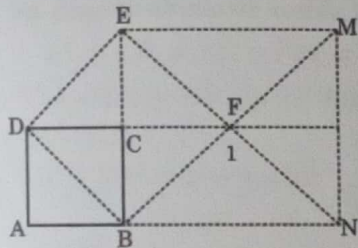


CHAPTER 2 : THE BAUDHAYANA-PYTHAGORAS THEOREM

CHALLENGE ZONE (PAGE-25)

- The square has area x . We draw a new square using its diagonal to get a square of area $2x$. On the diagonal of this new square we again draw a square which will have the area of $4x$.



Square BEMN has an area equal to $4x$.

EXERCISE 2.1 (PAGE-27)

- Area of original square = 36 sq. units
Area of smaller square formed by joining

$$= \frac{36}{2}$$

the mid points of original square = 18 sq. units

Side length of the smaller square

$$= \sqrt{18} = 3\sqrt{2} \text{ units}$$

- (a) side length = 4 units

$$\text{hypotenuse} = \sqrt{4^2 + 4^2} = \sqrt{32}$$

$$= 4\sqrt{2} \text{ units}$$

Area of square constructed on hypotenuse

$$= (\sqrt{32})^2 = 32 \text{ sq. units}$$

- (b) side length = 7 units

$$\text{Hypotenuse} = 7\sqrt{2} \text{ units}$$

Area of square constructed

$$\text{on hypotenuse} = (7\sqrt{2})^2 = 98 \text{ sq. units}$$

- (c) side length = 10 units

$$\text{Hypotenuse} = 10\sqrt{2} \text{ units}$$

Area of square constructed on hypotenuse

$$= (10\sqrt{2})^2 = 200 \text{ sq. units}$$

- Side = 5 units

$$\text{Hypotenuse} = \sqrt{50} \text{ units long}$$

$$\sqrt{49} < \sqrt{50} < \sqrt{64}$$

$$7 < \sqrt{50} < 8$$

$$\sqrt{50} \text{ is between 7 and 8}$$

7 is the lower bound and 8 is the upper bound.

- $2 < \sqrt{5} < 3$

2 is the lower bound and 3 is the upper bound

$$(2.2)^2 = 4.84$$

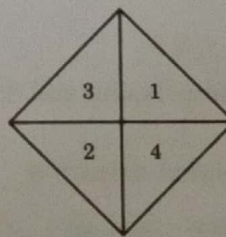
$$(2.3)^2 = 5.29$$

Since 5 is between 4.84 and 5.29

$$4.84 < 5 < 5.29$$

$$2.2 < \sqrt{5} < 2.3$$

-



- (a) length of equal sides = 3

$$\text{Hypotenuse} = \sqrt{9+9} = \sqrt{18}$$

$$16 < 18 < 25$$

$$4 < \sqrt{18} < 5$$

$$(4.1)^2 = 16.81$$

$$(4.2)^2 = 17.64$$

$$(4.3)^2 = 18.49$$

$$16.81 < 18 < 18.49$$

$$4.1 < \sqrt{18} < 4.3$$

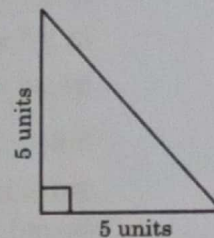
4.1 is the lower bound and 4.3 is the upper bound.

- (b) Length of equal sides = 4

$$\text{Hypotenuse} = \sqrt{16+16} = \sqrt{32}$$

$$25 < 32 < 36$$

$$5 < \sqrt{32} < 6$$



Since, 32 is closer to 36 than 25. We start from 5.6

$$(5.6)^2 = 31.36$$

$$(5.7)^2 = 32.49$$

$$31.36 < 32 < 32.49$$

$$5.6 < \sqrt{32} < 5.7$$

5.6 is the lower bound and 5.7 is the upper bound.

- (c) Length of equal sides = 6

$$\text{Hypotenuse} = \sqrt{36 + 36} = \sqrt{72}$$

$$64 < 72 < 81$$

$$8 < \sqrt{72} < 9$$

Since, 72 is relatively closer to 64 than 81, we start with a decimal closer to 8.

$$(8.3)^2 = 68.89$$

$$(8.4)^2 = 70.56$$

$$(8.5)^2 = 72.25$$

$$70.56 < 72 < 72.25$$

$$8.4 < \sqrt{72} < 8.5$$

8.4 is the lower bound and 8.5 is the upper bound.

- (d) Length of equal sides = 8

$$\text{Hypotenuse} = \sqrt{64 + 64} = \sqrt{128}$$

$$121 < 128 < 144$$

$$11 < \sqrt{128} < 12$$

Since, 128 is closer to 121 than 144, we start with a decimal closer to 11.

$$(11.2)^2 = 125.44$$

$$(11.3)^2 = 127.69$$

$$(11.4)^2 = 129.96$$

$$127.69 < 128 < 129.96$$

$$11.3 < \sqrt{128} < 11.4$$

11.3 is the lower bound and 11.4 is the upper bound.

- (e) Length of the sides = 9

$$\text{Hypotenuse} = \sqrt{81 + 81} = \sqrt{162}$$

$$144 < 162 < 169$$

$$12 < \sqrt{162} < 13$$

Since, 162 is closer to 169, we start with a decimal closer to 13.

$$(12.7)^2 = 161.29$$

$$(12.8)^2 = 163.84$$

$$161.29 < 162 < 163.84$$

$$12.7 < \sqrt{162} < 12.8$$

12.7 is the lower bound and 12.8 is the upper bound.

7. Hypotenuse = 10

Let the other two side length be 'x'

$$x^2 + x^2 = 10^2$$

$$2x^2 = 100$$

$$x^2 = 50$$

$$x = \sqrt{50}$$

CHALLENGE ZONE (PAGE-28)

2. No, a right-angled triangle cannot have sides that are all odd number. Let a triangle has sides a, b and c, where c = hypotenuse.

$$a^2 + b^2 = c^2$$

If a and b are odd, a^2 and b^2 will also be odd.

$$\text{odd} + \text{odd} = \text{even}$$

$$c^2 = \text{even, which means } c \text{ is even}$$

Taking (3, 5, 7)

$$3^2 + 5^2 = 9 + 25 = 34$$

$$7^2 = 49$$

$$3^2 + 5^2 \neq 7^2$$

Taking (7, 9, 11)

$$7^2 + 9^2 = 49 + 81 = 130$$

$$11^2 = 121$$

$$7^2 + 9^2 \neq 11^2$$

A right-angled triangle with all sides odd is not possible.

EXERCISE 2.2 (PAGE-31)

1. $h^2 = 7^2 + 24^2$

$$h^2 = 49 + 576$$

$$h^2 = 625$$

$$h = 25 \text{ cm}$$

verify it yourself.

2. Length of the diagonal beam = $\sqrt{(1.5)^2 + 2^2}$

$$= \sqrt{2.25 + 4}$$

$$= \sqrt{6.25} = 2.5 \text{ m}$$

Maths (Part-II)-8

$$\begin{aligned}
 3. \quad a^2 + b^2 &= c^2 \\
 81 + b^2 &= 225 \\
 b^2 &= 225 - 81 \\
 b^2 &= 144 \\
 b &= 12
 \end{aligned}$$

$$\begin{aligned}
 4. \quad (a) \quad 8^2 + 15^2 &= 64 + 225 \\
 &= 289 \\
 17^2 &= 289 \\
 8^2 + 15^2 &= 17^2
 \end{aligned}$$

The sides 8, 15 and 17 form a right-angled triangle.

$$\begin{aligned}
 (b) \quad 10^2 + 20^2 &= 100 + 400 \\
 &= 500
 \end{aligned}$$

$$25^2 = 625$$

$$10^2 + 20^2 \neq 25^2$$

The sides 10, 20 and 25 do not form a right-angle triangle.

$$\begin{aligned}
 (c) \quad 9^2 + 40^2 &= 81 + 1600 \\
 &= 1681
 \end{aligned}$$

$$41^2 = 1681$$

$$9^2 + 40^2 = 41^2$$

The sides 9, 40 and 41 form a right-angled triangle

5. Let the vertical height of the kite be 'x' m

$$x^2 + 30^2 = 50^2$$

$$x^2 + 900 = 2500$$

$$x^2 = 2500 - 900$$

$$x^2 = 1600$$

$$x = 40 \text{ m}$$

The vertical height of the kite is 40 m.

$$6. \quad (a) \quad a^2 + b^2 = c^2$$

$$5^2 + 7^2 = c^2$$

$$25 + 49 = c^2$$

$$74 = c^2$$

$$c = \sqrt{74}$$

$$(b) \quad a^2 + b^2 = c^2$$

$$8^2 + 12^2 = c^2$$

$$64 + 144 = c^2$$

$$208 = c^2$$

$$c = \sqrt{208}$$

$$(c) \quad a^2 + b^2 = c^2$$

$$81 + b^2 = 225$$

$$b^2 = 225 - 81$$

$$b^2 = 144$$

$$b = 12$$

$$(d) \quad a^2 + b^2 = c^2$$

$$7^2 + 12^2 = c^2$$

$$49 + 144 = c^2$$

$$193 = c^2$$

$$c = \sqrt{193}$$

$$(e) \quad a^2 + b^2 = c^2$$

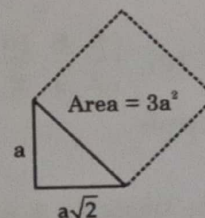
$$(1.5)^2 + (3.5)^2 = c^2$$

$$2.25 + 12.25 = c^2$$

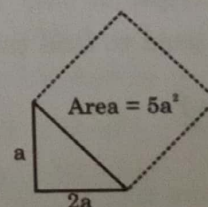
$$14.50 = c^2$$

$$c = \sqrt{14.5}$$

7. To make a square whose area is triple the area of a given square, we will make a triangle with legs of length a and $a\sqrt{2}$.



To make a square whose area is five times the area of the given square, we will make a triangle with legs of length 'a' and '2a'.



8. Let the length of hypotenuse be 'h'.

$$h^2 = 5^2 + 12^2$$

$$h^2 = 25 + 144$$

$$h^2 = 169$$

$$h = 13 \text{ cm}$$

EXERCISE 2.3 (PAGE-32)

1. (a) Non Primitive because $\text{GCD}(9, 12, 15) = 3$
- (b) Primitive because $\text{GCD}(7, 24, 25) = 1$
- (c) Scaled because $\text{GCD}(20, 48, 52) = 4$

2. The primitive triple is $n, \frac{n^2-1}{2}, \frac{n^2+1}{2}$

$$n = 7$$

$$\frac{n^2-1}{2} = \frac{49-1}{2} = \frac{48}{2} = 24$$

$$\frac{n^2+1}{2} = \frac{49+1}{2} = \frac{50}{2} = 25$$

Primitive triple is (7, 24, 25)

3. Primitive triple = (8, 15, 17)

Scaled versions of the primitive triple are:

(16, 30, 34), (24, 45, 51) and (32, 60, 68)

4. No. (a, b, c) is a triple where a, b, c are integers.

Then, $\left(\frac{a}{2}, \frac{b}{2}, \frac{c}{2}\right)$ is not always a Baudhayana triple.

Taking (6, 8, 10), $\left(\frac{6}{2}, \frac{8}{2}, \frac{10}{2}\right) = (3, 4, 5)$ is a Baudhayana triple.

Considering the triple (3, 4, 5), $\left(\frac{3}{2}, \frac{4}{2}, \frac{5}{2}\right) = (1.5, 2, 2.5)$

While the numbers (1.5, 2, 2.5) satisfy the relationship $a^2 + b^2 = c^2$, they are not Baudhayana triple as they are not integers.

5. The formula used to find triplet is

$$n, \frac{n^2-1}{2}, \frac{n^2+1}{2}$$

- (a) Let us take $n = 3$

$$\frac{n^2-1}{2} = \frac{9-1}{2} = \frac{8}{2} = 4$$

$$\frac{n^2+1}{2} = \frac{9+1}{2} = \frac{10}{2} = 5$$

The triple is (3, 4, 5)

- (b) Let us take $n = 7$

$$\frac{n^2-1}{2} = \frac{49-1}{2} = \frac{48}{2} = 24$$

$$\frac{n^2+1}{2} = \frac{49+1}{2} = \frac{50}{2} = 25$$

The triple is (7, 24, 25)

- (c) Let us take $n = 9$

$$\frac{n^2-1}{2} = \frac{81-1}{2} = \frac{80}{2} = 40$$

$$\frac{n^2+1}{2} = \frac{81+1}{2} = \frac{82}{2} = 41$$

The triple is (9, 40, 41)

- (d) Let us take $n = 11$

$$\frac{n^2-1}{2} = \frac{121-1}{2} = \frac{120}{2} = 60$$

$$\frac{n^2+1}{2} = \frac{121+1}{2} = \frac{122}{2} = 61$$

The triple is (11, 60, 61)

- (e) Let us take $n = 13$

$$\frac{n^2-1}{2} = \frac{169-1}{2} = \frac{168}{2} = 84$$

$$\frac{n^2+1}{2} = \frac{169+1}{2} = \frac{170}{2} = 85$$

The triple is (13, 84, 85)

6. No, it never yields non-primitive Baudhayana triples.

7. Yes, there are primitive triples that cannot be obtained through this method.

The method only generates the triples where the hypotenuse is 1 unit larger than the longer side.

But there are primitives that don't follow this logic. Example 8, 15, 17

CHAPTER DRILL (PAGE-34)

- | | | |
|----|--------------|---------|
| A. | 1. (B) | 2. (C) |
| | 3. (A) | 4. (D) |
| | 5. (C) | 6. (A) |
| | 7. (C) | 8. (B) |
| | 9. (B) | 10. (C) |
| B. | 1. congruent | 2. 90° |
| | 3. primitive | 4. 2 |
| | 5. length | 6. two |