Squares and Square Roots: Exercise 6.3

Q.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
***Sol.* (i) 9801:** The given number 9801 ends with digit '1' then the one's digit of the square root of given number may be 1 or 9.

(ii) 99856: The given number 99856 ends with digit '6' then the one's digit of the square root of given number may be 4 or 6.

(iii) 998001: The given number 998001 ends with digit '1' then the one's digit of the square root of given number may be 1 or 9.

(iv) 657666025: The given number 657666025 ends with digit '5' then the one's digit of the square root of given number may be 5.

Q.2 Without doing any calculation, find the numbers which are surely not perfect squares.
(i) 153 (ii) 257 (iii) 408 (iv) 441
Sol. Since, perfect square of a number ends only with digits 0, 1, 4, 5, 6, 9 or even number of zeros.
(i) 153: It is not perfect square number. Because given number153 ends with '3'.
(ii) 257: It is not perfect square number. Because given number 257 ends with '7'.
(iii) 408: It is not perfect square number. Because given number 408 ends with '8'.
(iv) 441: It can be perfect square number. Because given number 441 ends with '1'.

Q.3 Find the square roots of 100 and 169 by the method of repeated subtraction.
Sol. Since, sum of first n odd natural numbers is n^2.
Now, for finding the square root of 100 by repeated subtraction method:
(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
From above, we get the zero at the 10^{th} step.
Thus, $\sqrt{100}$ = 10.

And finding square root of 169 by repeated subtraction method:
(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
(xii) 25 – 25 = 0
From above, we get zero at the 13^{th} step.
Thus, $\sqrt{169}$ = 13.

Q.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**

Sol. (i) Square root of 729 by the prime factorization method:

$$\begin{array}{r|l} 3 & 729 \\ 3 & 729 \\ 3 & 81 \\ 3 & 27 \\ 3 & 9 \\ 3 & 3 \\ & 1 \end{array}$$

So, prime factors of 729 = 3 x 3 x 3 x 3 x 3 x 3

Therefore, square root of 729, $\sqrt{729}$ = 3 x 3 x 3 = 27.

(ii) Square root of 400 by the prime factorization method:

$$\begin{array}{r|l} 2 & 400 \\ 2 & 200 \\ 2 & 100 \\ 2 & 50 \\ 5 & 25 \\ 5 & 5 \\ & 1 \end{array}$$

So, prime factors of 400 = 2 x 2 x 2 x 2 x 5 x 5

Therefore, square root of 400, $\sqrt{400}$ = 2 x 2 x 5 = 20

(iii) Square root of 1764 by the prime factorization method:

$$\begin{array}{r|l} 2 & 1764 \\ 2 & 882 \\ 3 & 441 \\ 3 & 147 \\ 7 & 49 \\ 7 & 7 \\ & 1 \end{array}$$

So, prime factors of 1764 = 2 x 2 x 3 x 3 x 7 x 7

Therefore, square root of 1764, $\sqrt{1764}$ = 2 x 3 x 7 = 42

(iv) Square root of 4096 by the prime factorization method:

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

So, prime factors of 4096 = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2

Therefore, square root of 4096, $\sqrt{4096}$ = 2 x 2 x 2 x 2 x 2 x 2 = 64

(v) Square root of 7744 by the prime factorization method:

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

So, prime factors of 7744 = 2 x 2 x 2 x 2 x 2 x 2 x 11 x 11

Therefore, square root of 7744, $\sqrt{7744}$ = 2 x 2 x 2 x 11 = 88

(vi) Square root of 9604 by the prime factorization method:

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

So, prime factors of 9604 = 2 x 2 x 7 x 7 x 7 x 7

Therefore, square root of 9604, $\sqrt{9604}$ = 2 x 7 x 7 = 98

(vii) Square root of 5929 by the prime factorization method:

$$\begin{array}{r|l} 7 & 5929 \\ 7 & 847 \\ 11 & 121 \\ 11 & 11 \\ & 1 \end{array}$$

So, prime factors of 5929 = 7 x 7 x 11 x 11

Therefore, square root of 5929, $\sqrt{5929}$ = 7 x 11 = 77

(viii) Square root of 9216 by the prime factorization method:

$$\begin{array}{r|l} 2 & 9216 \\ 2 & 4608 \\ 2 & 2304 \\ 2 & 1152 \\ 2 & 576 \\ 2 & 288 \\ 2 & 144 \\ 2 & 72 \\ 2 & 36 \\ 2 & 18 \\ 3 & 9 \\ 3 & 3 \\ & 1 \end{array}$$

So, prime factors of 9216 = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 3 x 3

Therefore, square root of 9216, $\sqrt{9216}$ = 2 x 2 x 2 x 2 x 2 x 3 = 96

(ix) Square root of 529 by the prime factorization method:

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

So, prime factors of 529 = 23 x 23

Therefore, square root of 529, $\sqrt{529}$ = 23

(x) Square root of 8100 by the prime factorization method:

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

So, prime factors of 8100 = 2 x 2 x 3 x 3 x 3 x 3 x 5 x 5

Therefore, square root of 8100, $\sqrt{8100}$ = 2 x 3 x 3 x 5 = 90

Q.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

Sol. (i) Firstly, prime factors of 252:

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

So, 252 = 2 x 2 x 3 x 3 x 7

Since in prime factors, 7 has no pair. So, 252 should be multiplied by 7 so that it becomes a perfect square.

252 x 7 = 1764

Therefore square root of 1764, $\sqrt{1764}$ = 2 x 3 x 7 = 42

(ii) Firstly, prime factors of 180:

2|180
2|90
3|45
3|15
5|5
|1

So, 180 = 2 x 2 x 3 x 3 x 5

Since in prime factors, 5 has no pair. So, 180 should be multiplied by 5 so that it becomes a perfect square.

180 x 5 = 900

Therefore square root of 900, $\sqrt{900}$ = 2 x 3 x 5 = 30

(iii) Firstly, prime factors of 1008:

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

So, 1008 = 2 x 2 x 2 x 2 x 3 x 3 x 7
Since in prime factors, 7 has no pair. So, 1008 should be multiplied by 7 so that it becomes a perfect square.
1008 x7 = 7056
Therefore square root of 7056, $\sqrt{7056}$ = 2 x 2 x 3 x 7 = 84

(iv) Firstly, prime factor of 2028:

$$\begin{array}{r|l} 2 & 2028 \\ 2 & 1014 \\ 3 & 507 \\ 3 & 169 \\ 13 & 13 \\ & 1 \end{array}$$

So, 2028 = 2 x 2 x 3 x 13 x 13
Since in prime factors, 3 has no pair. So 2028 should be multiplied by 7 so that it becomes a perfect square.
2028 x3 = 6084
Therefore square root of 6084, $\sqrt{6084}$ = 2 x 3 x 13 = 78

(v) Firstly, prime factors of 1458:

$$\begin{array}{r|l} 3 & 1458 \\ 3 & 729 \\ 3 & 243 \\ 3 & 81 \\ 3 & 27 \\ 3 & 9 \\ 3 & 3 \\ & 1 \end{array}$$

So, 1458 = 2 x 3 x 3 x 3 x 3 x 3 x 3
Since in prime factors, 2 has no pair. So 1458 should be multiplied by 2 so that it becomes a perfect square.
1458 x 2 = 2916
Therefore square root of 2916, $\sqrt{2916}$ = 2 x 3 x 3 x 3 = 54

(vi) Firstly, prime factors of 768

$$\begin{array}{r|l} 2 & 768 \\ 2 & 384 \\ 2 & 192 \\ 2 & 96 \\ 2 & 48 \\ 2 & 24 \\ 2 & 12 \\ 2 & 6 \\ 3 & 3 \\ & 1 \end{array}$$

So, 768 = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 3
Since in prime factors, 3 has no pair. So, 768 should be multiplied by 3 so that it becomes a perfect square.
768 x3 = 2304
Therefore square root of 2304, $\sqrt{2304}$ = 2 x 2 x 2 x 2 x 3 = 48

Q.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
Sol. (i) Firstly, prime factors of 252

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

So, 252 = 2 x 2 x 3 x 3 x 7
Since in prime factors, 7 has no pair. So, 252 should be divided by 7 so that it becomes a perfect square.
252 ÷7 = 36
Therefore square root of 36, $\sqrt{36}$ = 2 x 3 = 6

(ii) Firstly, prime factors of 2925

$$\begin{array}{r|l} 3 & 2925 \\ 3 & 975 \\ 5 & 325 \\ 5 & 65 \\ 13 & 13 \\ & 1 \end{array}$$

So, 2925 = 3 x 3 x 5 x 5 x 13
Since in prime factors, 13 has no pair. So, 2925 should be divided by 13 so that it becomes a perfect square.
2925 ÷13 = 225
Therefore square root of 225, $\sqrt{225}$ = 3 x 5 = 15

(iii) Firstly, prime factors of 396:

2|396
2|196
3|99
3|33
11|11
|1

So, 396 = 2 x 2 x 3 x 3 x 11
Since in prime factors, 11 has no pair. So, 396 should be divided by 11 so that it becomes a perfect square.
Therefore, 396 ÷11 = 36
Therefore square root of 36, $\sqrt{36}$ = 2 x 3 = 6

(vi) Firstly, prime factor of 2645:

5|2645
23|529
23|23
|1

So, 2645 = 5 x 23 x 23
Since in prime factor 5 has no pair. So, 396 should be divided by 5 so that it becomes a perfect square.
2645 ÷5 = 529
Therefore square root of 529, $\sqrt{529}$ = 23 x 23 = 23

(v) Firstly, prime factors of 2800:

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

So, 2800 = 2 x 2 x 2 x 2 x 5 x 5 x 7
Since in prime factors, 7 has no pair. So, 396 should be divided by 7 so that it becomes a perfect square.
2800 ÷7 = 400
Therefore square root of 400, $\sqrt{400}$ = 2 x 2 x 5 = 20

(vi) Firstly, prime factors of 1620:

$$
\begin{array}{r|l}
2 & 1620 \\
2 & 810 \\
3 & 405 \\
3 & 135 \\
3 & 45 \\
3 & 15 \\
5 & 5 \\
 & 1
\end{array}
$$

So, 1620 = 2 x 2 x 3 x 3 x 3 x 3 x 5
Since in prime factors, 5 has no pair. So, 1620 should be divided by 5 so that it becomes a perfect square.

1620 ÷5 = 324

Therefore square root of 324, $\sqrt{324}$ = 2 x 3 x 3 = 18

Q.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.

Sol. Since, each student of class VIII of a school donated as many rupees as the number of students in the class.
So, number of students in class will be the square root of the amount donated.
Now, the total amount donated = Rs 2401.

Therefore, number of students in class = $\sqrt{2401}$

Prime factors of 2401:

$$
\begin{array}{r|l}
7 & 2401 \\
7 & 343 \\
7 & 49 \\
7 & 7 \\
 & 1
\end{array}
$$

So, 2401 = 7 x 7 x 7 x 7

Square root of 2401, $\sqrt{2401}$ = 7 x 7 = 49.

Thus, number of students in the class VIII is 49.

Q.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.

Sol. Since, each row contains as many plants as the number of rows in the garden.
So, number of rows is equal to square root of 2025.

Number of rows = $\sqrt{2025}$

Prime factors:

5|2025
5|405
3|81
3|27
3|9
3|3
|1

2025 = 5 x 5 x 3 x 3 x 3 x 3

Therefore, square root of 2025, $\sqrt{2025}$ = 5 x 3 x 3 = 45

Thus, the number of rows and the number of plants in each row = 45

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

Sol. Firstly we need to find the LCM of 4, 9 and 10.

So, LCM of 4, 9 and 10 = 180

Now prime factors of 180:

2|180
2|90
3|45
3|15
5|5
|1

So, 180 = 2 x 2 x 3 x 3 x 5

Since in prime factors, 5 has no pair. So 180 should be multiplied by 5 so that it becomes a perfect square.

180 x 5 = 900

Thus, the smallest square number which is divisible by 4, 9 and 10 = 900

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

Sol. Firstly we need to find the LCM of 8, 15 and 20.

So, LCM is 120.

2|120
2|60
2|30
3|15
5|5
|1

Therefore, prime factors of 120 = 2 x 2 x 2 x 3 x 5

Since in prime factor 2, 3 & 5 has no pair. So, 120 should be multiplied by 2 x 3 x 5 so that it becomes a perfect square.

120 x 2 x 3 x 5 = 3600

Thus, the smallest square number divisible by 8, 15 and 20 = 3600