Class 8

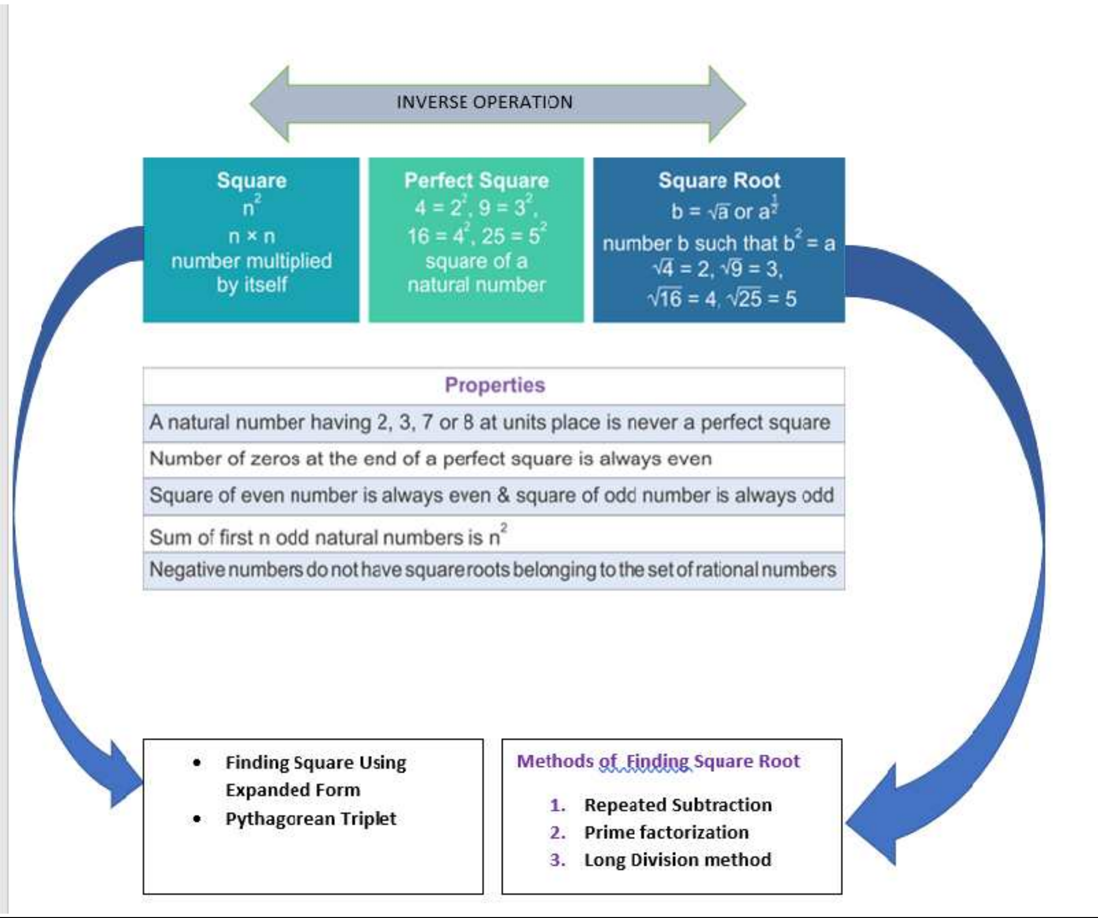
Mathematics

Book – Mathematics Textbook for Class 8 by NCERT

Chapter 6 – Square and Square Roots

General Instructions

- ***Read the notes thoroughly and practice examples simultaneously.***
- ***Solve the NCERT exercises in Mathematics Notebook/Practice notebook/loose sheets.***



Square Numbers

When a number has been multiplied by itself, we call that answer as a **Square Number.**

That is when you multiply a number by itself, you square a number.

Example: Square of 3 is $\boxed{3 \times 3 = 3^2}$

Square of 6 is $\boxed{6 \times 6 = 6^2}$

What is so special about 1, 4 ,9, 25,….?

1, 4 ,9, 25,…………are all square numbers

as 1 can be written as 1^2

4 can be written as 2^2

9 cab be written as 3^2

$16 = 4^2$

$25 = 5^2$ and so on

- **If a natural number x can be expressed as a square of y, then x is a square number.**

$$\boxed{x = y^2}$$

Example 1 Is 49 a square number?

Sol Yes, as $49 = 7^2$

Example 2 Is 121 a square number?

Sol Yes, as $121 = 11^2$

Example 3 Is 50 a square number?

Sol No, as 50 cannot be written as a square of any number

1^2	1×1	1
2^2	2×2	4
3^2	3×3	9
4^2	4×4	16
5^2	5×5	25
6^2	6×6	36
7^2	7×7	49
8^2	8×8	64
9^2	9×9	81
10^2	10×10	100

Perfect Squares/ Square Numbers

- Such numbers are also called **Perfect Squares**

Example: Find a Perfect Square Number between 40 and 50

Sol: 49

It is very much clear from the table that 49 is only perfect square which is coming in between 40 and 50.

Example: Find a Perfect Square Number between 80 and 90

Sol: 81

It is very much clear from the table that 81 is only perfect square which is coming in between 80 and 90.

For better understanding of meaning of Square Numbers , refer to this link https://www.youtube.com/watch?v=PDyyvPdi1tI

Properties of Square Numbers

PROPERTY 1

a) *All Square numbers end with 0 ,1 ,4 ,5 ,6 or 9.*

b) *Square number do not end with 2, 3, 7 and 8.*

Example: Are the following numbers Perfect Square?

i)	1057	No, it is not as it has 7 at its unit's place
ii)	7928	No, it is not as it has 8 at its unit's place
iii)	3569	Yes, it can be as it has 8 at its unit's place
iv)	12061	Yes, it can be as it has 1 at its unit's place

Solve Ex 6.1 - Ques 2

TRY THESE (Pg. 90)

PROPERTY 2

a) *If a number has 1 or 9 at its unit's place, then its square ends in 1*

Number	Square
1	1
9	81
11	121
19	361
21	441

b) *If a number has 2 or 8 at its unit's place, then its square ends with 4*

Number	Square
2	4
8	64
12	144
18	324
22	484

c) *<u>If a number has 3 or 7 at its unit's place, then its square ends with 9</u>*

Number	Square
3	9
7	49
13	169
17	289
23	529

d) *<u>If a number has 4 or 6 at its unit's place, then its square ends with 6</u>*

Number	Square
4	16
6	36
14	196
16	256
24	576

e) *<u>If a number has 5 at its unit's place, then its square ends with 5</u>*

Number	Square
5	25
15	225
25	625

f) *<u>If a number has 0 at its unit's place, then its square ends with 0</u>*

Number	Square
0	0
10	10
20	20

Example What will be the unit digit of

a) Square of 62

Ans 4

Refer to Property 2 (b)

b) Square of 26837

Ans 9

Refer to Property 2 (c)

c) Square of 12796

Ans 6

Refer to Property 2 (d)

d) Square of 219

Ans 1

Refer to Property 2 (a)

Solve Ex 6.1 – Ques 1

TRY THESE (Pg. 91 and 92)

PROPERTY 3

a) *Square of an even number is even*

Example: $2^2 = 4$ which is even

$6^2 = 36$ which is even

b) *Square of an odd number is odd*

Example: $5^2 = 25$ which is odd

$17^2 = 289$ which is odd

Solve Ex 6.1 – Ques 3

TRY THESE Pg. 92

PROPERTY 4

Square numbers can have only even number of zeroes at the end

1 zero

$20^2 = 400$

$30^2 = 900$

$90^2 = 8100$

But here we have 2 zeroes

2 zeroes

$100^2 = 10000$

$700^2 = 490000$

$500^2 = 250000$

Here we have 4 zeroes

3 zeroes

$9000^2 = 81000000$

$2000^2 = 4000000$

$12000^2 = 144000000$

Here we have six zeroes

We notice

- Square of a number with 1 zero has 2 zeroes.
- Square of a number with 2 zeroes has 4 zeroes.
- Square of a number with 3 zeroes has 6 zeroes.

So, we can say Square of a number always has even number of zeroes

Example: What will be the number of zeroes in the square of 750000?

Ans Since 750000 has 4 zeroes, so the square will have 8 zeroes

Square of a number has double the zeroes a number has

Solve TRY THESE Pg 92

PROPERTY 5

There are 2n non perfect square numbers between the squares of the numbers n and (n+1)

	Perfect Squares	Numbers between perfect squares	
1^2	1		
		2, 3	There are 2 numbers between the square of 1 and 2 *(Here n = 1, n+1 =2)*
2^2	4		
		5, 6, 7, 8	There are 4 numbers between the square of 2 and 3 *(Here n =2, n+1 =3)*
3^2	9		
		10, 11, 12, 13, 14, 15	There are 6 numbers between the square of 3 and 4 *(Here n = 3, n+1 =4)*
4^2	16		
		17, 18, 19, 20, 21 , 22 23, 24	There are 8 numbers between the square of 4 and 5 *(Here n = 4, n+1 =5)*
5^2	25		

We conclude that

There are 2n natural numbers between the square of n and n+1

Example: *How many natural numbers/ non perfect squares are there in between the square of 21 and 22?*

Sol: If n = 21

Then n+ 1 = 21 +1 = 22

We know there are 2n numbers between the square of n and n+ 1

So, 2n = 2 x 21 = 42

Thus, there are 42 natural numbers between the square of 21 and 22.

Example: *How many natural numbers/ non perfect squares are there in between* 9^2 *and* 10^2*?*

Sol: If $n = 9$

Then $n + 1 = 9 + 1 = 10$

We know there are 2n natural numbers between the square of n and n+ 1

So, $2n = 2 \times 9 = 18$

Thus, there are 18 natural numbers between 9^2 and 10^2.

NOTE:

Finding natural numbers between square numbers or finding non perfect square numbers *between square numbers is the same thing*

Solve Ex 6.1 – Ques 9

TRY THESE Pg. 94

PROPERTY 6

Sum of first n odd natural number is n^2

			Observation
1 [one odd number]	= 1	= 1^2	*Sum of 1 odd number is* 1^2
1 + 3 [sum of first two odd numbers]	= 4	= 2^2	*Sum of first 2 odd numbers is* 2^2
1 + 3 + 5 [sum of first three odd numbers]	= 9	= 3^2	*Sum of first 3 odd numbers is* 3^2
1 + 3 + 5 + 7	= 16	= 4^2	*Sum of first 4 odd numbers is* 4^2
1 + 3 + 5 + 7 + 9	= 25	= 5^2	*Sum of first 5 odd numbers is* 5^2
1 + 3 + 5 + 7 + 9 + 11	= 36	= 6^2	*Sum of first 6 odd numbers is* 6^2

Conclusion:

Sum of first n odd natural numbers is n^2

Other version of this property:

If the number is a square number, it has to be the sum of successive odd numbers starting from 1

Example: 25

25 – 1 = 24

24 – 3 = 21

21 – 5 = 16

16 – 7 = 9

9 – 9 = 0

What is 'Subtracting successive odd numbers'?

Subtracting successive odd numbers means subtracting first odd number 1 and then next odd number 3 from the previous result and then next odd number 5 from the previous result and so on…… till we achieve 0

This means, 25 = 1 + 3 + 5 + 7 + 9.

Also, 25 is a perfect square.

Conclusion:

If a natural number can be expressed as a sum of successive odd natural numbers starting with 1, then it is a perfect square.

(As 25 can be expressed a sum of successive odd numbers, so 25 is a perfect square)

Example 22

22 – 1 = 20

20 – 3 = 17

17 - 5 = 12

12 – 7 = 5

5 – 9 = negative number (the result is not zero)

This means 22 cannot be expressed as a sum of successive odd numbers

Also, 22 is not a perfect square

Conlusion **:**

If a natural number cannot be expressed as a sum of successive odd natural numbers starting with 1, then it is not a perfect square.

(As 22 cannot be expressed a sum of successive odd numbers, so 22 is not a perfect square)

NOTE:

We can use this result to find whether a number is a perfect square or not.

Example Express 49 as a sum of successive odd numbers

Sol 49 = 7^2

= 1 + 3 + 5 + 7 + 9 + 11 + 13 (Sum of n odd natural numbers is n^2)

Solve Ex 6.1 – Ques 7 and 8

TRY THESE Pg. 94

PROPERTY 7

The square of any odd number can be expressed as the sum of two consecutive positive integers

Let us take square of 3

$\mathbf{3^2}$ which is 9

We notice 9 = 4 + 5

9 can be expressed as sum of two consecutive numbers that is 4 and 5

Let's look at square of 5

$\mathbf{5^2} = 25$

We notice 25 = 12 + 13

25 can also be expressed as sum of two consecutive numbers 12 and 13

Similarly

$\mathbf{7^2} = 49 = 24 + 25$

$\mathbf{9^2} = 81 = 40 + 41$

$\mathbf{11^2} = 121 = 60 + 61$

$\mathbf{15^2} = 225 = 112 + 113$

Wow …. We notice few consecutive numbers

24 and 25, 40 and 41, 60 and 61,

112 and 113

Example: Express 13^2 as a sum of consecutive numbers.

Sol $13^2 = 169$

$= 84 + 85$

Two consecutive numbers which give 169?

a) Think of 2 consecutive digits whch gives 9 ________?

It is 4 and 5 ….so last two digits are 4 and 5

b) Now think of two same digits which give 16?

It is 8 and 8

Note : Such questions are mostly done by Hit and Trial Method

Solve: TRY THESE Pg. 95

Ex 6.1 Ques 5 and 6

BRIEF OF PROPERTIES OF SQUARE NUMBERS

PROPERTY 1	a) *All Square numbers end with 0 ,1 ,4 ,5 ,6 or 9.* b) *Square number do not end with 2, 3, 7 and 8.*
PROPERTY 2	a) *If a number has 1 or 9 at its unit's place, then its square ends in 1* b) *If a number has 2 or 8 at its unit's place, then its square ends with 4* c) *If a number has 3 or 7 at its unit's place, then its square ends with 9* d) *If a number has 4 or 6 at its unit's place, then its square ends with 6* e) *If a number has 5 at its unit's place, then its square ends with 5* f) *If a number has 0 at its unit's place, then its square ends with 0*
PROPERTY 3	a) *Square of an even number is even* b) *Square of a odd number is odd*
PROPERTY 4	*Square numbers can have only even number of zeroes at the end*
PROPERTY 5	*There are 2n non perfect square numbers between the squares of the numbers n and (n+1)*
PROPERTY 6	a) *Sum of first n odd natural number is n^2* b) If the number is a square number, it has to be the sum of successive odd numbers starting from 1 c) *If a natural number can be expressed as a sum of successive odd natural numbers starting with 1, then it is a perfect square.* d) *If a natural number cannot be expressed as a sum of successive odd natural numbers starting with 1, then it is not a perfect square.*
PROPERTY 7	*The square of any odd number can be expressed as the sum of two consecutive positive integers*

Finding the square of a number without actual multiplication

Example: **21^2**

$= (20 + 1)^2$ — Breaking **21** into **20 + 1**

$= (20 + 1)\ \underline{(20 + 1)}$ — Removing the square sign

$= 20\ (20 + 1) + 1\ (20 + 1)$ — First multiply 20 with (20+1) And then multiply 1 with (20+ 1)

$= (20 \times 20) + (20 \times 1) + (1 \times 20) + (1 \times 1)$ — Opening both the brackets that is applying distributive property

$= 400 + 20 + 20 + 1$

$= 400 + 41$

$= 441$

❖ **How to find the square of a number having 5 at its unit's place in an easy way?**

$(a5)^2 = a(a + 1)$ hundred + 25 — Refer to book for derivation Pg. 97

where a is any natural number

Example Find the square of 45.

Sol Here a = 4

$(a5)^2$ = a (a + 1) hundred + 25

$(45)^2$ = 4(4+ 1) hundred + 25

= 4 (5) x 100 + 25

= 20 x 100 + 25

= 2000 + 25

= 2025

NOTE:

Square of a number ending with 5 can be calculated both ways - by using the above stated formula or by using the expanded form method

Solve Ex 6.2 – Ques 1

TRY THESE Pg 97

Pythagorean Triplet

Let's solve few calculations

$3^2 + 4^2 = 9 + 16 = 25 = 5^2$ — 3, 4, 5 is a Pythagorean triplet

$6^2 + 8^2 = 36 + 64 = 100 = 10^2$ — 6, 8, 10 is a Pythagorean triplet

$5^2 + 12^2 = 25 + 144 = 169 = 13^2$ — 5, 12, 13 is a Pythagorean triplet

Did u notice it is looks almost similar to PYTHAGORAS PROPERTY you studied in class 7?

Conclusion

For any rational number **m**,

$$(2m)^2 + (m^2 - 1)^2 = (m^2 + 1)^2$$

implies $(2m, m^2 - 1, m^2 + 1)$ form Pythagorean triplet.

Example: Write Pythagorean triplet whose one number is **14**.

Solution: We know $(2m, m^2 - 1, m^2 + 1)$ form Pythagorean triplet

*As one member is **14** and 14 is an even number so we can make it equal to **2m***

Let 2**m** = **14**

$$m = \frac{14}{2} = 7$$

$\mathbf{m^2 - 1} = 7^2 - 1 = 49 - 1 = \mathbf{48}$

$\mathbf{m^2 + 1} = 7^2 + 1 = 49 + 1 = \mathbf{50}$

Thus, the required triplet is (**14**, **48**, **50**).

Example: Write Pythagorean triplet whose smallest number is **10**.

Solution: We know ($2m$, $m^2 - 1$, $m^2 + 1$) form Pythagorean triplet

As one member is ***10*** *and 10 is an even number so we can make it equal to* ***2m***

Let $\mathbf{2m} = 10$

$$m = \frac{10}{2} = 5$$

$\mathbf{m^2 - 1} = 5^2 - 1 = 25 - 1 = \mathbf{24}$

$\mathbf{m^2 + 1} = 5^2 + 1 = 25 + 1 = \mathbf{25}$

Thus, the required triplet is (**10**, **24**, **25**).

Solve Ex 6.2 - Ques. 2

SQUARE ROOT

The inverse (opposite) operation of addition is subtraction

The inverse operation of multiplication is division.

Similarly, finding the square root is the inverse operation of squaring

We notice

As $1^2 = 1$, therefore square root of 1 is 1

As $2^2 = 4$, therefore square root of 4 is 2

As $3^2 = 9$, therefore square root of 9 is 3

Square and Square Root Table

Square	Square Root	Square	Square Root
$1^2 = 1$	$\sqrt{1} = 1$	$16^2 = 256$	$\sqrt{256} = 16$
$2^2 = 4$	$\sqrt{4} = 2$	$17^2 = 289$	$\sqrt{289} = 17$
$3^2 = 9$	$\sqrt{9} = 3$	$18^2 = 324$	$\sqrt{324} = 18$
$4^2 = 16$	$\sqrt{16} = 4$	$19^2 = 361$	$\sqrt{361} = 19$
$5^2 = 25$	$\sqrt{25} = 5$	$20^2 = 400$	$\sqrt{400} = 20$
$6^2 = 36$	$\sqrt{36} = 6$	$21^2 = 441$	$\sqrt{441} = 21$
$7^2 = 49$	$\sqrt{49} = 7$	$22^2 = 484$	$\sqrt{484} = 22$
$8^2 = 64$	$\sqrt{64} = 8$	$23^2 = 529$	$\sqrt{529} = 23$
$9^2 = 81$	$\sqrt{81} = 9$	$24^2 = 576$	$\sqrt{576} = 24$
$10^2 = 100$	$\sqrt{100} = 10$	$25^2 = 625$	$\sqrt{625} = 25$
$11^2 = 121$	$\sqrt{121} = 11$	$26^2 = 676$	$\sqrt{676} = 26$
$12^2 = 144$	$\sqrt{144} = 12$	$27^2 = 729$	$\sqrt{729} = 27$
$13^2 = 169$	$\sqrt{169} = 13$	$28^2 = 784$	$\sqrt{784} = 28$
$14^2 = 196$	$\sqrt{196} = 14$	$29^2 = 841$	$\sqrt{841} = 29$
$15^2 = 225$	$\sqrt{225} = 15$	$30^2 = 900$	$\sqrt{900} = 30$

NOTE: We know

$(-2)^2 = 4$ and $(2)^2 = 4$

But $\sqrt{4} = 2$

We shall take up only positive square root of a number

$\sqrt{4}$ can never be -2

Solve Ex 6.3 – Ques 1

Finding the number of digits in the square root of a number without calculating

The number of bars over a pair of digits starting from one's place indicate the number of digits in the square root.

Example $\overline{3}\ \overline{68}\ \overline{64}$ $\longrightarrow$ 3 digits will be there in the square root

$\overline{2}\ \overline{56}$ $\longrightarrow$ 2 digits will be there in the square root

Solve TRY THESE Pg. 105

Ex 6.4 – Ques 2

Methods for finding Square Root

- Repeated Subtraction
- Prime Factorization
- Long Division

Finding square root through repeated subtraction

In this method we subtract odd numbers successively from the previous number till we attain zero.

Example $\sqrt{81}$

(i) $81 - 1 = 80$ First we subtract the first odd number 1

(ii) $80 - 3 = 77$ Now we will subtract the next odd number 3

(iii) $77 - 5 = 72$

(iv) $72 - 7 = 65$

(v) $65 - 9 = 56$

(vi) $56 - 11 = 45$

(vii) $45 - 13 = 32$

(viii) $32 - 15 = 17$

Similarly we will keep subtracting other successive odd numbers

(ix) $17 - 17 = 0$ → We have stopped subtraction as we have got 0

From 81 we have subtracted successive odd numbers starting from 1 and obtained 0 at 9th step

So $\sqrt{81} = 9$

NOTE:

The number of steps involved in subtraction of successive odd numbers decide the square root of that number

Example $\sqrt{25}$

(i) $25 - 1 = 24$

(ii) $24 - 3 = 21$

(iii) $21 - 5 = 16$

(iv) $16 - 7 = 9$

(v) $9 - 9 = 0$

From 25 we have subtracted successive odd numbers starting from 1 and obtained 0 at 5th step

So $\sqrt{25} = 5$

Note: Repeated subtraction method also helps in deciding whether a number is a perfect square or not. If we do not attain zero at any step, the number is not a perfect square

Example: Check whether 20 is a perfect square or not

$20 - 1 = 19$

$19 - 3 = 16$

$16 - 5 = 11$

$11 - 7 = -4$ which is not zero

For a number to be a perfect square, we should have 0 at any step

So, 20 is not a perfect square

Solve TRY THESE Pg. 100

Ex 6. 3 - Ques 3

Finding square root through prime factorisation

Let's observe few facts about prime factorization

6 = 2 x 3	**36 = 2 x 2 x 3 x 3**
10 = 2 x 5	**100 = 2x 2 x 5 x 5**
8 = 2x 2 x 2	**64 = 2x 2 x 2 x 2x 2 x 2**
45 = 3x 3 x 5	**2025 = 3x 3 x 3x 3 x 5 x 5**

We notice how a number which appears **once in the prime factorization of a number** gets **doubled in the prime factorization of the square of that number**.

Each prime factor in the prime factorisation of the square of a number, occurs twice the number of times it occurs in the prime factorisation of the number itself.

Finding Square root using Prime Factorization

Example $\sqrt{256}$

2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

256 = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2

Prime factorization of 256

$\sqrt{256} = \sqrt{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2}$

Taking square root on both sides and forming pairs

$\sqrt{256}$ = 2 x 2 x 2 x 2

To remove the square root sign, for every pair of 2, write 2 once

= 4 x 4

= 16

So, $\sqrt{256}$ = 16

Example $\sqrt{400}$

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

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

Prime factorization of 400

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

Taking square root on both sides and forming pairs

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

To remove the square root sign, for every pair of 2, write 2 once and a pair of 5, write 5 once

$= 4 \times 5$

$= 20$

So, $\sqrt{400} = 20$

Example $\sqrt{2025}$

3	2025
3	675
3	225
3	75
5	25
5	5
	1

$2025 = 3 \times 3 \times 3 \times 3 \times 5 \times 5$

Prime factorization of 2025

$\sqrt{2025} = \sqrt{3 \times 3 \times 3 \times 3 \times 5 \times 5}$

Taking square root on both sides and forming pairs

$\sqrt{2025} = 3 \times 3 \times 5$

To remove the square root sign, for every pair of 3, write 3 once and. for a pair of 5 write 5 once

$= 9 \times 5$

$= 45$

So, $\sqrt{256} = 16$

Solve Ex 6.3 – Ques 4

Example Is 162 a perfect square? If not, find the smallest number which must be multiplied with 162 to make it a perfect square. Find the square root of the new number.

Sol

2	162
3	81
3	27
3	9
3	3
	1

$162 = 2 \times 3 \times 3 \times 3 \times 3$

Prime factorization of 162

On pairing, we notice 162 is not a perfect square

Both the 3's have their pair but 2 doesn't have any pair

As 2 doesn't have any pair.

So, we should multiply 162 by 2 to make it a perfect square

Multiplying 162 by 2 will add one more 2 in the prime factorization of new number

New number formed (Perfect Square) = 162 X 2

= 324

$\sqrt{324} = \sqrt{2 \times 2 \times 3 \times 3 \times 3 \times 3}$

$= 2 \times 3 \times 3$

$= 2 \times 9$

$= 18$

So, $\sqrt{324} = 18$

Did u notice the difference between the Prime Factorization of 162 and 324?

Single 2 is extra in the prime factorization of 324

Solve Ex 6.3 – Ques 5

Example Is 396 a perfect square? If not, find the smallest number which must be divided by 396 to make it a perfect square. Find the square root of the new number.

Sol

2	396
2	198
3	99
3	33
11	11
	1

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

Prime factorization of 396

On pairing, we notice 396 is not a perfect square

2 and 3 both have their pair but 11 doesn't have any pair

As 11 doesn't have any pair.

So, we should divide 396 by 11 to make it a perfect square

Dividing 396 by 11 will vanish 11 from the prime factorization of new number

New number formed (Perfect Square) = 396 ÷ 11

= 36

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

$= 2 \times 3$

$= 6$

So, $\sqrt{36} = 6$

Did u notice the difference between the Prime Factorization of 396 and 36?

Single 11 is missing in the prime factorization of 36

Solve Ex 6.3 – Ques 6, 7 and 8

What do we mean by a least number exactly divisible by 3, 4 and 5?

It means finding a least number which on dividing by 3, 4 and 5 gives remainder 0.

Such numbers can be found out using LCM.

LCM OF 3, 4 and 5 is 60.

Did u notice 60 on getting divided by 3, 4 and 5 gives the remainder 0? Yes

Concept of LCM and exactly divisible has been taught in class 6

Example Find the least square number which is exactly divisible by 6, 8 and 12

Sol **Least number divisible by 6, 8 and 12**

LCM of 6, 8 and 12

2	6, 8 , 12
2	3, 4, 6
2	3, 2, 3
3	3, 1, 3
	1, 1, 1

Finding Least square number

Least number — For this we will find LCM

Square number — For this we will find perfect square using prime factorization

LCM = 2 x 2 x 2 x 3

= 24

So, the least number divisible by 6, 8 and 12 is 24

But 24 is not the square number

Prime factorization of 24 has few numbers not having their pair

24 = 2 x 2 x 2 x 3

<u>Least Square number divisible by 6, 8 and 12</u>

Required number = LCM x 2 x 3

= 24 X 6

= 144

Why LCM has been multiplied by 2 and 3?

Prime factorization of LCM (24) doesn't have pair of 2 and 3

So, 144 is the least square number divisible 6, 8 and 12

Did u notice 144 is a square number?

Yes, $144 = 12^2$

And also, we notice 144 is **exactly divisible** by 6, 8 and 12 (means gives gives remainder 0)

Solve Ex 6.3 – Ques 9 and 10

Example A hall has a capacity of 2704 seats. If the number of rows is equal to number of seats in each row, find the number of seats in each row

Sol let the number of seats in each row be x

Number of seats in 1 row = x

Number of seats in x rows = x x x

$= x^2$

We know

Total capacity of hall = 2704

$2704 = x^2$

$\sqrt{2704} = x$

Number of seats in each row

= Number of rows

If number of seats in each row is 9, then there are 9 rows.

If number of seats in each row is 5, then there are 5 rows.

If there are x seats in each row,

Then there are x rows

2	2704
2	1352

2	676
2	338
13	169
13	13
	1

2704 = 2 x 2 x 2 x 2 x 13 x 13

$\sqrt{2704} = \sqrt{2 \times 2 \times 2 \times 2 \times 13 \times 13}$

$\sqrt{2704} = 2 \times 2 \times 13$

x = 4 x 13

x = 52

So, there are 52 seats in each row

Finding square root using long division method

Example $\sqrt{529}$

Step 1 Place a bar over every pair of digits starting from the digit at one's place. If the number of digits in it is odd, then the left-most single digit too will have a bar.

Thus, we have, $\overline{5}\ \overline{29}$.

$$\begin{array}{r|l} \hline & \overline{5}\ \ \overline{29} \\ & \\ & \end{array}$$

Step 2 Think of a square number which is less than 5.

It is 4. we can get 4 as 2x 2

$$\begin{array}{r|l} & \ \ 2 \\ \hline 2 & \ \ \overline{5}\ \overline{29} \\ & \ 4 \\ & \end{array}$$

Step3 Now subtract 4 from 5 to get remainder 1

$$\begin{array}{r|l} & \ \ 2 \\ \hline 2 & \ \ \overline{5}\ \overline{29} \\ & -\ 4 \\ \hline & \ \ 1 \end{array}$$

Step 4 Note down the next pair of digits

	2
2	5 $\overline{29}$
	- 4
	1 29

Step 5 Note down the divisor 2 again and add both to get 4

Also make a $\boxed{\ }$ after 4

	2 $\boxed{\ }$
2	$\overline{5}$ $\overline{29}$
2	- 4
4 $\boxed{\ }$	1 29

Step 6 Now think of a number such that

4 $\boxed{\ }$ x $\boxed{\ }$ = 129

Let's start guessing 41 x 1 = 41

42 x 2 = 84

43 x 3 = 129

We can also guess the digit by thinking of a number which on squaring gives units place of 129, that is 9……..the possibilities are

43 x 3 or **47 x 7** (Unit's place 9 can be given by 3 or 7)

The best option is 43 x 3 = 129

	2 $\boxed{3}$
2	$\overline{5}$ $\overline{29}$
+ 2	- 4
4 $\boxed{3}$	1 29
+ 3	- 1 29
4 6	0 00

So, $\sqrt{529}$ = 23

Example $\sqrt{3481}$

Step 1 Place a bar over every pair of digits starting from the digit at one's place.

Thus, we have, $\overline{34}$ $\overline{81}$.

$\overline{34}\ \overline{81}$

Step 2 Think of a square number which is less than 34.

It is 25. we can get 25 as 5 x 5

$$
\begin{array}{r|l}
 & 5 \\ \hline
5 & \overline{34}\ \overline{81} \\
 & 25
\end{array}
$$

Step3 Now subtract 25 from 34 to get remainder 9

$$
\begin{array}{r|l}
 & 5 \\ \hline
5 & \overline{34}\ \overline{81} \\
 & -\ 25 \\ \hline
 & \quad 9
\end{array}
$$

Step 4 Note down the next pair of digits 81

$$
\begin{array}{r|l}
 & 5 \\ \hline
5 & \overline{34}\ \overline{81} \\
 & -\ 25 \\ \hline
 & \quad 9\ 81
\end{array}
$$

Step 5 Note down the divisor 5 again and add both to get 10

And draw $\square$ ahead of 10

$$
\begin{array}{r|l}
 & 5\ \square \\ \hline
5 & \overline{34}\ \overline{81} \\
5 & -\ 25 \\ \hline
10\ \square & \quad 9\ 81
\end{array}
$$

Step 6 Now think of a number such that

10$\square$ x $\square$ = 981

Let's start guessing 101 x 1 = 101

102 x 2 = 204

103 x 3 = 309

109 x 9 = 981

We can also guess the digit by thinking of a number which on squaring gives units place of 981, that is 1……..the possibilities are

101 x 1 = 101 or 109 x 9 = 981 (Unit's place 1 can be given by 1 or 9)

The best option is 109 x 9 = 981

		5 $\boxed{9}$
5		$\overline{34}\ \overline{81}$
+ 5		- 25
10 $\boxed{9}$		9 81
+ 9		- 9 81
118		0 0 0

So, $\sqrt{3481}$ = 59

Solve Ex 6.4- Ques 1

<u>Refer to below links for better understanding of Square root using Long Division Method</u>

https://www.youtube.com/watch?v=Ga1_wuLz0QM

https://www.youtube.com/watch?v=gkx5krbE2Pw

<u>Example</u>: Find the least number that must be subtracted from 1989 to get perfect square. Also find the square root of the perfect square.

<u>Solution</u>: Let's find $\sqrt{1989}$ using long division method

		4 $\boxed{4}$
4		$\overline{19}\ \overline{89}$
+ 4		- 16
8 $\boxed{4}$		3 89
+ 4		- 3 36
8 8		53

Step 1: Think of a square number less than or equal to 19.

It is 16 (16 = 4 × 4)

Step 2: Note down 89 and write down 4 again to add it to get 8.

Step 3: Think of a number such that

$8\boxed{} \times \boxed{}$ is less than equal to 389.

By hit and trial 84 × 4 = 336 is the best option.

As 53 is the remainder.

If we subtract 53 from 1989, we get a perfect square.

Required perfect square = 1989-53

= 1936

And $\sqrt{1936}$ = 44

Solve Ex 6.4- Ques 4 and 9

Example: Find the least number that must be added to 1750 to get perfect square. Also find the square root of the perfect square.

Solution: Let's find $\sqrt{1750}$ using long division method

	4 $\boxed{1}$
4	$\overline{17}$ $\overline{50}$
+ 4	- 16
8 $\boxed{1}$	1 50
+ 1	- 81
8 2	69

Step 1: Think of a square number less than or equal to 17.

It is 16 (16 = 4 × 4)

Step 2: Note down 50 and write down 4 again to add it to get 8.

Step 3: Think of a number such that

$8\boxed{} \times \boxed{}$ is less than equal to 150.

By hit and trial 81 × 1 = 81 is the best option.

Now we know $41^2 < 1750 < 42^2$

Number to be added is $42^2 - 1750$

=1764 – 1750

= 14

So, 14 should be added to 1750 to make it a perfect square.

And $\sqrt{1764}$ = 42.

Solve Ex 6.4- Ques 5 and 8

Finding square root of decimals

The process of finding square root of a decimal number is similar to that of a whole number. The only difference is to note down decimal in the quotient whenever the required part of divisor is used.

Example: $\sqrt{7.29}$

	2.$\boxed{7}$
2	$\overline{7}\,.\,\overline{29}$
+ 2	- 4
4$\boxed{7}$	3 29
+ 7	- 3 29
5 4	0 0 0

Before you note down 29, put the decimal in the quotient.

$\sqrt{7.29} = 2.7$

Example: $\sqrt{42.25}$

	6 $\boxed{5}$
6	$\overline{42}.\,\overline{25}$
+ 6	- 36
12$\boxed{5}$	6 25
+ 5	- 6 25
13 0	0 00

Before you note down 29, put the decimal in the quotient.

$\sqrt{42.25} = 6.5$

Solve Ex 6.4- Ques 3

Example Find the side of a square whose area is 2704 m^2

Sol let the side of a square be x metres

Area of a square = side x side

$2704 = x \times x$

$2704 = x^2$

$\sqrt{2704} = x$

Inverse operation of square is square root

	5 2
5	$\overline{27}\ \overline{04}$
5	- 25
10 2	2 04
	- 2 04
	0 00

$\sqrt{2704} = 52$

So, side of a square is 52 metres

Refer to link https://www.youtube.com/watch?v=rnoIHK3d7jw **for recapitulation of square roots by all three methods – Repeated subtraction, Prime Factorization and Long Division method**

Refer to the link "https://www.vedantu.com/ncert-solutions/ncert-solutions-class-8-maths-chapter-6-squares-and-square-roots" ***for the solutions to NCERT Exercises***