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

Answer: (i) If a number has 1 or 9 in its unit digit, then its square ends with 1.

Since 81 has 1 as its unit digit, 1 will be the unit digit of its square. ($1 \times 1 = 1$)

Similar Examples - 91, 721, 4321

(ii) If a number has either 2 or 8 as its unit digit, then its square ends with 4.

Since 272 has 2 as its unit digit, 4 will be the unit digit of its square. ($2 \times 2 = 4$)

Similar Examples - 22, 2432, 147322

(iii) If a number has 1 or 9 in its unit digit, then its square ends with 1

Since 799 has 9 as its unit digit, 1 will be the unit digit of its square. ($9 \times 9 = 81$)

(iv) If a number has either 3 or 7 as its unit digit, then its square number ends with 9.

Since 3853 has 3 as its unit digit, 9 will be the unit digit of its square. ($3 \times 3 = 9$)

Similar Examples - 13, 433, 63

(v) If a number has either 4 or 6 as its unit digit, then its square ends with 6.

Since 1234 has 4 as its unit digit, 6 will be the unit digit of its square. ($4 \times 4 = 16$)

Similar Examples - 14, 114, 484, 1594

(vi) If a number has either 3 or 7 as its unit digit, then its square number ends with 9.

Since 26387 has 7 as its unit digit, 9 will be the unit digit of its square. ($7 \times 7 = 49$)

(viii) If a number has 0 as its unit digit, then its square ends with 0.

Since 99880 has 0 as its unit digit, 0 will be the unit digit of its square.

Similar Examples - 190, 1240, 167850

(ix) If a number has either 4 or 6 as its unit digit, then its square ends with 6.

Since 12796 has 6 as its unit digit, 6 will be the unit digit of its square. ($6 \times 6 = 36$)

(x) If a number has 5 as its unit digit, then its square ends with 5.

Since 55555 has 5 as its unit digit, 5 will be the unit digit of its square. ($5 \times 5 = 25$)

Similar Examples - 105, 85, 3425

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

Answer: The square of a number having 0, 1, 4, 5, 6 or 9 at its unit place is perfect squares. Also, the square of a number can only have an even number of zeros at the end.

In the above question unit digit of numbers (i) 1057 (ii) 23453 (iii) 7928 (iv) 222222 (v) 64000 (vi) 89722 (vii) 222000 (viii) 505050 are 7, 3, 8, 2, 000, 2, 000, 0 respectively.

So these numbers are obviously not perfect squares as they do not end with the digits 0, 1, 4, 5, 6 or 9 and also have odd number of zeros.

3. The squares of which of the following would be odd numbers?
(i) 431 (ii) 2826 (iii) 7779 (iv) 82004

Answer:

The square of an odd number is always odd and the square of an even number is always even.

Since 431 and 7779 are odd numbers, their squares will also be odd numbers.

Let's understand in detail.

We know that when the unit's digit of a number is 1 or 9, the square of the number will also have the unit digit ending with 1. Thus the square of 431 and 7779 will have their unit digit as 1 and thus they will be odd numbers.

4. 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 = ...

Answer: From the given pattern we see that the square of the given number has the same number of zeros before and after digit 2 as it is present in the original number.

11^2 = 121

101^2 = 10201

1001^2 = 1002001

100001^2 = 10000200001

10000001^2 = 100000020000001

5. Observe the following pattern and supply the missing numbers.
11^2 = 121
101^2 = 10201
10101^2 = 102030201
1010101^2 = ?
$?^2$ = 10203040504030201

Answer: nopeThe square of the given number has the same number of zeros before and after digit 2 as it has in the original number.

11^2 = 121

101^2 = 10201

10101^2 = 1002001

1010101^2 = 1020304030201

101010101^2 = 10203040504030201

6. Using the given pattern, find the missing numbers
$1^2 + 2^2 + 2^2 = 3^2$
$2^2 + 3^2 + 6^2 = 7^2$
$3^2 + 4^2 + 12^2 = 13^2$
$4^2 + 5^2 + \_^2 = 21^2$
$5^2 + \_^2 + 30^2 = 31^2$
$6^2 + 7^2 + \_^2 = \_^2$

Answer: Let's find the missing squares in the pattern.

The third number is the product of the first two numbers and the fourth number is obtained by adding 1 to the third number.

$1^2 + 2^2 + 2^2 = 3^2$

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

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

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

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

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

7. 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

Answer: Sum of Consecutive odd numbers is given.

We know that, sum of the first n odd natural numbers is n^2

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

Here number of term (n) is 5

Sum = $(5)^2$ = 25

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

Here number of term (n) is 10

Sum = $(10)^2$ = 100

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

Here number of term (n) is 12

Sum = $(12)^2$ = 144

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

Answer: We need to express 49 as sum of 7 odd numbers and 121 as sum of 11 odd numbers

We know that the sum of successive odd natural numbers is n^2

(i) 49 = $(7)^2$

Therefore, 49 is the sum of first 7 odd natural numbers

49 = 1 + 3 + 5 + 7 + 9 + 11 + 13

(ii) 121 = $(11)^2$

Therefore, 121 is the sum of first 11 odd natural numbers

121 = 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

Answer: '2n' numbers lie between the square of two consecutive numbers n and (n+1).

(i) 12 and 13

Here, n = 12. Thus, 2n = 2 × 12 = 24 ,

i.e., 24 numbers lie between $(12)^2$ and $(13)^2$

(ii) 25 and 26

Here, n = 25 gives 2 × 25 = 50 , i.e., 50 numbers lie between $(25)^2$ and $(26)^2$

(iii) 99 and 100

Here, n = 99 gives 2 × 99 = 198, i.e., 198 numbers between $(99)^2$ and $(100)^2$

Exercise 6.2

1. Find the square of the following numbers
(i) 32 (ii) 35 (iii) 86 (iv) 93 (v) 71 (vi) 46

Answer:

(i) 32 = 30 + 2

$32^2 = (30 + 2)^2$

= (30 + 2)(30 + 2)

= 30(30 + 2) + 2(30 + 2) you

$= 30^2 + 30 \times 2 + 2 \times 30 + 2^2$

= 900 + 60 + 60 + 4

= 1024

(ii) 35 = 30 + 5

$35^2 = (30 + 5)^2$

= (30 + 5)(30 + 5)

= 30(30 + 5) + 5(30 + 5)

$= 30^2 + 30 \times 5 + 5 \times 30 + 5^2$

= 900 + 150 + 150 + 25

= 1225

(iii) 86 = 80 + 6

$86^2 = (80 + 6)^2$

= (80 + 6)(80 + 6)

= 80(80 + 6) + 6(80 + 6)

$= 80^2 + 80 \times 6 + 6 \times 80 + 6^2$

= 6400 + 480 + 480 + 36

= 7396

(iv) 93 = 90 + 3

$93^2 = (90 + 3)^2$

$= (90 + 3)(90 + 3)$

$= 90(90 + 3) + 3(90 + 3)$

$= 90^2 + 90 \times 3 + 3 \times 90 + 3^2$

= 8100 + 270 + 270 + 9

= 8649

(v) 71 = 70 + 1

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

$= (70 + 1)(70 + 1)$

$= 70(70 + 1) + 1(70 + 1)$

$= 70^2 + 70 \times 1 + 1 \times 70 + 1^2$

= 4900 + 70 + 70 + 1

= 5041

(vi) 46 = 40 + 6

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

$= (40 + 6)(40 + 6)$

$= 40(40 + 6) + 6(40 + 6)$

$= 40^2 + 40 \times 6 + 6 \times 40 + 6^2$

= 1600 + 240 + 240 + 36

= 2116

2. Write a Pythagorean triplet whose one member is:

(i) 6 (ii) 14 (iii) 16 (iv) 18

Answer: For any natural number 'm' where m > 1, we have $(2m)^2 + (m^2 - 1)^2 = (m^2 + 1)^2$.

So, 2m, $m^2 - 1$ and $m^2 + 1$ forms a Pythagorean triplet

(i) If we take $m^2 + 1 = 6$,

$m^2 = 5$

The value of m will not be an integer.

If we take $m^2 - 1 = 6$

$m^2 = 7$

Again, the value of m will not be an integer.

Let 2m = 6

m = 6/2 = 3

$m^2 - 1 = (3)^2 - 1$

= 9 - 1 = 8

$m^2 + 1 = (3)^2 + 1$

= 9 + 1 = 10

Therefore, Pythagorean triplets are 6, 8 and 10

(ii) If we take $m^2 + 1 = 14$,

$m^2 = 13$

The value of the m will not be an integer.

If we take $m^2 - 1 = 14$

$m^2 = 15$

Again, the value of m will not be an integer.

Let 2m = 14

Thus, m = 7

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

= 49 - 1 = 48

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

= 49 + 1 = 50

Therefore, 14, 48, 50 are Pythagorean triplets.

(iii) If we take $m^2 + 1 = 16$,

$m^2 = 15$

The value of the m will not be an integer.

If we take $m^2 - 1 = 16$

$m^2 = 17$

The value of the m will not be an integer

Let 2m = 16

Thus, m = 8

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

= 64 - 1 = 63

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

= 64 + 1 = 65

Therefore, 16, 63, 65 are Pythagorean triplets.

(iv) If we take $m^2 + 1 = 18$,

$m^2 = 17$

The value of the m will not be an integer.

If we take $m^2 - 1 = 18$

$m^2 = 19$

Again, the value of m will not be an integer.

Let 2m = 18

Thus, m = 9

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

= 81 - 1 = 80

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

= 81 + 1 = 82

Therefore, 18, 80, 82 are Pythagorean triplets.

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

Answer: If the number ends with 1, then the one's digit of the square root of that number maybe 1 or 9

If the number ends with 6, the one's digit of the square root of that number maybe 4 or 6

If the number ends with 5, the one's digit of the square root of that number will be 5

(i) 9801

Since the number ends with 1, the one's digit of the square root maybe 1 or 9

(ii) 99856

Since the number ends with 6, the one’s digit of the square root maybe 4 or 6

(iii) 998001

Since the number ends with 1, the one’s digit of the square root maybe 1 or 9

(iv) 657666025

Since the number ends with 5, the one’s digit of the square root will be 5

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

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

Answer: The perfect square of a number has 0, 1, 2, 4, 5, 6, or 9 at the unit’s place.

(i) 153

Since the number 153 has 3 at its unit’s place, it is NOT a perfect square.

(ii) 257

Since the number 257 has 7 at its unit’s place, it is NOT a perfect square.

(iii) 408

Since the number 408 has 8 at its unit’s place, it is NOT a perfect square.

(iv) 441

Since the number 441 has 1 at its unit’s place, it is a perfect square of 21.

The numbers which are surely not perfect squares are (i) 153, (ii) 257, and (iii) 408

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

Answer: The sum of the first n odd natural numbers is n^2 i.e. every square number can be expressed as a sum of successive odd numbers starting from 1.

Consider √100

(i) 100 - 1 = 99
(ii) 99 - 3 = 96
(iii) 96 - 5 = 91
(iv) 91 - 7 = 84
(v) 84 - 9 = 75
(vi) 75 - 11 = 64

(vii) 64 - 13 = 51
(viii) 51 - 15 = 36
(ix) 36 - 17 = 19
(x) 19 - 19 = 0

We have subtracted successive odd numbers, and 10 steps have been required for getting the result as 0

So, the square root of 100 is 10

Consider √169

(i) 169 - 1 = 168
(ii) 168 - 3 = 165
(iii) 165 - 5 = 160
(iv) 160 - 7 = 153
(v) 153 - 9 = 144
(vi) 144 - 11 = 133
(vii) 133 - 13 = 120
(viii) 120 - 15 = 105
(ix) 105 - 17 = 88
(x) 88 - 19 = 69
(xi) 69 - 21 = 48
(xii) 48 - 23 = 25
(xiii) 25 - 25 = 0

We have subtracted successive odd numbers, and 13 steps have been required for getting the result as 0

So, the square root of 169 is 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

Answer: As we know, each prime factor in the prime factorization of the square of a number occurs twice the number of times than that of the prime factorization of the number itself. Let us use this to find the square root of a given square number by pairing the prime factors.

(i) 729 = 3 × 3 × 3 × 3 × 3 × 3

$\sqrt{729} = \sqrt{(\underline{3 \times 3} \times \underline{3 \times 3} \times \underline{3 \times 3})}$

= 3 × 3 × 3

= 27

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

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

$\sqrt{400} = \sqrt{(\underline{2 \times 2} \times \underline{2 \times 2} \times \underline{5 \times 5})}$

$= 2 \times 2 \times 5$

$= 20$

2	400
2	200
2	100
2	50
5	25
	5

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

$\sqrt{1764} = \sqrt{(\underline{2 \times 2} \times \underline{3 \times 3} \times \underline{7 \times 7})}$

$= 2 \times 3 \times 7$

$= 42$

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

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

$\sqrt{4096} = \sqrt{(\underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2})}$

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

$= 64$

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

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

$\sqrt{7744} = \sqrt{(\underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{11 \times 11})}$

$= 2 \times 2 \times 2 \times 11$

$= 88$

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

(vi) 9604 = 2 × 2 × 7 × 7 × 7 × 7

√9604 = √(2 × 2 × 7 × 7 × 7 × 7)

= 2 × 7 × 7

= 98

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

(vii) 5929 = 7 × 7 × 11 × 11

√5929 = √(7 × 7 × 11 × 11)

= 7 × 11

= 77

7	5929
7	847
11	121
11	11
	1

(viii) 9216 = 2 × 2 × 2 × 2 × 2 × 2 × 2 × 2 × 2 × 2 × 3 × 3

√9216 = √(2 × 2 × 2 × 2 × 2 × 2 × 2 × 2 × 2 × 2 × 3 × 3)

= 2 × 2 × 2 × 2 × 2 × 3

= 96

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

(ix) 529 = 23 × 23

√529 = √(23 × 23)

= 23

23	529
23	23
	1

(x) 8100 = 2 × 2 × 3 × 3 × 3 × 3 × 5 × 5

√8100 = √(2 × 2 × 3 × 3 × 3 × 3 × 5 × 5)

= 2 × 3 × 3 × 5

= 90

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

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

Answer: We have to find the smallest whole number by which the number should be multiplied so as to get a perfect square number

To get a perfect square, each factor of the given number must be paired.

(i) 252

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

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

Hence, prime factor 7 does not have its pair. If 7 gets a pair, then the number becomes a perfect square. Therefore, 252 has to be multiplied by 7 to get a perfect square.

So, perfect square is 252 × 7 = 1764

1764 = 2 × 2 × 3 × 3 × 7 × 7

Thus, √1764 = 2 × 3 × 7 = 42

(ii) 180

Hence, prime factor 5 does not have its pair. If 5 gets a pair, then the number becomes a perfect square. Therefore, 180 has to be multiplied by 5 to get a perfect square.

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

$$\begin{array}{r|l} 2 & 180 \\ 2 & 90 \\ 3 & 45 \\ 3 & 15 \\ 5 & 5 \\ 1 & 1 \end{array}$$

So, perfect square is 180 × 5 = 900

900 = 2 × 2 × 3 × 3 × 5 × 5

Thus, √900 = 2 × 3 × 5 = 30

(iii) 1008

Hence, prime factor 7 does not have its pair. If 7 gets a pair, then the number becomes a perfect square. Therefore, 1008 has to be multiplied by 7 to get a perfect square.

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

$$\begin{array}{r|l} 2 & 1008 \\ 2 & 504 \\ 2 & 252 \\ 2 & 126 \\ 3 & 63 \\ 3 & 21 \\ 7 & 7 \\ 1 & 1 \end{array}$$

So, perfect square is 1008 × 7 = 7056

7056 = 2 × 2 × 2 × 2 × 3 × 3 × 7 × 7

Thus, √7056 = 2 × 2 × 3 × 7 = 84

(iv) 2028

Hence, prime factor 3 does not have its pair. If 3 gets a pair, then the number becomes a perfect square. Therefore, 2028 has to be multiplied by 3 to get a perfect square.

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

$$\begin{array}{r|l} 2 & 2028 \\ 2 & 1014 \\ 13 & 507 \\ 13 & 39 \\ 3 & 3 \\ 1 & 1 \end{array}$$

So, perfect square is 2028 × 3 = 6084

6084 = 2 × 2 × 13 × 13 × 3 × 3

Thus, √6084 = 2 × 13 × 3 = 78

(v) 1458

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

3	1458
3	486
3	162
3	54
3	18
3	6
2	2
1	1

Hence, prime factor 2 does not have its pair. If 2 gets a pair, then the number becomes a perfect square. Therefore, 1458 has to be multiplied by 2 to get a perfect square.

So, perfect square is 1458 × 2 = 2916

2916 = 3 × 3 × 3 × 3 × 3 × 3 × 2 × 2

Thus, √2916 = 3 × 3 × 3 × 2 = 54

(vi) 768

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

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

Hence, prime factor 3 does not have its pair. If 3 gets a pair, then the number becomes a perfect square. Therefore, 768 has to be multiplied by 3 to get a perfect square.

So, perfect square is 768 × 3 = 2304

2304 = 2 × 2 × 2 × 2 × 2 × 2 × 2 × 2 × 3 × 3

Thus, √2304 = 2 × 2 × 2 × 2 × 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

Answer: We have to find the smallest whole number by which the number should be divided so as to get a perfect square number

To get a perfect square, each factor of the given number must be paired.

(i) 252

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

$$\begin{array}{r|l} 2 & \underline{252} \\ 2 & \underline{126} \\ 3 & \underline{63} \\ 3 & \underline{21} \\ 7 & \underline{7} \\ 1 & \underline{1} \end{array}$$

Hence, prime factor 7 does not have its pair. If the number is divided by 7, then the rest of the prime factor will be in pairs. Therefore, 252 has to be divided by 7 to get a perfect square.

252 ÷ 7 = 36

36 is perfect square

36 = 2 × 2 × 3 × 3

= $2^2 \times 3^2$

= $(2 \times 3)^2$

Thus, √36 = 2 × 3 = 6

(ii) 2925

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

$$\begin{array}{r|l} 5 & \underline{2925} \\ 5 & \underline{585} \\ 3 & \underline{117} \\ 3 & \underline{39} \\ 13 & \underline{13} \\ 1 & \underline{1} \end{array}$$

Hence, prime factor 13 does not have its pair. If the number is divided by 13, then the rest of the prime factor will be in pairs. Therefore, 2925 has to be divided by 13 to get a perfect square.

2925 ÷ 13 = 225

225 is a perfect square

225 = 5 × 5 × 3 × 3

= $5^2 \times 3^2$

= $(5 \times 3)^2$

Thus, √225 = 15

(iii) 396

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

$$\begin{array}{r|l} 3 & \underline{396} \\ 3 & \underline{132} \\ 2 & \underline{44} \\ 2 & \underline{22} \\ 11 & \underline{11} \\ 1 & \underline{1} \end{array}$$

Hence, prime factor 11 does not have its pair. If the number is divided by 11, then the rest of the prime factor will be in pairs.

Therefore, 396 has to be divided by 11 to get a perfect square.

396 ÷ 11 = 36

36 is a perfect square

36 = 3 × 3 × 2 × 2

= $3^2 \times 2^2$

= $(3 \times 2)^2$

Thus, √36 = 3 × 2 = 6

(iv) 2645

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

5	2645
23	529
23	23
1	1

Hence, prime factor 5 does not have its pair. If the number is divided by 5, then the rest of the prime factor will be in pairs.

Therefore, 2645 has to be divided by 5 to get a perfect square.

2645 ÷ 5 = 529

529 is a perfect square

529 = 23 × 23

= 23^2

Thus, √529 = 23

(v) 2800

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

2800 = 2 × 2 × 2 × 2 × 5 × 5 × 7

Hence, prime factor 7 does not have its pair. If the number is divided by 7, then the rest of the prime factor will be in pairs. Therefore, 2800 has to be divided by 7 to get a perfect square

2800 ÷ 7 = 400

400 is a perfect square

400 = 2 × 2 × 2 × 2 × 5 × 5

= $2^2 \times 2^2 \times 5^2$

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

Thus, √400 = 2 × 2 × 5 = 20

(vi) 1620

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

Hence, prime factor 5 does not have its pair. If the number is divided by 5, then the rest of the prime factor will be in pairs.

Therefore, 1620 has to be divided by 5 to get a perfect square.

1620 ÷ 5 = 324

324 is a perfect square

324 = 2 × 2 × 3 × 3 × 3 × 3

= $2^2 \times 3^2 \times 3^2$

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

Thus, $\sqrt{324} = 2 \times 3 \times 3 = 18$

7. The students of Class VIII of a school donated ₹ 2401 in all for the 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

Answer: Each student donated as many rupees as the number of students in the class i.e. money donated by each student is equal to the number of students in the class.

Thus, the total amount of donation is equal to the product of the number of students in the class and the money donated by each student.

Let the number of students in a class be x

So, money donated by each student is also x (as they donated as much amount as the number of students in the class).

The total amount of donation = ₹ 2401

Total amount of donation = Number of students × Money donated by each student

$2401 = x \times x$

$2401 = x^2$

$x = \sqrt{2401}$

$x = \sqrt{(7 \times 7 \times 7 \times 7)}$ [By prime factorising 2401]

$x = \sqrt{7^2 \times 7^2}$

$x = \sqrt{(7 \times 7)^2}$

$x = 7 \times 7 = 49$

Therefore, the number of students in class is 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

Answer: Each row contains as many plants as the number of rows i.e. the number of rows equal to the number of plants in each row.

Thus, the total number of plants to be planted is equal to the product of the number of plants and number of rows.

Let the number of rows be x

The number of plants in each row is also x

The total number of plants = 2025

(Number of rows) × (Number of plants in each row) = 2025

$x \times x = 2025$

$x^2 = 2025$

$x = \sqrt{2025}$

$x = \sqrt{(5 \times 5 \times 3 \times 3 \times 3 \times 3)}$ [By prime factorising 2025]

$x = \sqrt{(5^2 \times 3^2 \times 3^2)}$

$x = \sqrt{(5 \times 3 \times 3)^2}$

$x = 5 \times 3 \times 3 = 45$

Therefore, the number of rows and the number of plants in each row is 45.

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

Answer: The number that will be perfectly divisible by each of the numbers 4, 9, and 10 will be their LCM.

$$\begin{array}{r|l} 2 & 4, 9, 10 \\ 2 & 2, 9, 5 \\ 3 & 1, 9, 5 \\ 3 & 1, 3, 5 \\ 5 & 1, 1, 5 \\ 1 & 1, 1, 1 \end{array}$$

LCM of 4, 9, 10

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

Here, the prime factor 5 does not have a pair. Therefore 180 is multiplied by 5 then the number obtained is a perfect square.

Thus, $180 \times 5 = 900$

So, 900 is the smallest square that is divisible by 4, 9, and 10

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

Answer: The number that will be perfectly divisible by each of the numbers 8, 15, and 20 will be their LCM.

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

LCM of 8,15, 20

= 2 × 2 × 2 × 3 × 5

= 120

Here we see that prime factors 2, 3, and 5 do not have their respective pairs.

Therefore 120 is not a perfect square.

If 120 is multiplied by 2 × 3 × 5, then the number obtained will be a perfect square.

Therefore, 120 × 2 × 3 × 5 = 3600

Thus, the perfect square number is 3600 which is completely divisible by 8, 15, and 20.

Exercise 6.4

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

Answer:

What is known: Perfect Squares

What is unknown: Square root by using the division method.

Reasoning: When a number is large, even the method of trading the square root by prime factorization becomes lengthy and difficult, so the division method is used.

(i) 2304

Steps 1: The square root of 2304 is calculated as follows.

	48
4	2304 16
88	704 704
	0

Since the remainder is zero, we can conclude that

√2304 = 48

(ii) 4489

√4489 = 67

	67
6	4489
	36
127	889
	889
	0

(iii) 3481

√3481 = 59

	59
5	3481
	25
109	981
	981
	0

(iv) 529

√529 = 23

	23
2	529
	4
43	129
	129
	0

(v) 3249

√3249 = 57

	57
5	3249
	25
107	749
	749
	0

(vi) 1369

	37
3	1369
	9
67	469
	469
	0

Therefore,

√1369 = 37

(vii) 5776

	76
7	5776
	49
146	876
	876
	0

Therefore,

√5776 = 76

(viii) 7921

	89
8	7921
	64
169	1521
	1521
	0

√7921 = 89

(ix) 576

	24
2	576
	4
44	176
	176
	0

√576 = 24

(x) 1024

	32
3	1024
	9
62	124
	124
	0

√1024 = 32

(xi) 3136

$\sqrt{3136} = 56$

	56
5	3136 25
106	636 636
	0

(xii) 900

$\sqrt{900} = 30$

	30
3	900 9
60	00 00
	0

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

(i) 64 (ii) 144 (iii) 4489 (iv) 27225 (v) 390625

Answer: If a perfect square is of n digits then its square root will have n/2 digits if n is even and (n + 1)/2 if n is odd

(i) 64

n = 2 (even)

Number of digits in its square root = $\frac{2}{2} = 1$

(ii) 144

n = 3 (odd)

Number of digits in its square root = $\frac{n+1}{2} = \frac{3+1}{2} = \frac{4}{2} = 2$

(iii) 4489

n = 4 (even)

Number of digits in its square root = $\frac{4}{2} = 2$

(iv) 27225

n = 5 (odd)

Number of digits in its square root = $\frac{n+1}{2} = \frac{5+1}{2} = \frac{6}{2} = 3$

(v) 390625

n = 6 (even)

Number of digits in its square root = $\frac{6}{2} = 3$

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

Answer: To find the square root of decimal numbers, put bars on the integral part of the number and place bars on the decimal part on every pair of digits starting with the first decimal place.

(i) 2.56

The square root of 2.56 is calculated as

1.6
1 | 2.56
  | 1
26 | 156
   | 156
   | 0

√2.56 = 1.6

(ii) 7.29

2.7
2 | 7.29
  | 4
47 | 329
   | 329
   | 0

√7.29 = 2.7

(iii) 51.84

7.2
7 | 51.84
  | 49
142 | 284
    | 284
    | 0

√51.84 = 7.2

(iv) 42.25

6.5
6 | 42.25
  | 36
125 | 625
    | 625
    | 0

√42.25 = 6.5

(v) 31.36

	5.6
5	31.36
	25
106	636
	636
	0

√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**

Answer: The given numbers that are not perfect squares

If we subtract the remainder from the number, we get a perfect square.

(i) 402

	20
2	402
	4
40	002
	000
	2

The square of 20 is less than 402 by 2. If we subtract the remainder from the number, we get a perfect square.

Therefore, required perfect square = 402 - 2 = 400

√400 = 20

(ii) 1989

	44
4	1989
	16
84	389
	336
	53

The remainder obtained is 53. The square of 44 is less than the given number 1989 by 53.

Therefore, required perfect square = 1989 - 53 = 1936

√1936 = 44

(iii) 3250

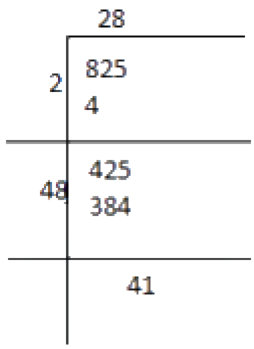
	57
5	3250
	25
107	750
	749
	1

The remainder obtained is 1. The square of 57 is less than 3250 by 1. Therefore, the required perfect square = 3250 - 1 = 3249

√3249 = 57

(iv) 825

The square root of 825 is calculated as

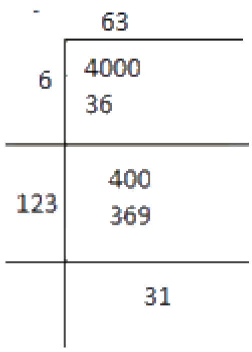


The remainder is 41.it shows that the square of 28 is less than 825 by 41. Therefore, required perfect square = 825 - 41 = 784

√784 = 28

(v) 4000

The square root of 4000 is calculated as



The remainder is 31, it represents that the square of 63 is less than 4000 by 31. Therefore, the square perfect square = 4000 - 31 = 3969.

√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

Answer: Given numbers are not perfect squares.

First find out the square root of the number, then round it off to the next whole number. That number is the next possible perfect square root. So we add the difference between the two to get the perfect square.

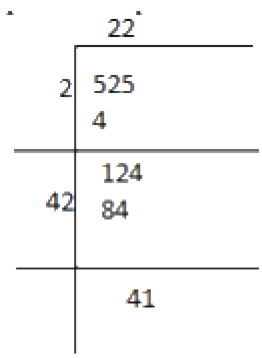
(i) 525

The square root of 525 is calculated as

It is evident that $22^2 < 525$

The next perfect square of a whole number is

$23^2 = 529$



Hence, the number to be added to 529

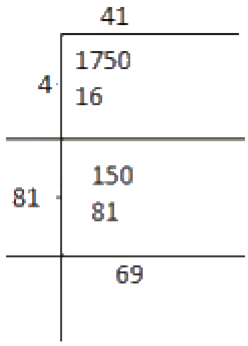
= 529 - 525

= 4

The required perfect square is 525 + 4 = 529 whose root is 23

(ii) 1750

The square root of 1750 is calculated as



This shows that $41^2 < 1750$

Next perfect square is $42^2 = 1764$

Hence number to be added to 1750

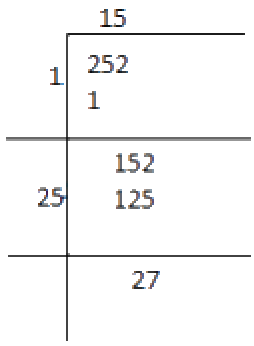
= 1764 - 1750

= 14

The required perfect square is 1750 + 14 = 1764 whose root is 42

(iii) 252

The square root of 252 is calculated as



This shows that $15^2 < 252$

Next perfect square is $16^2 = 256$

Hence number to be added to 252

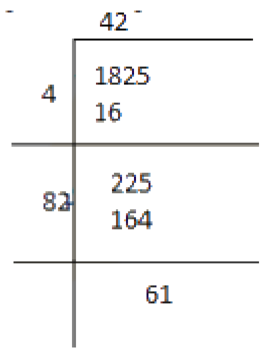
= 256 - 252

= 4

The required perfect square is 252 + 4 = 256 whose root is 16

(iv) 1825

The square root of 1825 is calculated as



This shows that $42^2 < 1825$

Next perfect square is $43^2 = 1849$

Hence number to be added to 1825

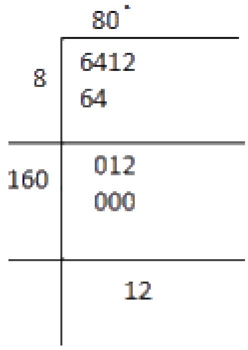
$= 43^2 - 1825$

= 1849 - 1825

= 24

The required perfect square is 1825 + 24 = 1849 whose root is 43

(v) 6412



The square root of 6412 is calculated as

This shows that $80^2 < 6412$

Next perfect square is $81^2 = 6561$

Hence number to be added to 6412 is

= 6561 - 6412

= 149

The required perfect square is 6412 + 149 = 6561 whose root is 81

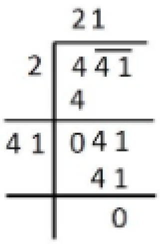
6. Find the length of the side of a square whose area is 441 m^2

Answer: We know that,

Area of the square = side of a square × side of a square

Since the area of a square is equal to the square of its side., the length of the side can be calculated by finding the square root of the area.

441 m^2 = $(\text{side of a square})^2$

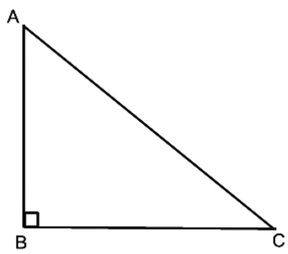


Side of a square = √441 = 21 m

The length of the side of a square whose area is 441 m^2 is 21 m

7. In a right triangle ABC, ∠ B = 90°, (i) If AB = 6 cm, BC = 8 cm, find AC
(ii) If AC = 13 cm, BC = 5 cm, find AB

Answer: In a right-angled triangle if two sides are given then the third side can be calculated using the Pythagoras theorem.



Given that, in the right triangle ABC, ∠ B = 90°, thus AC is the hypotenuse

(i) AB = 6 cm, BC = 8 cm, AC = ?

According to Pythagoras theorem,

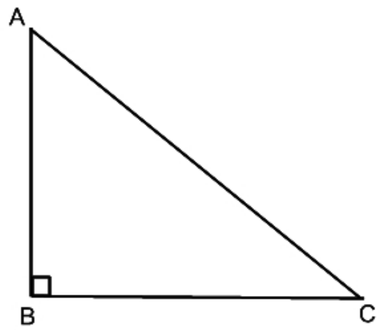
$AC^2 = AB^2 + BC^2$

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

$AC^2 = 100$

$AC = \sqrt{100} = 10$ cm

(ii) AC = 13 cm, BC = 5 cm, AB = ?



According to Pythagoras theorem

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

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

$169 = AB^2 + 25$

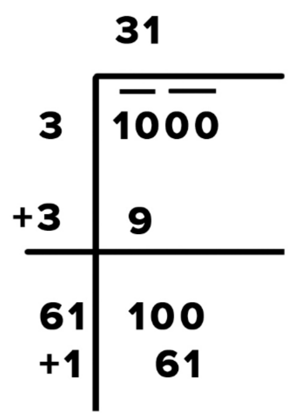
$AB^2 = 169 - 25 = 144$

$AB = \sqrt{144} = 12$ cm

Therefore, the length of sides AC and sides AB in the respective right triangles are AC = 10 cm and 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.

Answer: Given that, he wants to plant these in such a way that the number of rows and the number of columns remain same.



Number of plants = 1000

Thus, we will find the square root of 1000

The square root of 1000 can be calculated by the long division method.

It shows that $31^2 < 1000$

Thus, we will take the next number 32 and the square of 32 is 1024

Hence, the number to be added to 1000 to make it a perfect square is:

= 1024 -1000

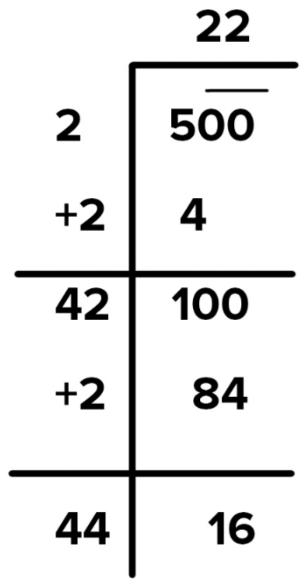
= 24

Thus, the required number of plants = 24

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

Answer:

Number of children in a school = 500



Given that, for a P.T. drill they have to stand in such a manner that the number of rows is equal to number of columns.

Thus, we will find the square root of 500

The square root of 500 can be calculated using long division method.

The remainder is 16. It shows that

$(22)^2 < 500$.

Therefore, a perfect square can be obtained by subtracting 16 from the given number. Therefore, the required perfect square is

= 500 - 16

= 484

Thus, 484 students can be perfectly arranged and the number of children left out in PT drill arrangement will be 16.