Unit 5 Squares and Square Root of Positive Numbers

Exercise 5.1

1. Find the squares of the following 2-digit positive integers.

(i) 19
Solution: To find square of 19

$19^2 = 19 \times 19$

$= 361$

(ii) 39
Solution: To find square of 39

$39^2 = 39 \times 39$

$= 1,521$

(iii) 59
Solution: To find square of 59

$59^2 = 59 \times 59$

$= 3,481$

(iv) 28
Solution: To find square of 28

$28^2 = 28 \times 28$

$= 784$

(v) 77
Solution: To find square of 77

$77^2 = 77 \times 77$

$= 5,929$

(vi) 78
Solution: To find square of 78

$78^2 = 78 \times 78$

$= 6,084$

(vii) 88
Solution: To find square of 88

$88^2 = 88 \times 88$

$= 7,744$

(viii) 89
Solution: To find square of 89

$89^2 = 89 \times 89$

$= 7,921$

(ix) 79
Solution: To find square of 79

$79^2 = 79 \times 79$

$= 6,241$

2. Find the squares of the following 3-digit positive integers.

(i) 312
Solution: To find square of 312

$312^2 = 312 \times 312$

$= 97,344$

(ii) 413
Solution: To find square of 413

$413^2 = 413 \times 413$

$= 170,569$

(iii) 514
Solution: To find square of 514

$514^2 = 514 \times 514$

$= 264,196$

(iv) 218
Solution: To find square of 218

$218^2 = 218 \times 218$

$= 47,524$

(v) 217
Solution: To find square of 217

$217^2 = 217 \times 217$

$= 47,089$

(vi) 319
Solution: To find square of 319

$319^2 = 319 \times 319$

$= 101,761$

(vii) 888
Solution: To find square of 888

$888^2 = 888 \times 888$

$= 788,544$

(viii) 999
Solution: To find square of 999

$999^2 = 999 \times 999$

$= 998,001$

(ix) 777
Solution: To find square of 777

$777^2 = 777 \times 777$

$= 603,729$

Exercise 5.2

1. Find the square roots of the following positive integers by prime factorization method.

(i) 676

Solution: To calculate square root of 676 find prime factorization of 676.

Prime factorization of $676 = 2 \times 2 \times 13 \times 13$

Index notation $= 2^2 \times 13^2$

It implies that

$676 = 2^2 \times 13^2$

2	676
2	338
13	169
	13

Taking square root on both sides

$$\sqrt{676} = \sqrt{2^2 \times 13^2}$$

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

Square and square root cancle each other out.

$$= 2 \times 13$$

$$= 26$$

So, the square root of 676 is 26.

(ii) 729

Solution: To calculate square root of 729 find prime factorization of 729.

Prime factorization of 729 = 3 × 3 × 3 × 3 × 3 × 3

Index notation = $3^2 \times 3^2 \times 3^2$

It implies that

$$729 = 3^2 \times 3^2 \times 3^2$$

Taking square root on both sides

$$\sqrt{729} = \sqrt{3^2 \times 3^2 \times 3^2}$$

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

Square and square root cancle each other out.

$$= 3 \times 3 \times 3$$

$$= 27$$

So, the square root of 729 is 27.

3	729
3	243
3	81
3	27
3	9
	3

(iii) 5776

Solution: To calculate square root of 5776 find prime factorization of 5776.

Prime factorization of 5776 = 2 × 2 × 2 × 2 × 19 × 19

Index notation = $2^2 \times 2^2 \times 19^2$

It implies that

$$5776 = 2^2 \times 2^2 \times 19^2$$

Taking square root on both sides

$$\sqrt{5776} = \sqrt{2^2 \times 2^2 \times 19^2}$$

$$= \sqrt{2^2} \times \sqrt{2^2} \times \sqrt{19^2}$$

Square and square root cancle each other out.

$$= 2 \times 2 \times 19$$

$$= 76$$

So, the square root of 5776 is 76.

2	5776
2	2888
2	1444
2	722
19	361
	19

(iv) 50625

Solution: To calculate square root of 50625 find prime factorization of 50625.

Prime factorization of 50625 = 5 × 5 × 5 × 5 × 3 × 3 × 3 × 3

Index notation = $5^2 \times 5^2 \times 3^2 \times 3^2$

It implies that

$$50625 = 5^2 \times 5^2 \times 3^2 \times 3^2$$

Taking square root on both sides

5	50625
5	10125
5	2025
5	405
3	81
3	27
3	9
	3

$$\sqrt{50625} = \sqrt{5^2 \times 5^2 \times 3^2 \times 3^2}$$
$$= \sqrt{5^2} \times \sqrt{5^2} \times \sqrt{3^2} \times \sqrt{3^2}$$

Square and square root cancle each other out.

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

So, the square root of 50625 is 225.

(v) 441

Solution: To calculate square root of 441 find prime factorization of 441.

Prime factorization of 441 = 3 × 3 × 7 × 7

Index notation = $3^2 \times 7^2$

3	441
3	147
7	49
	7

It implies that

$$441 = 3^2 \times 7^2$$

Taking square root on both sides

$$\sqrt{441} = \sqrt{3^2 \times 7^2}$$
$$= \sqrt{3^2} \times \sqrt{7^2}$$

Square and square root cancle each other out

$$= 3 \times 7$$
$$= 21$$

So, the square root of 441 is 21.

(vi) 2500

Solution: To calculate square root of 2500 find prime factorization of 2500.

Prime factorization of 2500 = 2 × 2 × 5 × 5 × 5 × 5

Index notation = $2^2 \times 5^2 \times 5^2$

2	2500
2	1250
5	625
5	125
5	25
	5

It implies that

$$2500 = 2^2 \times 5^2 \times 5^2$$

Taking square root on both sides

$$\sqrt{2500} = \sqrt{2^2 \times 5^2 \times 5^2}$$
$$= \sqrt{2^2} \times \sqrt{5^2} \times \sqrt{5^2}$$

Square and square root cancle each other out.

$$= 2 \times 5 \times 5$$
$$= 50$$

So, the square root of 2500 is 50.

2. Find the square roots of the following fractions by prime factorization.

(i) $\frac{64}{121}$

Solution: To calculate square root of $\frac{64}{121}$ find prime factorization of numerator and denominator separately.

Prime factorization of 64 = 2 × 2 × 2 × 2 × 2 × 2

Index notation = $2^2 \times 2^2 \times 2^2$

2	64
2	32
2	16
2	8
2	4
	2

11	121
	11

Prime factorization of 121 = 11 × 11

Index notation = 11^2

It implies that

$$\frac{64}{121} = \frac{2^2 \times 2^2 \times 2^2}{11^2}$$

Taking square root on both sides

$$\sqrt{\frac{64}{121}} = \sqrt{\frac{2^2 \times 2^2 \times 2^2}{11^2}}$$

$$= \frac{\sqrt{2^2} \times \sqrt{2^2} \times \sqrt{2^2}}{\sqrt{11^2}}$$

Square and square root cancle each other out.

$$= \frac{2 \times 2 \times 2}{11}$$

$$= \frac{8}{11}$$

So, the square root of $\frac{64}{121}$ is $\frac{8}{11}$.

(ii) $\frac{\mathbf{36}}{\mathbf{169}}$

Solution: To calculate square root of $\frac{36}{169}$ find prime factorization of numerator and denominator separately.

Prime factorization of 36 = 2 × 2 × 3 × 3

Index notation = $2^2 \times 3^2$

Prime factorization of 169 = 13 × 13

Index notation = 13^2

2	36
2	18
3	9
	3

13	169
	13

It implies that

$$\frac{36}{169} = \frac{2^2 \times 3^2}{13^2}$$

Taking square root on both sides

$$\sqrt{\frac{36}{169}} = \sqrt{\frac{2^2 \times 3^2}{13^2}}$$

$$= \frac{\sqrt{2^2} \times \sqrt{3^2}}{\sqrt{13^2}}$$

Square and square root cancle each other out

$$= \frac{2 \times 3}{13}$$

$$= \frac{6}{13}$$

So, the square root of $\frac{36}{169}$ is $\frac{6}{13}$.

(iii) $\dfrac{\mathbf{81}}{\mathbf{144}}$

Solution: To calculate square root of $\frac{81}{144}$ find prime factorization of numerator and denominator separately.

Prime factorization of 81 = 3 × 3 × 3 × 3

Index notation = $3^2 \times 3^2$

3	81
3	27
3	9
	3

Prime factorization of 144 = 2 × 2 × 2 × 2 × 3 × 3

Index notation = $2^2 \times 2^2 \times 3^2$

2	144
2	72
2	36
2	18
3	9
	3

It implies that

$$\frac{81}{144} = \frac{3^2 \times 3^2}{2^2 \times 2^2 \times 3^2}$$

Taking square root on both sides

$$\sqrt{\frac{81}{144}} = \sqrt{\frac{3^2 \times 3^2}{2^2 \times 2^2 \times 3^2}}$$

$$= \frac{\sqrt{3^2} \times \sqrt{3^2}}{\sqrt{2^2} \times \sqrt{2^2} \times \sqrt{3^2}}$$

Square and square root cancle each other out.

$$= \frac{3 \times 3}{2 \times 2 \times 3} = \frac{9}{12}$$

So, the square root of $\frac{81}{144}$ is $\frac{9}{12}$.

(iv) $\mathbf{1\dfrac{63}{81}}$

Solution: Firstly, convert mixed number into improper fraction. $1\frac{63}{81} = \frac{144}{81}$

To calculate square root of $\frac{144}{81}$ find prime factorization of numerator and denominator separately.

2	144
2	72
2	36
2	18
3	9
	3

Prime factorization of 144 = 2 × 2 × 2 × 2 × 3 × 3

Index notation = $2^2 \times 2^2 \times 3^2$

3	81
3	27
3	9
	3

Prime factorization of 81 = 3 × 3 × 3 × 3

Index notation = $3^2 \times 3^2$

It implies that

$$1\frac{63}{81} = \frac{144}{81} = \frac{2^2 \times 2^2 \times 3^2}{3^2 \times 3^2}$$

Taking square root on both sides

$$\sqrt{\frac{144}{81}} = \sqrt{\frac{2^2 \times 2^2 \times 3^2}{3^2 \times 3^2}}$$

$$= \frac{\sqrt{2^2} \times \sqrt{2^2} \times \sqrt{3^2}}{\sqrt{3^2} \times \sqrt{3^2}}$$

Square and square root cancle each other out.

$$= \frac{2 \times 2 \times 3}{3 \times 3} = \frac{12}{9}$$

So, the square root of $1\frac{63}{81}$ is $\frac{12}{9}$.

(v) $\mathbf{1\frac{32}{49}}$

Solution: Firstly, convert mixed number into improper fraction.

$$1\frac{32}{49} = \frac{81}{49}$$

To calculate square root of $\frac{81}{49}$ find prime factorization of numerator and denominator separately.

Prime factorization of 81 = 3 × 3 × 3 × 3

Index notation = $3^2 \times 3^2$

Prime factorization of 49 = 7 × 7

Index notation = 7^2

3	81
3	27
3	9
	3

7	49
	7

It implies that

$$1\frac{32}{49} = \frac{81}{49} = \frac{3^2 \times 3^2}{7^2}$$

Taking square root on both sides

$$\sqrt{\frac{81}{49}} = \sqrt{\frac{3^2 \times 3^2}{7^2}}$$

$$= \frac{\sqrt{3^2} \times \sqrt{3^2}}{\sqrt{7^2}}$$

Square and square root cancle each other out.

$$= \frac{3 \times 3}{7}$$

$$= \frac{9}{7}$$

So, the square root of $1\frac{32}{49}$ is $\frac{9}{7}$.

(vi) $\mathbf{1\frac{57}{64}}$

Solution: Firstly, convert mixed number into improper fraction.

$$1\frac{57}{64} = \frac{121}{64}$$

To calculate square root of $\frac{121}{64}$ find prime factorization of numerator and denominator separately.

Prime factorization of 121 = 11 × 11

Index notation = 11^2

Prime factorization of 64 = 2 × 2 × 2 × 2 × 2 × 2

Index notation = $2^2 \times 2^2 \times 2^2$

It implies that

$$1\frac{57}{64} = \frac{121}{64} = \frac{11^2}{2^2 \times 2^2 \times 2^2}$$

2	64
2	32
2	16
2	8
2	4
	2

7	49
	7

Taking square root on both sides

$$\sqrt{\frac{121}{64}} = \sqrt{\frac{11^2}{2^2 \times 2^2 \times 2^2}}$$

$$= \frac{\sqrt{11^2}}{\sqrt{2^2} \times \sqrt{2^2} \times \sqrt{2^2}}$$

Square and square root cancle each other out.

$$= \frac{11}{2 \times 2 \times 2}$$

$$= \frac{11}{8}$$

So, the square root of $1\frac{57}{64}$ is $\frac{11}{8}$.

3. Find the square roots of the following decimal numbers by prime factorization method.

(i) 7.29

Solution: First of all, convert the decimal number into fraction.

$$7.29 = \frac{729}{100}$$

To calculate square root of $\frac{729}{100}$ find prime factorization of numerator and denominator separately.

Prime factorization of 729 = 3 × 3 × 3 × 3 × 3 × 3

Index notation = $3^2 \times 3^2 \times 3^2$

Prime factorization of 100 = 2 × 2 × 5 × 5

Index notation = $2^2 \times 5^2$

3	729
3	243
3	81
3	27
3	9
	3

2	100
2	50
5	25
	5

It implies that

$$7.29 = \frac{729}{100} = \frac{3^2 \times 3^2 \times 3^2}{2^2 \times 5^2}$$

Taking square root on both sides

$$\sqrt{7.29} = \sqrt{\frac{729}{100}} = \sqrt{\frac{3^2 \times 3^2 \times 3^2}{2^2 \times 5^2}}$$

$$= \frac{\sqrt{3^2} \times \sqrt{3^2} \times \sqrt{3^2}}{\sqrt{2^2} \times \sqrt{5^2}}$$

Square and square root cancle each other out.

$$= \frac{3 \times 3 \times 3}{2 \times 5} = \frac{27}{10} \text{ or } 2.7$$

So, the square root of 7.29 is $\frac{27}{10}$ or 2.7.

(ii) 3.24

Solution: First of all, convert the decimal number into fraction.

$$3.24 = \frac{324}{100}$$

To calculate square root of $\frac{324}{100}$ find prime factorization of numerator and denominator separately.

Prime factorization of 324 = 2 × 2 × 3 × 3 × 3 × 3

Index notation = $2^2 \times 3^2 \times 3^2$

Prime factorization of 100 = 2 × 2 × 5 × 5

Index notation = $2^2 \times 5^2$

2	324
2	162
3	81
3	27
3	9
	3

2	100
2	50
5	25
	5

It implies that

$$3.24 = \frac{324}{100} = \frac{2^2 \times 3^2 \times 3^2}{2^2 \times 5^2}$$

Taking square root on both sides

$$\sqrt{3.24} = \sqrt{\frac{324}{100}} = \sqrt{\frac{2^2 \times 3^2 \times 3^2}{2^2 \times 5^2}}$$

$$= \frac{\sqrt{2^2} \times \sqrt{3^2} \times \sqrt{3^2}}{\sqrt{2^2} \times \sqrt{5^2}}$$

Square and square root cancle each other out.

$$= \frac{2 \times 3 \times 3}{2 \times 5} = \frac{18}{10} \text{ or } 1.8$$

So, the square root of 3.24 is $\frac{18}{10}$ or 1.8.

(iii) 4.41

Solution: First of all, convert the decimal number into fraction.

$$4.41 = \frac{441}{100}$$

To calculate square root of $\frac{441}{100}$ find prime factorization of numerator and denominator separately.

Prime factorization of 441 = 3 × 3 × 7 × 7

Index notation = $3^2 \times 7^2$

Prime factorization of 100 = 2 × 2 × 5 × 5

Index notation = $2^2 \times 5^2$

3	441
3	147
7	49
	7

2	100
2	50
5	25
	5

It implies that

$$4.41 = \frac{441}{100} = \frac{3^2 \times 7^2}{2^2 \times 5^2}$$

Taking square root on both sides

$$\sqrt{4.41} = \sqrt{\frac{441}{100}} = \sqrt{\frac{3^2 \times 7^2}{2^2 \times 5^2}}$$

$$= \frac{\sqrt{3^2} \times \sqrt{7^2}}{\sqrt{2^2} \times \sqrt{5^2}}$$

Square and square root cancle each other out.

$$= \frac{3 \times 7}{2 \times 5} = \frac{21}{10} \text{ or } 2.1$$

So, the square root of 4.41 is $\frac{21}{10}$ or 2.1.

(iv) 5.76

Solution: First of all, convert the decimal number into fraction.

$$5.76 = \frac{576}{100}$$

To calculate square root of $\frac{576}{100}$ find prime factorization of numerator and denominator separately.

Prime factorization of 576 = 2 × 2 × 2 × 2 × 2 × 2 × 3 × 3

Index notation = $2^2 \times 2^2 \times 2^2 \times 3^2$

Prime factorization of 100 = 2 × 2 × 5 × 5

Index notation = $2^2 \times 5^2$

2	576
2	288
2	144
2	72
2	36
2	18
3	9
	3

2	100
2	50
5	25
	5

It implies that

$$5.76 = \frac{576}{100} = \frac{2^2 \times 2^2 \times 2^2 \times 3^2}{2^2 \times 5^2}$$

Taking square root on both sides

$$\sqrt{5.76} = \sqrt{\frac{576}{100}} = \sqrt{\frac{2^2 \times 2^2 \times 2^2 \times 3^2}{2^2 \times 5^2}}$$

$$= \frac{\sqrt{2^2} \times \sqrt{2^2} \times \sqrt{2^2} \times \sqrt{3^2}}{\sqrt{2^2} \times \sqrt{5^2}}$$

Squar and square root cancle each other out.

$$= \frac{2 \times 2 \times 2 \times 3}{2 \times 5} = \frac{24}{10} \text{ or } 2.4$$

So, the square root of 5.76 is $\frac{24}{10}$ or 2.4.

(v) 0.81

Solution: First of all, convert the decimal number into fraction.

$$0.81 = \frac{81}{100}$$

To calculate square root of $\frac{81}{100}$ find prime factorization of numerator and denominator separately.

Prime factorization of 81 = 3 × 3 × 3 × 3

Index notation = $3^2 \times 3^2$

Prime factorization of 100 = 2 × 2 × 5 × 5

Index notation = $2^2 \times 5^2$

3	81
3	27
3	9
	3

2	100
2	50
5	25
	5

It implies that

$$0.81 = \frac{81}{100} = \frac{3^2 \times 3^2}{2^2 \times 5^2}$$

Taking square root on both sides

$$\sqrt{0.81} = \sqrt{\frac{81}{100}} = \sqrt{\frac{3^2 \times 3^2}{2^2 \times 5^2}}$$

$$= \frac{\sqrt{3^2} \times \sqrt{3^2}}{\sqrt{2^2} \times \sqrt{5^2}}$$

Square and square root cancle each other out.

$$= \frac{3 \times 3}{2 \times 5} = \frac{9}{10} \text{ or } 0.9$$

So, the square root of 0.81 is $\frac{9}{10}$ or 0.9.

(vi) 3.61

Solution: First of all, convert the decimal number into fraction.

$$3.61 = \frac{361}{100}$$

To calculate square root of $\frac{361}{100}$ find prime factorization of numerator and denominator separately.

Prime factorization of $361 = 19 \times 19$

Index notation $= 19^2$

Prime factorization of $100 = 2 \times 2 \times 5 \times 5$

Index notation $= 2^2 \times 5^2$

19	361
	19

2	100
2	50
5	25
	5

It implies that

$$3.61 = \frac{361}{100} = \frac{19^2}{2^2 \times 5^2}$$

Taking square root on both sides

$$\sqrt{3.61} = \sqrt{\frac{361}{100}} = \sqrt{\frac{19^2}{2^2 \times 5^2}}$$

$$= \frac{\sqrt{19^2}}{\sqrt{2^2} \times \sqrt{5^2}}$$

Square and square root cancle each other out.

$$= \frac{19}{2 \times 5} = \frac{19}{10} \text{ or } 1.9$$

So, the square root of 3.61 is $\frac{19}{10}$ or 1.9.

Exercise 5.3

1. The length of the side of a square is 12 *cm*. Find the area of the square.

Solution: Given that:

Length of side of square = 12 *cm*

As we know that

Area of square = Length × Length

= (Length)^2

= (12 *cm*)^2

= 12 × 12 *cm*^{2}

= 144 *cm*^{2}

Hence, the area of given square is 144 cm^2.

2. If the area of a square is 169 cm^2, find the length of the side of the square.

Solution: Given that:

Area of square = 169 cm^2

As we know that

Area of square = (Length)^2

169 cm^2 = (Length)^2

Taking square root on both sides

$$\sqrt{169\,cm^2} = \sqrt{(\text{Length})^2}$$

$$\sqrt{(13)^2\,cm^2} = \sqrt{(\text{Length})^2}$$

$$13\,cm = \text{Length}$$

Hence, the length of side of given square is 13 cm.

13	169
	13

3. 64 people are standing in rows in this manner that the number of rows is equal to the number of people in a row. Find the number of people in each row.

Solution: Given that:

Total number of people = 64

We have to find the number of people in each row in such a way that number of people and number of rows are same. So, we will calculate square root of 64.

Prime factorization of 64 = 2 × 2× 2 × 2 × 2 × 2

Index notation = $2^2 \times 2^2 \times 2^2$

$$\sqrt{64} = \sqrt{2^2 \times 2^2 \times 2^2}$$

Squar and square root cancle each other out.

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

$$= 8$$

Hence, 8 people are stand in 8 rows.

2	64
2	32
2	16
2	8
2	4
	2

4. If the area of a square is 2.89 cm^2, find the length of the side of the square.

Solution: Given that:

Area of square = 2.89 cm^2

As we know that, Area of square = (Length)^2

2.89 cm^2 = (Length)^2

Taking square root on both sides

$$\sqrt{2.89\,cm^2} = \sqrt{(\text{Length})^2}$$

$$\sqrt{\frac{289}{100}\,cm^2} = \sqrt{(\text{Length})^2}$$

$$\sqrt{\frac{289}{100}\,cm^2} = \sqrt{(\text{Length})^2}$$

$$\sqrt{\frac{(17)^2}{(10)^2}\,cm^2} = \sqrt{(\text{Length})^2}$$

$$\frac{17}{10}\,cm = \text{Length}$$

$$1.7\,cm = \text{Length}$$

Hence, the length of side of given square is 1.7 cm.

17	289
	17

Review Exercise 5

1. Choose the correct option.

(i) The last digit of any perfect square of positive integer cannot be:

(a) 1 (b) 9 (c) 6 (d) 2

(ii) The last digit of any perfect square of positive integer can be:

(a) 0 (b) 3 (c) 7 (d) 8

(iii) $\sqrt{\frac{144}{121}}$ = - - -

(a) $\frac{12}{11}$ (b) $\frac{11}{12}$ (c) $\frac{4}{3}$ (d) $\frac{12}{11}$

(iv) $\sqrt{1.69}$ = - - -

(a) 1.39 (b) 1.6 (c) 1.9 (d) 1.3

(v) $\sqrt{640000}$ = - - -

(a) 80 (b) 800 (c) 8000 (d) 80000

2. Find the square root of the following fractions by prime factorization method.

(i) $\frac{81}{121}$

Solution: To calculate square root of $\frac{81}{121}$ find prime factorization of numerator and denominator separately.

Prime factorization of $81 = 3 \times 3 \times 3 \times 3$

Index notation $= 3^2 \times 3^2$

Prime factorization of $121 = 11 \times 11$

Index notation $= 11^2$

3	81
3	27
3	9
	3

11	121
	11

It implies that

$$\frac{81}{121} = \frac{3^2 \times 3^2}{11^2}$$

Taking square root on both sides

$$\sqrt{\frac{81}{121}} = \sqrt{\frac{3^2 \times 3^2}{11^2}}$$

$$= \frac{\sqrt{3^2} \times \sqrt{3^2}}{\sqrt{11^2}}$$

Square and square root cancle each other out.

$$= \frac{3 \times 3}{11}$$

$$= \frac{9}{11}$$

So, the square root of $\frac{64}{121}$ is $\frac{8}{11}$.

(ii) $\frac{49}{100}$

Solution: To calculate square root of $\frac{49}{100}$ find prime factorization of numerator and denominator separately.

Prime factorization of 49 = 7 × 7

Index notation = 7^2

Prime factorization of 100 = 2 × 2 × 5 × 5

Index notation = $2^2 \times 5^2$

7	49
	7

2	100
2	50
5	25
	5

It implies that

$$\frac{49}{100} = \frac{7^2}{2^2 \times 5^2}$$

Taking square root on both sides

$$\sqrt{\frac{49}{100}} = \sqrt{\frac{7^2}{2^2 \times 5^2}}$$

$$= \frac{\sqrt{7^2}}{\sqrt{2^2} \times \sqrt{5^2}}$$

Square and square root cancle each other out.

$$= \frac{7}{2 \times 5}$$

$$= \frac{7}{10}$$

So, the square root of $\frac{49}{100}$ is $\frac{7}{10}$.

(iii) $\frac{\mathbf{144}}{\mathbf{169}}$

Solution: To calculate square root of $\frac{144}{169}$ find prime factorization of numerator and denominator separately.

Prime factorization of 144 = 2 × 2 × 2 × 2 × 3 × 3

Index notation = $2^2 \times 2^2 \times 3^2$

Prime factorization of 169 = 13 × 13

Index notation = 13^2

2	144
2	72
2	36
2	18
3	9
	3

13	169
	13

It implies that

$$\frac{144}{169} = \frac{2^2 \times 2^2 \times 3^2}{13^2}$$

Taking square root on both sides

$$\sqrt{\frac{144}{169}} = \sqrt{\frac{2^2 \times 2^2 \times 3^2}{13^2}}$$

$$= \frac{\sqrt{2^2} \times \sqrt{2^2} \times \sqrt{3^2}}{\sqrt{13^2}}$$

Square and square root cancle each other out.

$$= \frac{2 \times 2 \times 3}{13}$$

$$= \frac{12}{13}$$

So, the square root of $\frac{144}{169}$ is $\frac{12}{13}$.

(iv) $\frac{36}{25}$

Solution: To calculate square root of $\frac{36}{25}$ find prime factorization of numerator and denominator separately.

Prime factorization of 36 = 2 × 2 × 3 × 3

Index notation = $2^2 \times 3^2$

Prime factorization of 25 = 5 × 5

Index notation = 5^2

2	36
2	18
3	9
	3

5	25
	5

It implies that

$$\frac{36}{25} = \frac{2^2 \times 3^2}{5^2}$$

Taking square root on both sides

$$\sqrt{\frac{36}{25}} = \sqrt{\frac{2^2 \times 3^2}{5^2}}$$

$$= \frac{\sqrt{2^2} \times \sqrt{3^2}}{\sqrt{5^2}}$$

Square and square root cancle each other out.

$$= \frac{2 \times 3}{5}$$

$$= \frac{6}{5}$$

So, the square root of $\frac{36}{25}$ is $\frac{6}{5}$.

(v) $\frac{625}{196}$

Solution: To calculate square root of $\frac{625}{196}$ find prime factorization of numerator and denominator separately.

Prime factorization of 625 = 5 × 5 × 5 × 5

Index notation = $5^2 \times 5^2$

Prime factorization of 196 = 2 × 2 × 7 × 7

Index notation = $2^2 \times 7^2$

5	625
5	125
5	25
	5

2	196
2	98
7	49
	7

It implies that

$$\frac{625}{196} = \frac{5^2 \times 5^2}{2^2 \times 7^2}$$

Taking square root on both sides

$$\sqrt{\frac{625}{196}} = \sqrt{\frac{5^2 \times 5^2}{2^2 \times 7^2}}$$

$$= \frac{\sqrt{5^2} \times \sqrt{5^2}}{\sqrt{2^2} \times \sqrt{7^2}}$$

Square and square root cancle each other out.

$$= \frac{5 \times 5}{2 \times 7}$$

$$= \frac{25}{14}$$

So, the square root of $\frac{625}{196}$ is $\frac{25}{14}$.

(vi) $\frac{256}{289}$

Solution: To calculate square root of $\frac{256}{289}$ find prime factorization of numerator and denominator separately.

Prime factorization of 256 = 2 × 2 × 2 × 2 × 2 × 2 × 2 × 2

Index notation = $2^2 \times 2^2 \times 2^2 \times 2^2$

Prime factorization of 289 = 17 × 17

Index notation = 17^2

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

17	289
	17

It implies that

$$\frac{256}{289} = \frac{2^2 \times 2^2 \times 2^2 \times 2^2}{17^2}$$

Taking square root on both sides

$$\sqrt{\frac{256}{289}} = \sqrt{\frac{2^2 \times 2^2 \times 2^2 \times 2^2}{17^2}}$$

$$= \frac{\sqrt{2^2} \times \sqrt{2^2} \times \sqrt{2^2} \times \sqrt{2^2}}{\sqrt{17^2}}$$

Square and square root cancle each other out.

$$= \frac{2 \times 2 \times 2 \times 2}{17}$$

$$= \frac{16}{17}$$

So, the square root of $\frac{256}{289}$ is $\frac{16}{17}$.

3. Find the square roots of the following decimal numbers by prime factorization method.

(i) 0.36

Solution: First of all, convert the decimal number into fraction.

$$0.36 = \frac{36}{100}$$

To calculate square root of $\frac{36}{100}$ find prime factorization of numerator and denominator separately.

Prime factorization of 36 = 2 × 2 × 3 × 3

Index notation = $2^2 \times 3^2$

Prime factorization of 100 = 2 × 2 × 5 × 5

Index notation = $2^2 \times 5^2$

2	36
2	18
3	9
	3

2	100
2	50
5	25
	5

It implies that

$$0.36 = \frac{36}{100} = \frac{2^2 \times 3^2}{2^2 \times 5^2}$$

Taking square root on both sides

$$\sqrt{0.36} = \sqrt{\frac{36}{100}} = \sqrt{\frac{2^2 \times 3^2}{2^2 \times 5^2}}$$

$$= \frac{\sqrt{2^2} \times \sqrt{3^2}}{\sqrt{2^2} \times \sqrt{5^2}}$$

Square and square root cancle each other out.

$$= \frac{2 \times 3}{2 \times 5}$$

$$= \frac{6}{10} \text{ or } 0.6$$

So, the square root of 0.36 is $\frac{6}{10}$ or 0.6.

(ii) 6.25

Solution: First of all, convert the decimal number into fraction.

$$6.25 = \frac{625}{100}$$

To calculate square root of $\frac{625}{100}$ find prime factorization of numerator and denominator separately.

Prime factorization of $625 = 5 \times 5 \times 5 \times 5$

Index notation $= 5^2 \times 5^2$

Prime factorization of $100 = 2 \times 2 \times 5 \times 5$

Index notation $= 2^2 \times 5^2$

5	625
5	125
5	25
	5

2	100
2	50
5	25
	5

It implies that

$$6.25 = \frac{625}{100} = \frac{5^2 \times 5^2}{2^2 \times 5^2}$$

Taking square root on both sides

$$\sqrt{6.25} = \sqrt{\frac{625}{100}} = \sqrt{\frac{5^2 \times 5^2}{2^2 \times 5^2}}$$

$$= \frac{\sqrt{5^2} \times \sqrt{5^2}}{\sqrt{2^2} \times \sqrt{5^2}}$$

Square and square root cancle each other out.

$$= \frac{5 \times 5}{2 \times 5}$$

$$= \frac{25}{10} \text{ or } 2.5$$

So, the square root of 6.25 is $\frac{25}{10}$ or 2.5.

(iii) 2.89

Solution: First of all, convert the decimal number into fraction.

$$2.89 = \frac{289}{100}$$

To calculate square root of $\frac{289}{100}$ find prime factorization of numerator and denominator separately.

Prime factorization of 289 = 17 × 17

Index notation = 17^2

Prime factorization of 100 = 2 × 2 × 5 × 5

Index notation = $2^2 \times 5^2$

17	289
	17

2	100
2	50
5	25
	5

It implies that

$$2.89 = \frac{289}{100} = \frac{17^2}{2^2 \times 5^2}$$

Taking square root on both sides

$$\sqrt{2.89} = \sqrt{\frac{289}{100}} = \sqrt{\frac{17^2}{2^2 \times 5^2}}$$

$$= \frac{\sqrt{17^2}}{\sqrt{2^2} \times \sqrt{5^2}}$$

Square and square root cancle each other out.

$$= \frac{17}{2 \times 5}$$

$$= \frac{17}{10} \text{ or } 1.7$$

So, the square root of 2.89 is $\frac{17}{10}$ or 1.7.

(iv) 1.96

Solution: First of all, convert the decimal number into fraction.

$$1.96 = \frac{196}{100}$$

To calculate square root of $\frac{196}{100}$ find prime factorization of numerator and denominator separately.

Prime factorization of 196 = 2 × 2 × 7 × 7

Index notation = $2^2 \times 7^2$

Prime factorization of 100 = 2 × 2 × 5 × 5

Index notation = $2^2 \times 5^2$

2	196
2	98
7	49
	7

2	100
2	50
5	25
	5

It implies that

$$1.96 = \frac{196}{100} = \frac{2^2 \times 7^2}{2^2 \times 5^2}$$

Taking square root on both sides

$$\sqrt{1.96} = \sqrt{\frac{196}{100}} = \sqrt{\frac{2^2 \times 7^2}{2^2 \times 5^2}}$$

$$= \frac{\sqrt{2^2} \times \sqrt{7^2}}{\sqrt{2^2} \times \sqrt{5^2}}$$

Square and square root cancle each other out

$$= \frac{2 \times 7}{2 \times 5}$$

$$= \frac{14}{10} \text{ or } 1.4$$

So, the square root of 1.96 is $\frac{14}{10}$ or 1.4.

(v) 2.56

Solution: First of all, convert the decimal number into fraction.

$$2.56 = \frac{256}{100}$$

To calculate square root of $\frac{256}{100}$ find prime factorization of numerator and denominator separately.

Prime factorization of $256 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$

Index notation $= 2^2 \times 2^2 \times 2^2 \times 2^2$

Prime factorization of $100 = 2 \times 2 \times 5 \times 5$

Index notation $= 2^2 \times 5^2$

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

2	100
2	50
5	25
	5

It implies that

$$2.56 = \frac{256}{100} = \frac{2^2 \times 2^2 \times 2^2 \times 2^2}{2^2 \times 5^2}$$

Taking square root on both sides

$$\sqrt{2.56} = \sqrt{\frac{256}{100}} = \sqrt{\frac{2^2 \times 2^2 \times 2^2 \times 2^2}{2^2 \times 5^2}}$$

$$= \frac{\sqrt{2^2} \times \sqrt{2^2} \times \sqrt{2^2} \times \sqrt{2^2}}{\sqrt{2^2} \times \sqrt{5^2}}$$

Square and square root cancle each other out.

$$= \frac{2 \times 2 \times 2 \times 2}{2 \times 5}$$

$$= \frac{16}{10} \text{ or } 1.6$$

So, the square root of 2.56 is $\frac{16}{10}$ or 1.6.

(vi) 1.69

Solution: First of all, convert the decimal number into fraction.

$$1.69 = \frac{169}{100}$$

To calculate square root of $\frac{169}{100}$ find prime factorization of numerator and denominator separately.

2	100
2	50
5	25
	5

13	169
	13

Prime factorization of $169 = 13 \times 13$

Index notation $= 13^2$

Prime factorization of $100 = 2 \times 2 \times 5 \times 5$

Index notation $= 2^2 \times 5^2$

It implies that

$$1.69 = \frac{169}{100} = \frac{13^2}{2^2 \times 5^2}$$

Taking square root on both sides

$$\sqrt{1.69} = \sqrt{\frac{169}{100}} = \sqrt{\frac{13^2}{2^2 \times 5^2}}$$

$$= \frac{\sqrt{13^2}}{\sqrt{2^2} \times \sqrt{5^2}}$$

Square and square root cancle each other out.

$$= \frac{13}{2 \times 5}$$

$$= \frac{13}{10} \text{ or } 1.3$$

So, the square root of 1.69 is $\frac{13}{10}$ or 1.3.

4. If the length of a square is 8 *cm*. Find the area of the square.

Solution: Given that:

Length of side of square = 8 *cm*

As we know that

Area of square = Length × Length

$= (\text{Length})^2$

$= (8\ cm)^2$

$= 64\ cm^2$

Hence, the area of given square is 64 cm^2.

5. If the area of a square shaped garden is 729 cm^2, find the length of the side of the garden.

Solution: Given that:

Area of square shaped garden = 729 cm^2

As we know that

Area of square = $(\text{Length})^2$

$729\ cm^2 = (\text{Length})^2$

Taking square root on both sides

$$\sqrt{729\,cm^2} = \sqrt{(\text{Length})^2}$$

3	729
3	243
3	81
3	27
3	9
	3

Prime factorization of $729 = 3 \times 3 \times 3 \times 3 \times 3 \times 3$

Index notation $= 3^2 \times 3^2 \times 3^2$

$$\sqrt{3^2 \times 3^2 \times 3^2\ cm^2} = \sqrt{(\text{Length})^2}$$

$$\sqrt{3^2} \times \sqrt{3^2} \times \sqrt{3^2} \times \sqrt{cm^2} = \sqrt{(\text{Length})^2}$$

$$3 \times 3 \times 3\ cm = \text{Length}$$

$$27\,cm = \text{Length}$$

Hence, the length of side of the garden is 27 *cm*.