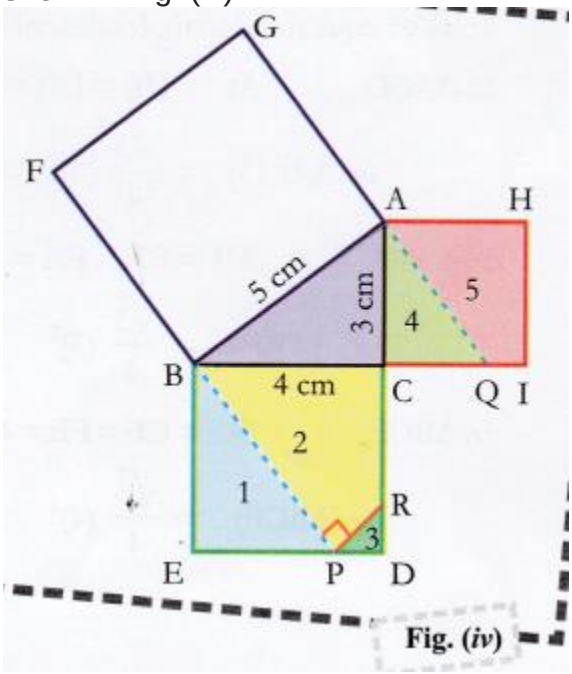


Fig. (iv)

6. Cut the pieces 1, 2, 3, 4 and 5 from the squares BCDE and ACIH and place the pieces on the square ABFG as shown in fig. (v).

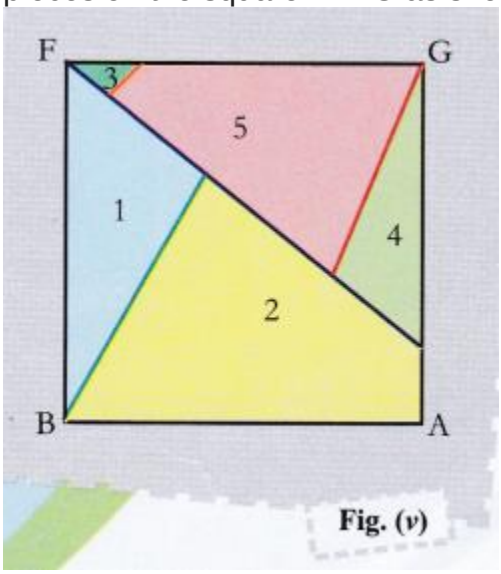


Fig. (v)

Observation

Cut pieces of squares ACIH and BCDH and completely cover the square ABFG.

∴ Area of square ACIH = AC^2 = $9cm^2$

Area of square BCDE = BC^2 = $16cm^2$

Area of square ABFG = AB^2 = $25\ cm^2$

∴ $AB^2 = BC^2 + AC^2$

25 = 9 + 16

Result
Pythagoras theorem is verified.

Learning Outcome
Students will learn practically that in a right-angled triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.

Activity Time
1. The area of an equilateral triangle described on the hypotenuse of a right-angled triangle is equal to the sum of the areas of equilateral triangles described on the other two sides.

In ΔACD, AC = DC = DA = 5cm

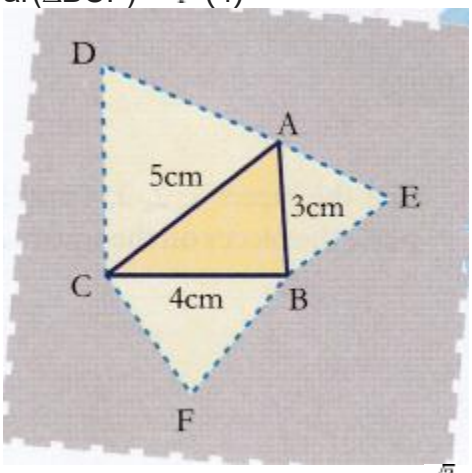
$ar(\Delta ACD) = \frac{\sqrt{3}}{4} (5)^2$

In ΔABE, AB = BE = EA = 3cm

$ar(\Delta ABE) = \frac{\sqrt{3}}{4} (3)^2$

In ΔBCF, BC = CF = FB = 4cm

$ar(\Delta BCF) = \frac{\sqrt{3}}{4} (4)^2$



Now, $ar(\Delta ABE) + ar(\Delta BCF) = \frac{\sqrt{3}}{4} (3)^2 + \frac{\sqrt{3}}{4} (4)^2$

$= \frac{\sqrt{3}}{4} [9+16]$

$= \frac{\sqrt{3}}{4} [25]$

$= \frac{\sqrt{3}}{4} (5)^2$

$\therefore ar(\Delta ABE) + ar(\Delta BCF) = ar(\Delta ACD)$ verified.

2. The area of a semi-circle described on the hypotenuse of a right-angled triangle is equal to the sum of the areas of semicircles described on the other two sides of right-angled triangle.

(Try yourself)

Viva Voce

Question 1.
What is the name given to the longest side of a right-angled triangle ?
Answer:
Hypotenuse.

Question 2.
If AC is the hypotenuse of a right-angled triangle ABC, then which angle will be a right angle ?
Answer:
Angle B.

Question 3.
Can we prove Pythagoras theorem for an acute angled triangle or obtuse angled triangle ?
Answer:
No.

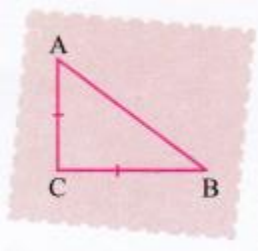
Question 4.
Write the converse of the Pythagoras theorem.
Answer:
In a triangle, if a square of the longest side is equal to the sum of the squares of other two sides, then the angle opposite to the longest side is a right angle.

Question 5.
What is the name of the triplet forming the sides of a right-angled triangle ?
Answer:
Pythagorean triplet.

Question 6.
Which of the following are Pythagorean triplets ?
(a) (3, 4, 6)
(b) (5, 12, 13)
(c) (6, 8, 10)
Answer:
(b), (c)

Question 7.
Name three sides of a right angled triangle.
Answer:
Base, perpendicular, hypotenuse.

Question 8.
ABC is an Isosceles triangle with AC = BC. If $AB^2 = 2AC^2$ then ABC is a right triangle and ∠B = 90°.



Answer:
No, ∠C = 90°.

Question 9.
Who was the founder of Pythagoras theorem ?
Answer:
Famous greekphilosopher, Phythagoras.

Question 10.
Is Pythagoras theorem applicable for an equilateral triangle ?
Answer:
No.

Question 11.
What is Pythagoras theorem ?
Answer:
In a right triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.

Multiple Choice Questions

Question 1.
Find all angles of an isosceles right-angled triangle.
(a) 30°, 60°, 90°
(b) 20°, 70°, 90°
(c) 45°, 45°, 90°
(d) none of these

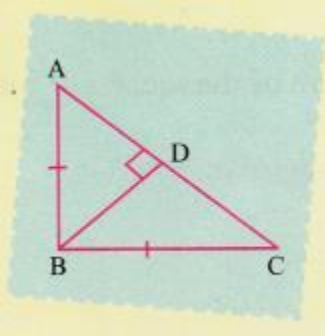
Question 2.
In right ΔABC, AB = 3cm, BC = 4 cm and ∠B = 90°, then AC is
(a) 7 cm
(b) 5 cm
(c) 2 cm
(d) 3 cm

Question 3.
The hypotenuse of a right triangle is 17 cm long. If one of the remaining two sides is of length 8 cm. Then the length of another side is
(a) 8 cm
(b) 15 cm
(r) 12 cm
(d) 24 cm

Question 4.
Sides of certain triangles are given below. Determine which of them are right triangles
(a) 7 cm, 24 cm, 25 cm
(b) 5 cm, 8 cm, 11 cm
(c) 5 cm, 20 cm, 25 cm
(d) none of these

Question 5.
ABC is an isosceles triangle, right angled at C. Tick the correct relation
(a) $2AB = AC^2$
(b) $BC = 2AB^2$
(c) $2AB^2 = AC^2 + BC^2$
(d) none of these

Question 6.
In ΔABC, $BD \perp AC$ and $\angle B = 90°$, then



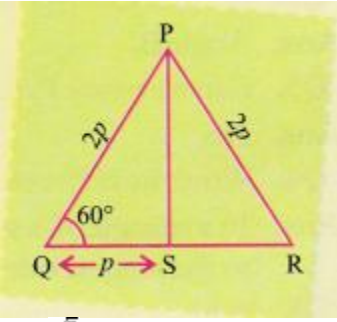
(a) $BD^2 = AD \times CD$
(b) $CD^2 = AD \times BD$
(c) $AD^2 = BD \times CD$
(d) none of these

Question 7.
The two legs of a right triangle are equal and the square of the hypotenuse is 50, then length of each leg is
(a) 13
(b) 5
(c) 10
(d) none of these

Question 8.
A man goes 15m due west and then 8 m due north. How far is he from the starting point ?
(a) 17m
(b) 9 m
(c) 12m
(d) 13 m

Question 9.
In ∆ABC, AB = 6√3 cm, AC = 12 cm and BC = 6 cm. The angle B is
(a) 120°
(b) 60°
(c) 90°
(d) 45°

Question 10.
∆PQR is an equilateral triangle with each side of length 2p. If PS ⊥QR, then PS is equal to



(a) $\frac{\sqrt{3}}{2}$ p
(b) p
(c) √3 p
(d) 2p

Answers

1. (c)
2. (b)
3. (b)
4. (a)
5. (d)
6. (a)
7. (b)
8. (a)
9. (c)
10. (c)