SpeedLabs

MATHS

CBSE 8th

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Square and Square roots
Exercise 6.3

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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) If the number ends with 1, then the one's digit of the square root of that number may be 1 or 9. Therefore, one's digit of the square root of 9801 is either 1 or 9.

(ii) If the number ends with 6, then the one's digit of the square root of that number may be 4 or 6. Therefore, one's digit of the square root of 99856 is either 4 or 6.

(iii) If the number ends with 1, then the one's digit of the square root of that number may be 1 or 9. Therefore, one's digit of the square root of 998001 is either 1 or 9.

(iv) If the number ends with 5, then the one's digit of the square root of that number will be 5. Therefore, the one's digit of the square root of 657666025 is 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: The perfect squares of a number can end with any of the digits 0, 1, 4, 5, 6, or 9 at unit's place. Also, a perfect square will end with even number of zeroes, if any.

(i) Since the number 153 has its unit's place digit as 3, it is not a perfect square.

(ii) Since the number 257 has its unit's place digit as 7, it is not a perfect square.

(iii) Since the number 408 has its unit's place digit as 8, it is not a perfect square.

(iv) Since the number 441 has its unit's place digit as 1, it is a perfect square.

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

Sol: We know that the sum of the first n odd natural numbers is n^2.

Consider $\sqrt{100}$

(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 starting from 1 to 100, and obtained 0 at 10th step.

Therefore, $\sqrt{100} = 10$

The square root of 169 can be obtained by the method of repeated subtraction as follows.

(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 starting from 1 to 169, and obtained 0 at 13th step.

Therefore, $\sqrt{169} = 13$

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

(i) 729 (ii) 400 (iii) 1764 (iv) 4096 (v) 7744

(vi) 9604 (vii) 5929 (viii) 9216 (ix) 529 (x) 8100

Sol: (i) 729 can be factorized as follows.

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

$729 = \underline{3 \times 3} \times \underline{3 \times 3} \times \underline{3 \times 3}$

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

(ii) 400 can be factorized as follows

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

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

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

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

(iii) 1764 can be factorized as follows

$1764 = \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{7 \times 7}$

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

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

(iv) 4096 can be factorized as follows.

$4096 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2}$

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

(v) 7744 can be factorized as follows.

$7744 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{11 \times 11}$

$\therefore \sqrt{7744} = 2 \times 2 \times 2 \times 11 = 88.$

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

(vi) 9604 can be factorized as follows.

$9604 = \underline{2 \times 2} \times \underline{7 \times 7} \times \underline{7 \times 7}$

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

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

(vii) 5929 can be factorized as follows.

$5929 = \underline{7 \times 7} \times \underline{11 \times 11}$

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

7	5929
7	847
11	121
11	11
	1

(viii) 9216 can be factorized as follows.

$9216 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{3 \times 3}$

$\therefore \sqrt{9216} = 2 \times 2 \times 2 \times 2 \times 2 \times 3 = 96$

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 can be factorized as follows.

$529 = \underline{23 \times 23}$

$\therefore \sqrt{529} = 23$

23	529
23	23
	1

(x) 8100 can be factorized as follows.

$8100 = \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{3 \times 3} \times \underline{5 \times 5}$

$\therefore \sqrt{8100} = 2 \times 3 \times 3 \times 5 = 90$

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

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) 252 can be factorized as follows.

$252 = \underline{2 \times 2} \times \underline{3 \times 3} \times 7$

Here, prime factor 7 does not have its pair.

If 7 gets a pair, then the number will become a perfect square.

Therefore, 252 has to be multiplied with 7 to obtain a perfect square.

$252 \times 7 = \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{7 \times 7}$

Therefore, $252 \times 7 = 1764$ is a perfect square.

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

2	252
2	126
3	63
3	21
7	7
	1

(ii) 180 can be factorized as follows.

$180 = \underline{2 \times 2} \times \underline{3 \times 3} \times 5$

Here, prime factor 5 does not have its pair.

If 5 gets a pair, then the number will become a perfect square.

Therefore, 180 has to be multiplied with 5 to obtain a perfect square.

$180 \times 5 = 900 = \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{5 \times 5}$

Therefore, $180 \times 5 = 900$ is a perfect square.

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

2	180
2	90
3	45
3	15
5	5
	1

(iii) 1008 can be factorized as follows.

$1008 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{3 \times 3} \times 7$

Here, prime factor 7 does not have its pair.

If 7 gets a pair, then the number will become a perfect square.

Therefore, 1008 can be multiplied with 7 to obtain a perfect square.

$1008 \times 7 = 7056 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{7 \times 7}$

Therefore, $1008 \times 7 = 7056$ is a perfect square.

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

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

(iv) 2028 can be factorized as follows.

2	2028
2	1014
3	507
13	169
13	13
	1

$2028 = \underline{2 \times 2} \times 3 \times \underline{13 \times 13}$

Here, prime factor 3 does not have its pair.

If 3 gets a pair, then the number will become a perfect square.

Therefore, 2028 has to be multiplied with 3 to obtain a perfect square.

Therefore, $2028 \times 3 = 6084$ is a perfect square.

$2028 \times 3 = 6084 = \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{13 \times 13}$

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

(v) 1458 can be factorized as follows.

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

$1458 = 2 \times \underline{3 \times 3} \times \underline{3 \times 3} \times \underline{3 \times 3}$

Here, prime factor 2 does not have its pair.

If 2 gets a pair, then the number will become a perfect square.

Therefore, 1458 has to be multiplied with 2 to obtain a perfect square.

Therefore, $1458 \times 2 = 2916$ is a perfect square.

$1458 \times 2 = 2916 = \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{3 \times 3} \times \underline{3 \times 3}$

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

(vi) 768 can be factorized as follows.

$768 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times 3$

Here, prime factor 3 does not have its pair.

If 3 gets a pair, then the number will become a perfect square.

Therefore, 768 has to be multiplied with 3 to obtain a perfect square.

Therefore, $768 \times 3 = 2304$ is a perfect square.

$768 \times 3 = 2304 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{3 \times 3}$

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

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

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 number. 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) 252 can be factorized as follows.

$252 = \underline{2 \times 2} \times \underline{3 \times 3} \times 7$

Here, prime factor 7 does not have its pair.

If we divide this number by 7, then the number will become a perfect square. Therefore, 252 has to be divided by 7 to obtain a perfect square.

$252 \div 7 = 36$ is a perfect square.

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

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

2	252
2	126
3	63
3	21
7	7
	1

(ii) 2925 can be factorized as follows.

3	2925
3	975
5	325
5	65
13	13
	1

$2925 = \underline{3 \times 3} \times \underline{5 \times 5} \times 13$

Here, prime factor 13 does not have its pair.

If we divide this number by 13, then the number will become a perfect square.

Therefore, 2925 has to be divided by 13 to obtain a perfect square.

$2925 \div 13 = 225$ is a perfect square.

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

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

(iii) 396 can be factorized as follows.

2	396
2	198
3	99
3	33
11	11
	1

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

Here, prime factor 11 does not have its pair.

If we divide this number by 11,

then the number will become a perfect square.

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

$396 \div 11 = 36$ is a perfect square.

$36 = 2 \times 2 \times 3 \times 3 \quad \therefore \sqrt{36} = 2 \times 3 = 6$

(iv) 2645 can be factorized as follows.

5	2645
23	529
23	23
	1

$2645 = 5 \times \underline{23 \times 23}$

Here, prime factor 5 does not have its pair.

If we divide this number by 5, then the number will become a perfect square.

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

$2645 \div 5 = 529$ is a perfect square.

$529 = \underline{23 \times 23} \qquad \therefore \sqrt{529} = 23$

(v) 2800 can be factorized as follows.

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

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

Here, prime factor 7 does not have its pair.

If we divide this number by 7, then the number will become a perfect square.

Therefore, 2800 has to be divided by 7 to obtain a perfect square.

$2800 \div 7 = 400$ is a perfect square.

$400 = 2 \times 2 \times 2 \times 2 \times 5 \times 5 \quad \therefore \sqrt{400} = 2 \times 2 \times 5 = 20$

(vi) 1620 can be factorized as follows.

$1620 = \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{3 \times 3} \times 5$

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

Here, prime factor 5 does not have its pair.

If we divide this number by 5,

then the number will become a perfect square.

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

$1620 \div 5 = 324$ is a perfect square.

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

$\therefore \sqrt{324} = 2 \times 3 \times 3 = 18$

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: It is given that each student donated as many rupees as the number of students of the class. Number of students in the class will be the square root of the amount donated by the students of the class.

The total amount of donation is Rs 2401.

Number of students in the class $= \sqrt{2401}$

$\therefore \sqrt{2401} = 7 \times 7 = 49$

Hence, the number of students in the class 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: It is given that in the garden, each row contains as many plants as the number of rows.

Hence, Number of rows = Number of plants in each row

Total number of plants = Number of rows × Number of plants in each row

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

$(\text{Number of rows})^2 = 2025$

Number of rows $= \sqrt{2025}$

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

$\therefore \sqrt{2025} = 5 \times 3 \times 3 = 45$

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

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

Sol: The number that will be perfectly divisible by each one of 4, 9, and 10 is their LCM. The LCM of these numbers is as follows.

2	4, 9, 10
2	2, 9, 5
3	1, 9, 5
3	1, 3, 5
5	1, 1, 5
	1, 1, 1

LCM of 4, 9, 10 = $\underline{2 \times 2} \times \underline{3 \times 3} \times 5 = 180$

Here, prime factor 5 does not have its pair.

Therefore, 180 is not a perfect square.

If we multiply 180 with 5, then the number will become a perfect square.

Therefore, 180 should be multiplied with 5 to obtain a perfect square.

Hence, the required square number is $180 \times 5 = 900$

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

Sol: The number that is perfectly divisible by each of the numbers 8, 15, and 20 is their LCM.

LCM of 8, 15, and 20 = $\underline{2 \times 2} \times 2 \times 3 \times 5 = 120$

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

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

Therefore, 120 is not a perfect square.

Therefore, 120 should be multiplied by $2 \times 3 \times 5$, i.e. 30, to obtain a perfect square.

Hence, the required square number is $120 \times 2 \times 3 \times 5 = 3600$