



# Squares and Square Roots

$$\sqrt{25} = 5 \times 5 = 5$$

SQUARES

AND

SQUARE ROOT

## Square of a Number

When a number is multiplied by itself, the product we get  
is the **SQUARE** of the number

$$2 \times 2 = 4 \quad \text{Square of 2 is 4}$$

$$3 \times 3 = 9 \quad \text{Square of 3 is 9}$$

$$4 \times 4 = 16 \quad \text{Square of 4 is 16}$$

$$5 \times 5 = 25 \quad \text{Square of 5 is 25}$$

## PROPERTIES

| NUMBER | SQUARE |
|--------|--------|
| 1      | 1      |
| 2      | 4      |
| 3      | 9      |
| 4      | 16     |
| 5      | 25     |
| 6      | 36     |
| 7      | 49     |
| 8      | 64     |
| 9      | 81     |
| 10     | 100    |
| 11     | 121    |
| 12     | 144    |
| 13     | 169    |
| 14     | 196    |
| 15     | 225    |
| 16     | 256    |
| 17     | 289    |
| 18     | 324    |
| 19     | 361    |
| 20     | 400    |

All the squares end with 1, 4, 9, 6 or 5 at their unit's place.

None of these numbers are also called perfect squares.

## PROPERTIES

| NUMBER | SQUARE |
|--------|--------|
| 1      | 1      |
| 2      | 4      |
| 3      | 9      |
| 4      | 16     |
| 5      | 25     |
| 6      | 36     |
| 7      | 49     |
| 8      | 64     |
| 9      | 81     |
| 10     | 100    |
| 11     | 121    |
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| 15     | 225    |
| 16     | 256    |
| 17     | 289    |
| 18     | 324    |
| 19     | 361    |
| 20     | 400    |

Number      Square

Now, observe the  
one's (unit's) place  
in both.

If a number has 1 or 9 in  
the unit's place, then it's  
square ends in 1

## PROPERTIES

| NUMBER | SQUARE |
|--------|--------|
| 1      | 1      |
| 2      | 4      |
| 3      | 9      |
| 4      | 16     |
| 5      | 25     |
| 6      | 36     |
| 7      | 49     |
| 8      | 64     |
| 9      | 81     |
| 10     | 100    |
| 11     | 121    |
| 12     | 144    |
| 13     | 169    |
| 14     | 196    |
| 15     | 225    |
| 16     | 256    |
| 17     | 289    |
| 18     | 324    |
| 19     | 361    |
| 20     | 400    |

Number      Square

If a number has 4 or 6 in the unit's place, then it's square numbers ending in 6.  
Let's consider square ends in 6.

## PROPERTIES

| NUMBER | SQUARE |
|--------|--------|
| 1      | 1      |
| 2      | 4      |
| 3      | 9      |
| 4      | 16     |
| 5      | 25     |
| 6      | 36     |
| 7      | 49     |
| 8      | 64     |
| 9      | 81     |
| 10     | 100    |
| 11     | 121    |
| 12     | 144    |
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| 14     | 196    |
| 15     | 225    |
| 16     | 256    |
| 17     | 289    |
| 18     | 324    |
| 19     | 361    |
| 20     | 400    |

Number      Square

**When a number ends in 5 or 0 in the unit's place, the square number also ends in 5 or 0.**

## PROPERTIES

| NUMBER | SQUARE |
|--------|--------|
| 1      | 1      |
| 2      | 4      |
| 3      | 9      |
| 4      | 16     |
| 5      | 25     |
| 6      | 36     |
| 7      | 49     |
| 8      | 64     |
| 9      | 81     |
| 10     | 100    |
| 11     | 121    |
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| 15     | 225    |
| 16     | 256    |
| 17     | 289    |
| 18     | 324    |
| 19     | 361    |
| 20     | 400    |

Since the square of  
an odd natural  
number is odd

That of an even  
number is an even  
number.

**Q.**

**The square of which of the following would be odd number ?**

**(i) 431**

**(ii) 2826**

**(iii) 7779**

**(iv) 82004**

**Sol.**

**Since the square of an odd natural number is odd and that of an even number is an even number.**

**The square of 431 and 7729 are an odd number.**

**[ ∵ 431 and 7729 are an odd number.]**

**The square of 2826 and 82004 are an even number.**

**[ ∵ 2826 and 82004 are an even number.]**

**Q.**

**What will be the unit digit of the squares of the following numbers?**

(i) **81**       $1 \times 1 = 1$

**Sol.** The square of unit's place digit 1 is **1**.

∴ The unit's digit of square of 81 is 1.

(ii) **272**       $2 \times 2 = 4$

**Sol.** The square of unit's place digit 2 is **4**.

∴ The unit's digit of square of 272 is 4.

(iii) **799**       $9 \times 9 = 81$

**Sol.** The square of unit's place digit 9 is **81**.

∴ The unit's digit of square of 799 is 1.

**Q.**

**What will be the unit digit of the squares of the following numbers?**

(iv) **3853**     **$3 \times 3 = 9$**

**Sol.** The square of unit's place digit 3 is **9**.

∴ The unit's digit of square of 3853 is 9.

(v) **1234**     **$4 \times 4 = 16$**

**Sol.** The square of unit's place digit 4 is **16**.

∴ The unit's digit of square of 1234 is 6.

**Q.**

**What will be the unit digit of the squares of the following numbers?**

(vi) **26387**

$$7 \times 7 = 49$$

**Sol.** The square of unit's place digit 7 is 49.

∴ The unit's digit of square of 26387 is 9.

(vii) **52698**

$$8 \times 8 = 64$$

**Sol.** The square of unit's place digit 8 is 64.

∴ The unit's digit of square of 52698 is 4.

(viii) **99880**

$$0 \times 0 = 0$$

**Sol.** The square of unit's place digit 0 is 0.

∴ The unit's digit of square of 99880 is 0.

**Q.**

**What will be the unit digit of the squares of the following numbers?**

(ix) **12796**     **$6 \times 6 = 36$**

**Sol.** The square of unit's place digit 6 is **36**.

∴ The unit's digit of square of 12796 is 6.

(x) **55555**     **$5 \times 5 = 25$**

**Sol.** The square of unit's place digit 5 is **25**.

∴ The unit's digit of square of 55555 is 5.

## Square of numbers which are multiples of 10

We have one zero

$$10^2 = 100$$

$$20^2 = 400$$

$$80^2 = 6400$$

We have two zeros

$$100^2 = 10000$$

$$200^2 = 40000$$

$$700^2 = 490000$$

$$900^2 = 810000$$

But we have two zeros

Numbers which are multiples of 10 only have even number of zeros at the end.

But we have four zeros

**Example**

$$1000^2 = 1000000$$

$$2000^2 = 4000000$$

**Q.**

**The following numbers are obviously not perfect squares. Give reason?**

**(i) 1057**

**Sol.** Since, the unit place digit is 7  
 $\therefore$  1057 is not a perfect square.

**Which is not one of  
(0, 1, 4, 5, 6 or 9).**

**(ii) 23453**

**Sol.** Since, the unit place digit is 3.  
 $\therefore$  23453 is not a perfect square.

**Which is not one of  
(0, 1, 4, 5, 6 or 9).**

**(iii) 7928**

**Sol.** Since, the unit place digit is 8  
 $\therefore$  7928 is not a perfect square.

**Which is not one of  
(0, 1, 4, 5, 6 or 9).**

**Q.**

**The following numbers are obviously not perfect squares. Give reason?**

**(iv) 222222**

**Sol.** Since, the units place digit is 2  
 $\therefore$  222222 is not a perfect square.

**Which is not one of  
(0, 1, 4, 5, 6 or 9).**

**(v) 64000**

**Sol.** Since, the number of 0 is odd  
 $\therefore$  64000 is not a perfect square.

**Number of  
zeroes is 3**

**(vi) 89722**

**Sol.** Since, the unit place digit is 2  
 $\therefore$  89722 is not a perfect square.

**Which is not one of  
(0, 1, 4, 5, 6 or 9).**

**Q.**

**The following numbers are obviously not perfect squares. Give reason?**

**(vii) 222000**

**Sol.** Since, the number of 0 is odd  
 $\therefore$  222000 is not perfect square.

**Number of zeroes is 3**

**(viii) 505050**

**Sol.** Since, the number of 0 is odd  
 $\therefore$  505050 can not be perfect square.

**Number of zeroes is 1**

## (1) Find the square :

Trick: To find square of a number whose last digit is 5

For example : 35

Method

(1) Not considering the last digit

Multiply the remaining number

With it's successive natural number

Next consecutive  
number

$$\times 4 = 12$$

(2) Attach '25'

to the end of the number obtained in  
step 1

Example:

$$(35)^2$$

$$(3 \times 4) \quad 5^2 = 25$$

$$1225$$

Example:

$$(45)^2$$

$$(4 \times 5) \quad 5^2 = 25$$

$$2025$$

## SOME MORE INTERESTING FACTS

### 1. Adding triangular numbers.



1



3



$$1 + 3 = 4$$

$$= 2^2$$



6



$$3 + 6 = 9$$

$$= 3^2$$



10



$$6 + 10 = 16$$

$$= 4^2$$

If we combine two consecutive triangular numbers we get square numbers

## NUMBERS BETWEEN SQUARE NUMBERS



The numbers of terms between  
the square numbers are  
2, 4, 6, and 8.  
These numbers are even  
and increase by 2 every time.

## ADDING ODD NUMBERS

1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17, 19, 21, 23, 25, 27, 29, 31 . . .

$$1 = 1^2$$

$$4 = 2^2$$

$$9 = 3^2$$

$$16 = 4^2$$

$$25 = 5^2$$

$$36 = 6^2$$

$$49 = 7^2$$

$$64 = 8^2$$

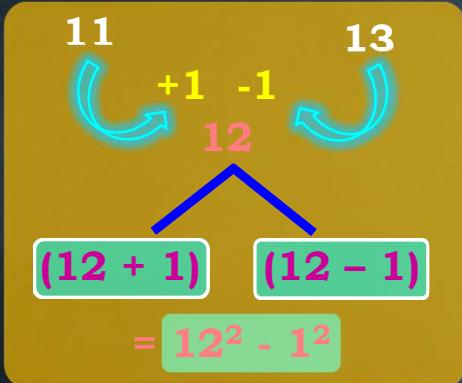
$$81 = 9^2$$

$$= \dots \dots \dots$$

Sum of first nine  
odd numbers  
is nine times.

## Product of two consecutive even or odd numbers

### Example



Lets us take 2 consecutive  
Similarly,  
odd numbers 11 & 13.

$$(a + 1) \times (a - 1) = a^2 - 1$$

$$11 \times 13 = (12 - 1) \times (12 + 1) = 12^2 - 1$$

$$12 \times 14 = (13 - 1) \times (13 + 1) = 13^2 - 1$$

$$23 \times 25 = (24 - 1) \times (24 + 1) = 24^2 - 1$$

$$18 \times 20 = (19 - 1) \times (19 + 1) = 19^2 - 1$$

## Some more patterns in square numbers

$$1^2 =$$

1

$$11^2 =$$

1 2 1

$$111^2 =$$

1 2 3 2 1

$$1111^2 =$$

1 2 3 4 3 2 1

$$11111^2 =$$

1 2 3 4 5 4 3 2 1

$$111111^2 =$$

1 2 3 4 5 6 5 4 3 2 1

Observe the  
pattern

## Some more patterns in square numbers

$$7^2 = \quad \quad \quad 49$$

$$67^2 = \quad \quad \quad 4 \ 4 \ 8 \ 9$$

$$667^2 = \quad \quad \quad 4 \ 4 \ 4 \ 8 \ 8 \ 9$$

$$6667^2 = \quad \quad \quad 4 \ 4 \ 4 \ 4 \ 8 \ 8 \ 8 \ 9$$

$$66667^2 = \quad \quad \quad 4 \ 4 \ 4 \ 4 \ 4 \ 8 \ 8 \ 8 \ 8 \ 9$$

$$666667^2 = \quad 4 \ 4 \ 4 \ 4 \ 4 \ 4 \ 8 \ 8 \ 8 \ 8 \ 8 \ 9$$

Observe the  
pattern

**Q.** Observe the following pattern and find the missing digits.

$$11^2 = 121$$

$$101^2 = 10201$$

$$1001^2 = 1002001$$

$$100001^2 = 1.....2.....1$$

$$10000001^2 = .......$$

Have the same number of zeroes before and after the digit 2 as it was in original number.

**Sol.** Observing the above pattern, we have

$$(i) \quad 100001^2 = 10000200001$$

$$(ii) \quad 10000001^2 = 100000020000001$$

**Q.** Observe the following pattern and find the missing digits.

$$11^2 = 121$$

$$101^2 = 10201$$

$$10101^2 = 102030201$$

$$1010101^2 = \dots\dots\dots$$

$$\dots\dots\dots^2 = 10203040504030201$$

by following the pattern  
which was every time after  
the original number.

**Sol.** Observing the above, we have

$$(i) \quad (1010101)^2 = 10203040504030201$$

$$(ii) \quad 10203040504030201 = (101010101)^2$$

**Q.** Using the given pattern. Find the missing numbers.

$$1^2 + 2^2 + \underline{2^2} = 3^2$$

$$2^2 + 3^2 + \underline{6^2} = 7^2$$

$$3^2 + 4^2 + \underline{12^2} = 13^2$$

$$4^2 + 5^2 + \underline{\quad}^2 = 21^2$$

$$5^2 + \underline{\quad}^2 + 30^2 = 31^2$$

$$6^2 + 7^2 + \underline{\quad}^2 = \underline{\quad}^2$$

**Sol.** The missing number are

(i)  $4^2 + 5^2 + \underline{20^2} = 21^2$

(ii)  $5^2 + \underline{6^2} + 30^2 = 31^2$

(iii)  $6^2 + 7^2 + \underline{42^2} = 43^2$

To find pattern :

Third number is related  
to first and second  
number. How ?

Fourth number is related  
to third number. How ?

The fourth number is  
can be obtained by  
adding one to the  
third number.

*2 + 1*

*42 + 1*

**Q.** Without adding, find the sum.

(i)  $1 + 3 + 5 + 7 + 9$

(ii)  $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19$

(iii)  $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23$

**Sol.**

(i) The sum of first 5 odd numbers =  $5^2$   
= 25

(ii) The sum of first 10 odd numbers =  $10^2$   
= 100

(iii) The sum of first 12 odd numbers =  $12^2$   
= 144

**ADDING ODD NUMBERS**

1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31 ...

|    |   |       |
|----|---|-------|
| 1  | = | $1^2$ |
| 4  | = | $2^2$ |
| 9  | = | $3^2$ |
| 16 | = | $4^2$ |
| 25 | = | $5^2$ |

Sum of the first five  
odd number

- Q.** (i) Express 49 as the sum of 7 odd numbers.  
(ii) Express 121 as the sum of 11 odd numbers.

**7 odd numbers**

$$\begin{aligned}49 &= 7^2 \\&= 1 + 3 + 5 + 7 + 9 + 11 + 13\end{aligned}$$

**11 odd numbers**

$$\begin{aligned}121 &= 11^2 \\&= 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21\end{aligned}$$

**Q.** How many numbers lie between squares of the following numbers ?

- (i) 12 and 13   (ii) 25 and 26   (iii) 99 and 100

**Sol.** (i) Between  $12^2$  and  $13^2$ , there are

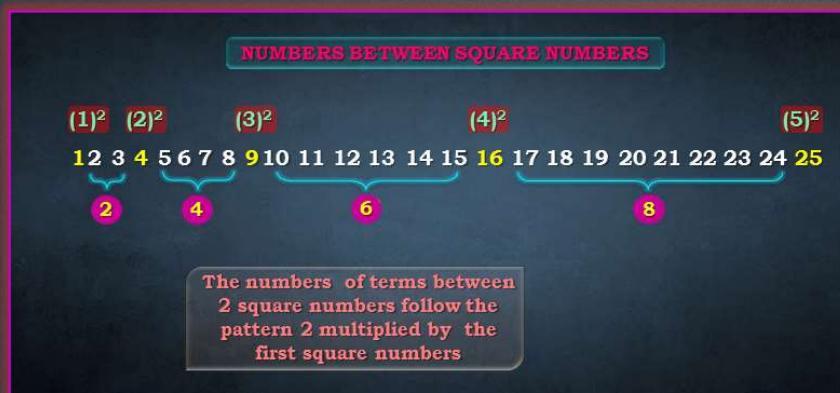
$2 \times 12$  i.e., 24 numbers.

(ii) Between  $25^2$  and  $26^2$ , there are

$2 \times 25$  i.e., 50 numbers.

(iii) Between  $99^2$  and  $100^2$ , there are

$2 \times 99$  i.e., 198 numbers.



## Finding the square of a number without actual multiplication

**Example**

To find the square of number 39

1.  $39^2 = (30 + 9)^2$

Sol.  $(30 + 9)^2 = (30)^2 + \underline{2 \times 30 \times 9} + (9)^2$

What is  $b$  ?

$$= 900 + 540 + 81$$

= 1521



2.  $42^2 = (40 + 2)^2$

$$= 40^2 + \underline{2 \times 40 \times 2} + 2^2$$

$$= 1600 + 160 + 4$$

= 1764

$$(a + 1) \times (a - 1)$$
  
$$= a^2 - 1$$

Let us replace  
Simplifying,  
the formula  
&  
 $b$  with 9

**Q.** Find the square of the following numbers.

(i) 32

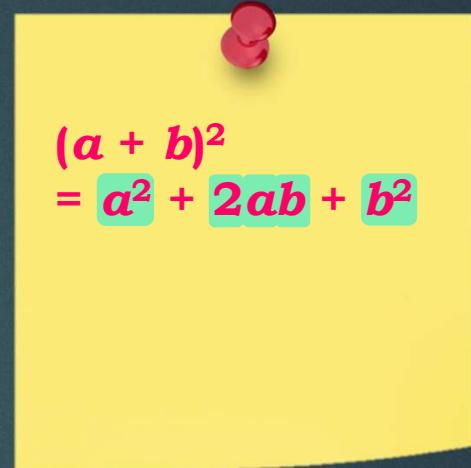
Sol. 
$$\begin{aligned}(32)^2 &= (30 + 2)^2 \\&= (30)^2 + 2(30)(2) + (2)^2 \\&= 900 + 120 + 4\end{aligned}$$

$$\therefore (32)^2 = 1024$$

(ii) 35

Sol. 
$$\begin{aligned}(35)^2 &= (30 + 5)^2 \\&= (30)^2 + 2(30)(5) + (5)^2 \\&= 900 + 300 + 25\end{aligned}$$

$$\therefore (35)^2 = 1225$$



**Q.** Find the square of the following numbers.

(iii) 86

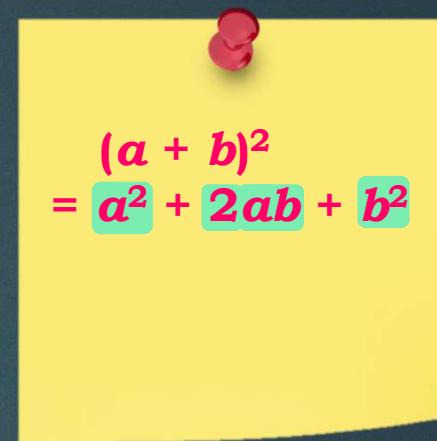
Sol. 
$$\begin{aligned}(86)^2 &= (80 + 6)^2 \\&= (80)^2 + 2(80)(6) + (6)^2 \\&= 6400 + 960 + 36\end{aligned}$$

$$\therefore (86)^2 = 7396$$

(iv) 93

Sol. 
$$\begin{aligned}(93)^2 &= (90 + 3)^2 \\&= (90)^2 + 2(90)(3) + (3)^2 \\&= 8100 + 540 + 9\end{aligned}$$

$$\therefore (93)^2 = 8649$$



**Q.** Find the square of the following numbers.

(v) 71

Sol.  $(71)^2 = (70 + 1)^2$

$$\begin{aligned} &= (70)^2 + 2(70)(1) + (1)^2 \\ &= 4900 + 140 + 1 \end{aligned}$$

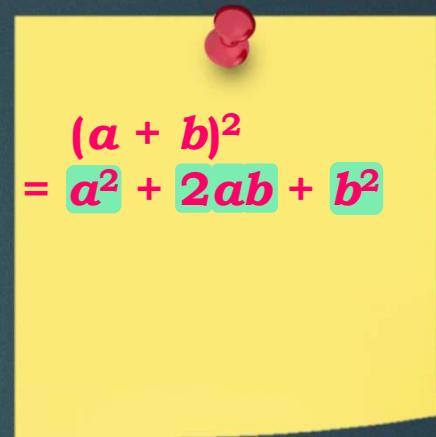
$$\therefore (71)^2 = 5041$$

(vi) 46

Sol.  $(46)^2 = (40 + 6)^2$

$$\begin{aligned} &= (40)^2 + 2(40)(6) + (6)^2 \\ &= 1600 + 480 + 36 \end{aligned}$$

$$\therefore (46)^2 = 2116$$



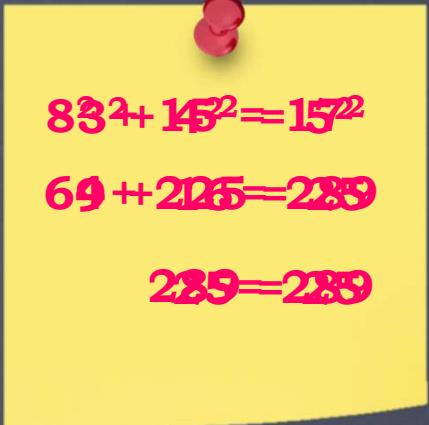
## PYTHAGOREAN TRIPLET

If 3 numbers  $a, b, c$  are such that  $a^2 + b^2 = c^2$  then  
they are called as  
**PYTHAGOREAN TRIPLET.**

### Example

3, 4, 5 form a Pythagorean Triplet  
[  $\because 3^2 + 4^2 = 5^2$  ]

8, 15, 17 form a Pythagorean Triplet  
[  $\because 8^2 + 15^2 = 17^2$  ]


$$8^2 + 15^2 = 17^2$$
$$64 + 225 = 289$$
$$229 = 289$$

## PYTHAGOREAN TRIPLET

NOTE : For any natural number  $n, (n > 1)$ ,  $(2n)^2 + (n^2 - 1)^2 = (n^2 + 1)^2$

**Example** Write a Pythagorean triplet whose one number is 15.

**Sol :** Since, a Pythagorean triplet is formed by  $2n$ ,  $n^2 - 1$  and  $n^2 + 1$ .

If  $2n = 15$  ;  $n = \frac{15}{2}$  is not a natural number.

So, now let us assume that

∴ It is natural  
triplet is formed by  
number.

$$n^2 - 1 = 15$$

$$\therefore n^2 = 15 + 1$$

$$\therefore n^2 = 16$$

$$\therefore n = 4$$

Taking square  
roots on both]

Now, the required Pythagorean triplet is

$$\therefore 2n = 2(4) = 8$$

$$n^2 - 1 = 4^2 - 1 = 15$$

$$n^2 + 1 = 4^2 + 1 = 17$$

Note :

All the Pythagorean  
triplets may not be  
obtained using this form

**Q.** Write a Pythagorean triplet whose one member is

(i) 6

Sol. Let  $2n = 6 \therefore n = \frac{6}{2} = 3$

Now,  $n^2 - 1 = 3^2 - 1 = 9 - 1 = 8$

and,  $n^2 + 1 = 3^2 + 1 = 9 + 1 = 10$

Now, the required Pythagorean triplet is  
 $2n, n^2 - 1$  and  $n^2 + 1$

Thus, the required Pythagorean triplet is 6, 8, 10.

(ii) 14

Sol. Let  $2n = 14 \therefore n = \frac{14}{2} = 7$

Now,  $n^2 - 1 = 7^2 - 1 = 49 - 1 = 48$

and,  $n^2 + 1 = 7^2 + 1 = 49 + 1 = 50$

Thus, the required Pythagorean triplet is 14, 48, 50.

**Q.** Write a Pythagorean triplet whose one member is

(iii) 16

Sol. Let  $2n = 16 \therefore n = \frac{16}{2} = 8$

Now,  $n^2 - 1 = 8^2 - 1 = 64 - 1 = 63$

and,  $n^2 + 1 = 8^2 + 1 = 64 + 1 = 65$

Now, the required Pythagorean triplet is  
 $2n, n^2 - 1$  and  $n^2 + 1$

Thus, the required Pythagorean triplet is 16, 63, 65.

(iv) 18

Sol. Let  $2n = 18 \therefore n = \frac{18}{2} = 9$

Now,  $n^2 - 1 = 9^2 - 1 = 81 - 1 = 80$

and,  $n^2 + 1 = 9^2 + 1 = 81 + 1 = 82$

Thus, the required Pythagorean triplet is 18, 80, 82.

**Q.** What could be the possible ‘ones’ digit of the square root of each of the following numbers?

- (i) 9801 (ii) 99856 (iii) 998001 (iv) 65766025

**Sol.** The possible digit at one’s place of the square root of

- (i) 9801 can be 1 or 9.  
[ $\because 1 \times 1 = 1$  and  $9 \times 9 = 81$ ]
- (ii) 99856 can be 4 or 6.  
[ $\because 4 \times 4 = 16$  and  $6 \times 6 = 36$ ]
- (iii) 998001 can be 1 or 9.  
[ $\because 1 \times 1 = 1$  and  $9 \times 9 = 81$ ]
- (iv) 65766025 can be 5.  
[ $\because 5 \times 5 = 25$ ]

| NUMBER | SQUARE |
|--------|--------|
| 1      | 1      |
| 2      | 4      |
| 3      | 9      |
| 4      | 16     |
| 5      | 25     |
| 6      | 36     |
| 7      | 49     |
| 8      | 64     |
| 9      | 81     |
| 10     | 100    |
| 11     | 121    |
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| 16     | 256    |
| 17     | 289    |
| 18     | 324    |
| 19     | 361    |
| 20     | 400    |

**PROPERTIES**

| Number | Square |
|--------|--------|
| 1      | 1      |
| 9      | 81     |
| 11     | 121    |
| 19     | 361    |

When a number ends in 5 or 0 in the unit’s place, the square number also ends in 5 or 0.

**Q.** Without doing any calculation find the numbers which are surely not perfect squares.

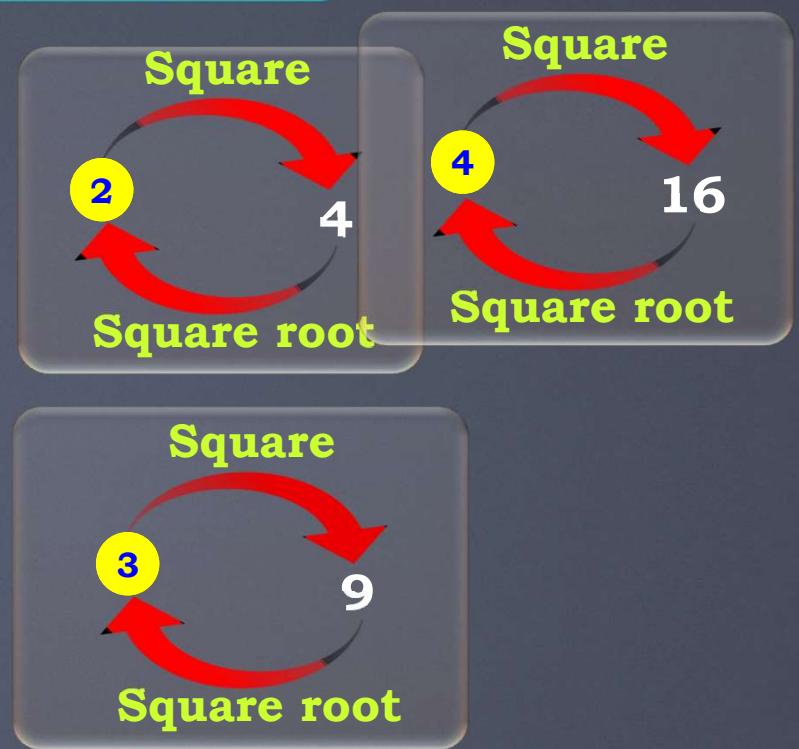
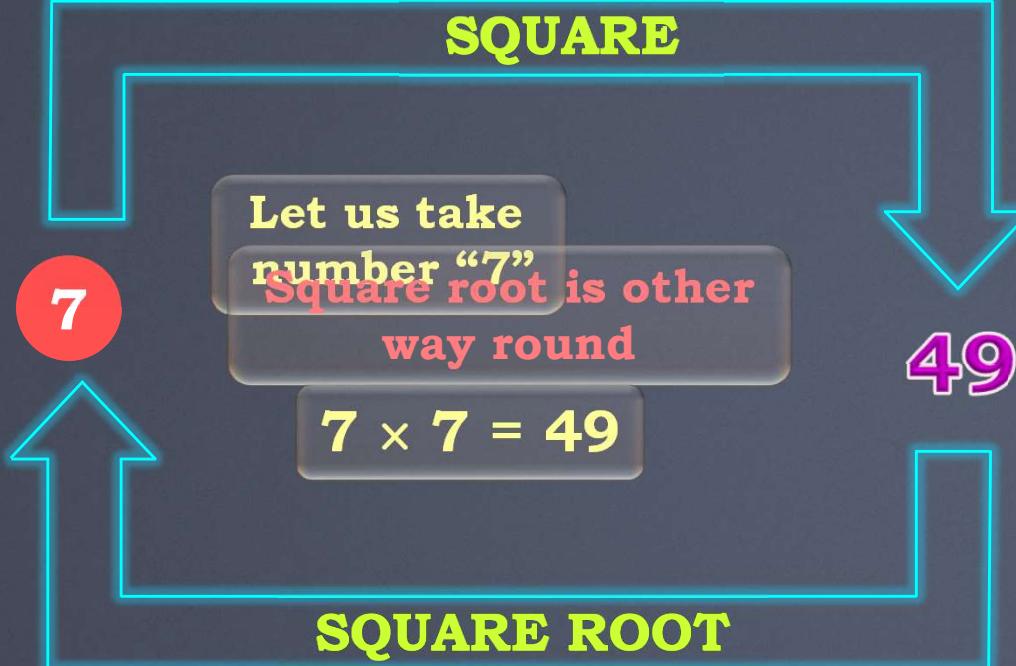
- (i) 153    (ii) 257    (iii) 408    (iv) 441

**Sol.** We know that the ending digit of perfect square is 0, 1, 4, 5, 6 and 9.

- (i) 153, cannot be a perfect square.  
(ii) 257, cannot be a perfect square.  
(iii) 408, cannot be a perfect square.  
(iv) 441, can be a perfect square.

But here the  
ending digits are

## $\sqrt{}$ (Square Root) of a Number



" $\sqrt{ }$ " is used to denote Square root of any number.

$$7^2 = 49 \quad \sqrt{49} = 7$$

## Square Roots Of Positive Number

What are square roots of 64 ?

$$\begin{aligned} 64 &= 8 \times 8 \\ &= 8^2 \end{aligned}$$

Square root of 64 is 8

$$\sqrt{64} = 8$$

Thus, there are two square roots.  
These are 8 and (- 8)

**REMEMBER THIS :-**

Every positive number has two square roots.  
i.e. one positive and the other negative.

Let's take  
square root of 64

$$\begin{aligned} 64 &= (- 8) \times (- 8) \\ &= (- 8)^2 \end{aligned}$$

Square root of 64 is (- 8)

$$\sqrt{64} = (- 8)$$

Ex :

$$\sqrt{4} = 2 \text{ and } - 2$$

$$\sqrt{9} = 3 \text{ and } - 3$$

$$\sqrt{16} = 4 \text{ and } - 4$$

$$\sqrt{25} = 5 \text{ and } - 5$$

**There are 3 methods to find square root of number.**

**Repeated  
subtraction  
Method**

**Factorisation  
Method**

**Division  
Method**

**How to find out Square  
root of a number**

Finding square roots through repeated subtraction.

$$\therefore \sqrt{81} = 9$$

1

$$81 - 1 = 80$$

4

$$- 7 = 65$$

7

$$- 13 = 32$$

2

$$- 3 = 77$$

5

$$- 9 = 56$$

8

$$- 15 = 17$$

3

$$- 5 = 72$$

6

$$- 11 = 45$$

9

$$- 17 = 0$$

The step at which we get zero is the square root of the number.

Subtract successive odd numbers till we get zero starting from 1 and obtained 0 at the ninth step

**Q.**

Find the square roots of 100 and 169 by the method of repeated subtraction.

Sol.  $\therefore \sqrt{100} = 10$

1

$$100 - 1 = 99$$

4

$$- 7 = 84$$

7

$$- 13 = 51$$

10

$$- 19 = 0$$

2

$$- 3 = 96$$

5

$$- 9 = 75$$

8

$$- 15 = 36$$

3

$$- 5 = 91$$

6

$$- 11 = 64$$

9

$$- 17 = 19$$



From 100 we have  
Subtract successive odd  
numbers starting from 1 and  
obtained 0 at the tenth step

The step at which we

get zero. Now let's count

numbers starting from 1 and

root of the the steps

**Q.**

Find the square roots of 100 and 169 by the method of repeated subtraction.

Sol.  $\therefore \sqrt{169} = 13$

From 169 we have subtracted  
Subtract successive odd  
successive odd numbers starting  
numbers till we reach  
from 1 and stopped 0 at the 13<sup>th</sup>  
root of zero number.  
step

1

$$169 - 1 = 168$$

4

$$- 7 = 153$$

7

$$- 13 = 120$$

10

$$- 19 = 69$$

13

$$- 25 = 0$$

2

$$- 3 = 165$$

5

$$- 9 = 144$$

8

$$- 15 = 105$$

11

$$- 21 = 48$$

3

$$- 5 = 160$$

6

$$- 11 = 133$$

9

$$- 17 = 88$$

12

$$- 23 = 25$$



**Q.** Find the square roots of the following numbers by the Prime Factorisation Method.

(i) 729

Sol.  $729 = 3 \times 3 \times 3 \times 3 \times 3 \times 3$

$\therefore \sqrt{729} = 3 \times 3 \times 3$

$\therefore \sqrt{729} = 27$

$\therefore$  Thus, the square root of 729  
= 27

Let us do prime factorisation of same number  
of 729

Let us make pairs

Rough work

|   |     |
|---|-----|
| 3 | 729 |
| 3 | 243 |
| 3 | 81  |
| 3 | 27  |
| 3 | 9   |
| 3 | 3   |
|   | 1   |

**Q.**

Find the square roots of the following numbers by the Prime Factorisation Method.

(ii) 400

**Sol.**  $400 = 2 \times 2 \times 2 \times 2 \times 5 \times 5$

$$\therefore \sqrt{400} = 2 \times 2 \times 5$$

$$\therefore \sqrt{400} = 20$$

$\therefore$  Thus, the square root of 400  
= 20

Let us make pairs  
of same numbers

Rough work

|   |     |
|---|-----|
| 2 | 400 |
| 2 | 200 |
| 2 | 100 |
| 2 | 50  |
| 5 | 25  |
| 5 | 5   |
|   | 1   |

**Q.** Find the square roots of the following numbers by the Prime Factorisation Method.

(iii) 1764

**Sol.**  $1764 = 2 \times 2 \times 3 \times 3 \times 7 \times 7$

$$\therefore \sqrt{1764} = 2 \times 3 \times 7$$

$$\therefore \sqrt{1764} = 42$$

**∴ Thus, the square root of 1764  
= 42**

Let us make prime factorisation of 1764

Rough work

|   |      |
|---|------|
| 2 | 1764 |
| 2 | 882  |
| 3 | 441  |
| 3 | 147  |
| 7 | 49   |
| 7 | 7    |
|   | 1    |

**Q.**

Find the square roots of the following numbers by Prime Factorisation Method.

(iv) 4096

Sol.  $4096 = 2 \times 2 \times 2 \times 2 \times 2 \times 2$   
 $\quad \quad \quad \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$

$$\therefore \sqrt{4096} = 2 \times 2 \times 2 \times 2$$
$$\quad \quad \quad \times 2 \times 2 \times 2 \times 2$$

$$\therefore \sqrt{4096} = 64$$

Let us make pairs  
of same number

Thus, the square root of 4096  
= 64

Let us do prime factorisation  
4096

| Rough work |      |
|------------|------|
| 2          | 4096 |
| 2          | 2048 |
| 2          | 1024 |
| 2          | 512  |
| 2          | 256  |
| 2          | 128  |
| 2          | 64   |
| 2          | 32   |
| 2          | 16   |
| 2          | 8    |
| 2          | 4    |
| 2          | 2    |
|            | 1    |

**Q.**

Find the square roots of the following numbers by the Prime Factorisation Method.

(v) 7744

Sol.  $7744 = 2 \times 2 \times 2 \times 2 \times 2 \times 11 \times 11$

$$\therefore \sqrt{7744} = 2 \times 2 \times 2 \times 11$$

$$\therefore \sqrt{7744} = 88$$

∴ Thus, the square root of 7744

Let us do prime factorisation of same number  
7744

Rough work

|    |      |
|----|------|
| 2  | 7744 |
| 2  | 3872 |
| 2  | 1936 |
| 2  | 968  |
| 2  | 484  |
| 2  | 242  |
| 11 | 121  |
| 11 | 11   |
|    | 1    |

**Q.**

Find the square roots of the following numbers by the Prime Factorisation Method.

(vi) 9604

Sol.  $9604 = 2 \times 2 \times 7 \times 7 \times 7 \times 7$

$$\therefore \sqrt{9604} = 2 \times 7 \times 7$$

$$\therefore \sqrt{9604} = 98$$

$\therefore$  Thus, the square root of 9604  
= 98

Let us make pairs  
of factorisation of  
9604

Rough work

|   |      |
|---|------|
| 2 | 9604 |
| 2 | 4802 |
| 7 | 2401 |
| 7 | 343  |
| 7 | 49   |
| 7 | 7    |
|   | 1    |

**Q.** Find the square roots of the following numbers by the Prime Factorisation Method.

(vii) 5929

Sol.  $5929 = 7 \times 7 \times 11 \times 11$

$$\therefore \sqrt{5929} = 7 \times 11$$

$$\therefore \sqrt{5929} = 77$$

$$\begin{aligned}\therefore \text{Thus, the square root of } 9604 \\ = 77\end{aligned}$$

Let us make pairs  
of factorisation of  
5929

Rough work

|    |      |
|----|------|
| 7  | 5929 |
| 7  | 847  |
| 11 | 121  |
| 11 | 11   |
|    | 1    |

**Q.**

Find the square roots of the following numbers  
Prime Factorisation Method.

(viii) 9216

Sol.  $9216 = 2 \times 3 \times 3$

$$\therefore \sqrt{9216} = 2 \times 2 \times 2 \times 2 \times 3$$

$$\therefore \sqrt{9216} = 96$$

∴ Thus, the square root of 4096

Let us make pairs  
of same number  
9216

Rough work

|   |      |
|---|------|
| 2 | 9216 |
| 2 | 4608 |
| 2 | 2304 |
| 2 | 1152 |
| 2 | 576  |
| 2 | 288  |
| 2 | 144  |
| 2 | 72   |
| 2 | 36   |
| 2 | 18   |
| 3 | 9    |
| 3 | 3    |
|   | 1    |

**Q.** Find the square roots of the following numbers by the Prime Factorisation Method.

(ix) 529

**Sol.**  $529 = 23 \times 23$

$$\therefore \sqrt{529} = 23$$

$\therefore$  Thus, the square root of 529 = 23

Let us make pairs  
of factors in 529

Rough work

$$\begin{array}{r|l} 23 & 529 \\ 23 & 23 \\ \hline & 1 \end{array}$$

**Q.**

Find the square roots of the following numbers by the Prime Factorisation Method.

(x) 8100

Sol.  $8100 = 2 \times 2 \times 3 \times 3 \times 3 \times 3$   
 $\quad \quad \quad \times 5 \times 5$

$$\therefore \sqrt{8100} = 2 \times 3 \times 3 \times 5$$

$$\therefore \sqrt{8100} = 90$$

∴ Thus, the square root of 8100  
= 90

Let us make pairs  
of same number  
8100

Rough work

|   |      |
|---|------|
| 2 | 8100 |
| 2 | 4050 |
| 3 | 2025 |
| 3 | 675  |
| 3 | 225  |
| 3 | 75   |
| 5 | 25   |
| 5 | 5    |
|   | 1    |

**Q.**

For each of the following numbers, find the smallest whole number by which it should be multiplied so as to get a perfect square number. Also find the square root of the square number so obtained.

(i) 252

**Sol.**

$$252 \times 7 = 2 \times 2 \times 3 \times 3 \times 7 \times 7$$

$$1764 = 2 \times 2 \times 3 \times 3 \times 7 \times 7$$

$$\therefore \sqrt{1764} = 2 \times 3 \times 7$$

$$\sqrt{1764} = 42$$

*Since 7 is taken 2 times  
So, now the perfect  
square of 7 is 49  
So, the required square is 1764*

Thus, the required multiply by whole number = 7.

Also, the square root of 1764 = 42.

**Rough work**

|   |     |
|---|-----|
| 2 | 252 |
| 2 | 126 |
| 3 | 63  |
| 3 | 21  |
| 7 | 7   |
|   | 1   |

**Q.**

For each of the following numbers, find the smallest whole number by which it should be multiplied so as to get a perfect square number. Also find the square root of the square number so obtained.

(iii) 1008

**Sol.**

$$1008 \times 7 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 7 \times 7$$

$$7056 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 7 \times 7$$

$$\therefore \sqrt{7056} = 2 \times 2 \times 3 \times 7$$

Thus, the required smallest whole number = 7.

Also, the square root of 1008 is 84.

So, now the perfect square is 7056

**Rough work**

|   |      |
|---|------|
| 2 | 1008 |
| 2 | 504  |
| 2 | 252  |
| 2 | 126  |
| 3 | 63   |
| 3 | 21   |
| 7 | 7    |
|   | 1    |

**Q.**

For each of the following numbers, find the smallest whole number by which it should be multiplied so as to get a perfect square number. Also find the square root of the square number so obtained.

(iv) 2028

**Sol.**

$$2028 \times 3 = 2 \times 2 \times 13 \times 13 \times 3 \times 3$$

$$6084 = 2 \times 2 \times 13 \times 13 \times 3 \times 3$$

$$\therefore \sqrt{6084} = 2 \times 13 \times 3$$

$$\sqrt{6084} = 78$$

Thus, the required smallest whole number = 3. factorisation of 2028 is 2<sup>2</sup> × 13<sup>2</sup>. So, now the perfect square is 6084.

Also, the square root of 2028 is 78.

| Rough work |      |
|------------|------|
| 2          | 2028 |
| 2          | 1014 |
| 3          | 507  |
| 13         | 169  |
| 13         | 13   |
|            | 1    |

**Q.**

For each of the following numbers, find the smallest whole number by which it should be multiplied so as to get a perfect square number. Also find the square root of the square number so obtained.

(v) 1458

**Sol.**

$$1458 \times 2 = 3 \times 3 \times 3 \times 3 \times 3 \times 2 \times 2$$

$$2916 = 3 \times 3 \times 3 \times 3 \times 3 \times 2 \times 2$$

$$\therefore \sqrt{2916} = 3 \times 3 \times 3 \times 2$$

Thus, the required smallest whole number is 2.  
Let us do prime factorisation of 1458.  
So, now the perfect square is 2916 = 54.  
Also, the square root of 1458 is 36. Let us multiply by 2.

**Rough work**

|   |      |
|---|------|
| 2 | 1458 |
| 3 | 729  |
| 3 | 243  |
| 3 | 81   |
| 3 | 27   |
| 3 | 9    |
| 3 | 3    |
|   | 1    |

**Q.**

For each of the following numbers, find the smallest whole number by which it should be multiplied so as to get a perfect square number. Also find the square root of the square number so obtained.

(vi) 768

Sol.

Let us do prime factorisation of square of 768.  
Since 768 is not a perfect square, we multiply by 3.

$$768 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3$$

$$768 \times 3 = 2 \times 3 \times 3$$

$$2304 = 2 \times 3 \times 3$$

$$\therefore \sqrt{2304} = 2 \times 2 \times 2 \times 2 \times 3$$

$$\sqrt{2304} = 48$$

Thus, the required smallest whole number = 3.

Also, the square root of 2304 = 48.

Rough work

|   |     |
|---|-----|
| 2 | 768 |
| 2 | 384 |
| 2 | 192 |
| 2 | 96  |
| 2 | 48  |
| 2 | 24  |
| 2 | 12  |
| 2 | 6   |
| 2 | 3   |
| 3 | 1   |

**Q.**

For each of the following numbers, find the smallest whole number by which it should be divided so as to get a perfect square number. Also find the square root of the square number so obtained.

(i) 252

**Sol.**

$$\therefore 252 = 2 \times 2 \times 3 \times 3 \times 7$$

$$\therefore \frac{252}{7} = \frac{36}{7}$$

$$36 = 2 \times 2 \times 3 \times 3$$

$$\sqrt{36} = 2 \times 3$$

$$\sqrt{36} = 6$$

Let us do prime factorisation of  
Thus, the required number = 7.

... to make 252 a perfect square  
divide by 7.

Also, the square root of 36 = 6.

**Rough work**

|   |     |
|---|-----|
| 2 | 252 |
| 2 | 126 |
| 3 | 63  |
| 3 | 21  |
| 7 | 7   |
|   | 1   |

**Q.**

For each of the following numbers, find the smallest whole number by which it should be divided so as to get a perfect square number. Also find the square root of the square number so obtained.

(ii) 2925

**Sol.**

$$\therefore 2925 = 3 \times 3 \times 5 \times 5 \times 13$$

**225**

$$\therefore \frac{2925}{13} = \frac{3 \times 3 \times 5 \times 5 \times 13}{13}$$

$$225 = 3 \times 3 \times 5 \times 5$$

$$\sqrt{225} = 3 \times 5$$

$$\sqrt{225} = 15$$

Thus, the required smallest whole number = 13.

Also, the square root of 225 = 15.

**Rough work**

|    |      |
|----|------|
| 3  | 2925 |
| 3  | 975  |
| 5  | 325  |
| 5  | 65   |
| 13 | 13   |
|    | 1    |

**Q.**

For each of the following numbers, find the smallest whole number by which it should be divided so as to get a perfect square number. Also find the square root of the square number so obtained.

(iii) 396

**Sol.**

$$\therefore 396 = 2 \times 2 \times 3 \times 3 \times 11$$

$$\therefore \frac{396}{11} = \frac{2 \times 2 \times 3 \times 3 \times 11}{11}$$

$$36 = 2 \times 2 \times 3 \times 3$$

$$\sqrt{36} = 2 \times 3$$

$$\sqrt{36} = 6$$

Since the pair of 1's is not a perfect square, we have to divide 36 by 11.

Thus, the required smallest whole number = 11.

So, now the perfect square is 36.

Also, the square root of 36 = 6.

**Rough work**

|    |     |
|----|-----|
| 2  | 396 |
| 2  | 198 |
| 3  | 99  |
| 3  | 33  |
| 11 | 11  |
|    |     |

**Q.**

For each of the following numbers, find the smallest whole number by which it should be divided so as to get a perfect square number. Also find the square root of the square number so obtained.

(iv) 2645

**Sol.**

$$\therefore 2645 = 5 \times 23 \times 23$$

529

$$\therefore \frac{2645}{5} = \frac{5 \times 23 \times 23}{5}$$

$$529 = 23 \times 23$$

$$\sqrt{529} = 23$$

Since we have one 5 factor 5  
Thus, the required smallest whole  
number = 5. by 5.

Also, the square root of 529 = 23.

| Rough work |      |
|------------|------|
| 5          | 2645 |
| 23         | 529  |
| 23         | 23   |
|            | 1    |

**Q.**

For each of the following numbers, find the smallest whole number by which it should be divided so as to get a perfect square number. Also find the square root of the square number so obtained.

(v) 2800

**Sol.**

$$\therefore 2800 = 2 \times 2 \times 2 \times 2 \times 5 \times 5 \times 7$$

400

$$\therefore \frac{2800}{7} = \frac{2 \times 2 \times 2 \times 5 \times 5 \times 7}{7}$$

7

$$400 = 2 \times 2 \times 2 \times 5 \times 5$$

$$\therefore \sqrt{400} = 2 \times 2 \times 5$$

$$\sqrt{400} = 20$$

Since, the prime factors of 400 are 2 and 5.  
So, now the perfect square is 400.  
Thus, the required smallest whole number = 7.

Also, the square root of 400 = 20.

**Rough work**

|   |      |
|---|------|
| 2 | 2800 |
| 2 | 1400 |
| 2 | 700  |
| 2 | 350  |
| 5 | 175  |
| 5 | 35   |
| 7 | 7    |
|   | 1    |

**Q.**

For each of the following numbers, find the smallest whole number by which it should be divided so as to get a perfect square number. Also find the square root of the square number so obtained.

(vi) 1620

**Sol.**

$$1620 = 2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 5$$

$$\frac{1620}{5} = \boxed{2 \times 2} \times \boxed{3 \times 3} \times \boxed{3 \times 3} \times \cancel{\boxed{5}}$$

$$\therefore 324 = 2 \times 3 \times 3$$

$$\sqrt{324} = 18$$

Let us do prime factorisation of 1620.  
Thus, the required smallest whole number = 5.

Also, the square root of 324 = 18.

**Rough work**

|   |      |
|---|------|
| 2 | 1620 |
| 2 | 810  |
| 3 | 405  |
| 3 | 135  |
| 3 | 45   |
| 3 | 15   |
| 5 | 5    |
|   | 1    |

# Q.

The students of Class VIII of a school donated [Rs. 2401] in all, for Prime Minister's National Relief Fund. Each student donated as many rupees as the number of student in the class. Find the number of students in the class.

### Example

$$+ = 4$$

Let the number of students =  $x$

$\therefore$  Each student donated Rs  $x$ .

Total amount donated by the class = Rs  $x \times x =$  Rs  $x^2$ .

Thus,  $x^2 = 2401$  [given]



$$\begin{array}{r} \sqrt{2401} \\ \hline 7 \end{array}$$

Taking 7 as a factor,  
what is the remainder,  
or suppose the value  
in the question?

### Rough work

|   |      |
|---|------|
| 7 | 2401 |
| 7 | 343  |
| 7 | 49   |
| 7 | 7    |
|   | 1    |

$\therefore$  the total contribution is  $20 \times 20 =$  Rs 400

$$\times = 4$$

If the number of students are 20,

$\therefore$  The number of students in the class = 49.

**Q.**

2025 plants are to be planted in a garden in such a way that each row contains as many plants as the number of rows. Find the number of rows and the number of plants in each row.

**Sol.**

Let the number of rows =  $x$

∴ Number of plants in a row =  $x$

So, the number of plants to be planted =  $x \times x = x^2$

Thus,  $x^2 = 2025$  [given]

$$x = \sqrt{2025}$$

$$= \sqrt{3 \times 3 \times 3 \times 3 \times 5 \times 5}$$

$$= 3 \times 3 \times 5$$

Thus, number of rows = 45

∴ Also, number of plants in a row = 45.



What are we  
asked to find?  
What are we  
supposed to find in  
the question?

| Rough work |      |
|------------|------|
| 3          | 2025 |
| 3          | 675  |
| 3          | 225  |
| 3          | 75   |
| 5          | 25   |
| 5          | 5    |
|            | 1    |

**Q.**

Find the **smallest square number** that is **divisible** by each of the numbers and .

**Example**

**Sol.**

We know that LCM is the smallest number divisible by all its factors.  
 $\therefore$  LCM of 4, 9 and 10 =  $2 \times 2 \times 9 \times 5$

$$= 180$$

$\therefore$  900 is a perfect square.

$\therefore$  This number = 900.

$$180 \times 5 = 2 \times 2$$

$$900 = 2 \times 2$$

**Rough work**

|   |        |
|---|--------|
| 2 | 4,9,10 |
| 2 | 2,9,5  |
| 5 | 1,9,5  |
| 9 | 1,9,1  |
|   | 1,1,1  |



Let us make pairs  
So, we spoke about the number 400  
of same number  
Number 4, 9 and 10.

**Q.**

Find the **smallest square number** that is divisible by each of the numbers 8, 15 and 20.

**Sol.**

The smallest number divisible by 8, 15, and 20 is their LCM.

Since, LCM of 8, 15, and 20  
=  $2 \times 2 \times 2 \times 3 \times 5 = 120$   
 $\therefore 3600$  is a perfect square.

$$120 \times 2 \times 3 \times 5 = 2 \times 2 \times \underline{2} \times \underline{3} \times 3600 = 2 \times 2 \times 2 \times 2 \times 3 \times 5$$

| Rough work |         |
|------------|---------|
| 2          | 8,15,20 |
| 2          | 4,15,10 |
| 5          | 2,15,6  |
|            | 2,3,1   |



Since 0 the prime factors of 120 are required factor 2, 3 and 5. The only number which is 120 is 120.

**Square root  
by  
Division method**

**Exercise 6.4**

## Steps

1. Make a set of 2 digits, Sets are always made from right to left.

For Example

2. Put a horizontal line over the digits to understand them even better.

Follow these steps to find.

To find square root

BY 3 1 90 24

3 21 90 24

3. While solving division in this case 17 is the first set  
64 will be the second.

4. Now find a whole number whose square is equal to or less than the first set.

Lets take an example

3 55 75  
3,45,67,890

So, lets find the  $\sqrt{1764}$  by  
DIVISION METHOD.  
example 1,96,24  
example 2,19,024

$$2 \times 4, 3 \times 9, 4 \times 16$$

## Steps

5. Subtract 16 from 17, so we get 1.

6. Now ,add the number to the left of the line i.e 4 add the same number to it, so we get 8.

7. Now, write down the second pair from the given number i.e 64 after the number 1. The new number so formed is 164.

$$\begin{array}{r} & 4 \\ & \underline{-} \\ 17 & - 64 \\ + & 4 \\ \hline & 1 \end{array}$$

$$\begin{array}{r} & 4 \\ & \underline{-} \\ 17 & - 64 \\ + & 4 \\ \hline & 1 \quad 64 \end{array}$$

## Steps

8. Now, think of a digit that should be written besides 8, so that when we multiply the new number formed with the same digit, we should get a number equal to 164 or just less than 164.

- So lets think of the digit.....
- Since we get zero as remainder, 42 is the square root of 1764.

$$(\therefore \sqrt{1764} = 42)$$

Rough work  
Follow these steps to find  
So, when we have to find square root  
To find square root  
By division method  
 $\sqrt{164}$   
of any numbers

|            |            |            |
|------------|------------|------------|
| 80         | 81         | 82         |
| $\times 0$ | $\times 1$ | $\times 2$ |
| 00         | 81         | 164        |

|     |        |
|-----|--------|
| 4   | 2      |
| + 4 | - 16   |
| 8 2 | 1 64   |
| + 2 | - 1 64 |
| 8 4 | 0 00   |

**Q.**

Find the square root of each of the following numbers by division method.

(i) 2304

A diagram showing the division method for finding the square root of 2304. The number 2304 is divided by 16, resulting in a quotient of 144. The steps are as follows:

- Step 1: Divide 23 by 16, write 16 above the line and 16 below the 23. Subtract 16 from 23, remainder is 7.
- Step 2: Bring down 04. Divide 70 by 16, write 16 above the line and 16 below the 70. Subtract 16 from 70, remainder is 04.
- Step 3: Bring down 00. Divide 04 by 16, write 16 above the line and 16 below the 04. Subtract 16 from 04, remainder is 00.

The final result is 144.

$$\therefore \sqrt{2304} = 48$$

Find a square of a number  
that is less than or equal to  
the first set of digits.  
So, we have to find a number  
such that its square is less than  
or equal to the first set of digits.  
1.  $1^2 = 1$   
2.  $2^2 = 4$   
3.  $3^2 = 9$   
4.  $4^2 = 16$   
5.  $5^2 = 25$   
6.  $6^2 = 36$   
7.  $7^2 = 49$   
8.  $8^2 = 64$   
9.  $9^2 = 81$



**Rough Work**

|            |            |
|------------|------------|
|            | 8          |
| 8 7        | 8 8        |
| $\times 7$ | $\times 8$ |
| <hr/>      | <hr/>      |
| 60 9       | 70 4       |

**Q.**

Find the square root of each of the following numbers by division method.

(ii) 4489

A diagram showing the division method for finding the square root of 4489. It consists of two rows of subtraction. The first row has a divisor of 12, a quotient digit of 6, and a remainder of 36. The second row has a divisor of 12, a quotient digit of 7, and a remainder of 0. A red arrow points from the number 6 to the quotient 67 above the first row. The remainder 36 is also highlighted in a blue box at the bottom of the first row.

$\therefore \sqrt{4489} = 67$



A digital-style calculator interface for finding square roots. It shows a stack of cards with squares of numbers from 1 to 9. A text overlay says: "Find a square of a digit which is less than or equal to the first set of digits." Below the calculator, there is a large green circle containing a red 'X' symbol.

|            |            |            |
|------------|------------|------------|
| $1^2 = 1$  | $2^2 = 4$  | $3^2 = 9$  |
| $4^2 = 16$ | $5^2 = 25$ | $6^2 = 36$ |
| $7^2 = 49$ | $8^2 = 64$ | $9^2 = 81$ |

**Rough Work**

|             |             |         |
|-------------|-------------|---------|
| $7$         | $12\ 6$     | $12\ 7$ |
| $\times\ 6$ | $\times\ 7$ |         |
| $75\ 6$     | $88\ 9$     |         |

**Q.**

Find the square root of each of the following numbers by division method.

(iii) 3481

A diagram showing the division method for finding the square root of 3481. It consists of a grid with four quadrants. The top-right quadrant contains the number 3481. The top-left quadrant has a divisor 5 and a quotient 59 above it. The bottom-left quadrant shows the subtraction steps: 34 minus 25 leaves a remainder of 9; then 98 minus 98 leaves a remainder of 0. The bottom-right quadrant shows the final result: 09 81 minus 0 00 leaves a remainder of 0. A red arrow points from the digit 5 in the quotient to the first digit of the dividend 3.

$$\therefore \sqrt{3481} = 59$$

Find a square of a number  
which is less than or equal to  
the given number or less  
than the next number.  
To find the square of a number  
first set two digits.

|            |
|------------|
| $1^2 = 1$  |
| $2^2 = 4$  |
| $3^2 = 9$  |
| $4^2 = 16$ |
| $5^2 = 25$ |
| $6^2 = 36$ |
| $7^2 = 49$ |
| $8^2 = 64$ |
| $9^2 = 81$ |

**Rough Work**

~~9~~

|             |             |
|-------------|-------------|
| $10\ 8$     | $10\ 9$     |
| $\times\ 8$ | $\times\ 9$ |
| <hr/>       |             |
| $86\ 4$     | $98\ 1$     |

**Q.**

Find the square root of each of the following numbers by division method.

(iv) 529

A division method diagram for finding the square root of 529. It shows a grid with 529 inside. The first digit 5 is above the first column, and the last two digits 29 are above the second column. A bracket labeled 2 is to the left of the first column. An arrow points from the number 2 to the digit 2 in 529. The digit 3 is circled in orange at the bottom of the first column. The result 23 is written above the grid. The remainder 01 29 is shown below the grid, with a green box around it. The final answer is 0 00 at the bottom.

$$\therefore \sqrt{529} = 23$$

A table showing squares of numbers from 1 to 9. The table is partially obscured by a boy's head.

|            |
|------------|
| $1^2 = 1$  |
| $2^2 = 4$  |
| $3^2 = 9$  |
| $4^2 = 16$ |
| $5^2 = 25$ |
| $6^2 = 36$ |
| $7^2 = 49$ |
| $8^2 = 64$ |
| $9^2 = 81$ |



**Rough Work**

A rough work section with a red 'X' on a green circle. To its right is a column of numbers: 3, 4 3,  $\times 2$ , 8 4, and 1 29. The multiplication part is shown as  $43 \times 2$  with a line under it, and the result 84 is shown below. The final result 129 is also shown in a green box.

**Q.**

Find the square root of each of the following numbers by division method.

(v) 3249

A diagram showing the division method for finding the square root of 3249. It consists of two rows of subtraction. The first row has a divisor of 10, a quotient digit of 5, and a remainder of 07 49. The second row has a divisor of 7, a quotient digit of 7, and a remainder of 00. Arrows point from the quotient digits 5 and 7 to the next digits of the dividend 32 and 49 respectively. A red circle highlights the 7 in the quotient and the 49 in the dividend.

$$\therefore \sqrt{3249} = 57$$



Find a square of a number  
that is less than or equal to  
the first set of digits  
or less than or equal to  
the first two digits.  
  
 $1^2 = 1$   
 $2^2 = 4$   
 $3^2 = 9$   
 $4^2 = 16$   
 $5^2 = 25$   
 $6^2 = 36$   
 $7^2 = 49$   
 $8^2 = 64$   
 $9^2 = 81$

**Rough Work**

|                  |                  |
|------------------|------------------|
|                  | 7                |
| 10 6             | 10 7             |
| $\times \quad 6$ | $\times \quad 7$ |
| <hr/>            | <hr/>            |
| 63 6             | 74 9             |

**Q.**

Find the square root of each of the following numbers by division method.

(vi) 1369

A diagram showing the division method for finding the square root of 1369. It consists of a grid with a divisor (3), a quotient (37), and a remainder (0). The steps are as follows:

- Step 1: Divide 13 by 3, quotient is 3, remainder is 9.
- Step 2: Bring down 69, making it 69. Divide 69 by 3, quotient is 7, remainder is 0.
- Step 3: The final result is 37, and the remainder is 0.

The quotient 37 is circled in pink, and the remainder 0 is circled in green.

$$\therefore \sqrt{1369} = 37$$



Find a square of a number  
that is less than or equal to  
the first set of digits  
or less than  
the first two digits.  
  
 $1^2 = 1$   
 $2^2 = 4$   
 $3^2 = 9$   
 $4^2 = 16$   
 $5^2 = 25$   
 $6^2 = 36$   
 $7^2 = 49$   
 $8^2 = 64$   
 $9^2 = 81$

**Rough Work**

|   |   |
|---|---|
| <del>7</del>  | 7   |
| $\begin{array}{r} 6 \\ \times 6 \\ \hline 36 \end{array}$ | $\begin{array}{r} 6 \\ \times 7 \\ \hline 42 \end{array}$ |
| <b>63 6</b>   | <b>46 9</b>   |

**Q.**

Find the square root of each of the following numbers by division method.

(vii) 5776

A division method diagram for finding the square root of 5776. It shows a grid with a divisor of 14 and a quotient of 146. The dividend 5776 is divided into two parts: 57 and 76. The first step shows 7 being subtracted from 57, leaving a remainder of 49. The next step shows 08 being subtracted from 76, leaving a remainder of 00. A red arrow points from the digit 7 in the quotient to the digit 7 in the dividend. The final result is 146.

$$\therefore \sqrt{5776} = 76$$



A small window containing a table of squares and a note about finding square roots.

|            |
|------------|
| $1^2 = 1$  |
| $2^2 = 4$  |
| $3^2 = 9$  |
| $4^2 = 16$ |
| $5^2 = 25$ |
| $6^2 = 36$ |
| $7^2 = 49$ |
| $8^2 = 64$ |
| $9^2 = 81$ |

Find a square of a number  
that is less than or equal to  
the first set of digits  
or less than  
or more than  
the first set of digits.  
Besides 25, 76, 725, 876.

**Rough Work**

|            |            |
|------------|------------|
| X          | 6          |
| 14 5       | 14 6       |
| $\times 5$ | $\times 6$ |
| 72 5       | 87 6       |

**Q.**

Find the square root of each of the following numbers by division method.

(viii) 7921

A diagram showing the division method for finding the square root of 7921. It consists of two rows of subtraction. The first row has a divisor of 16, a quotient digit of 8, a remainder of 64, and a dividend of 79. The second row has a divisor of 16, a quotient digit of 9, a remainder of 15, and a dividend of 21. The final result is 000, indicating no remainder. An orange arrow points from the top 9 in the first row to the top 9 in the second row.

$$\begin{array}{r} & 8 \\ \sqrt{16} & 9 \\ - & 64 \\ \hline & 15 \end{array} \quad \begin{array}{r} & 9 \\ \sqrt{16} & 21 \\ - & 15 \\ \hline & 21 \\ - & 15 \\ \hline & 0 \end{array}$$

$$\therefore \sqrt{7921} = 89$$



Find a square of a number  
less than or equal to  
first set of digits.  
 $1^2 = 1$   
 $2^2 = 4$   
 $3^2 = 9$   
 $4^2 = 16$   
 $5^2 = 25$   
 $6^2 = 36$   
 $7^2 = 49$   
 $8^2 = 64$   
 $9^2 = 81$

**Rough Work**

|                                   |                                |
|-----------------------------------|--------------------------------|
|                                   | 9                              |
| $16 \ 8$<br>$\times \ 8$<br><hr/> | $169$<br>$\times \ 9$<br><hr/> |
| 1344                              | 1521                           |

**Q.**

Find the square root of each of the following numbers by division method.

(ix) 576

A diagram showing the division method for finding the square root of 576. It consists of two rows of subtraction. The first row has a divisor of 2, a quotient of 2, and a remainder of 5. The second row has a divisor of 4, a quotient of 4, and a remainder of 176. A red arrow points from the number 2 in the first row to the number 4 in the second row. The number 5 is highlighted in pink.

$$\begin{array}{r} & 2 \quad 4 \\ 2 & \overline{)5 \quad 76} \\ - & 4 \\ \hline & 1 \quad 76 \\ - & 1 \quad 76 \\ \hline & 0 \quad 00 \end{array}$$

$$\therefore \sqrt{576} = 24$$

Find a square of a number  
No. which is less than or equal to  
the given number  
or less than  
the given number  
first set  
of digits.

|            |
|------------|
| $1^2 = 1$  |
| $2^2 = 4$  |
| $3^2 = 9$  |
| $4^2 = 16$ |
| $5^2 = 25$ |
| $6^2 = 36$ |
| $7^2 = 49$ |
| $8^2 = 64$ |
| $9^2 = 81$ |



**Rough Work**

|            |            |
|------------|------------|
| X          | 4          |
| 4 3        | 4 4        |
| $\times 3$ | $\times 4$ |
| <hr/>      | <hr/>      |
| 12 9       | 17 6       |

**Q.**

Find the square root of each of the following numbers by division method.

(x) 1024

A diagram showing the division method for finding the square root of 1024. It consists of two rows of subtraction. The first row has a divisor of 6, a quotient digit of 3, and a remainder of 9. The second row has a divisor of 12, a quotient digit of 2, and a remainder of 0. A red arrow points from the number 3 to the top of the first column. Another red arrow points from the number 2 to the top of the second column. The final result is 32.

$$\begin{array}{r} 32 \\ \hline 10\ \underline{-}\ 24 \\ -\ 9 \\ \hline 01\ \underline{24} \\ -\ 1\ 24 \\ \hline 0\ 00 \end{array}$$

A digital-style calculator interface for finding square roots. It shows a sequence of operations: 6 → 12 → 24. To the left, a boy with brown hair and a white shirt is thinking. To the right, a green board displays squares of numbers from 1 to 9. Overlaid text provides instructions: "Find a square of a number that is less than or equal to the first set of digits or less than or equal to the first two digits." The board also lists squares:  $1^2 = 1$ ,  $2^2 = 4$ ,  $3^2 = 9$ ,  $4^2 = 16$ ,  $5^2 = 25$ ,  $6^2 = 36$ ,  $7^2 = 49$ ,  $8^2 = 64$ ,  $9^2 = 81$ .

**Rough Work**

A rough work section with a black background. It shows a large red X over a green circle containing the number 2. To the right, there are two multiplication problems:  $61 \times 1$  and  $62 \times 2$ . The results are  $\underline{\underline{6\ 1}}$  and  $\underline{\underline{12\ 4}}$  respectively.

$$\therefore \sqrt{1024} = 32$$

**Q.**

Find the square root of each of the following numbers by division method.

(xi) 3136

A division method diagram for finding the square root of 3136. It shows a grid with 5 in the top-left corner. A blue arrow points from 5 to the top of the first column of digits (31). The first digit of the quotient is 5, shown above the grid. The first two digits of the dividend (31) are subtracted from 25, resulting in 06. The next two digits (36) are brought down, making it 0636. This process is repeated, resulting in 0000 as the remainder. The quotient is 56.

$$\begin{array}{r} 56 \\ \overline{)3136} \\ -25 \\ \hline 06 \\ -06 \\ \hline 00 \end{array}$$

$$\therefore \sqrt{3136} = 56$$



Find a square of a number  
whose square less than or equal to  
the given number or less than  
or equal to hundred.  
**5<sup>2</sup> first set**  
**6<sup>2</sup> = 36**  
**7<sup>2</sup> = 49**  
**8<sup>2</sup> = 64**  
**9<sup>2</sup> = 81**

**Rough Work**

|            |            |
|------------|------------|
|            | 6          |
| 10 5       | 10 6       |
| $\times 5$ | $\times 6$ |
| <hr/>      | <hr/>      |
| 52 5       | 63 6       |

**Q.**

Find the square root of each of the following numbers by division method.

(xii) 900

A diagram showing the division method for finding the square root of 900. A horizontal line separates the dividend (900) from the quotient (30). The divisor is 3. The first digit of the quotient is 3, which is written above the first digit of the dividend. The product of 3 and 3 is 9, which is subtracted from the first digit of the dividend. The remainder is 0, which is brought down with two zeros. The next digit of the quotient is 0, which is written above the next two digits of the dividend. The product of 0 and 3 is 0, which is subtracted from the next two digits of the dividend. The remainder is 00, which is brought down with two zeros. The process stops here as the remainder is zero.

|            |
|------------|
| $1^2 = 1$  |
| $2^2 = 4$  |
| $3^2 = 9$  |
| $4^2 = 16$ |
| $5^2 = 25$ |
| $6^2 = 36$ |
| $7^2 = 49$ |
| $8^2 = 64$ |
| $9^2 = 81$ |

Find a number which is equal to sum of its digits or less than sum of its digits with the difference equal to 9.

If a number has a unit digit 0, then the square root will have a unit digit 0.

$\therefore \sqrt{900} = 30$

### Example

| NUMBERS | SQUARE ROOTS |
|---------|--------------|
| 1       | 1            |
| 4       | 2            |
| 9       | 3            |
| 16      | 4            |
| 25      | 5            |
| 36      | 6            |
| 49      | 7            |
| 64      | 8            |
| 81      | 9            |
| 100     | 10           |
| 121     | 11           |
| 144     | 12           |
| 169     | 13           |
| 196     | 14           |
| 225     | 15           |
| 256     | 16           |
| 289     | 17           |
| 324     | 18           |
| 361     | 19           |
| 400     | 20           |

What do we observe ?

Number of digits  
2

$$= \frac{n}{2} = \frac{2}{2} = 1$$

Then the digits in  
Observe, square  
If number of digits  
is even, square  
roots of these  
obtained by  
numbers

## Example

| NUMBERS | SQUARE ROOTS |
|---------|--------------|
| 1       | 1            |
| 4       | 2            |
| 9       | 3            |
| 16      | 4            |
| 25      | 5            |
| 36      | 6            |
| 49      | 7            |
| 64      | 8            |
| 81      | 9            |
| 100     | 10           |
| 121     | 11           |
| 144     | 12           |
| 169     | 13           |
| 196     | 14           |
| 225     | 15           |
| 256     | 16           |
| 289     | 17           |
| 324     | 18           |
| 361     | 19           |
| 400     | 20           |

Then the digits in  
the square roots of  
that number is  
obtained by  
If number of digits is  
odd number  
Similarly

$$\frac{n+1}{2} = \frac{3+1}{2} = \frac{4}{2} = 2$$

$$\frac{n+1}{2} = \frac{3+1}{2} = \frac{4}{2} = 2$$

**Q.**

Find the number of digits in the square root of each of the following numbers (without any calculation).

(i) 64

**Sol :**

If ‘n’ stands for number of digits in the given number, then

For 64,  $n = 2$  [ even number ]

$$\therefore \text{Number of digit is its square root} = \frac{n}{2} = \frac{\cancel{2}}{\cancel{2}} = 1$$

(ii) 144

**Sol :**

If ‘n’ stands for number of digits in the given number, then For 144,  $n = 3$  [ odd number ]

$$\therefore \text{Number of digit is its square root} = \frac{n+1}{2} = \frac{3+1}{2} = \frac{\cancel{4}}{\cancel{2}} = 2$$

**Q.**

Find the number of digits in the square root of each of the following numbers (without any calculation).

(iii) 4489

**Sol :**

If 'n' stands for number of digits in the given number, then

For 4489,  $n = 4$  [ even number ]

$$\therefore \text{Number of digit is its square root} = \frac{n}{2} = \frac{\cancel{4}}{\cancel{2}} = 2$$

(iv) 27225

**Sol :**

If 'n' stands for number of digits in the given number, then

For 27225,  $n = 5$  [ odd number ]

$$\therefore \text{Number of digit is its square root} = \frac{n+1}{2} = \frac{5+1}{2} = \frac{\cancel{6}}{\cancel{2}} = 3$$

**Q.**

Find the number of digits in the square root of each of the following numbers (without any calculation).

(v) 390625

**Sol :**

If 'n' stands for number of digits in the given number, then

For 390625,  $n = 6$  [even number]

$$\therefore \text{Number of digit is its square root} = \frac{n}{2} = \frac{6}{2}$$
$$= 3$$

If 'n' stands for number of digits in the given number, then

## Square root of a decimal fraction by the division method :

For example :

If the given number is 555.5449

Pairing of integral part is  $\overline{\overline{5}} \overline{\overline{55}}$

Pairing of decimal part is  $\overline{\overline{54}} \overline{\overline{49}}$

Thus, the group so formed is  $\overline{\overline{5}} \overline{\overline{55}} \overline{\overline{54}} \overline{\overline{49}}$

Make a set of two  
digit from right to  
left.

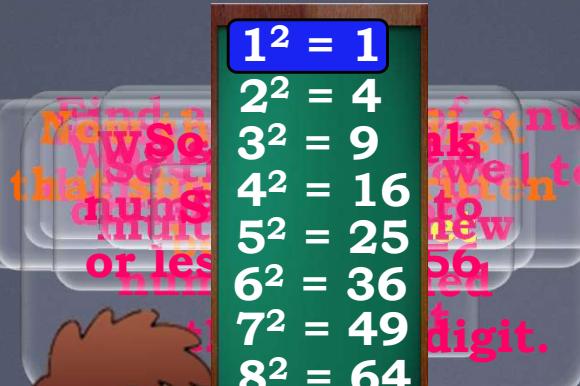
# Q.

Find the square root of the following decimal numbers.

(i) 2.56

$$\begin{array}{r} 1 \\ \sqrt{2.56} \\ - 1 \\ \hline 156 \\ - 156 \\ \hline 000 \end{array}$$

01 56



$$\begin{array}{l} 1^2 = 1 \\ 2^2 = 4 \\ 3^2 = 9 \\ 4^2 = 16 \\ 5^2 = 25 \\ 6^2 = 36 \\ 7^2 = 49 \\ 8^2 = 64 \\ 9^2 = 81 \end{array}$$

**Rough Work**

~~6~~

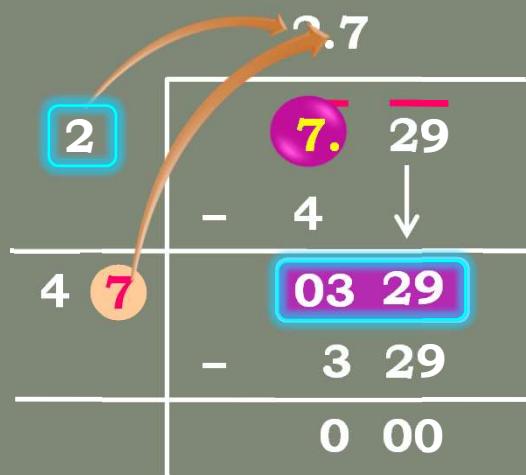
|       |       |
|-------|-------|
| 2 5   | 2 6   |
| × 5   | × 6   |
| <hr/> | <hr/> |
| 12 5  | 15 6  |

$$\therefore \sqrt{2.56} = 1.6$$

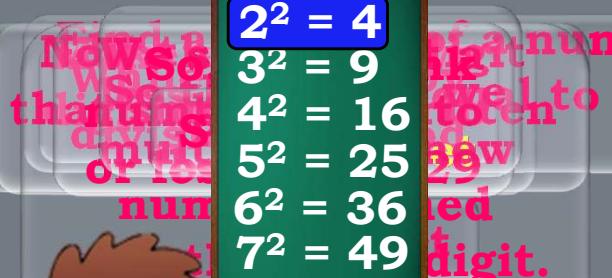
# Q.

Find the square root of the following decimal numbers.

(ii) 7.29



$$\therefore \sqrt{7.29} = 2.7$$



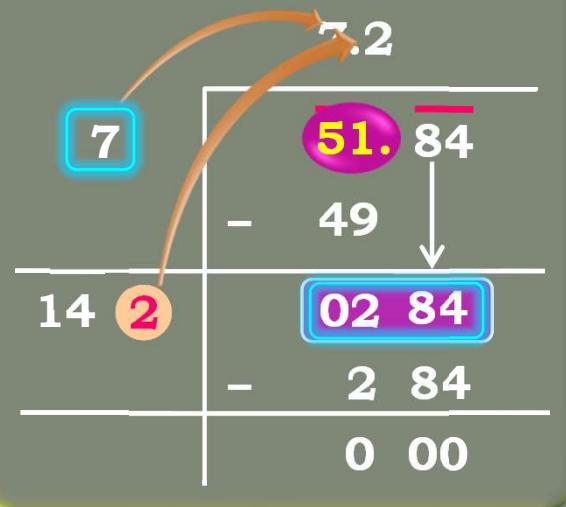
Rough Work

|       |       |
|-------|-------|
|       | 7     |
| 4 6   | 4 7   |
| x 6   | x 7   |
| <hr/> | <hr/> |
| 27 6  | 32 9  |

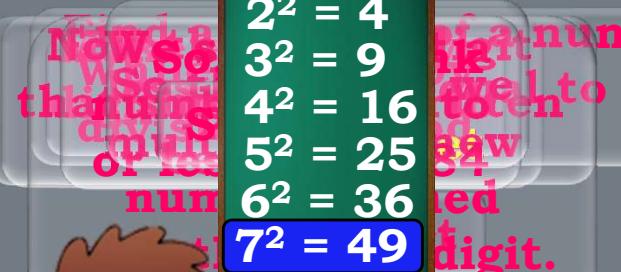
**Q.**

Find the square root of the following decimal numbers.

(iii) 51.84



$$\therefore \sqrt{51.84} = 7.2$$



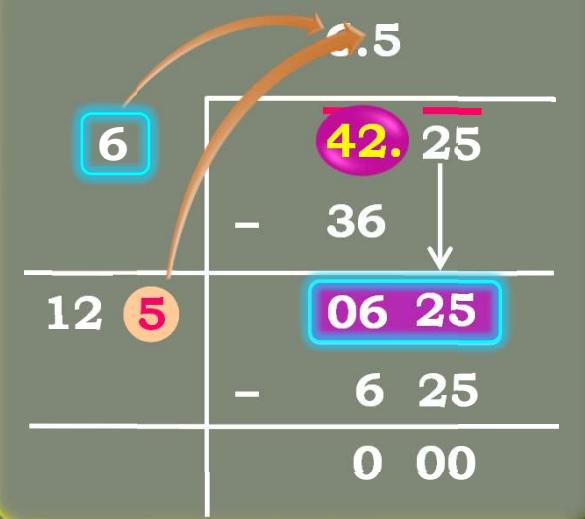
|            |
|------------|
| $1^2 = 1$  |
| $2^2 = 4$  |
| $3^2 = 9$  |
| $4^2 = 16$ |
| $5^2 = 25$ |
| $6^2 = 36$ |
| $7^2 = 49$ |
| $8^2 = 64$ |
| $9^2 = 81$ |

| Rough Work       |                  |
|------------------|------------------|
|                  | 2                |
| 14 1             | 14 2             |
| $\times \quad 1$ | $\times \quad 2$ |
| <hr/>            | <hr/>            |
| 14 1             | 28 4             |

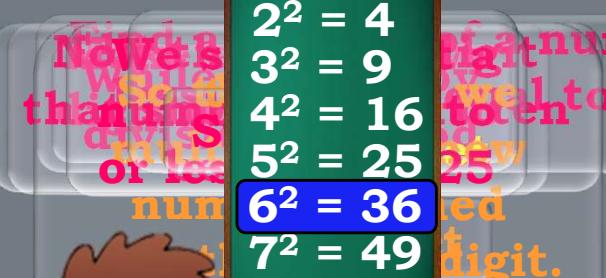
**Q.**

Find the square root of the following decimal numbers.

(iv) 42.25



$$\therefore \sqrt{42.25} = 6.5$$



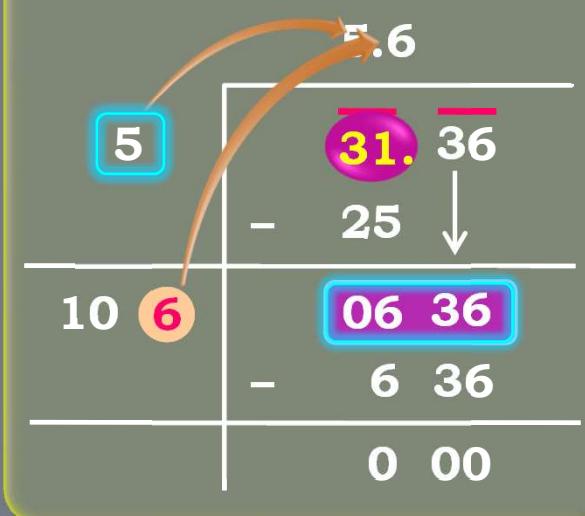
**Rough Work**

|                 |       |
|-----------------|-------|
| <del>12 4</del> | 12 5  |
| × 4             | × 5   |
| <hr/>           | <hr/> |
| 49 6            | 62 5  |

**Q.**

Find the square root of the following decimal numbers.

(v) 31.36



|            |
|------------|
| $1^2 = 1$  |
| $2^2 = 4$  |
| $3^2 = 9$  |
| $4^2 = 16$ |
| $5^2 = 25$ |
| $6^2 = 36$ |
| $7^2 = 49$ |
| $8^2 = 64$ |
| $9^2 = 81$ |

**Rough Work**

~~6~~ 6

$10 \overline{)5}$        $10 \overline{)6}$

$\times \quad 5$        $\times \quad 6$

$\hline$        $\hline$

52 5      63 6

$$\therefore \sqrt{31.36} = 5.6$$

**Q.**

Find the least number which must be subtracted from each of the following numbers so as to get a perfect square.  
Also find the square root of the perfect square so obtained.

(i) 402

A division algorithm diagram for 402 divided by 4. The divisor 4 is written outside the division bracket. Inside, the dividend 402 is shown. The first digit 4 is divided by 4, resulting in 1 (written above the line). The remainder 0 is brought down. The next step shows 02 being divided by 4, resulting in 0 (written above the line) with a remainder of 2, which is circled in blue.

Since, we get a remainder 2

∴ The least number to be subtracted  
from the given number = 2

$$\therefore 402 - 2 = 400$$

$$\therefore \sqrt{400} = 20$$

$$\begin{aligned}1^2 &= 1 \\2^2 &= 4\end{aligned}$$

New's  
W  
tliam  
So th  
m  
num  
with t  
It is the  
Perfect square

number  
digit  
we l to to  
otent  
new  
red  
digit.

$3^2 = 9$   
 $4^2 = 16$   
 $5^2 = 25$   
 $6^2 = 36$   
 $7^2 = 49$   
 $8^2 = 64$   
 $9^2 = 81$

**Q.**

Find the least number which must be subtracted from each of the following numbers so as to get a perfect square.  
Also find the square root of the perfect square so obtained.

(ii) 1989

A subtraction diagram showing the calculation of 1989 minus 16 to get 1936. The process is as follows:

- 1989 - 16 = 1936
- 1936 - 36 = 1900
- 1900 - 00 = 1900

The number 16 is highlighted with a green circle and an orange arrow points to it from the top right. The result 1936 is highlighted with a blue box.

Since, we get a remainder of 53  
 $\therefore$  The least number to be subtracted from the given number = 53  
 $\therefore 1989 - 53 = 1936$

$$\therefore \sqrt{1936} = 44$$



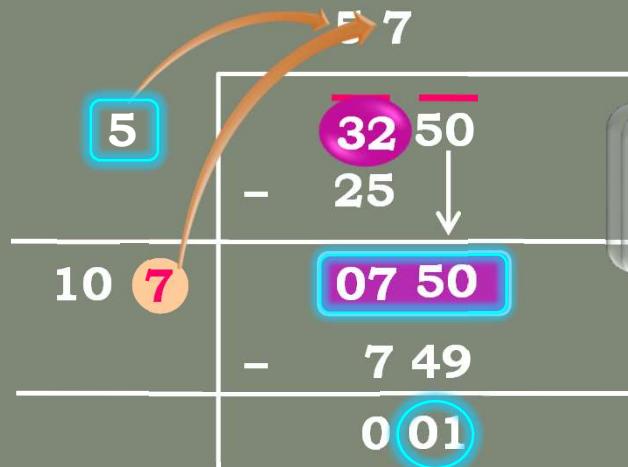
### Rough Work

|            |            |            |
|------------|------------|------------|
|            | 4          |            |
| 8 3        | 8 4        | 8 5        |
| $\times 3$ | $\times 4$ | $\times 5$ |
| <hr/>      | <hr/>      | <hr/>      |
| 2 49       | 3 36       | 4 25       |

**Q.**

Find the least number which must be subtracted from each of the following numbers so as to get a perfect square.  
Also find the square root of the perfect square so obtained.

(iii) 3250



Since, we get a remainder of 01  
 $\therefore$  The least number to be subtracted  
from the given number = 1  
 $\therefore 3250 - 1 = 3249$

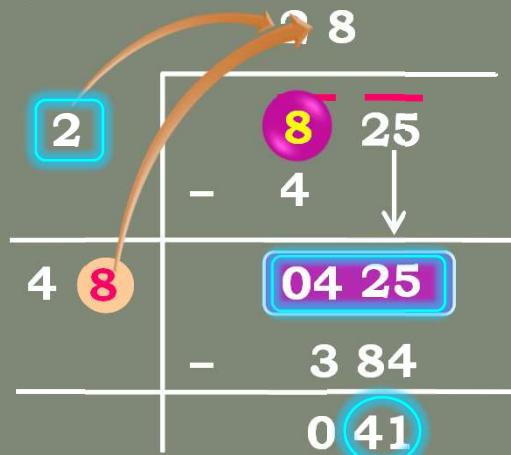
$$\therefore \sqrt{3249} = 57$$

| Rough Work |            |            |
|------------|------------|------------|
| 7          | 7          | 7          |
| 10 6       | 10 7       | 10 8       |
| $\times 6$ | $\times 7$ | $\times 8$ |
| <hr/>      | <hr/>      | <hr/>      |
| 6 36       | 7 49       | 8 64       |

**Q.**

Find the least number which must be subtracted from each of the following numbers so as to get a perfect square.  
Also find the square root of the perfect square so obtained.

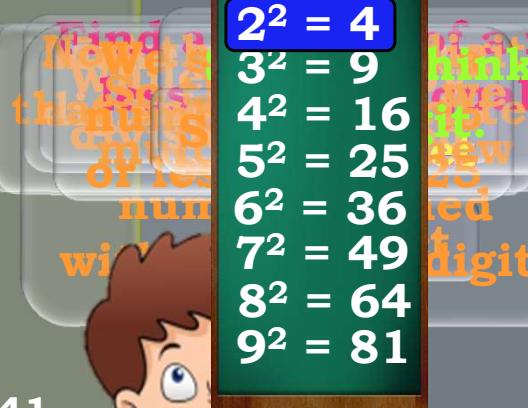
(iv) 825



Since, we get a remainder of 41

∴ The least number to be subtracted  
from the given number = 41

$$\therefore 825 - 41 = 784$$



It is the  
Perfect square

$$\therefore \sqrt{784} = 28$$

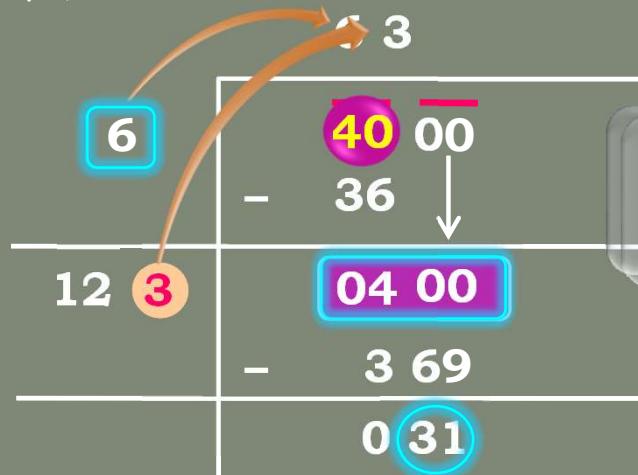
### Rough Work

|            |            |            |
|------------|------------|------------|
|            | 8          |            |
| 4 7        | 4 8        | 4 9        |
| $\times 7$ | $\times 8$ | $\times 9$ |
| <hr/>      | <hr/>      | <hr/>      |
| 3 29       | 3 84       | 4 41       |

**Q.**

Find the least number which must be subtracted from each of the following numbers so as to get a perfect square.  
Also find the square root of the perfect square so obtained.

(v) 4000



|                           |
|---------------------------|
| 1 <sup>2</sup> = 1        |
| 2 <sup>2</sup> = 4        |
| 3 <sup>2</sup> = 9        |
| 4 <sup>2</sup> = 16       |
| 5 <sup>2</sup> = 25       |
| <b>6<sup>2</sup> = 36</b> |
| 7 <sup>2</sup> = 49       |
| 8 <sup>2</sup> = 64       |
| 9 <sup>2</sup> = 81       |

Since, we get a remainder of 31

∴ The least number to be subtracted  
from the given number = 31

$$\therefore 4000 - 31 = 3969$$

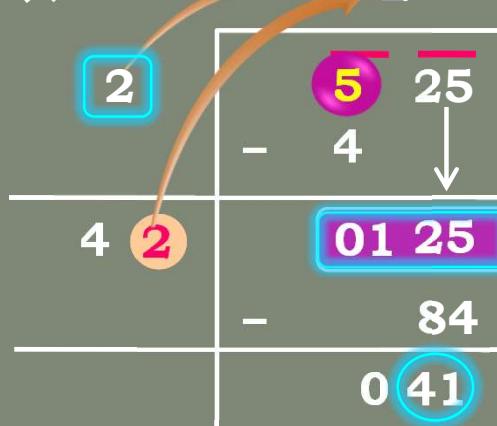
**Rough Work**

|      |      |      |
|------|------|------|
|      | 3    |      |
| 12 2 | 12 3 | 12 4 |
| × 2  | × 3  | × 4  |
| —    | —    | —    |
| 2 44 | 3 69 | 4 96 |

**Q.**

Find the least number which must be subtracted from each of the following numbers so as to get a perfect square.  
Also find the square root of the perfect square so obtained.

(i) 525



∴ we get a remainder of 41

$$22^2 < 525$$

Next perfect square number,  
 $23^2 = 529$

∴ The least number to be added from the given number =  $529 - 525$  It is the Perfect square

$$\therefore 525 + 4 = 529 \quad \therefore \sqrt{529} = 23$$

|            |
|------------|
| $1^2 = 1$  |
| $2^2 = 4$  |
| $3^2 = 9$  |
| $4^2 = 16$ |
| $5^2 = 25$ |
| $6^2 = 36$ |
| $7^2 = 49$ |
| $8^2 = 64$ |
| $9^2 = 81$ |

### Rough Work



2



$$\begin{array}{r} 41 \\ \times 1 \\ \hline 41 \end{array}$$

$$\begin{array}{r} 42 \\ \times 2 \\ \hline 84 \end{array}$$

$$\begin{array}{r} 43 \\ \times 3 \\ \hline 129 \end{array}$$

**Q.**

Find the least number which must be subtracted from each of the following numbers so as to get a perfect square.  
Also find the square root of the perfect square so obtained.

(ii) 1750

1750  
- 16  
-----  
150  
- 16  
-----  
81  
- 16  
-----  
69

Since, we get a remainder of 69

$$41^2 < 1750$$

Next perfect square number,

$$42^2 = 1764$$

∴ The least number to be added from the given number =  $1764 - 1750 = 14$

$$\therefore 1750 + 14 = 1764 \therefore \sqrt{1764} = 42$$

|            |
|------------|
| $1^2 = 1$  |
| $2^2 = 4$  |
| $3^2 = 9$  |
| $4^2 = 16$ |
| $5^2 = 25$ |
| $6^2 = 36$ |
| $7^2 = 49$ |
| $8^2 = 64$ |
| $9^2 = 81$ |



### Rough Work

|            |            |            |
|------------|------------|------------|
| X          | 1          | X          |
| 8 0        | 8 1        | 8 2        |
| $\times 0$ | $\times 1$ | $\times 2$ |
| 00         | 81         | 164        |

**Q.**

Find the least number which must be subtracted from each of the following numbers so as to get a perfect square.  
Also find the square root of the perfect square so obtained.

(iii) 252

$$\begin{array}{r} 15 \\ \overline{)01\ 52} \\ -1\ 25 \\ \hline 0\ 27 \end{array}$$

Since, we get a remainder of 27

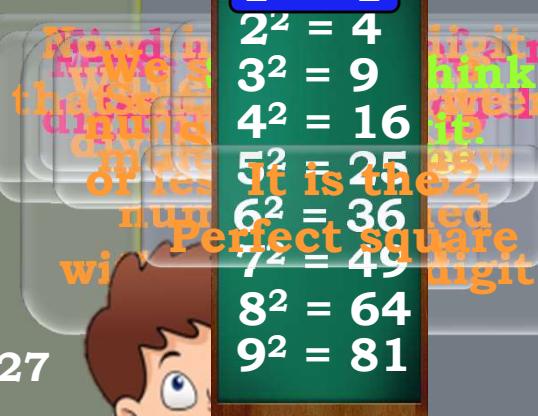
$$15^2 < 252$$

Next perfect square number,

$$16^2 = 256$$

∴ The least number to be added from the given number =  $256 - 252 = 4$

$$\therefore 252 + 4 = 256 \quad \therefore \sqrt{256} = 16$$



### Rough Work



5



$$\begin{array}{r} 2\ 4 \\ \times 4 \\ \hline 96 \end{array}$$

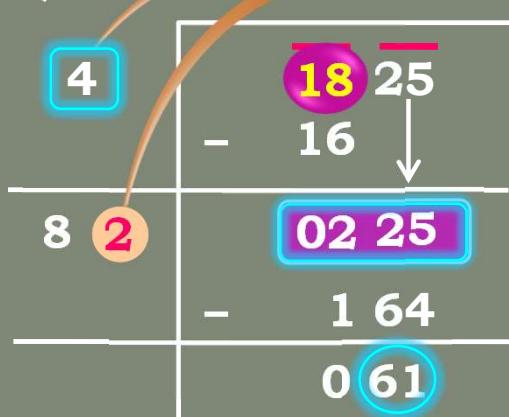
$$\begin{array}{r} 2\ 5 \\ \times 5 \\ \hline 1\ 25 \end{array}$$

$$\begin{array}{r} 2\ 6 \\ \times 6 \\ \hline 1\ 56 \end{array}$$

**Q.**

Find the least number which must be subtracted from each of the following numbers so as to get a perfect square.  
Also find the square root of the perfect square so obtained.

(iv) 1825



Since, we get a remainder of 61

$$42^2 < 1825$$

Next perfect square number,

$$43^2 = 1849$$

∴ The least number to be added from the given number =  $1849 - 1825 = 24$

$$\therefore 1825 + 24 = 1849 \therefore \sqrt{1849} = 43$$

|            |
|------------|
| $1^2 = 1$  |
| $2^2 = 4$  |
| $3^2 = 9$  |
| $4^2 = 16$ |
| $5^2 = 25$ |
| $6^2 = 36$ |
| $7^2 = 49$ |
| $8^2 = 64$ |
| $9^2 = 81$ |

### Rough Work



2



$$\begin{array}{r} 81 \\ \times 1 \\ \hline 81 \end{array}$$

$$\begin{array}{r} 82 \\ \times 2 \\ \hline 164 \end{array}$$

$$\begin{array}{r} 83 \\ \times 3 \\ \hline 249 \end{array}$$

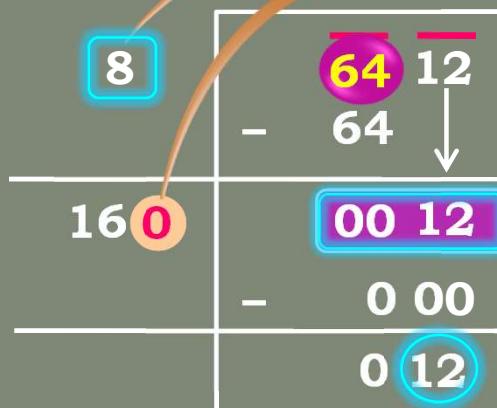


It is the  
Perfect square

**Q.**

Find the least number which must be subtracted from each of the following numbers so as to get a perfect square.  
Also find the square root of the perfect square so obtained.

(v) 6412



Since, we get a remainder of 12

$$80^2 < 6412$$

Next perfect square number,

$$81^2 = 6561$$

∴ The least number to be added from the given number =  $6561 - 6412 = 149$

$$\therefore 6412 + 149 = 6561 \quad \therefore \sqrt{6561} = 81$$

|            |
|------------|
| $1^2 = 1$  |
| $2^2 = 4$  |
| $3^2 = 9$  |
| $4^2 = 16$ |
| $5^2 = 25$ |
| $6^2 = 36$ |
| $7^2 = 49$ |
| $8^2 = 64$ |
| $9^2 = 81$ |

It is the  
Perfect square

**Q.**

Find the length of the side of a square whose area is  $441 \text{ m}^2$

**Sol :**

Let the length of side of the square =  $x$  meter

$$\therefore \text{Area} = \text{side} \times \text{side}$$

$$= x \times x = x^2$$

$$x^2 = 441 \text{ m}^2 \text{ [given]}$$

$$\therefore x = 21 \quad \text{[Taking square root]}$$

Thus, The required side is 21 m.

Lets  
We know,  
assume,  
Area of Square =  
 $\text{side} \times \text{side}$

$$\begin{array}{r} & 2 & 1 \\ & \boxed{4} & \boxed{4} \\ \hline & 4 & \downarrow \\ 2 & - & 4 \\ \hline & 4 & 1 \\ + 2 & - & 0 \\ \hline & 4 & 1 \\ & 0 & 4 \\ \hline & 4 & 1 \\ + 1 & - & 0 \\ \hline & 4 & 2 \\ & 0 & 0 \end{array}$$

**Q.**

In a right triangle ABC,  $\angle B = 90^\circ$

(a) If AB = 6 cm, BC = 8 cm, find AC

**Sol.** In  $\triangle ABC$ ,

$$m\angle B = 90^\circ$$

$$l(AB) = 6 \text{ cm}$$

$$l(AB) = 8 \text{ cm}$$

By Pythagoras theorem,

$$(\text{HYPOTENUSE})^2 = (\text{ONE SIDE})^2 + (\text{OTHER SIDE})^2$$

$$l(AC)^2 = l(AB)^2 + l(BC)^2$$

$$l(AC)^2 = (6)^2 + (8)^2$$

$$l(AC)^2 = 36 + 64$$

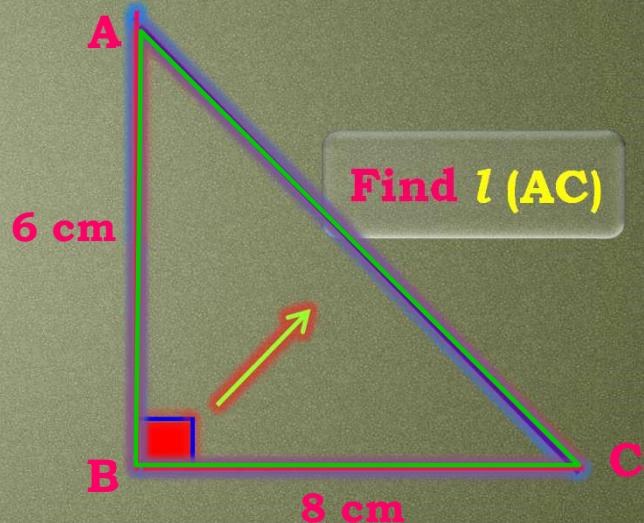
$$l(AC)^2 = 100$$

$$l(AC) = \sqrt{100} \text{ cm (Taking square root)}$$

$$AC = 10 \text{ cm}$$

The length of AC is 10 cm.

What we have  
to find ?



**Q.**

In a right triangle ABC,  $\angle B = 90^\circ$

(b) If AC = 13 cm, BC = 5 cm, find AB

Sol. In  $\triangle ABC$ ,

$$m\angle B = 90^\circ$$

$$l(AC) = 13 \text{ cm}$$

$$l(BC) = 5 \text{ cm}$$

By Pythagoras theorem,

$$(\text{HYPOTENUSE})^2 = (\text{ONE SIDE})^2 + (\text{OTHER SIDE})^2$$

$$l(AC)^2 = l(AB)^2 + l(BC)^2$$

$$l(13)^2 = (AB)^2 + (5)^2$$

$$l(AB)^2 = (13)^2 - (5)^2$$

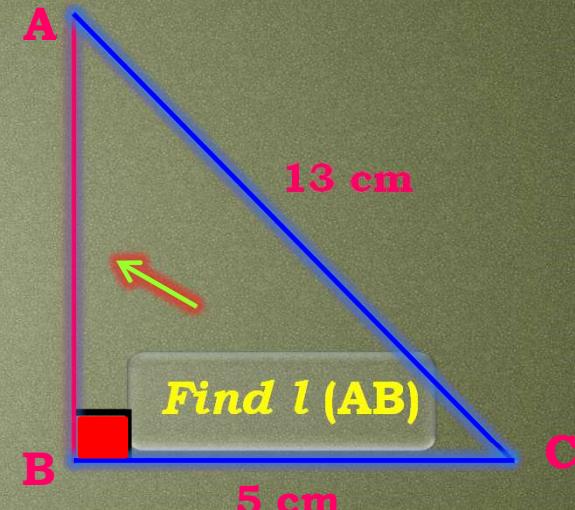
$$l(AB)^2 = (169) - (25)$$

$$l(AB)^2 = 144$$

$$\sqrt{AB^2} = \sqrt{144} \quad (\text{Taking square root})$$

AB = 12 cm    The length of AB is 12 cm.

What we have  
to find ?



**Q.** A gardener has 1000 plants. He wants to plant these in such a way that the number of rows and the number of columns remain same. Find the minimum number of plants he needs more for this. a right triangle ABC,  $\angle B = 90^\circ$

**Sol.**

The number of plants in a row and the number of columns are the same.

Let Number of rows = number of columns =  $x$

$\therefore$  Their product must be a square number.

$\therefore$  1000 is not a perfect square.

Since, we get a remainder 39

$$1000 > 31^2$$

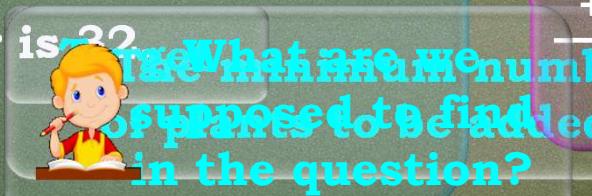
and next square number is  $32^2$

$$32^2 = 1024$$

$$\therefore 1000 + 24 = 1024$$

The minimum number of plants required to be added is 24.

|     |  |         |
|-----|--|---------|
|     |  | 3 1     |
|     |  | 1 0 0 0 |
| 3   |  | - 9     |
| + 3 |  | ↓       |
| 6 1 |  | 1 0 0   |
| + 1 |  | - 0 6 1 |
|     |  | 3 9     |



**Q.**

There are 500 children in a school. For a P.T. drill they have to stand in such a manner that the number of rows is equal to the number of columns.

How many children would be left out in this arrangement.

**Sol.**

The number of rows and the number of columns are same.  
**Example**

∴ Total number (i.e. their product) must be a square number. Similarly, there are 5 students in a school. But 500 is not a perfect square.



$$\therefore 500 - 16 = 484$$

484

Thus, the required number of children to be left out is 16



## Exercise

Q. In a right triangle ABC,  $\angle B = 90^\circ$

(a) If AB = 6 cm, BC = 8 cm, find AC

Sol. In  $\triangle ABC$ ,

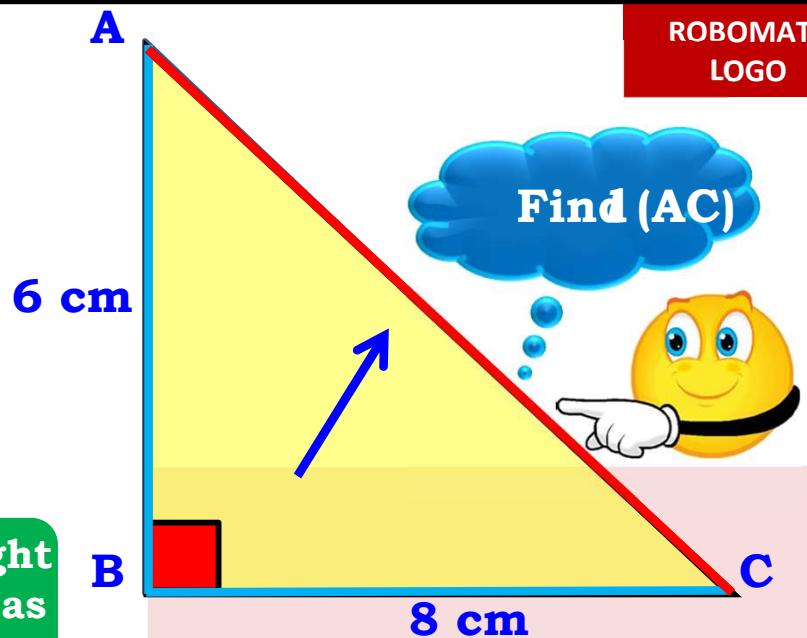
$$m\angle B = 90^\circ$$

$$l(AB) = 6 \text{ cm}$$

$$l(BC) = 8 \text{ cm}$$

First let us find what is GIVEN in the question

The side opposite to right angle (i.e. $90^\circ$ ) is called as the hypotenuse.



ROBOMATE  
LOGO

TEACHER

## Exercise

ROBOMATE  
LOGO

Q. In a right triangle ABC,  $\angle B = 90^\circ$

(b) If AC = 13 cm, BC = 5 cm, find AB

Sol. In  $\triangle ABC$ ,

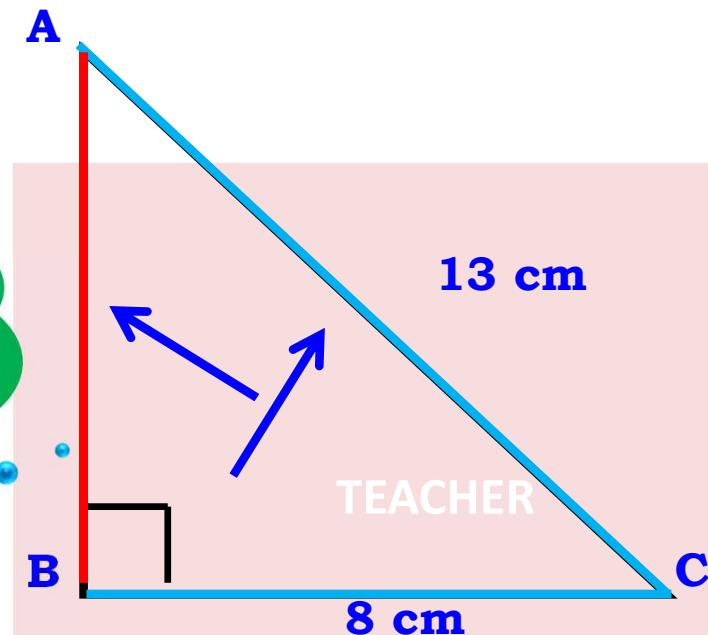
$$m\angle B = 90^\circ$$

$$l(AC) = 13 \text{ cm}$$

$$l(BC) = 5 \text{ cm}$$

The side opposite to right angle ( $90^\circ$ ) is called a the hypotenuse.

Find  $l(AB)$



## Exercise

By Pythagoras theorem,

$$(HYPOTENUSE)^2 = (ONE\ SIDE)^2 + (OTHER\ SIDE)^2$$

$$l(AC)^2 = l(AB)^2 + l(BC)^2$$

$$l(AC)^2 = (6)^2 + (8)^2$$

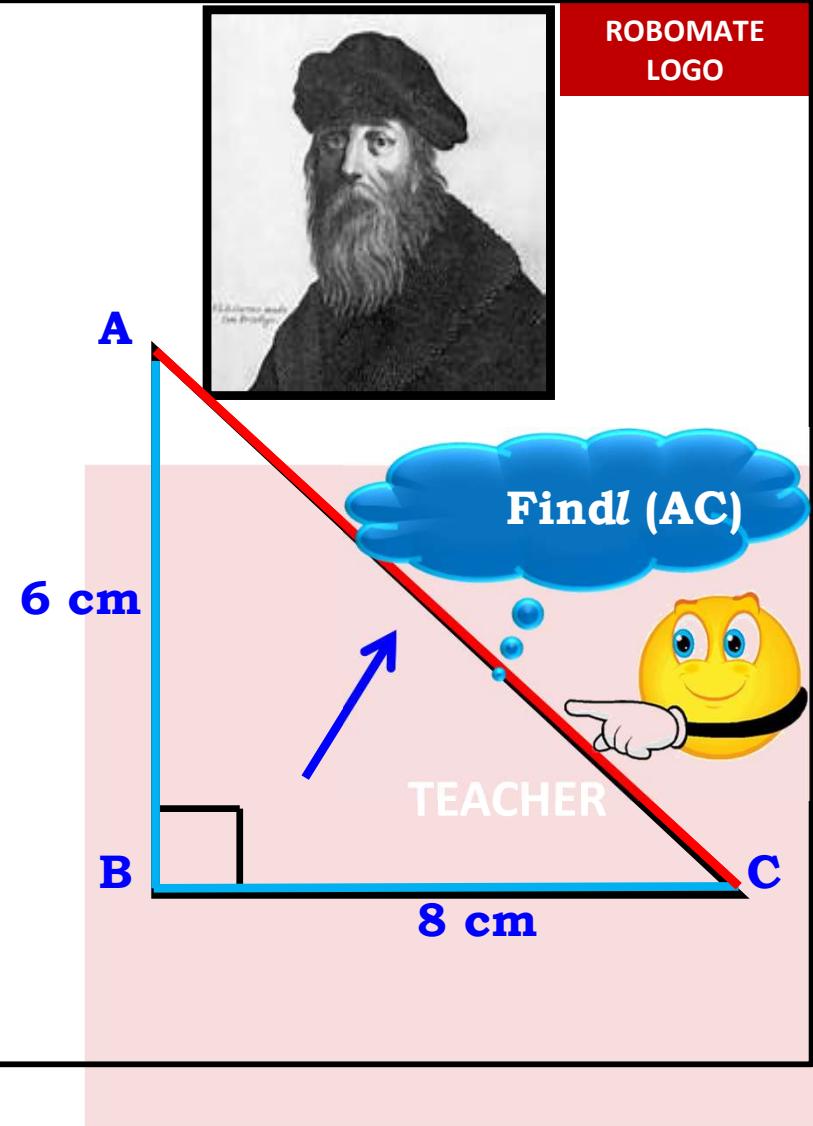
$$l(AC)^2 = 36 + 64$$

$\sqrt{AC}^2 = \sqrt{100}$  (Taking square root)

$$AC = 10\ cm$$

The length of AC is 10 cm.

ROBOMATE  
LOGO



## Exercise

By Pythagoras theorem

$$(HYPOTENUSE)^2 = (ONE SIDE)^2 + (OTHER SIDE)^2$$

$$l(AC)^2 = l(AB)^2 + l(BC)^2$$

$$(13)^2 = (AB)^2 + (5)^2$$

$$(AB)^2 = (13)^2 - (5)^2$$

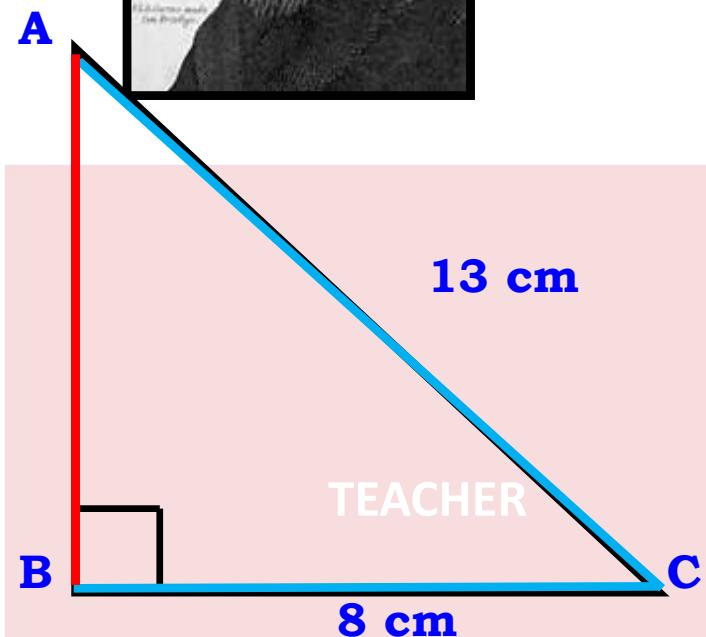
$$(AB)^2 = 169 - 25$$

$$(AB)^2 = 144$$

$\sqrt{AB^2} = \sqrt{144}$  (Taking square root)

$$AB = 12 \text{ cm}$$

The length of AB is 12 cm.





THANK  
YOU

**Q.**

5929 students are sitting in an auditorium in such a manner that there are as many students in a row as there are rows in the auditorium. How many rows are there in the auditorium?

**Example**

|              |  |              |
|--------------|--|--------------|
| <b>Row 1</b> |  | = 3 students |
| <b>Row 2</b> |  | = 3 students |
| <b>Row 3</b> |  | = 3 students |

**Total = 9 students**

i.e, total number of student =

$$\text{total number of rows} \times \text{Total number of students in each row} = 3 \times 3 = 3^2$$

**Q.**

5929 students are sitting in an auditorium in such a manner that there are as many students in a row as there are rows in the auditorium. How many rows are there in the auditorium?

To find square  
Let us do prime root of 5929  
factorisation of  
We need to  
5929  
factorize

**Sol.**

Let the number of rows in a auditorium be  $x$

Since the number of students in each row is equal to the number of rows

∴ The number of students in each row =  $x$

∴ total number of students =

total number of rows ×  
total number of students in each row

$$\text{i.e., } x \times x = 5929$$

$$x^2 = 5929$$

$$x^2 = 7 \times 7 \times 11 \times 11$$

Rough work

|    |      |
|----|------|
| 7  | 5929 |
| 7  | 847  |
| 11 | 121  |
| 11 | 11   |
|    | 1    |

**Q.**

5929 students are sitting in an auditorium in such a manner that there are as many students in a row as there are rows in the auditorium. How many rows are there in the auditorium?

**Sol.**

$$x = \sqrt{(7 \times 7) \times (11 \times 11)} \text{ cm}$$

$$x = 7 \times 11$$

$$x = 77$$

Hence, there are 77 rows in the auditorium

Taking one factor  
from each pair

**Q.**

Find the least number which must be added to 306452 to make it a perfect square.

**Sol.** Let us first work out the process of finding the square root by the division method :

$$\begin{array}{r} 5 \quad \quad \quad 5 \ 5 \ 3 \\ \overline{)3 \ 0 \ 6 \ 4 \ 5 \ 2} \\ -25 \\ \hline 5 \ 6 \ 4 \\ -5 \ 2 \ 5 \\ \hline 3 \ 9 \ 5 \ 2 \\ -3 \ 3 \ 0 \ 1 \\ \hline 6 \ 5 \end{array}$$

We should get a number equal to Now think of a digit that is less than 564 that should be written So that when we have to multiply the new digit to number formed set with the same digit.

Now think of a digit that should be written besides 10

### Rough Work

|            |                 |                    |
|------------|-----------------|--------------------|
| 3          | <del>1103</del> | <del>1104</del>    |
| $\times 3$ | $\times 4$      | $\underline{3309}$ |
|            |                 | $4416$             |

|                |                 |
|----------------|-----------------|
| <del>106</del> | <del>106</del>  |
| $\times 6$     | $\underline{6}$ |

|            |
|------------|
| $1^2 = 1$  |
| $2^2 = 4$  |
| $3^2 = 9$  |
| $4^2 = 16$ |
| $5^2 = 25$ |
| $6^2 = 36$ |
| $7^2 = 49$ |
| $8^2 = 64$ |
| $9^2 = 81$ |

**Q.**

Find the least number which must be added to 306452 to make it a perfect square.

**Sol.**

$$\begin{array}{r}
 & 5 & 5 & 3 \\
 & \overline{-} & \overline{3} & \overline{0} & \overline{6} & \overline{4} & \overline{5} & \overline{2} \\
 5 & & & & & & & \\
 - & 105 & & & & & & \\
 & & & & 564 & & & \\
 - & & 105 & & & & & \\
 & & & & 525 & & & \\
 & & & & & 3952 & & \\
 & & & & & - & 3309 & \\
 & & & & & & & \\
 & 1103 & & & & & & 
 \end{array}$$

It is evident from the above working that  
 $(553)^2 < 306452 < (554)^2$ .

Now think of a digit that makes a set of three digits from right to left.

Subtract so that when we multiply the new number formed

Find a square of a number less than or equal to to

first set and get a number equal to or less than 3952

**Rough Work**

|            |            |            |
|------------|------------|------------|
|            | 3          |            |
| 1102       | 1103       | 1104       |
| $\times 2$ | $\times 3$ | $\times 4$ |
| <hr/>      | <hr/>      | <hr/>      |
| 2204       | 3309       | 4416       |

|            |
|------------|
| $2^2 = 4$  |
| $3^2 = 9$  |
| $4^2 = 16$ |
| $5^2 = 25$ |
| $6^2 = 36$ |
| $7^2 = 49$ |
| $8^2 = 64$ |
| $9^2 = 81$ |

**Q.**

Find the least number which must be added to 306452 to make it a perfect square.

**Sol.**

Also 306452 is  $(4416 - 3952) = 464$  less than  $(554)^2$ .

Thus, if we add 464 to 306452, it will be a perfect square.

Hence, the required least number is 464.

**Q.**

Find the greatest number of six digits which is a perfect square.

**Sol.** We know that the greatest number of six digits is 999999.

In order to find greatest number of six digits which is perfect square, we must first find the smallest number that must be subtracted from 999999 to make it a perfect square.

For this, we work out the process of finding the square root of 999999 by long division method as given below.

**Q.**

Find the greatest number of six digits which is a perfect square.

**Sol.**

$$\begin{array}{r}
 & 999 \\
 - & 999999 \\
 \hline
 & 1899 \\
 - & 1701 \\
 \hline
 & 1989 \\
 - & 19899 \\
 \hline
 & 17901 \\
 - & 1998 \\
 \hline
 \end{array}$$

Now think of a digit that should be written besides 198

Subtract  
So that when we multiply the new number formed

With a square of a number less than or equal to to

first set  
We should get a number equal to or less than 19899

**Rough Work**



9

$$\begin{array}{r}
 1988 \\
 \times 8 \\
 \hline
 15904
 \end{array}
 \qquad
 \begin{array}{r}
 1989 \\
 \times 9 \\
 \hline
 17901
 \end{array}$$

|            |
|------------|
| $2^2 = 4$  |
| $3^2 = 9$  |
| $4^2 = 16$ |
| $5^2 = 25$ |
| $6^2 = 36$ |
| $7^2 = 49$ |
| $8^2 = 64$ |
| $9^2 = 81$ |

**Q.**

Find the greatest number of six digits which is a perfect square.

**Sol.**

It follows from this, that we must subtract 1998 from 999999 to make it a perfect square.

$$\begin{aligned}\therefore \text{Required number} &= 999999 - 1998 \\ &= 998001\end{aligned}$$

**Q.**

Find the square root of 0.00008281.

**Sol.** Here, the number of decimal places is even. So, we place the ~~that should be written~~ square root as shown below. besides 18

$$\begin{array}{r}
 & 0.00008281 \\
 \hline
 & -0 \\
 & \downarrow \\
 0 & 00\ 00\ 82\ 81 \\
 - & 0 \\
 \hline
 & 00\ 00\ 82 \\
 & - 81 \\
 \hline
 & 181 \\
 & - 181 \\
 \hline
 & 0
 \end{array}$$

Now think of a digit that should be written

So that when we multiply it right to make a set of two digits from right to left. Subtract the new number formed with a square root of a number less than or equal to first set

We should get a number equal to or less than 181

Thus,  $\sqrt{310.00008281} = 0.0091$

### Rough Work

1

18 1

$\times$  1

181



182

$\times$  2

364

$$2^2 = 4$$

$$3^2 = 9$$

$$4^2 = 16$$

$$5^2 = 25$$

$$6^2 = 36$$

$$7^2 = 49$$

$$8^2 = 64$$

$$9^2 = 81$$

**Q.** Find the value of  $\sqrt{15625}$  and then use it to find the value of  $\sqrt{156.25} + \sqrt{1.5625}$

**Sol.** We first find the value of  $\sqrt{15625}$  by long division method as given below :

$$\begin{array}{r}
 & 1 \ 2 \ 5 \\
 \sqrt{1} & 1 \ 56 \ 25 \\
 - & 1 \\
 \hline
 & 56 \\
 - & 44 \\
 \hline
 & 245 \\
 - & 1225 \\
 \hline
 & 0
 \end{array}$$

New think of a digit  
So that when we  
that should be written  
nummby the new  
w be 112 get a  
we should get a  
number equal to or  
number equal to or  
less than 156  
less than 1225

Find a square of a number  
Now think of a digit  
less than or equal to  
that should be written  
first set  
besides 24

### Rough Work

|   |            |   |
|---|------------|---|
|  | 5          |  |
| 244   | 245        | 246   |
| $\times 4$  | $\times 5$ | $\times 6$  |
| <hr/>   | <hr/>      | <hr/>   |
| 976   | 1225       | 1476  |

|            |
|------------|
| $2^2 = 4$  |
| $3^2 = 9$  |
| $4^2 = 16$ |
| $5^2 = 25$ |
| $6^2 = 36$ |
| $7^2 = 49$ |
| $8^2 = 64$ |
| $9^2 = 81$ |

**Q.** Find the value of  $\sqrt{15625}$  and then use it to find the value of  $\sqrt{156.25} + \sqrt{1.5625}$

**Sol.**  $\therefore \sqrt{15625} = 125$

Now,

$$\begin{aligned}& \sqrt{156.25} + \sqrt{1.5625} \\&= \sqrt{\frac{15625}{100}} + \sqrt{\frac{15625}{10000}} \\&= \frac{125}{10} + \frac{125}{100} \\&= 12.5 + 12.5 \\&= 13.75\end{aligned}$$

**Q.**

Given that  $\sqrt{2} = 1.414$  and  $\sqrt{5} = 2.236$ , evaluate each of the following:

(i)  $\sqrt{\frac{36}{5}}$       (ii)  $\sqrt{\frac{625}{98}}$

**Sol.**

$$(i) \quad \sqrt{\frac{36}{5}} = \frac{6}{\sqrt{5}}$$

$$= \frac{6}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$$

$$= \frac{6\sqrt{5}}{\sqrt{5}}$$

$$\Rightarrow \sqrt{\frac{36}{5}} = \frac{6 \times 2.236}{5}$$
$$= \frac{13.416}{5} = 2.6832$$

**Q.**

Given that  $\sqrt{2} = 1.414$  and  $\sqrt{5} = 2.236$ , evaluate each of the following:

(i)  $\sqrt{\frac{36}{5}}$       (ii)  $\sqrt{\frac{625}{98}}$

**Sol.** (ii) 
$$\begin{aligned}\sqrt{\frac{625}{98}} &= \frac{\sqrt{25 \times 25}}{\sqrt{49 \times 2}} = \frac{25}{7\sqrt{2}} \\&= \frac{25}{7\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} \\&= \frac{25\sqrt{2}}{7 \times 2} \\&= \frac{25\sqrt{2}}{14} \\ \Rightarrow \sqrt{\frac{625}{98}} &= \frac{25 \times 1.414}{14} \\&= \frac{35.35}{14} = 2.525\end{aligned}$$