

NCERT Class 8 Chapter 6 – Squares and Square Roots

Exercise 6.1

1. What will be the unit digit of the squares of the following numbers?

i. 81

ii. 272

iii. 799

iv. 3853

v. 1234

vi. 26387

vii. 52698

viii. 99880

ix. 12796

x. 55555

Solution:

The unit digit of square of a number having 'a' at its unit place ends with $a \times a$.

i. The unit digit of the square of a number having digit 1 as unit's place is 1.

∴ Unit digit of the square of number 81 is equal to 1.

ii. The unit digit of the square of a number having digit 2 as unit's place is 4.

∴ Unit digit of the square of number 272 is equal to 4.

iii. The unit digit of the square of a number having digit 9 as unit's place is 1.

∴ Unit digit of the square of number 799 is equal to 1.

iv. The unit digit of the square of a number having digit 3 as unit's place is 9.

∴ Unit digit of the square of number 3853 is equal to 9.

v. The unit digit of the square of a number having digit 4 as unit's place is 6.

∴ Unit digit of the square of number 1234 is equal to 6.

vi. The unit digit of the square of a number having digit 7 as unit's place is 9.

∴ Unit digit of the square of number 26387 is equal to 9.

vii. The unit digit of the square of a number having digit 8 as unit's place is 4.

∴ Unit digit of the square of number 52698 is equal to 4.

viii. The unit digit of the square of a number having digit 0 as unit's place is 0.

∴ Unit digit of the square of number 99880 is equal to 0.

ix. The unit digit of the square of a number having digit 6 as unit's place is 6.

∴ Unit digit of the square of number 12796 is equal to 6.

x. The unit digit of the square of a number having digit 5 as unit's place is 5.

∴ Unit digit of the square of number 55555 is equal to 5.

2. The following numbers are obviously not perfect squares. Give reason.

i. 1057

ii. 23453

iii. 7928

iv. 222222

v. 64000

vi. 89722

vii. 222000

viii. 505050

Solution:

We know that natural numbers ending in the digits 0, 2, 3, 7 and 8 are not perfect squares.

i. 1057 \Rightarrow Ends with 7

ii. 23453 \Rightarrow Ends with 3

iii. 7928 \Rightarrow Ends with 8

iv. 222222 \Rightarrow Ends with 2

v. 64000 \Rightarrow Ends with 0

vi. 89722 \Rightarrow Ends with 2

vii. 222000 \Rightarrow Ends with 0

viii. 505050 \Rightarrow Ends with 0

3. The squares of which of the following would be odd numbers?

i. 431

ii. 2826

iii. 7779

iv. 82004

Solution:

We know that the square of an odd number is odd and the square of an even number is even.

i. The square of 431 is an odd number.

ii. The square of 2826 is an even number.

iii. The square of 7779 is an odd number.

iv. The square of 82004 is an even number.

4. Observe the following pattern and find the missing numbers. $11^2 = 121$

$$101^2 = 10201$$

$$1001^2 = 1002001$$

$$100001^2 = 1 \dots\dots 2 \dots\dots 1$$

$$10000001^2 = \dots\dots\dots$$

Solution:

We observe that the square on the number on R.H.S of the equality has an odd number of digits such that the first and last digits both are 1 and middle digit is 2. And the number of zeros between left most digits 1 and the middle digit 2 and right most digit 1 and the middle digit 2 is same as the number of zeros in the given number.

$$\therefore 100001^2 = 10000200001$$

$$10000001^2 = 100000020000001$$

5. Observe the following pattern and supply the missing numbers. $112 = 121$

$$1012 = 10201$$

$$101012 = 102030201$$

$$10101012 = \dots\dots\dots$$

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

Solution:

We observe that the square on the number on R.H.S of the equality has an odd number of digits such that the first and last digits both are 1. And, the square is symmetric about the middle digit. If the middle digit is 4, then the number to be squared is 10101 and its square is 102030201.

$$\text{So, } 10101012 = 1020304030201$$

$$1010101012 = 10203040505030201$$

6. Using the given pattern, find the missing numbers. $1^2 + 2^2 + 2^2 = 3^2$

$$2^2 + 3^2 + 6^2 = 7^2$$

$$3^2 + 4^2 + 12^2 = 13^2$$

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

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

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

Solution:

$$\text{Given, } 1^2 + 2^2 + 2^2 = 3^2$$

$$\text{i.e } 1^2 + 2^2 + (1 \times 2)^2 = (1^2 + 2^2 - 1 \times 2)^2$$

$$2^2 + 3^2 + 6^2 = 7^2$$

$$\therefore 2^2 + 3^2 + (2 \times 3)^2 = (2^2 + 3^2 - 2 \times 3)^2$$

$$3^2 + 4^2 + 12^2 = 13^2$$

$$\therefore 3^2 + 4^2 + (3 \times 4)^2 = (3^2 + 4^2 - 3 \times 4)^2$$

$$4^2 + 5^2 + (4 \times 5)^2 = (4^2 + 5^2 - 4 \times 5)^2$$

$$\therefore 4^2 + 5^2 + 20^2 = 21^2$$

$$5^2 + 6^2 + (5 \times 6)^2 = (5^2 + 6^2 - 5 \times 6)^2$$

$$\therefore 5^2 + 6^2 + 30^2 = 31^2$$

$$6^2 + 7^2 + (6 \times 7)^2 = (6^2 + 7^2 - 6 \times 7)^2$$

$$\therefore 6^2 + 7^2 + 42^2 = 43^2$$

7. Without adding, find the sum.

i. $1 + 3 + 5 + 7 + 9$

Solution:

Sum of first five odd number = $(5)^2 = 25$

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

Solution:

Sum of first ten odd number = $(10)^2 = 100$

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

Solution:

Sum of first thirteen odd number = $(13)^2 = 169$

8. (i) Express 49 as the sum of 7 odd numbers.

Solution:

We know, sum of first n odd natural numbers is n^2 . Since, $49 = 7^2$

$\therefore 49 = \text{sum of first 7 odd natural numbers} = 1 + 3 + 5 + 7 + 9 + 11 + 13$

(ii) Express 121 as the sum of 11 odd numbers. Solution:

Since, $121 = 11^2$

$\therefore 121 = \text{sum of first 11 odd natural numbers} = 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21$

9. How many numbers lie between squares of the following numbers?

i. 12 and 13

ii. 25 and 26

iii. 99 and 100

Solution:

Between n^2 and $(n+1)^2$, there are $2n$ non-perfect square numbers.

i. 122 and 132 there are $2 \times 12 = 24$ natural numbers.

ii. 252 and 262 there are $2 \times 25 = 50$ natural numbers.

iii. 992 and 1002 there are $2 \times 99 = 198$ natural numbers.

Exercise 6.2

1. Find the square of the following numbers.

i. 32

ii. 35

iii. 86

iv. 93

v. 71

vi. 46

Solution:

i. $(32)^2$

$$= (30 + 2)^2$$

$$= (30)^2 + (2)^2 + 2 \times 30 \times 2 \text{ [Since, } (a+b)^2 = a^2 + b^2 + 2ab \text{]}$$

$$= 900 + 4 + 120$$

$$= 1024$$

ii. $(35)^2$

$$= (30 + 5)^2$$

$$= (30)^2 + (5)^2 + 2 \times 30 \times 5 \text{ [Since, } (a+b)^2 = a^2 + b^2 + 2ab \text{]}$$

$$= 900 + 25 + 300$$

$$= 1225$$

iii. $(86)^2$

$$= (90 - 4)^2$$

$$= (90)^2 + (4)^2 - 2 \times 90 \times 4 \text{ [Since, } (a-b)^2 = a^2 + b^2 - 2ab \text{]}$$

$$= 8100 + 16 - 720$$

$$= 8116 - 720$$

$$= 7396$$

iv. $(93)^2$

$$= (90 + 3)^2$$

$$= (90)^2 + (3)^2 + 2 \times 90 \times 3 \text{ [Since, } (a+b)^2 = a^2 + b^2 + 2ab \text{]}$$

$$= 8100 + 9 + 540$$

$$= 8649$$

$$\begin{aligned}
 & \text{v. } (71)^2 \\
 &= (70+1)^2 \\
 &= (70)^2 + (1)^2 + 2 \times 70 \times 1 \text{ [Since, } (a+b)^2 = a^2 + b^2 + 2ab\text{]} \\
 &= 4900 + 1 + 140 \\
 &= 5041
 \end{aligned}$$

$$\begin{aligned}
 & \text{vi. } (46)^2 \\
 &= (50-4)^2 \\
 &= (50)^2 + (4)^2 - 2 \times 50 \times 4 \text{ [Since, } (a+b)^2 = a^2 + b^2 + 2ab\text{]} \\
 &= 2500 + 16 - 400 \\
 &= 2116
 \end{aligned}$$

2. Write a Pythagorean triplet whose one member is.

i. 6

ii. 14

iii. 16

iv. 18

Solution:

For any natural number m , we know that $2m$, m^2-1 , m^2+1 is a Pythagorean triplet.

i. $2m = 6$

$$\Rightarrow m = 6/2 = 3$$

$$m^2-1 = 3^2-1 = 9-1 = 8$$

$$m^2+1 = 3^2+1 = 9+1 = 10$$

$\therefore (6, 8, 10)$ is a Pythagorean triplet.

ii. $2m = 14$

$$\Rightarrow m = 14/2 = 7$$

$$m^2-1 = 7^2-1 = 49-1 = 48$$

$$m^2+1 = 7^2+1 = 49+1 = 50$$

$\therefore (14, 48, 50)$ is not a Pythagorean triplet.

iii. $2m = 16$

$$\Rightarrow m = 16/2 = 8$$

$$m^2-1 = 8^2-1 = 64-1 = 63$$

$$m^2+1 = 8^2+1 = 64+1 = 65$$

$\therefore (16, 63, 65)$ is a Pythagorean triplet.

iv. $2m = 18$

$$\Rightarrow m = 18/2 = 9$$

$$m^2 - 1 = 9^2 - 1 = 81 - 1 = 80$$

$$m^2 + 1 = 9^2 + 1 = 81 + 1 = 82$$

$\therefore (18, 80, 82)$ is a Pythagorean triplet.

Exercise 6.3

1. What could be the possible 'one's' digits of the square root of each of the following numbers?

i. 9801

ii. 99856

iii. 998001

iv. 657666025

Solution:

i. We know that the unit's digit of the square of a number having digit as unit's place 1 is 1 and also 9 is 1 [$9^2=81$ whose unit place is 1].

\therefore Unit's digit of the square root of number 9801 is equal to 1 or 9.

ii. We know that the unit's digit of the square of a number having digit as unit's place 6 is 6 and also 4 is 6 [$6^2=36$ and $4^2=16$, both the squares have unit digit 6].

\therefore Unit's digit of the square root of number 99856 is equal to 6.

iii. We know that the unit's digit of the square of a number having digit as unit's place 1 is 1 and also 9 is 1 [$9^2=81$ whose unit place is 1].

\therefore Unit's digit of the square root of number 998001 is equal to 1 or 9.

iv. We know that the unit's digit of the square of a number having digit as unit's place 5 is 5.

\therefore Unit's digit of the square root of number 657666025 is equal to 5.

2. Without doing any calculation, find the numbers which are surely not perfect squares.

i. 153

ii. 257

iii. 408

iv. 441

Solution:

We know that natural numbers ending with the digits 0, 2, 3, 7 and 8 are not perfect square.

i. $153 \Rightarrow$ Ends with 3.

\therefore , 153 is not a perfect square

ii. $257 \Rightarrow$ Ends with 7

\therefore , 257 is not a perfect square

iii. $408 \Rightarrow$ Ends with 8

\therefore , 408 is not a perfect square

iv. $441 \Rightarrow$ Ends with 1

\therefore , 441 is a perfect square.

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

Solution:

100

$$100 - 1 = 99$$

$$99 - 3 = 96$$

$$96 - 5 = 91$$

$$91 - 7 = 84$$

$$84 - 9 = 75$$

$$75 - 11 = 64$$

$$64 - 13 = 51$$

$$51 - 15 = 36$$

$$36 - 17 = 19$$

$$19 - 19 = 0$$

Here, we have performed subtraction ten times.

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

169

$$169 - 1 = 168$$

$$168 - 3 = 165$$

$$165 - 5 = 160$$

$$160 - 7 = 153$$

$$153 - 9 = 144$$

$$144 - 11 = 133$$

$$133 - 13 = 120$$

$$120 - 15 = 105$$

$$105 - 17 = 88$$

$$88 - 19 = 69$$

$$69 - 21 = 48$$

$$48 - 23 = 25$$

$$25 - 25 = 0$$

Here, we have performed subtraction thirteen times.

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

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

i. 729

ii. 400

iii. 1764

iv. 4096

v. 7744

vi. 9604

vii. 5929

viii. 9216

ix. 529

x. 8100

Solution:

i.

3	729
3	243
3	81
3	27
3	9
3	3
	1

$$729 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 1$$

$$\Rightarrow 729 = (3 \times 3) \times (3 \times 3) \times (3 \times 3)$$

$$\Rightarrow 729 = (3 \times 3 \times 3) \times (3 \times 3 \times 3)$$

$$\Rightarrow 729 = (3 \times 3 \times 3)^2$$

$$\Rightarrow \sqrt{729} = 3 \times 3 \times 3 = 27$$

ii.

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

$$400 = 2 \times 2 \times 2 \times 2 \times 5 \times 5 \times 1$$

$$\Rightarrow 400 = (2 \times 2) \times (2 \times 2) \times (5 \times 5)$$

$$\Rightarrow 400 = (2 \times 2 \times 5) \times (2 \times 2 \times 5)$$

$$\Rightarrow 400 = (2 \times 2 \times 5)^2$$

$$\Rightarrow \sqrt{400} = 2 \times 2 \times 5 = 20$$

iii.

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

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

$$\Rightarrow 1764 = (2 \times 2) \times (3 \times 3) \times (7 \times 7)$$

$$\Rightarrow 1764 = (2 \times 3 \times 7) \times (2 \times 3 \times 7)$$

$$\Rightarrow 1764 = (2 \times 3 \times 7)^2$$

$$\Rightarrow \sqrt{1764} = 2 \times 3 \times 7 = 42$$

iv.

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

$$4096 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$$

$$\Rightarrow 4096 = (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (2 \times 2)$$

$$\Rightarrow 4096 = (2 \times 2 \times 2 \times 2 \times 2 \times 2) \times (2 \times 2 \times 2 \times 2 \times 2 \times 2)$$

$$\Rightarrow 4096 = (2 \times 2 \times 2 \times 2 \times 2 \times 2)^2$$

$$\Rightarrow \sqrt{4096} = 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 64$$

v.

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

$$7744 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 11 \times 11 \times 1$$

$$\Rightarrow 7744 = (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (11 \times 11)$$

$$\Rightarrow 7744 = (2 \times 2 \times 2 \times 11) \times (2 \times 2 \times 2 \times 11)$$

$$\Rightarrow 7744 = (2 \times 2 \times 2 \times 11)^2$$

$$\Rightarrow \sqrt{7744} = 2 \times 2 \times 2 \times 11 = 88$$

vi.

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

$$9604 = 2 \times 2 \times 7 \times 7 \times 7 \times 7$$

$$\Rightarrow 9604 = (2 \times 2) \times (7 \times 7) \times (7 \times 7)$$

$$\Rightarrow 9604 = (2 \times 7 \times 7) \times (2 \times 7 \times 7)$$

$$\Rightarrow 9604 = (2 \times 7 \times 7)^2$$

$$\Rightarrow \sqrt{9604} = 2 \times 7 \times 7 = 98$$

7	5929
7	847
11	121
11	11
	1

vii.

$$5929 = 7 \times 7 \times 11 \times 11$$

$$\Rightarrow 5929 = (7 \times 7) \times (11 \times 11)$$

$$\Rightarrow 5929 = (7 \times 11) \times (7 \times 11)$$

$$\Rightarrow 5929 = (7 \times 11)^2$$

$$\Rightarrow \sqrt{5929} = 7 \times 11 = 77$$

viii.

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

$$9216 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 1$$

$$\Rightarrow 9216 = (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (3 \times 3)$$

$$\Rightarrow 9216 = (2 \times 2 \times 2 \times 2 \times 2 \times 3) \times (2 \times 2 \times 2 \times 2 \times 2 \times 3)$$

$$\Rightarrow 9216 = 96 \times 96$$

$$\Rightarrow 9216 = (96)^2$$

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

ix.

23	529
23	23
	1

$$529 = 23 \times 23$$

$$529 = (23)^2$$

$$\sqrt{529} = 23$$

x.

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

$$8100 = 2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 5 \times 5 \times 1$$

$$\Rightarrow 8100 = (2 \times 2) \times (3 \times 3) \times (3 \times 3) \times (5 \times 5)$$

$$\Rightarrow 8100 = (2 \times 3 \times 3 \times 5) \times (2 \times 3 \times 3 \times 5)$$

$$\Rightarrow 8100 = 90 \times 90$$

$$\Rightarrow 8100 = (90)^2$$

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

5. 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

ii. 180

iii. 1008

iv. 2028

v. 1458

vi. 768

Solution:

i.

2	252
2	126
3	63
3	21
7	7
	1

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

$$= (2 \times 2) \times (3 \times 3) \times 7$$

Here, 7 cannot be paired.

\therefore We will multiply 252 by 7 to get perfect square.

$$\text{New number} = 252 \times 7 = 1764$$

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

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

$$\Rightarrow 1764 = (2 \times 2) \times (3 \times 3) \times (7 \times 7)$$

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

$$\Rightarrow 1764 = (2 \times 3 \times 7)^2$$

$$\Rightarrow \sqrt{1764} = 2 \times 3 \times 7 = 42$$

ii.

2	180
2	90
3	45
3	15
5	5
	1

$$180 = 2 \times 2 \times 3 \times 3 \times 5$$

$$= (2 \times 2) \times (3 \times 3) \times 5$$

Here, 5 cannot be paired.

\therefore We will multiply 180 by 5 to get perfect square.

$$\text{New number} = 180 \times 5 = 900$$

2	900
2	450
3	225
3	75
5	25
5	5
	1

$$900 = 2 \times 2 \times 3 \times 3 \times 5 \times 5 \times 1$$

$$\Rightarrow 900 = (2 \times 2) \times (3 \times 3) \times (5 \times 5)$$

$$\Rightarrow 900 = 2^2 \times 3^2 \times 5^2$$

$$\Rightarrow 900 = (2 \times 3 \times 5)^2$$

$$\Rightarrow \sqrt{900} = 2 \times 3 \times 5 = 30$$

iii.

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

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

$$= (2 \times 2) \times (2 \times 2) \times (3 \times 3) \times 7$$

Here, 7 cannot be paired.

\therefore We will multiply 1008 by 7 to get perfect square.

$$\text{New number} = 1008 \times 7 = 7056$$

2	7056
2	3528
2	1764
2	882
3	441
3	147
7	49
7	7
	1

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

$$\Rightarrow 7056 = (2 \times 2) \times (2 \times 2) \times (3 \times 3) \times (7 \times 7)$$

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

$$\Rightarrow 7056 = (2 \times 2 \times 3 \times 7)^2$$

$$\Rightarrow \sqrt{7056} = 2 \times 2 \times 3 \times 7 = 84$$

iv.

2	2028
2	1014
3	507
13	169
13	13
	1

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

$$= (2 \times 2) \times (13 \times 13) \times 3$$

Here, 3 cannot be paired.

\therefore We will multiply 2028 by 3 to get perfect square. New number = $2028 \times 3 = 6084$

2	6084
2	3042
3	1521
3	507
13	169
13	13
	1

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

$$\Rightarrow 6084 = (2 \times 2) \times (3 \times 3) \times (13 \times 13)$$

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

$$\Rightarrow 6084 = (2 \times 3 \times 13)^2$$

$$\Rightarrow \sqrt{6084} = 2 \times 3 \times 13 = 78$$

v.

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

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

$$= (3 \times 3) \times (3 \times 3) \times (3 \times 3) \times 2$$

Here, 2 cannot be paired.

\therefore We will multiply 1458 by 2 to get perfect square. New number = $1458 \times 2 = 2916$

2	2916
2	1458
3	729
3	243
3	81
3	27
3	9
3	3
	1

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

$$\Rightarrow 2916 = (3 \times 3) \times (3 \times 3) \times (3 \times 3) \times (2 \times 2)$$

$$\Rightarrow 2916 = 3^2 \times 3^2 \times 3^2 \times 2^2$$

$$\Rightarrow 2916 = (3 \times 3 \times 3 \times 2)^2$$

$$\Rightarrow \sqrt{2916} = 3 \times 3 \times 3 \times 2 = 54$$

vi.

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

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

$$= (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times 3$$

Here, 3 cannot be paired.

\therefore We will multiply 768 by 3 to get perfect square.

$$\text{New number} = 768 \times 3 = 2304$$

2	2304
2	1152
2	576
2	288
2	144
2	72
2	36
2	18
3	9
3	3
	1

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

$$\Rightarrow 2304 = (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (3 \times 3)$$

$$\Rightarrow 2304 = 2^2 \times 2^2 \times 2^2 \times 2^2 \times 3^2$$

$$\Rightarrow 2304 = (2 \times 2 \times 2 \times 2 \times 3)^2$$

$$\Rightarrow \sqrt{2304} = 2 \times 2 \times 2 \times 2 \times 3 = 48$$

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

i. 252

ii. 2925

iii. 396

iv. 2645

v. 2800

vi. 1620

Solution:

i.

2	252
2	126
3	63
3	21
7	7
	1

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

$$= (2 \times 2) \times (3 \times 3) \times 7$$

Here, 7 cannot be paired.

\therefore We will divide 252 by 7 to get perfect square. New number = $252 \div 7 = 36$

2	36
2	18
3	9
3	3
	1

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

$$\Rightarrow 36 = (2 \times 2) \times (3 \times 3)$$

$$\Rightarrow 36 = 2^2 \times 3^2$$

$$\Rightarrow 36 = (2 \times 3)^2$$

$$\Rightarrow \sqrt{36} = 2 \times 3 = 6$$

ii.

3	2925
3	975
5	325
5	65
13	13
	1

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

$$= (3 \times 3) \times (5 \times 5) \times 13$$

Here, 13 cannot be paired.

\therefore We will divide 2925 by 13 to get perfect square. New number = $2925 \div 13 = 225$

3	225
3	75
5	25
5	5
	1

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

$$\Rightarrow 225 = (3 \times 3) \times (5 \times 5)$$

$$\Rightarrow 225 = 3^2 \times 5^2$$

$$\Rightarrow 225 = (3 \times 5)^2$$

$$\Rightarrow \sqrt{225} = 3 \times 5 = 15$$

iii.

2	396
2	198
3	99
3	33
11	11
	1

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

$$= (2 \times 2) \times (3 \times 3) \times 11$$

Here, 11 cannot be paired.

\therefore We will divide 396 by 11 to get perfect square. New number = $396 \div 11 = 36$

2	36
2	18
3	9
3	3
	1

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

$$\Rightarrow 36 = (2 \times 2) \times (3 \times 3)$$

$$\Rightarrow 36 = 2^2 \times 3^2$$

$$\Rightarrow 36 = (2 \times 3)^2$$

$$\Rightarrow \sqrt{36} = 2 \times 3 = 6$$

iv.

5	2645
23	529
23	23
	1

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

$$\Rightarrow 2645 = (23 \times 23) \times 5$$

Here, 5 cannot be paired.

\therefore We will divide 2645 by 5 to get perfect square.

$$\text{New number} = 2645 \div 5 = 529$$

23	529
23	23
	1

$$529 = 23 \times 23$$

$$\Rightarrow 529 = (23)^2$$

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

v.

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

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

$$= (2 \times 2) \times (2 \times 2) \times (5 \times 5) \times 7$$

Here, 7 cannot be paired.

\therefore We will divide 2800 by 7 to get perfect square. New number = $2800 \div 7 = 400$

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

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

$$\Rightarrow 400 = (2 \times 2) \times (2 \times 2) \times (5 \times 5)$$

$$\Rightarrow 400 = (2 \times 2 \times 5)^2$$

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

vi.

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

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

$$= (2 \times 2) \times (3 \times 3) \times (3 \times 3) \times 5$$

Here, 5 cannot be paired.

\therefore We will divide 1620 by 5 to get perfect square. New number = $1620 \div 5 = 324$

2	324
2	162
3	81
3	27
3	9
3	3
	1

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

$$\Rightarrow 324 = (2 \times 2) \times (3 \times 3) \times (3 \times 3)$$

$$\Rightarrow 324 = (2 \times 3 \times 3)^2$$

$$\Rightarrow \sqrt{324} = 18$$

7. 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 students in the class. Find the number of students in the class.

Solution:

Let the number of students in the school be, x .

\therefore Each student donate Rs. x .

Total many contributed by all the students= $x \times x = x^2$ Given, $x^2 = \text{Rs.}2401$

7	2401
7	343
7	49
7	7
	1

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

$$\Rightarrow x^2 = (7 \times 7) \times (7 \times 7)$$

$$\Rightarrow x^2 = 49 \times 49$$

$$\Rightarrow x = \sqrt{(49 \times 49)}$$

$$\Rightarrow x = 49$$

∴ The number of students = 49

8. 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.

Solution

Let the number of rows be, x .

∴ the number of plants in each rows = x .

Total many contributed by all the students = $x \times x = x^2$

Given,

$$x^2 = \text{Rs.}2025$$

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

$$x^2 = 3 \times 3 \times 3 \times 3 \times 5 \times 5$$

$$\Rightarrow x^2 = (3 \times 3) \times (3 \times 3) \times (5 \times 5)$$

$$\Rightarrow x^2 = (3 \times 3 \times 5) \times (3 \times 3 \times 5)$$

$$\Rightarrow x^2 = 45 \times 45$$

$$\Rightarrow x = \sqrt{45 \times 45}$$

$$\Rightarrow x = 45$$

∴ The number of rows = 45 and the number of plants in each rows = 45.

9. Find the smallest square number that is divisible by each of the numbers 4, 9 and 10.

Solution:

2	4, 9, 10
	2, 9, 5

L.C.M of 4, 9 and 10 is $(2 \times 2 \times 9 \times 5)$ 180.

$$180 = 2 \times 2 \times 9 \times 5$$

$$= (2 \times 2) \times 3 \times 3 \times 5$$

$$= (2 \times 2) \times (3 \times 3) \times 5$$

Here, 5 cannot be paired.

\therefore we will multiply 180 by 5 to get perfect square.

Hence, the smallest square number divisible by 4, 9 and 10 = $180 \times 5 = 900$

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

Solution:

2	8, 15, 20
2	4, 15, 10
5	2, 15, 5
	2, 3, 1

L.C.M of 8, 15 and 20 is $(2 \times 2 \times 5 \times 2 \times 3)$ 120.

$$120 = 2 \times 2 \times 3 \times 5 \times 2$$

$$= (2 \times 2) \times 3 \times 5 \times 2$$

Here, 3, 5 and 2 cannot be paired.

\therefore We will multiply 120 by $(3 \times 5 \times 2)$ 30 to get perfect square.

Hence, the smallest square number divisible by 8, 15 and 20 = $120 \times 30 = 3600$

Exercise 6.4

1. Find the square root of each of the following numbers by Division method.

i. 2304

ii. 4489

iii. 3481

iv. 529

v. 3249

vi. 1369

vii. 5776

viii. 7921

ix. 576

x. 1024

xi. 3136

xii. 900

Solution:

i.

	48	
4	$\overline{2304}$	
+ 4	16	
<hr/>		
88	704	
+8	704	
<hr/>		
96	0	

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

ii.

	67	
6	$\overline{4489}$	
+ 6	36	
<hr/>		
127	889	
+7	889	
<hr/>		
134	0	

$$\therefore \sqrt{4489} = 67$$

iii.

	59	
5	$\overline{3481}$	
+5	25	
<hr/>		
109	981	
+9	981	
<hr/>		
118	0	

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

iv.

$$\begin{array}{r|l}
 23 & \\
 2 & 529 \\
 +2 & 4 \\
 \hline
 43 & 129 \\
 +3 & 129 \\
 \hline
 46 & 0
 \end{array}$$

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

$$\begin{array}{r|l}
 57 & \\
 5 & 3249 \\
 +5 & 25 \\
 \hline
 107 & 749 \\
 +7 & 749 \\
 \hline
 114 & 0
 \end{array}$$

v.

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

vi.

$$\begin{array}{r|l}
 37 & \\
 3 & 1369 \\
 +3 & 9 \\
 \hline
 67 & 469 \\
 +7 & 469 \\
 \hline
 74 & 0
 \end{array}$$

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

	76	
7	$\overline{5776}$	
+7	49	
146	876	
+6	876	
152	0	vii.

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

	89	
8	$\overline{7921}$	
+8	64	
169	1521	
+9	1521	
178	0	viii.

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

ix.

	24	
2	$\overline{576}$	
+2	4	
44	176	
+4	176	
48	0	

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

x.

	32
3	$\overline{1024}$
+3	9
62	124
+2	124
64	0

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

xi.

	56
5	$\overline{3136}$
+5	25
106	636
+6	636
112	0

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

xii.

	30
3	$\overline{900}$
+3	9
60	00

$$\therefore \sqrt{900} = 30$$

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

i. 144

ii. 4489

iii. 27225

iv. 390625

Solution:

i.

$$\begin{array}{r|l} 12 & \\ 1 & 144 \\ +1 & 1 \\ \hline 22 & 44 \\ +2 & 44 \\ \hline 24 & 0 \end{array}$$

$$\therefore \sqrt{144} = 12$$

Hence, the square root of the number 144 has 2 digits.

ii.

$$\begin{array}{r|l} 67 & \\ 6 & 4489 \\ +6 & 36 \\ \hline 127 & 889 \\ +7 & 889 \\ \hline 134 & 0 \end{array}$$

$$\therefore \sqrt{4489} = 67$$

Hence, the square root of the number 4489 has 2 digits.

iii.

	165
1	$\overline{27225}$
+1	1
26	172
+6	156
325	1625
+5	1625
350	0

$$\sqrt{27225} = 165$$

Hence, the square root of the number 27225 has 3 digits.

	625
6	$\overline{390625}$
+6	36
122	306
+2	244
1245	6225
+5	6225
1250	0

iv.

$$\therefore \sqrt{390625} = 625$$

Hence, the square root of the number 390625 has 3 digits.

3. Find the square root of the following decimal numbers.

i. 2.56

ii. 7.29

iii. 51.84

iv. 42.25

v. 31.36

Solution:

i.

	1.6
1	2.56
+1	1
26	156
+6	156
32	0

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

ii.

	2.7
2	7.29
+2	4
47	329
+7	329
54	0

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

iii.

	7.2
7	51.84
+7	49
142	284
+2	284
144	0

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

iv.

6.5	
6	$\overline{42.25}$
+ 6	36
125	625
+ 5	625
130	0

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

5.6	
5	$\overline{31.36}$
+5	25
106	636
+6	636
112	0

v.

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

4. 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

ii. 1989

iii. 3250

iv. 825

v. 4000

Solution:

i.

$$\begin{array}{r}
 2 \\
 \hline
 2 \quad \overline{402} \\
 +2 \quad 4 \\
 \hline
 4 \quad 02
 \end{array}
 \quad \therefore \sqrt{400} = 20$$

\therefore We must subtracted 2 from 402 to get a perfect square.

$$\text{New number} = 402 - 2 = 400$$

$$\begin{array}{r}
 20 \\
 \hline
 2 \quad \overline{400} \\
 +2 \quad 4 \\
 \hline
 40 \quad 00
 \end{array}$$

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

ii.

$$\begin{array}{r}
 44 \\
 \hline
 4 \quad \overline{1989} \\
 +4 \quad 16 \\
 \hline
 84 \quad 389 \\
 +4 \quad 336 \\
 \hline
 88 \quad 53
 \end{array}$$

\therefore We must subtracted 53 from 1989 to get a perfect square. New number = $1989 - 53 = 1936$

	44
4	$\overline{1936}$
+4	16
84	336
+4	336
88	0

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

iii.

	57
5	$\overline{3250}$
+ 5	25
107	750
+7	749
114	1

\therefore We must subtracted 1 from 3250 to get a perfect square.

$$\text{New number} = 3250 - 1 = 3249$$

	57
5	$\overline{3249}$
+ 5	25
107	749
+7	749
114	0

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

iv.

	28
2	$\overline{825}$
+ 2	4
48	425
+ 8	384
56	41

∴ We must subtracted 41 from 825 to get a perfect square.

New number = $825 - 41 = 784$

	28
2	$\overline{784}$
+ 2	4
48	384
+ 8	384
56	0

∴ $\sqrt{784} = 28$

	63
6	$\overline{4000}$
+ 6	36
123	400
+ 3	369
126	31

∴ We must subtracted 31 from 4000 to get a perfect square. New number = $4000 - 31 = 3969$

∴ $\sqrt{3969} = 63$

5. Find the least number which must be added to 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

(ii) 1750

(iii) 252

(iv) 1825

(v) 6412

Solution:

(i)

	22
2	525
+2	4
42	125
+2	84
44	41

	23
2	525
+2	4
43	125
+3	129

Here, $(22)^2 < 525 < (23)^2$

We can say 525 is $(129 - 125)$ 4 less than $(23)^2$.

\therefore If we add 4 to 525, it will be perfect square. New number = $525 + 4 = 529$

	23
2	529
+2	4
43	129
+3	129
46	0

$\therefore \sqrt{529} = 23$

	41	
4		1750
+4		16
81		150
+1		81
82		69

(ii)

	42	
4		1750
4		16
82		150
+2		164

Here, $(41)^2 < 1750 < (42)^2$

We can say 1750 is (164 – 150) 14 less than $(42)^2$.

∴ If we add 14 to 1750, it will be perfect square.

New number = 1750 + 14 = 1764

	42	
4		1764
4		16
82		164
+2		164

∴ $\sqrt{1764} = 42$

(iii)

	15
1	$\overline{252}$
+1	1
<hr/>	
25	152
+5	125
<hr/>	
30	27

	16
1	$\overline{252}$
+1	1
<hr/>	
26	152
+6	156
<hr/>	

Here, $(15)^2 < 252 > (16)^2$

We can say 252 is (156 – 152) 4 less than $(16)^2$.

\therefore If we add 4 to 252, it will be perfect square.

New number = $252 + 4 = 256$

	16
1	$\overline{256}$
+1	1
<hr/>	
26	156
+6	156
<hr/>	
32	0

$\therefore \sqrt{256} = 16$

(iv)

	42
4	1825
+4	16
82	225
+2	162
84	63

	43
4	1825
+4	16
83	225
+3	249

Here, $(42)^2 < 1825 < (43)^2$

We can say 1825 is $(249 - 225)$ 24 less than $(43)^2$.

\therefore If we add 24 to 1825, it will be perfect square.

New number = $1825 + 24 = 1849$

	43
4	1849
+4	16
83	249
+3	249
86	0

$\therefore \sqrt{1849} = 43$

(v)

	80
8	$\overline{6412}$
+8	64
160	120
0	0

	81
8	$\overline{6412}$
+8	64
161	12
+1	161

Here, $(80)^2 < 6412 < (81)^2$

We can say 6412 is $(161 - 12)$ 149 less than $(81)^2$.

\therefore If we add 149 to 6412, it will be perfect square.

New number = $6412 + 149 = 6561$

	81
8	$\overline{6561}$
+8	64
161	161
+1	161
162	0

$\therefore \sqrt{6561} = 81$

6. Find the length of the side of a square whose area is 441 m².

Solution:

Let the length of each side of the field = a Then, area of the field = 441 m²

$\Rightarrow a^2 = 441 \text{ m}^2$

$$\Rightarrow a = \sqrt{441} \text{ m}$$

	21
2	441
+ 2	4
41	41
+1	41
42	0

\therefore The length of each side of the field = $a \text{ m} = 21 \text{ m}$.

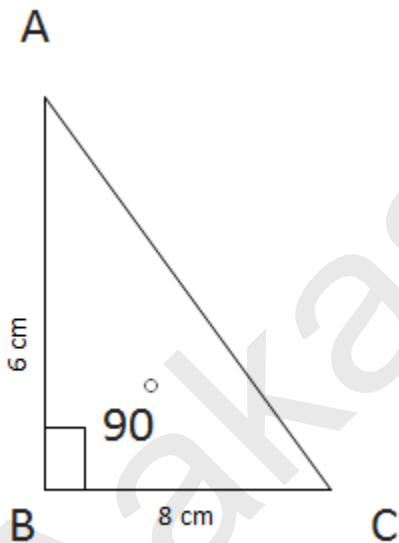
7. In a right triangle ABC, $\angle B = 90^\circ$.

a. If $AB = 6 \text{ cm}$, $BC = 8 \text{ cm}$, find AC

b. If $AC = 13 \text{ cm}$, $BC = 5 \text{ cm}$, find AB

Solution:

a.



Given, $AB = 6 \text{ cm}$, $BC = 8 \text{ cm}$

Let AC be $x \text{ cm}$.

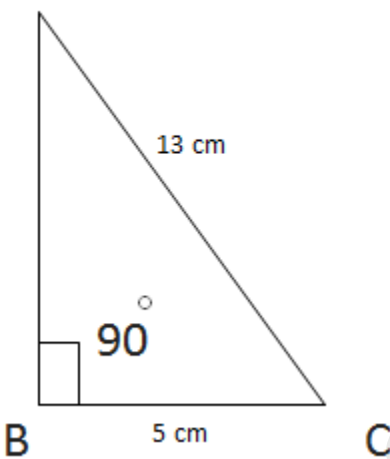
$$\therefore AC^2 = AB^2 + BC^2$$

$$\begin{aligned}
 AC &= \sqrt{AB^2 + BC^2} \\
 &= \sqrt{6^2 + 8^2} \\
 &= \sqrt{36 + 64} \\
 &= \sqrt{100} = 10
 \end{aligned}$$

Hence, AC = 10 cm.

b.

A



Given, AC = 13 cm, BC = 5 cm

Let AB be x cm.

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

$$\Rightarrow AC^2 - BC^2 = AB^2$$

$$\begin{aligned}
 AB &= \sqrt{AC^2 - BC^2} \\
 &= \sqrt{13^2 - 5^2} \\
 &= \sqrt{169 - 25} \\
 &= \sqrt{144} = 12
 \end{aligned}$$

Hence, AB = 12 cm

8. 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.

Solution:

Let the number of rows and column be, x .

\therefore Total number of row and column = $x \times x = x^2$ As per question, $x^2 = 1000$

$$\Rightarrow x = \sqrt{1000}$$

$$\begin{array}{r|l} 31 & 1000 \\ 3 & 9 \\ \hline +3 & 100 \\ 61 & 61 \\ \hline +1 & \end{array}$$

$$\begin{array}{r|l} 32 & 1000 \\ 3 & 9 \\ \hline +3 & 100 \\ 62 & 124 \\ \hline +2 & \end{array}$$

Here, $(31)^2 < 1000 < (32)^2$

We can say 1000 is (124 – 100) 24 less than $(32)^2$.

\therefore 24 more plants are needed.

9. 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 number of columns. How many children would be left out in this arrangement.

Solution:

Let the number of rows and column be, x .

\therefore Total number of row and column = $x \times x = x^2$ As per question, $x^2 = 500$

$$x = \sqrt{500}$$

	22
2	500
+2	4
42	100
+2	84
44	16

Hence, 16 children would be left out in the arrangement