## EXERCISE 3.1

**1. Which of the following natural numbers are perfect squares? Give reasons in support of your answer.**
**(i) 729**
**(ii) 5488**
**(iii) 1024**
**(iv) 243**
**Solution:**

(i) 729
We know that

| | |
|---|---|
| 3 | 729 |
| 3 | 243 |
| 3 | 81 |
| 3 | 27 |
| 3 | 9 |
| 3 | 3 |
| | 1 |

It can be written as
729 = 3 × 3 × 3 × 3 × 3 × 3
Here
729 is the product of pairs of equal prime factors
Therefore, 729 is a perfect square.

(ii) 5488
We know that

| | |
|---|---|
| 2 | 5488 |
| 2 | 2744 |
| 2 | 1372 |
| 2 | 686 |
| 7 | 343 |
| 7 | 49 |
| 7 | 7 |
| | 1 |

It can be written as
5488 = 2 × 2 × 2 × 2 × 7 × 7 × 7
Here
After pairing the same prime factors, one factor 7 is left unpaired.
Therefore, 5488 is not a perfect square.

(iii) 1024
We know that

| | |
|---|---|
| 2 | 1024 |
| 2 | 512 |
| 2 | 256 |
| 2 | 128 |
| 2 | 64 |
| 2 | 32 |
| 2 | 16 |
| 2 | 8 |
| 2 | 4 |
| 2 | 2 |
| | 1 |

It can be written as

$1024 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$

Here

After pairing the same prime factors, there is no factor left.

Therefore, 1024 is a perfect square.

(iv) 243

We know that

| | |
|---|---|
| 3 | 243 |
| 3 | 81 |
| 3 | 27 |
| 3 | 9 |
| 3 | 3 |
| | 1 |

It can be written as

$243 = 3 \times 3 \times 3 \times 3 \times 3$

Here

After pairing the same prime factors, factor 3 is left unpaired.

Therefore, 243 is not a perfect square.

**2. Show that each of the following numbers is a perfect square. Also, find the number whose square is the given number.**

**(i) 1296**

**(ii) 1764**

**(iii) 3025**

**(iv) 3969**

**Solution:**

(i) 1296

We know that

| | |
|---|---|
| 2 | 1296 |
| 2 | 648 |
| 2 | 324 |
| 2 | 162 |
| 3 | 81 |
| 3 | 27 |
| 3 | 9 |
| 3 | 3 |
| | 1 |

It can be written as

1296 = 2 × 2 × 2 × 2 × 3 × 3 × 3 × 3

Here

After pairing the same prime factors, no factor is left.

Therefore, 1296 is a perfect square of 2 × 2 × 3 × 3 = 36.

(ii) 1764

We know that

| | |
|---|---|
| 2 | 1764 |
| 2 | 882 |
| 7 | 441 |
| 7 | 63 |
| 3 | 9 |
| 3 | 3 |
| | 1 |

It can be written as

1764 = 2 × 2 × 3 × 3 × 7 × 7

Here

After pairing the same factors, no factor is left.

Therefore, 1764 is a perfect square of 2 × 3 × 7 = 42.

(iii) 3025

We know that

| | |
|---|---|
| 5 | 3025 |
| 5 | 605 |
| 11 | 121 |
| 11 | 11 |
| | 1 |

It can be written as

3025 = 5 × 5 × 11 × 11

Here

After pairing the same prime factors, no factor is left.

Therefore, 3025 is a perfect square of 5 × 11 = 55.

(iv) 3969

We know that

| | |
|---|---|
| 3 | 3969 |
| 3 | 1323 |
| 3 | 441 |
| 3 | 147 |
| 7 | 49 |
| 7 | 7 |
| | 1 |

It can be written as
3969 = 3 × 3 × 3 × 3 × 7 × 7
Here
After pairing the same prime factors, no factor is left.
Therefore, 3969 is a perfect square of 3 × 3 × 7 = 63.

**3. Find the smallest natural number by which 1008 should be multiplied to make it a perfect square.**
**Solution:**

We know that

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

It can be written as
1008 = 2 × 2 × 2 × 2 × 3 × 3 × 7
Here
After pairing the same kind of prime factors, one factor 7 is left.
Now multiplying 1008 by 7
We get a perfect square
Therefore, the required smallest number is 7.

**4. Find the smallest natural number by which 5808 should be divided to make it a perfect square. Also, find the number whose square is the resulting number.**
**Solution:**

We know that

| | |
|---|---|
| 2 | 5808 |
| 2 | 904 |
| 2 | 1452 |
| 2 | 726 |
| 3 | 363 |
| 11 | 121 |
| 11 | 11 |
| | 1 |

It can be written as
$5808 = 2 \times 2 \times 2 \times 2 \times 3 \times 11 \times 11$
Here
After pairing the same kind of prime factors, factor 3 is left.
Now dividing the number by 3, we get a perfect square.
Therefore, the square root of the resulting number is $2 \times 2 \times 11 = 44$.

## EXERCISE 3.2

**1. Write five numbers which you can decide by looking at their one's digit that they are not square numbers. Solution:**

We know that
A number which ends with the digits 2, 3, 7 or 8 at its unit places is not a perfect square.

Example – 111, 372, 563, 978, 1282 are not square numbers.

**2. What will be the unit digit of the squares of the following numbers?**
**(i) 951**
**(ii) 502**
**(iii) 329**
**(iv) 643**
**(v) 5124**
**(vi) 7625**
**(vii) 68327**
**(viii) 95628**
**(ix) 99880**
**(x) 12796**
**Solution:**

(i) 951
The unit digit of the square is 1.

(ii) 502
The unit digit of the square is 4.

(iii) 329
The unit digit of the square is 1.

(iv) 643
The unit digit of the square is 9.

(v) 5124
The unit digit of the square is 6.

(vi) 7625
The unit digit of the square is 5.

(vii) 68327
The unit digit of the square is 9.

(viii) 95628
The unit digit of the square is 4.

(ix) 99880
The unit digit of the square is 0.

(x) 12796
The unit digit of the square is 6.

**3. The following numbers are obviously not perfect. Give reason.**
**(i) 567**
**(ii) 2453**
**(iii) 5298**
**(iv) 46292**
**(v) 74000**
**Solution:**

In the given numbers
If the square of a number does not have 2, 3, 7, 8 or 0 as its unit digit, the squares 567, 2453, 5208, 46292 and 74000 cannot be the perfect squares as they have 7, 2, 8, 2 digits at the unit place.

**4. The square of which of the following numbers would be an odd number or an even number? Why?**
**(i) 573**
**(ii) 4096**
**(iii) 8267**
**(iv) 37916**
**Solution:**

We know that
The square of an odd number is odd and a square of an even number is even.
So 573 and 8262 are odd numbers and their squares will be an odd number.
4096 and 37916 are even numbers and their square will also be even number.

**5. How many natural numbers lie between square of the following numbers?**
**(i) 12 and 13**
**(ii) 90 and 91**
**Solution:**

(i) We know that
No. of natural numbers between the squares of 12 and 13 = $(13^2 – 12^2) – 1$
By further calculation
= (13 + 12 – 1)
So we get
= 25 – 1
= 24

(ii) We know that
No. of natural numbers between the squares of 90 and 91 = $(91^2 – 90^2) – 1$
By further calculation
= (91 + 90 – 1)
So we get
= 181 – 1
= 180

**6. Without adding, find the sum.**
**(i) 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15**

**(ii) 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23 + 25 + 27 + 29**
**Solution:**

(i) We know that
$1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 = n^2$
Here n = 8
So the sum = $8^2 = 64$

(ii) We know that
$1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23 + 25 + 27 + 29 = n^2$
Here n = 15
So the sum = $15^2 = 225$

**7. (i) Express 64 as the sum of 8 odd numbers.**
**(ii) 121 as the sum of 11 odd numbers.**
**Solution:**

(i) We know that
64 as the sum of 8 odd numbers = $8^2 = n^2$
Here n = 8
It can be written as
= 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15

(ii) We know that
121 as the sum of 11 odd numbers = $11^2 = n^2$
Here n = 11
It can be written as
= 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21

**8. Express the following as the sum of two consecutive integers.**
**(i) $19^2$**
**(ii) $33^2$**
**(iii) $47^2$**
**Solution:**

We know that
$n^2 = (n^2 – 1)/ 2 + (n^2 + 1)/ 2$ is the sum of two consecutive integers when n is odd

(i) $19^2 = (19^2 – 1)/ 2 + (19^2 + 1)/ 2$
We know that
$19^2 = 361$
By further calculation
= (361 – 1)/ 2 + (361 + 1)/ 2
So we get
= 180 + 181

(ii) $33^2 = (33^2 – 1)/ 2 + (33^2 + 1)/ 2$
We know that
$33^2 = 1089$
By further calculation

= (1089 – 1)/ 2 + (1089 + 1)/ 1
So we get
= 1088/2 + 1090/2
= 544 + 545

(iii) $47^2 = (47^2 – 1)/ 2 + (47^2 + 1)/ 2$
We know that
$47^2 = 2209$
By further calculation
= (2209 – 1)/ 2 + (2209 + 1)/ 1
So we get
= 2208/2 + 2210/2
= 1104 + 1105

**9. Find the squares of the following numbers without actual multiplication:**
**(i) 31**
**(ii) 42**
**(iii) 86**
**(iv) 94**
**Solution:**

We know that
$(a + b)^2 = a^2 + 2ab + b^2$

(i) $31^2 = (30 + 1)^2$
We can write it as
$= 30^2 + 2 \times 30 \times 1 + 1^2$
By further calculation
= 900 + 60 + 1
= 961

(ii) $42^2 = (40 + 2)^2$
We can write it as
$= 40^2 + 2 \times 40 \times 2 + 2^2$
By further calculation
= 1600 + 160 + 4
= 1764

(iii) $86^2 = (80 + 6)^2$
We can write it as
$= 80^2 + 2 \times 80 \times 6 + 6^2$
By further calculation
= 6400 + 960 + 36
= 7396

(iv) $94^2 = (90 + 4)^2$
We can write it as
$= 90^2 + 2 \times 90 \times 4 + 4^2$
By further calculation
= 8100 + 720 + 16

= 8836

**10. Find the squares of the following numbers containing 5 in unit's place:**
**(i) 45**
**(ii) 305**
**(iii) 525**
**Solution:**

(i) $45^2 = n5^2$
It can be written as
$= n (n + 1)$ hundred $+ 5^2$
Substituting the values
= 4 × 5 hundred + 25
By further calculation
= 2000 + 25
= 2025

(ii) $305^2$ = (30 × 31) hundred + 25
By further calculation
= 93000 + 25
= 93025

(iii) $525^2$ = (52 × 53) hundred + 25
By further calculation
= 275600 + 25
= 275625

**11. Write a Pythagorean triplet whose one number is**
**(i) 8**
**(ii) 15**
**(iii) 63**
**(iv) 80**
**Solution:**

(i) 8
Take n = 8
So the triplet will be $2n, n^2 – 1, n^2 + 1$

Here
If 2n = 8, then n = 8/2 = 4
Substituting the values
$n^2 – 1 = 4^2 – 1 = 16 – 1 = 15$
$n^2 + 1 = 4^2 + 1 = 16 + 1 = 17$

Therefore, the triplets are 8, 15 and 17.

(ii) 15
Take 2n = 15
So n = n/2 is not possible
$n^2 – 1 = 15$

By further calculation
$n^2 = 15 + 1 = 16 = 4^2$
n = 4

So we get
2n = 2 × 4 = 8
$n^2 - 1 = 15$
$n^2 + 1 = 4^2 + 1 = 16 + 1 = 17$

Therefore, the triplets are 8, 15 and 17.

(iii) 63
Take $n^2 - 1 = 63$
By further calculation
$n^2 = 63 + 1 = 64 = 8^2$
So n = 8

Here
2n = 2 × 8 = 16
$n^2 - 1 = 63$
$n^2 + 1 = 8^2 + 1 = 64 + 1 = 65$

Therefore, the triplets are 16, 63 and 65.

(iv) 80
Take 2n = 80
n = 80/2 = 40

Here
$n^2 - 1 = 40^2 - 1 = 1600 - 1 = 1599$
$n^2 + 1 = 40^2 + 1 = 1600 + 1 = 1601$

Therefore, the triplets are 80, 1599 and 1601.

**12. Observe the following pattern and find the missing digits:**
**$21^2 = 441$**
**$201^2 = 40401$**
**$2001^2 = 4004001$**
**$20001^2$ = 4---4---1**
**$200001^2$ = ------**
**Solution:**

$21^2 = 441$
$201^2 = 40401$
$2001^2 = 4004001$
$20001^2 = 400040001$
$200001^2 = 40000400001$

**13. Observe the following pattern and find the missing digits:**
**$9^2 = 81$**

**$99^2$ = 9801**
**$999^2$ = 998001**
**$9999^2$ = 99980001**
**$99999^2$ = 9---8---01**
**$999999^2$ = 9---0---1**
**Solution:**

$9^2 = 81$
$99^2 = 9801$
$999^2 = 998001$
$9999^2 = 99980001$
$99999^2 = 9999800001$
$999999^2 = 999998000001$

**14. Observe the following pattern and find the missing digits:**
**$7^2$ = 49**
**$67^2$ = 4489**
**$667^2$ = 444889**
**$6667^2$ = 44448889**
**$66667^2$ = 4----8-----9**
**$666667^2$ = 4----8----8-**
**Solution:**

$7^2 = 49$
$67^2 = 4489$
$667^2 = 444889$
$6667^2 = 44448889$
$66667^2 = 4444488889$
$666667^2 = 444444888889$

## EXERCISE 3.3

**1. By repeated subtraction of odd numbers starting from 1, find whether the following numbers are perfect squares or not? If the number is a perfect square then find its square root:**
**(i) 121**
**(ii) 55**
**(iii) 36**
**(iv) 90**
**Solution:**

(i) We know that
Square root of 121
121 – 1 = 120
120 – 3 = 117
117 – 5 = 112
112 – 7 = 105
105 – 9 = 96
96 – 11 = 85
85 – 13 = 72
72 – 15 = 57
57 – 17 = 40
40 – 19 = 21
21 – 21 = 0
So the square root of 121 is 11
Hence, 121 is a perfect square.

(ii) We know that
Square root of 55
55 – 1 = 54
54 – 3 = 51
51 – 5 = 46
46 – 7 = 39
39 – 9 = 30
30 – 11 = 19
19 – 13 = 6
6 – 15 = - 9 is not possible
Hence, 55 is not a perfect square.

(iii) We know that
Square root of 36
36 – 1 = 35
35 – 3 = 32
32 – 5 = 27
27 – 7 = 20
20 – 9 = 11
11 – 11 = 0
Hence, 36 is a perfect square and its square root is 6.

(iv) We know that
Square root of 90

90 – 1 = 89
89 – 3 = 86
86 – 5 = 81
81 – 7 = 74
74 – 9 = 65
65 – 11 = 54
54 – 13 = 41
41 – 15 = 26
26 – 17 = 9
9 – 19 = - 10 which is not possible
Hence, 90 is not a perfect square.

**2. Find the square roots of the following numbers by prime factorization method:**
**(i) 784**
**(ii) 441**
**(iii) 1849**
**(iv) 4356**
**(v) 6241**
**(vi) 8836**
**(vii) 8281**
**(viii) 9025**
**Solution:**

(i) We know that
Square root of 784

| | |
|---|---|
| 2 | 784 |
| 2 | 392 |
| 2 | 196 |
| 2 | 98 |
| 7 | 49 |
| 7 | 7 |
| | 1 |

It can be written as
$\sqrt{784} = \sqrt{2 \times 2 \times 2 \times 2 \times 7 \times 7}$
So we get
= 2 × 2 × 7
= 28

(ii) We know that
Square root of 441

| | |
|---|---|
| 3 | 441 |
| 7 | 147 |
| 7 | 49 |
| 7 | 7 |
| | 1 |

It can be written as
$\sqrt{441} = \sqrt{3 \times 3 \times 7 \times 7}$

So we get
= 3 × 7
= 21

(iii) We know that
Square root of 1849

| | |
|---|---|
| 43 | 1849 |
| 43 | 43 |
| | 1 |

It can be written as
$\sqrt{1849} = \sqrt{43 \times 43}$ = 43

(iv) We know that
Square root of 4356

| | |
|---|---|
| 2 | 4356 |
| 2 | 2178 |
| 3 | 1089 |
| 3 | 363 |
| 11 | 121 |
| 11 | 11 |
| | 1 |

It can be written as
$\sqrt{4356} = \sqrt{2 \times 2 \times 3 \times 3 \times 11 \times 11}$
So we get
= 2 × 3 × 11
= 66

(v) We know that
Square root of 6241

| | |
|---|---|
| 79 | 6241 |
| 79 | 79 |
| | 1 |

It can be written as
$\sqrt{6241} = \sqrt{79 \times 79}$ = 79

(vi) We know that
Square root of 8836

| | |
|---|---|
| 2 | 8836 |
| 2 | 4418 |
| 47 | 2209 |
| 47 | 47 |
| | 1 |

It can be written as
$\sqrt{8836} = \sqrt{2 \times 2 \times 47 \times 47}$
So we get
= 2 × 47

= 94

(vii) We know that
Square root of 8281

| | |
|---|---|
| 7 | 8281 |
| 7 | 1183 |
| 13 | 169 |
| 13 | 13 |
| | 1 |

It can be written as
$\sqrt{8281} = \sqrt{7 \times 7 \times 13 \times 13}$
So we get
= 7 × 13
= 91

(viii) We know that
Square root of 9025

| | |
|---|---|
| 5 | 9025 |
| 5 | 1805 |
| 19 | 361 |
| 19 | 19 |
| | 1 |

It can be written as
$\sqrt{9025} = \sqrt{5 \times 5 \times 19 \times 19}$
So we get
= 5 × 19
= 95

**3. Find the square roots of the following numbers by prime factorization method:**
**(i) 9 67/121**
**(ii) 17 13/36**
**(iii) 1.96**
**(iv) 0.0064**
**Solution:**

(i) 9 67/121 = (9 × 121 + 67)/ 121
By further calculation
= (1089 + 67)/ 121
= 1156/121
By squaring we get
$\sqrt{\frac{1156}{121}} = \frac{\sqrt{1156}}{\sqrt{121}}$
We know that

| | |
|---|---|
| 2 | 1156 |
| 2 | 578 |
| 17 | 289 |
| 17 | 17 |
| | 1 |

It can be written as

$$= \frac{\sqrt{2 \times 2 \times 17 \times 17}}{\sqrt{11 \times 11}}$$

So we get

= (2 × 17)/ 11

= 34/11

= 3 1/11

(ii) 17 13/36 = (17 × 36 + 13)/ 36

By further calculation

= (612 + 13)/ 36

= 625/36

By squaring we get

$$\sqrt{\frac{625}{36}} = \frac{\sqrt{625}}{\sqrt{36}}$$

We know that

| | |
|---|---|
| 5 | 625 |
| 5 | 125 |
| 5 | 25 |
| 5 | 5 |
| | 1 |

| | |
|---|---|
| 2 | 36 |
| 2 | 18 |
| 3 | 9 |
| 3 | 3 |
| | 1 |

It can be written as

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

So we get

= (5 × 5)/ (2 × 3)

= 25/6

= 4 1/6

(iii) 1.96 = 196/100

By squaring we get

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

We know that

| | |
|---|---|
| 2 | 196 |
| 2 | 98 |
| 7 | 49 |
| 7 | 7 |
| | 1 |

| | |
|---|---|
| 2 | 100 |
| 2 | 50 |
| 5 | 25 |
| 5 | 5 |
| | 1 |

It can be written as

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

So we get
= (2 × 7)/ (2 × 5)
= 14/10
= 1.4

(iv) 0.0064 = 64/10000
By squaring we get

$$\sqrt{\frac{64}{10000}} = \frac{\sqrt{64}}{\sqrt{10000}}$$

We know that

| | |
|---|---|
| 2 | 10000 |
| 2 | 5000 |
| 2 | 2500 |
| 2 | 1250 |
| 5 | 625 |
| 5 | 125 |
| 5 | 25 |
| 5 | 5 |
| | 1 |

It can be written as

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

So we get
= (2 × 2 × 2)/ (2 × 2 × 5 × 5)
= 8/100
= 0.08

**4. For each of the following numbers, find the smallest natural number by which it should be multiplied so as to get a perfect square. Also, find the square root of the square number so obtained:**
**(i) 588**
**(ii) 720**
**(iii) 2178**
**(iv) 3042**
**(v) 6300**
**Solution:**

(i) 588 = 2 × 2 × 3 × 7 × 7
We know that

| | |
|---|---|
| 2 | 588 |
| 2 | 294 |
| 3 | 147 |
| 7 | 49 |
| 7 | 7 |
| | 1 |

By pairing the same kind of factors, one factor 3 is left unpaired.
So to make it a pair we must multiply it by 3
Required least number = 3
Square root of 588 × 3 = 1764
Here
2 × 3 × 7 = 42

(ii) 720 = 2 × 2 × 2 × 2 × 3 × 3 × 5
We know that

| | |
|---|---|
| 2 | 720 |
| 2 | 360 |
| 2 | 180 |
| 2 | 90 |
| 3 | 45 |
| 3 | 15 |
| 5 | 5 |
| | 1 |

By pairing the same kind of factors, one factor 5 is left unpaired.
So to make it a pair we must multiply it by 5
Required least number = 5
Square root of 720 × 5 = 3600
Here
2 × 2 × 3 × 5 = 60

(iii) 2178 = 2 × 3 × 3 × 11 × 11
We know that

| | |
|---|---|
| 2 | 2178 |
| 3 | 1089 |
| 3 | 363 |
| 11 | 121 |
| 11 | 11 |
| | 1 |

By pairing the same kind of factors, one factor 2 is left unpaired.
So to make it a pair we must multiply it by 2
Required least number = 2
Square root of 2178 × 2 = 4356
Here
2 × 3 × 11 = 66

(iv) 3042 = 2 × 3 × 3 × 13 × 13

We know that

| | |
|---|---|
| 2 | 3042 |
| 3 | 1521 |
| 3 | 507 |
| 13 | 169 |
| 13 | 13 |
| | 1 |

By pairing the same kind of factors, one factor 2 is left unpaired
So to make it a pair we must multiply it by 2
Required least number = 2
Square root of 3042 × 2 = 6084
Here
2 × 3 × 13 = 78

(v) 6300 = 2 × 2 × 3 × 3 × 5 × 5 × 7
We know that

| | |
|---|---|
| 2 | 6300 |
| 2 | 3150 |
| 3 | 1575 |
| 3 | 525 |
| 3 | 175 |
| 5 | 35 |
| 7 | 7 |
| | 1 |

By pairing the same kind of factors, one factor 7 is left unpaired
So to make it a pair we must multiply it by 7
Required least number = 7
Square root of 6300 × 7 = 44100
Here
2 × 3 × 5 × 7 = 210

**5. For each of the following numbers, find the smallest natural number by which it should be divided so that this quotient is a perfect square. Also, find the square root of the square number so obtained:**
**(i) 1872**
**(ii) 2592**
**(iii) 3380**
**(iv) 16224**
**(v) 61347**
**Solution:**

(i) 1872 = 2 × 2 × 2 × 2 × 3 × 3 × 13
It can be written as

| | |
|---|---|
| 2 | 1872 |
| 2 | 936 |
| 2 | 468 |
| 2 | 234 |
| 3 | 117 |
| 3 | 39 |
| 13 | 13 |
| | 1 |

By pairing the same kind of factors, one factor 13 is left unpaired
Required least number = 13
The number 1872 should be divided by 13 so that the resultant number will be a perfect square
Resultant number = 1872 ÷ 13 = 144
Square root = 2 × 2 × 3 = 12

(ii) 2592 = 2 × 2 × 2 × 2 × 2 × 3 × 3 × 3 × 3
It can be written as

| | |
|---|---|
| 2 | 2592 |
| 2 | 1296 |
| 2 | 648 |
| 2 | 324 |
| 2 | 162 |
| 3 | 81 |
| 3 | 27 |
| 3 | 9 |
| 3 | 3 |
| | 1 |

By pairing the same kind of factors, one factor 2 is left unpaired
Required least number = 2
The number 2592 should be divided by 2 so that the resultant number will be a perfect square
Resultant number = 2592 ÷ 2 = 1296
Square root = 2 × 2 × 3 × 3 = 36

(iii) 3380 = 2 × 2 × 5 × 13 × 13
It can be written as

| | |
|---|---|
| 2 | 3380 |
| 2 | 1690 |
| 5 | 845 |
| 13 | 169 |
| 13 | 13 |
| | 1 |

By pairing the same kind of factors, one factor 5 is left unpaired
Required least number = 5
The number 3380 should be divided by 5 so that the resultant number will be a perfect square
Resultant number = 3380 ÷ 5 = 676
Square root = 2 × 13 = 26

(iv ) 16224 = 2 × 2 × 2 × 2 × 2 × 3 × 13 × 13

It can be written as

| | |
|---|---|
| 2 | 16224 |
| 2 | 8112 |
| 2 | 4056 |
| 2 | 2028 |
| 2 | 1014 |
| 3 | 507 |
| 13 | 169 |
| 13 | 13 |
| | 1 |

By pairing the same kind of factors, two factors 2 and 3 is left unpaired

Required least number = 2 × 3 = 6

The number 16224 should be divided by 6 so that the resultant number will be a perfect square

Resultant number = 16224 ÷ 6 = 2704

Square root = 2 × 2 × 13 = 52

(v) 61347 = 3 × 11 × 11 × 13 × 13

It can be written as

| | |
|---|---|
| 3 | 61347 |
| 11 | 20449 |
| 11 | 1859 |
| 13 | 169 |
| 13 | 13 |
| | 1 |

By pairing the same kind of factors, one factor 3 is left unpaired

Required least number = 3

The number 61347 should be divided by 3 so that the resultant number will be a perfect square

Resultant number = 61347 ÷ 3 = 20449

Square root = 11 × 13 = 143

**6. Find the smallest square number that is divisible by each of the following numbers:**
**(i) 3, 6, 10, 15**
**(ii) 6, 9, 27, 36**
**(iii) 4, 7, 8, 16**
**Solution:**

(i) 3, 6, 10, 15

Number which is divisible by

3, 6, 10, 15 = LCM of 3, 6, 10, 15

It can be written as

| | |
|---|---|
| 2 | 3, 6, 10, 15 |
| 3 | 3, 3, 5, 15 |
| 5 | 1, 1, 5, 5 |
| | 1, 1, 1, 1 |

So we get

= 2 × 3 × 5

= 30

(ii) 6, 9, 27, 36
Number which is divisible by
6, 9, 27, 36 = LCM of 6, 9, 27, 36
It can be written as

| | |
|---|---|
| 3 | 6, 9, 27, 36 |
| 3 | 2, 3, 9, 12 |
| 2 | 2, 1, 3, 4 |
| | 1, 1, 3, 2 |

So we get
= 3 × 3 × 2 × 2 × 3
= 108

Here the smallest square
= 108 × 3
= 324

(iii) 4, 7, 8, 16
Number which is divisible by
4, 7, 8, 16 = LCM of 4, 7, 8, 16
It can be written as

| | |
|---|---|
| 2 | 4, 7, 8, 16 |
| 2 | 2, 7, 4, 8 |
| 2 | 1, 7, 2, 4 |
| | 1, 7, 1, 2 |

So we get
= 2 × 2 × 2 × 2 × 7
= 112

Here the smallest square
= 112 × 7
= 784

**7. 4225 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:**

It is given that
Total number of plants = 4225
Here
Number of rows = Number of plant in each row
So the number of rows = square root of 4225
It can be written as

| | |
|---|---|
| 5 | 4225 |
| 5 | 845 |
| 13 | 169 |
| 13 | 13 |
| | 1 |

So we get

$= \sqrt{5 \times 5 \times 13 \times 13}$

= 5 × 13

= 65

Hence, the number of rows is 65 and the number of plants in each row is 65.

**8. The area of rectangle is 1936 sq. m. If the length of the rectangle is 4 times its breadth, find the dimensions of the rectangle.**

**Solution:**

It is given that

Area of rectangle = 1936 sq. m

Take breadth = x m

Length = 4x m

So we get

$4x^2 = 1936$

By further calculation

$x^2 = 1936/4 = 484$

We know that

| | |
|---|---|
| 2 | 484 |
| 2 | 242 |
| 11 | 121 |
| 11 | 11 |
| | 1 |

It can be written as

$x = \sqrt{484} = \sqrt{2 \times 2 \times 11 \times 11}$

By further calculation

= 2 × 11

= 22

Here

Length = 4x = 4 × 22 = 88 m

Breadth = x = 22 m

**9. In a school a P.T. teacher wants to arrange 2000 students in the form of rows and columns for P.T. display. If the number of rows is equal to number of columns and 64 students could not be accommodated in this arrangement. Find the number of rows.**

**Solution:**

It is given that

Total number of students in a school = 2000

The P.T. teacher arranges in such a way that
No. of rows = no. of students in each row
So 64 students are left
Required number of students = 2000 – 64 = 1936
No. of rows = √1936

We know that

| | |
|---|---|
| 2 | 1936 |
| 2 | 968 |
| 2 | 484 |
| 2 | 232 |
| 11 | 121 |
| 11 | 11 |
| | 1 |

It can be written as
$= \sqrt{2 \times 2 \times 2 \times 2 \times 11 \times 11}$
By further calculation
= 2 × 2 × 11
= 44

**10. In a school, the students of class VIII collected ₹2304 for a picnic. Each student contributed as many rupees as the number of students in the class. Find the number of students in the class.**
**Solution:**

It is given that
Amount collected for picnic = ₹2304
We know that
No. of students = no. of rupees contributed by each student = √2304

Here

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

It can be written as
$= \sqrt{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3}$
By further calculation
= 2 × 2 × 2 × 2 × 34= 48

Therefore, the number of students in class VIII is 4811.

**11. The product of two numbers is 7260. If one number is 15 times the other number, find the numbers.**
**Solution:**

It is given that
Product of two numbers = 7260
Consider one number = x
Second number = 15x
It can be written as
15x × x = 7260
$15x^2 = 7260$
By further calculation
$x^2 = 7260/15 = 484$
$x = \sqrt{484} = \sqrt{2 \times 2 \times 11 \times 11}$
So we get
= 2 × 11
= 22

Here
One number = 22
Second number = 22 × 15 = 330

**12. Find three positive numbers in the ratio 2: 3: 5, the sum of whose squares is 950.**
**Solution:**

It is given that
Ratio of three positive numbers = 2: 3: 5
Sum of their squares = 950
Consider
First number = 2x
Second number = 3x
Third number = 5x
It can be written as
$(2x)^2 + (3x)^2 + (5x)^2 = 950$
By further calculation
$4x^2 + 9x^2 + 25x^2 = 950$
$38x^2 = 950$
So we get
$X^2 = 950/38 = 25$
$x = \sqrt{25} = 5$

Here
First number = 2 × 5 = 10
Second number = 3 × 5 = 15
Third number = 5 × 5 = 25

**13. The perimeter of two squares is 60 metres and 144 metres respectively. Find the perimeter of another square equal in area to the sum of the first two squares.**
**Solution:**

It is given that
Perimeter of first square = 60 m
Side = 60/4 = 15 m
Perimeter of second square = 144 m
Side = 144/4 = 36 m
So the sum of perimeters of two squares = 60 + 144 = 204 m
Sum of areas of these two squares = $15^2 + 36^2$
= 225 + 1296
= 1521 $m^2$

Here
Area of third square = 1521 $m^2$
We know that

| | |
|---|---|
| 3 | 1521 |
| 3 | 507 |
| 13 | 169 |
| 13 | 13 |
| | 1 |

So we get
Side = √Area = √1521
It can be written as
$= \sqrt{3 \times 3 \times 13 \times 13}$
= 3 × 13
= 39 m

Here
Perimeter = 4 × side
Substituting the values
= 4 × 39
= 156 m

## EXERCISE 3.4

**1. Find the square root of each of the following by division method:**
**(i) 2401**
**(ii) 4489**
**(iii) 106929**
**(iv) 167281**
**(v) 53824**
**(vi) 213444**
**Solution:**

(i) √2401 = 49
By division method

| | |
|---|---|
| | 49 |
| 4 | $\overline{24}\ \overline{01}$ |
| | 16 |
| 89 | 801 |
| | 801 |
| | 0 |

(ii) √4489 = 67
By division method

| | |
|---|---|
| | 67 |
| 6 | $\overline{44}\ \overline{89}$ |
| | 36 |
| 127 | 889 |
| | 889 |
| | 0 |

(iii) √106929 = 327
By division method

| | |
|---|---|
| | 327 |
| 3 | $\overline{10}\ \overline{69}\ \overline{29}$ |
| | 9 |
| 62 | 169 |
| | 124 |
| 647 | 4529 |
| | 4529 |
| | 0 |

(iv) √167281 = 409
By division method

| | 409 |
|---|---|
| 4 | 16 72 81 |
| | 16 |
| 809 | 7281 |
| | 7281 |
| | 0 |

(v) √53824 = 232
By division method

| | 232 |
|---|---|
| 2 | 5 38 2 |
| | 4 |
| 43 | 138 |
| | 129 |
| 462 | 92 |
| | 92 |
| | 0 |

(vi) √213444 = 462
By division method

| | 462 |
|---|---|
| 4 | 21 34 44 |
| | 16 |
| 86 | 534 |
| | 516 |
| 922 | 1844 |
| | 1844 |
| | 0 |

**2. Find the number of digits in the square root of each of the following (without any calculation):**
**(i) 81**
**(ii) 169**
**(iii) 4761**
**(iv) 27889**
**(v) 525625**
**Solution:**

(i) 81
We know that
In 81, a group of two's is 1
Therefore, its square root has one digit.

(ii) 169
We know that
In 169, group of two's are 2
Therefore, its square root has two digits.

(iii) 4761
We know that
In 4761, group of two’s are 2
Therefore, its square root has two digits.

(iv) 27889
We know that
In 27889, groups of two’s are 3
Therefore, its square root has three digits.

(v) 525625
We know that
In 525625, groups of two’s are 3
Therefore, its square root has three digits.

**3. Find the square root of the following decimal numbers by division method:**
**(i) 51.84**
**(ii) 42.25**
**(iii) 18.4041**
**(iv) 5.774409**
**Solution:**

(i) √51.84 = 7.2
By division method

| | 7.2 |
|---|---|
| 7 | $\overline{51}.\overline{84}$ |
| | 49 |
| 142 | 284 |
| | 284 |
| | 0 |

(ii) √42.25 = 6.5
By division method

| | 6.5 |
|---|---|
| 6 | $\overline{42}.\overline{25}$ |
| | 36 |
| 125 | 625 |
| | 625 |
| | 0 |

(iii) √18.4041 = 4.29
By division method

| | 4.29 |
|---|---|
| 4 | 18.40 41 |
| | 16 |
| 82 | 240 |
| | 164 |
| 849 | 7641 |
| | 7641 |
| | 0 |

(iv) √5.774409 = 2.403
By division method

| | 2.403 |
|---|---|
| 2 | 5.77 44 36 |
| | 4 |
| 44 | 177 |
| | 176 |
| 4803 | 14409 |
| | 14409 |
| | 0 |

**4. Find the square root of the following numbers correct to two decimal places:**
**(i) 645.8**
**(ii) 107.45**
**(iii) 5.462**
**(iv) 2**
**(v) 3**
**Solution:**

(i) √645.8 = 25.41
It can be written as

| | 25.41 |
|---|---|
| 2 | 6 45.80 00 |
| | 4 |
| 45 | 245 |
| | 225 |
| 504 | 2080 |
| | 2016 |
| 5081 | 6400 |
| | 5081 |
| | 1319 |

(ii) √107.45 = 10.36
It can be written as

| | 10.36 |
|---|---|
| 1 | $\overline{1}\ \overline{07}.\overline{40}\ \overline{00}$ |
| | 1 |
| 203 | 740 |
| | 609 |
| 2066 | 13100 |
| | 12396 |
| | 704 |

(iii) √5.462 = 2.337 = 2.34

It can be written as

| | 2.337 |
|---|---|
| 2 | $\overline{5}.\overline{46}\ \overline{20}\ \overline{00}$ |
| | 4 |
| 43 | 146 |
| | 129 |
| 463 | 1720 |
| | 1389 |
| 4667 | 33100 |
| | 32669 |
| | 431 |

(iv) √2 = 1.41

It can be written as

| | 1.41 |
|---|---|
| 1 | $\overline{2}.\overline{00}\ \overline{00}$ |
| | 1 |
| 24 | 100 |
| | 96 |
| 281 | 400 |
| | 281 |
| | 119 |

(v) √3 = 1.73

It can be written as

| | 1.73 |
|---|---|
| 1 | $\overline{3}.\overline{00}\ \overline{00}$ |
| | 1 |
| 27 | 200 |
| | 189 |
| 343 | 1100 |
| | 1029 |
| | 71 |

**5. Find the square root of the following fractions by division method:**
**(i) 841/1521**
**(ii) 8 257/529**
**(iii) 16 169/441**
**Solution:**

(i) 841/1521
By squaring

$$\sqrt{\frac{841}{1521}} = \frac{\sqrt{841}}{\sqrt{1521}} = \frac{29}{39}$$

It can be written as

| | 29 |
|---|---|
| 2 | $\overline{8}\ \overline{41}$ |
| | 4 |
| 49 | 441 |
| | 441 |
| | 0 |

| | 39 |
|---|---|
| 3 | $\overline{15}\ \overline{21}$ |
| | 9 |
| 69 | 621 |
| | 621 |
| | 0 |

(ii) 8 257/529
By squaring

$$\sqrt{8\frac{257}{529}} = \sqrt{\frac{4232+257}{529}} = \sqrt{\frac{4489}{529}}$$

*So we get*

$$= \frac{67}{23} = 2\frac{21}{23}$$

It can be written as

| | 23 |
|---|---|
| 2 | $\overline{5}\ \overline{29}$ |
| | 4 |
| 43 | 129 |
| | 129 |
| | 0 |

| | 67 |
|---|---|
| 6 | $\overline{44}\ \overline{89}$ |
| | 36 |
| 127 | 889 |
| | 889 |
| | 0 |

(iii) 16 169/441
By squaring

$$\sqrt{16\frac{169}{441}}=\sqrt{\frac{7056+169}{441}}=\sqrt{\frac{7225}{441}}$$

*So we get*

$$=\frac{\sqrt{7225}}{\sqrt{441}}$$

$$=\frac{85}{21}=4\frac{1}{21}$$

It can be written as

| | 21 |
|---|---|
| 2 | $\overline{4}\ \overline{41}$ |
| | 4 |
| 41 | 41 |
| | 41 |
| | 0 |

| | 85 |
|---|---|
| 8 | $\overline{72}\ \overline{25}$ |
| | 64 |
| 165 | 825 |
| | 825 |
| | 0 |

**6. Find the least number which must be subtracted from each of the following numbers to make them a perfect square. Also find the square root of the perfect square number so obtained:**
**(i) 2000**
**(ii) 984**
**(iii) 8934**
**(iv) 11021**
**Solution:**

(i) 2000
We know that

| | 44 |
|---|---|
| 4 | $\overline{20}\ \overline{00}$ |
| | 16 |
| 84 | 400 |
| | 336 |
| | 64 |

By taking square root, 64 is left as remainder
Subtracting 64 from 2000
We get 1936 which is a perfect square and its square root is 44.

(ii) 984
We know that

| | 31 |
|---|---|
| 3 | $\overline{9}\ \overline{84}$ |
| | 9 |
| 61 | 84 |
| | 61 |
| | 23 |

By taking square root, 23 is left as remainder
Subtracting 23 from 984
We get 961 which is a perfect square and its square root is 31.

(iii) 8934
We know that

| | 94 |
|---|---|
| 9 | $\overline{89}\ \overline{34}$ |
| | 81 |
| 184 | 834 |
| | 736 |
| | 98 |

By taking square root, 98 is left as remainder
Subtracting 98 from 894
We get 8934 - 98 = 8836 which is a perfect square and its square root is 94.

(iv) 11021
We know that

| | 104 |
|---|---|
| 1 | $\overline{1}\ \overline{10}\ \overline{21}$ |
| | 1 |
| 204 | 1021 |
| | 816 |
| | 205 |

By taking square root, 205 is left as remainder
Subtracting 205 from 11021
We get 11021 – 205 = 10816 which is a perfect square and its square root is 104.

**7. Find the least number which must be added to each of the following numbers to make them a perfect square. Also, find the square root of the perfect square number so obtained:**
**(i) 1750**
**(ii) 6412**
**(iii) 6598**
**(iv) 8000**
**Solution:**

(i) 1750
We know that

| | 42 |
|---|---|
| 4 | $\overline{17}\ \overline{50}$ |
| | 16 |
| 82 | 150 |
| | 164 |
| | 14 |

By taking square root
$41^2$ is less than 1750

So by taking $42^2$
164 – 150 = 14 less
Adding 14 we get a square of 42 which is 1764.

(ii) 6412
We know that

| | 81 |
|---|---|
| 8 | $\overline{64}\ \overline{12}$ |
| | 64 |
| 161 | 12 |
| | 161 |
| | 149 |

By taking square root
$80^2$ is less than 6412
So by taking $81^2$
161 – 12 = 14 less
Adding 149 we get a square of 81 which is 6561.

(iii) 6598
We know that

| | 82 |
|---|---|
| 8 | $\overline{65}\ \overline{98}$ |
| | 64 |
| 162 | 198 |
| | 324 |
| | 126 |

By taking square root
$81^2$ is less than 6598
So by taking $82^2$
324 – 198 = 126 less
Adding 126 we get a square of 82 which is 6724.

(iv) 8000
We know that

| | 89 |
|---|---|
| 8 | $\overline{80}\ \overline{00}$ |
| | 64 |
| 169 | 1600 |
| | 1521 |
| | 79 |

By taking square root
$89^2$ is less than 8000
So by taking $90^2$
8100 – 8000 = 100 less
Adding 100 we get a square of 90 which is 8100.

| | | |
|---|---|---|
| 90 | 8000 | 90 |
| | − 8100 | |
| | 100 | |

**8. Find the smallest four-digit number which is a perfect square.**
**Solution:**

It is given that
Smallest four – digit number = 1000
We know that

| | |
|---|---|
| | 31 |
| 3 | $\overline{10}\ \overline{00}$ |
| | 9 |
| 61 | 100 |
| | 61 |
| | 39 |

By taking square root, we find that 39 is left.
If we subtract any number from 1000 we get 3 digit number
Take $32^2 = 1024$
Here 1024 – 1000 = 24 is to be added to get a perfect square of least 4 digit number

Therefore, the required 4 digit smallest number is 1024.

**9. Find the greatest number of six digits which is a perfect square.**
**Solution:**

It is given that
Greatest six digit number = 999999
We know that

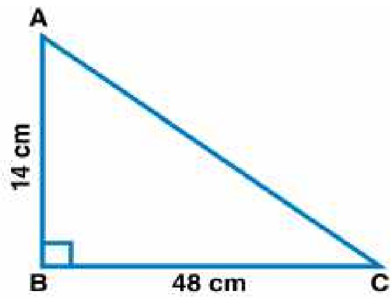
| | |
|---|---|
| | 999 |
| 9 | $\overline{99}\ \overline{99}\ \overline{99}$ |
| | 81 |
| 189 | 1899 |
| | 1701 |
| 1989 | 19899 |
| | 17901 |
| | 1998 |

By taking square root, we find that 1998 is left
If we subtract 1998 from 999999 we get 998001 which is a perfect square.

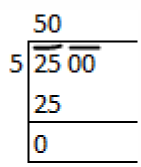
Therefore, required six digit greatest number is 998001.

**10. In a right triangle ABC, $\angle B = 90^0$.**
**(i) If AB = 14 cm, BC = 48 cm, find AC.**
**(ii) If AC = 37 cm, BC = 35 cm, find AB.**
**Solution:**

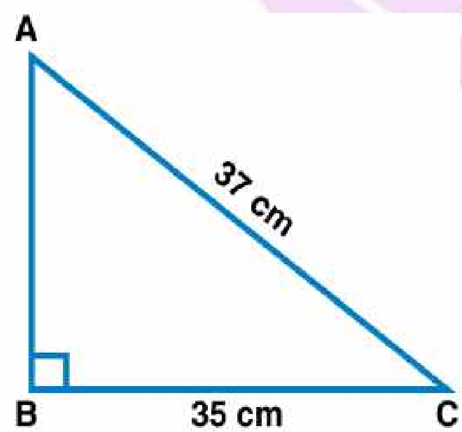
(i) In a right angled triangle ABC
It is given that
AB = 14 cm and BC = 48 cm




Using Pythagoras theorem
$AC^2 = AB^2 + BC^2$
Substituting the values
$= 14^2 + 48^2$
By further calculation
= 196 + 2304
= 2500
So we get
AC = $\sqrt{2500}$ = 50 cm




(ii) In right triangle ABC
B = $90^0$, AC = 37 cm, BC = 35 cm




Using Pythagoras Theorem
$AC^2 = AB^2 + BC^2$
Substituting the values
$37^2 = AB^2 + 352$

By further calculation

$1369 = AB^2 + 1225$

$AB^2 = 1369 – 1225 = 144$

So we get

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

| | |
|---|---|
| | 12 |
| 1 | $\overline{1}\ \overline{44}$ |
| | 1 |
| 22 | 44 |
| | 44 |
| | 0 |

**11. A gardener has 1400 plants. He wants to plant these in such a way that the number of rows and number of columns remains same. Find the minimum number of plants he needs more for this.**

**Solution:**

It is given that

Total number of plants = 1400

We know that

| | |
|---|---|
| | 37 |
| 3 | $\overline{14}\ \overline{00}$ |
| | 9 |
| 67 | 500 |
| | 469 |
| | 31 |

Here

Number of columns = Number of rows

By taking the square root of 1400

$37^2 < 1400$

So take $38^2 = 1444$

We need 1444 – 1400 = 44 plants more

Therefore, the minimum number of plants he needs more for this is 44.

**12. There are 1000 children in a school. For a P.T. drill they have to stand in such a way that the number of rows is equal to number of columns. How many children would be left out in this arrangement?**

**Solution:**

It is given that

No. of total children in a school = 1000

For a P.T. drill, children have to stand in such a way that

No. of rows = No. of columns

Take the square root of 1000

39 is left as remainder

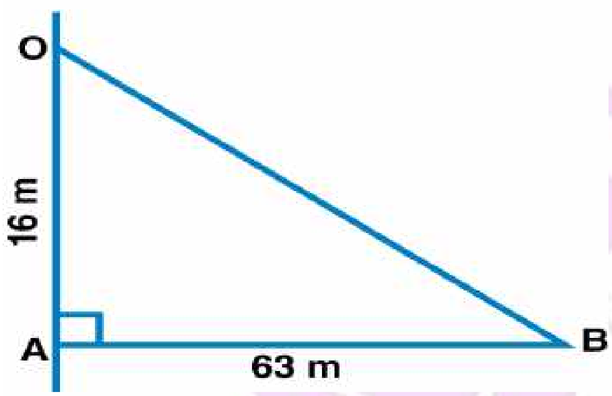
Left out children = 39

| | |
|---|---|
| | 31 |
| 3 | $\overline{10}\ \overline{00}$ |
| | 9 |
| 61 | 100 |
| | 61 |
| | 39 |

Hence, 39 children would be left out in this arrangement.

**13. Amit walks 16 m south from his house and turns east to walk 63 m to reach his friend's house. While returning, he walks diagonally from his friend's house to reach back to his house. What distance did he walk while returning?**
**Solution:**

It is given that
Amit walks 16 m south from his house and turns east to walk 63 m to reach his friend's house
Consider O as the house and A and B as the places
OA = 16 m, AO = 63 m




Using Pythagoras theorem
$OB^2 = OA^2 + AB^2$
Substituting the values
$= 16^2 + 63^2$
By further calculation
= 256 + 3969
= 4225
So we get
OB = √4225 = 65

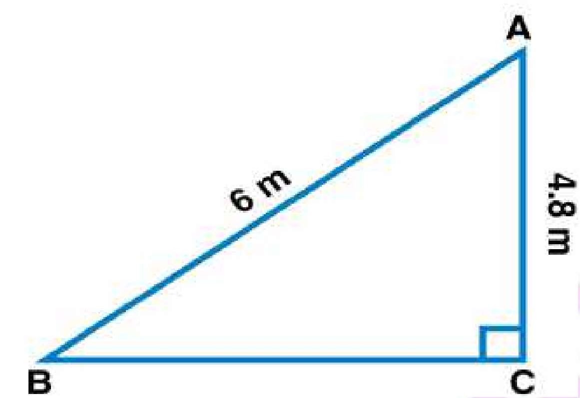
| | |
|---|---|
| | 65 |
| 6 | $\overline{42}\ \overline{25}$ |
| | 36 |
| 125 | 625 |
| | 625 |
| | 0 |

Therefore, Amit has to walk 65 m to reach his house.

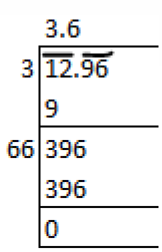
**14. A ladder 6 m long leaned against a wall. The ladder reaches the wall to a height of 4.8 m. Find the distance between the wall and the foot of the ladder.**
**Solution:**

It is given that
Length of ladder = 6 m
Ladder reaches the wall to a height of 4.8 m

Consider AB as the ladder and AC as the height of the wall
AB = 6 m and AC = 4.8 m




Distance between the foot of ladder and wall is BC
Using Pythagoras theorem,
$AB^2 = AC^2 + BC^2$
Substituting the values
$6^2 = 4.8^2 + BC^2$
By further calculation
$BC^2 = 6^2 - 4.8^2$
$BC^2 = 36 - 23.04 = 12.96$
So we get
$BC = \sqrt{12.96} = 3.6$ m




Hence, the distance between the wall and the foot of the ladder is 3.6 m.