

## EXERCISE 3.1

1. Which of the following numbers are perfect squares?

(i) 484

(ii) 625

(iii) 576

(iv) 941

(v) 961

(vi) 2500

**Solution:**

(i) 484

First find the prime factors for 484

$$484 = 2 \times 2 \times 11 \times 11$$

By grouping the prime factors in equal pairs we get,

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

By observation, none of the prime factors are left out.

∴ 484 is a perfect square.

(ii) 625

First find the prime factors for 625

$$625 = 5 \times 5 \times 5 \times 5$$

By grouping the prime factors in equal pairs we get,

$$= (5 \times 5) \times (5 \times 5)$$

By observation, none of the prime factors are left out.

∴ 625 is a perfect square.

(iii) 576

First find the prime factors for 576

$$576 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3$$

By grouping the prime factors in equal pairs we get,

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

By observation, none of the prime factors are left out.

∴ 576 is a perfect square.

(iv) 941

First find the prime factors for 941

$$941 = 941 \times 1$$

We know that 941 itself is a prime factor.

∴ 941 is not a perfect square.

(v) 961

First find the prime factors for 961

$$961 = 31 \times 31$$

By grouping the prime factors in equal pairs we get,  
 $= (31 \times 31)$

By observation, none of the prime factors are left out.

∴ 961 is a perfect square.

(vi) 2500

First find the prime factors for 2500

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

By grouping the prime factors in equal pairs we get,  
 $= (2 \times 2) \times (5 \times 5) \times (5 \times 5)$

By observation, none of the prime factors are left out.

∴ 2500 is 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 in each case:**

(i) 1156

(ii) 2025

(iii) 14641

(iv) 4761

**Solution:**

(i) 1156

First find the prime factors for 1156

$$1156 = 2 \times 2 \times 17 \times 17$$

By grouping the prime factors in equal pairs we get,  
 $= (2 \times 2) \times (17 \times 17)$

By observation, none of the prime factors are left out.

∴ 1156 is a perfect square.

To find the square of the given number

$$1156 = (2 \times 17) \times (2 \times 17)$$

$$= 34 \times 34$$

$$= (34)^2$$

∴ 1156 is a square of 34.

**(ii)** 2025

First find the prime factors for 2025

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

By grouping the prime factors in equal pairs we get,

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

By observation, none of the prime factors are left out.

$\therefore$  2025 is a perfect square.

To find the square of the given number

$$2025 = (3 \times 3 \times 5) \times (3 \times 3 \times 5)$$

$$= 45 \times 45$$

$$= (45)^2$$

$\therefore$  2025 is a square of 45.

**(iii)** 14641

First find the prime factors for 14641

$$14641 = 11 \times 11 \times 11 \times 11$$

By grouping the prime factors in equal pairs we get,

$$= (11 \times 11) \times (11 \times 11)$$

By observation, none of the prime factors are left out.

$\therefore$  14641 is a perfect square.

To find the square of the given number

$$14641 = (11 \times 11) \times (11 \times 11)$$

$$= 121 \times 121$$

$$= (121)^2$$

$\therefore$  14641 is a square of 121.

**(iv)** 4761

First find the prime factors for 4761

$$4761 = 3 \times 3 \times 23 \times 23$$

By grouping the prime factors in equal pairs we get,

$$= (3 \times 3) \times (23 \times 23)$$

By observation, none of the prime factors are left out.

$\therefore$  4761 is a perfect square.

To find the square of the given number

$$4761 = (3 \times 23) \times (3 \times 23)$$

$$= 69 \times 69$$

$$= (69)^2$$

$\therefore$  4761 is a square of 69.

**3. Find the smallest number by which the given number must be multiplied so that the product is a perfect square:**

**(i) 23805**

**(ii) 12150**

**(iii) 7688**

**Solution:**

**(i) 23805**

First find the prime factors for 23805

$$23805 = 3 \times 3 \times 23 \times 23 \times 5$$

By grouping the prime factors in equal pairs we get,

$$= (3 \times 3) \times (23 \times 23) \times 5$$

By observation, prime factor 5 is left out.

So, multiply by 5 we get,

$$23805 \times 5 = (3 \times 3) \times (23 \times 23) \times (5 \times 5)$$

$$= (3 \times 5 \times 23) \times (3 \times 5 \times 23)$$

$$= 345 \times 345$$

$$= (345)^2$$

∴ Product is the square of 345.

**(ii) 12150**

First find the prime factors for 12150

$$12150 = 2 \times 3 \times 3 \times 3 \times 3 \times 5 \times 5$$

By grouping the prime factors in equal pairs we get,

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

By observation, prime factor 2 and 3 are left out.

So, multiply by  $2 \times 3 = 6$  we get,

$$12150 \times 6 = 2 \times 3 \times (3 \times 3) \times (3 \times 3) \times (5 \times 5) \times 2 \times 3$$

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

$$= 270 \times 270$$

$$= (270)^2$$

∴ Product is the square of 270.

**(iii) 7688**

First find the prime factors for 7688

$$7688 = 2 \times 2 \times 31 \times 31 \times 2$$

By grouping the prime factors in equal pairs we get,

$$= (2 \times 2) \times (31 \times 31) \times 2$$

By observation, prime factor 2 is left out.

So, multiply by 2 we get,

$$\begin{aligned} 7688 \times 2 &= (2 \times 2) \times (31 \times 31) \times (2 \times 2) \\ &= (2 \times 31 \times 2) \times (2 \times 31 \times 2) \\ &= 124 \times 124 \\ &= (124)^2 \end{aligned}$$

∴ Product is the square of 124.

**4. Find the smallest number by which the given number must be divided so that the resulting number is a perfect square:**

**(i) 14283**

**(ii) 1800**

**(iii) 2904**

**Solution:**

**(i) 14283**

First find the prime factors for 14283

$$14283 = 3 \times 3 \times 3 \times 23 \times 23$$

By grouping the prime factors in equal pairs we get,

$$= (3 \times 3) \times (23 \times 23) \times 3$$

By observation, prime factor 3 is left out.

So, divide by 3 to eliminate 3 we get,

$$14283/3 = (3 \times 3) \times (23 \times 23)$$

$$= (3 \times 23) \times (3 \times 23)$$

$$= 69 \times 69$$

$$= (69)^2$$

∴ Resultant is the square of 69.

**(ii) 1800**

First find the prime factors for 1800

$$1800 = 2 \times 2 \times 5 \times 5 \times 3 \times 3 \times 2$$

By grouping the prime factors in equal pairs we get,

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

By observation, prime factor 2 is left out.

So, divide by 2 to eliminate 2 we get,

$$1800/2 = (2 \times 2) \times (5 \times 5) \times (3 \times 3)$$

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

$$= 30 \times 30$$

$$= (30)^2$$

∴ Resultant is the square of 30.

(iii) 2904

First find the prime factors for 2904

$$2904 = 2 \times 2 \times 11 \times 11 \times 2 \times 3$$

By grouping the prime factors in equal pairs we get,

$$= (2 \times 2) \times (11 \times 11) \times 2 \times 3$$

By observation, prime factor 2 and 3 are left out.

So, divide by 6 to eliminate 2 and 3 we get,

$$2904/6 = (2 \times 2) \times (11 \times 11)$$

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

$$= 22 \times 22$$

$$= (22)^2$$

∴ Resultant is the square of 22.

**5. Which of the following numbers are perfect squares?**

**11, 12, 16, 32, 36, 50, 64, 79, 81, 111, 121**

**Solution:**

11 it is a prime number by itself.

So it is not a perfect square.

12 is not a perfect square.

$$16 = (4)^2$$

16 is a perfect square.

32 is not a perfect square.

$$36 = (6)^2$$

36 is a perfect square.

50 is not a perfect square.

$$64 = (8)^2$$

64 is a perfect square.

79 it is a prime number.

So it is not a perfect square.

$$81 = (9)^2$$

81 is a perfect square.

111 it is a prime number.  
So it is not a perfect square.

$121 = (11)^2$   
121 is a perfect square.

**6. Using prime factorization method, find which of the following numbers are perfect squares?**

**189, 225, 2048, 343, 441, 2961, 11025, 3549**

**Solution:**

189 prime factors are

$$189 = 3^2 \times 3 \times 7$$

Since it does not have equal pair of factors 189 is not a perfect square.

225 prime factors are

$$225 = (5 \times 5) \times (3 \times 3)$$

Since 225 has equal pair of factors.  $\therefore$  It is a perfect square.

2048 prime factors are

$$2048 = (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times 2$$

Since it does not have equal pair of factors 2048 is not a perfect square.

343 prime factors are

$$343 = (7 \times 7) \times 7$$

Since it does not have equal pair of factors 2048 is not a perfect square.

441 prime factors are

$$441 = (7 \times 7) \times (3 \times 3)$$

Since 441 has equal pair of factors.  $\therefore$  It is a perfect square.

2961 prime factors are

$$2961 = (3 \times 3) \times (3 \times 3) \times (3 \times 3) \times (2 \times 2)$$

Since 2961 has equal pair of factors.  $\therefore$  It is a perfect square.

11025 prime factors are

$$11025 = (3 \times 3) \times (5 \times 5) \times (7 \times 7)$$

Since 11025 has equal pair of factors.  $\therefore$  It is a perfect square.

3549 prime factors are

$$3549 = (13 \times 13) \times 3 \times 7$$

Since it does not have equal pair of factors 3549 is not a perfect square.

**7. By what number should each of the following numbers be multiplied to get a perfect square in each case? Also find the number whose square is the new number.**

**(i) 8820**

**(ii) 3675**

**(iii) 605**

**(iv) 2880**

**(v) 4056**

**(vi) 3468**

**(vii) 7776**

**Solution:**

**(i) 8820**

First find the prime factors for 8820

$$8820 = 2 \times 2 \times 3 \times 3 \times 7 \times 7 \times 5$$

By grouping the prime factors in equal pairs we get,

$$= (2 \times 2) \times (3 \times 3) \times (7 \times 7) \times 5$$

By observation, prime factor 5 is left out.

So, multiply by 5 we get,

$$8820 \times 5 = (2 \times 2) \times (3 \times 3) \times (7 \times 7) \times (5 \times 5)$$

$$= (2 \times 3 \times 7 \times 5) \times (2 \times 3 \times 7 \times 5)$$

$$= 210 \times 210$$

$$= (210)^2$$

$\therefore$  Product is the square of 210.

**(ii) 3675**

First find the prime factors for 3675

$$3675 = 5 \times 5 \times 7 \times 7 \times 3$$

By grouping the prime factors in equal pairs we get,

$$= (5 \times 5) \times (7 \times 7) \times 3$$

By observation, prime factor 3 is left out.

So, multiply by 3 we get,

$$3675 \times 3 = (5 \times 5) \times (7 \times 7) \times (3 \times 3)$$

$$= (5 \times 7 \times 3) \times (5 \times 7 \times 3)$$

$$= 105 \times 105$$

$$= (105)^2$$

$\therefore$  Product is the square of 105.

**(iii) 605**

First find the prime factors for 605

$$605 = 5 \times 11 \times 11$$

By grouping the prime factors in equal pairs we get,

$$= (11 \times 11) \times 5$$

By observation, prime factor 5 is left out.

So, multiply by 5 we get,

$$\begin{aligned} 605 \times 5 &= (11 \times 11) \times (5 \times 5) \\ &= (11 \times 5) \times (11 \times 5) \\ &= 55 \times 55 \\ &= (55)^2 \end{aligned}$$

$\therefore$  Product is the square of 55.

**(iv) 2880**

First find the prime factors for 2880

$$2880 = 5 \times 3 \times 3 \times 2 \times 2 \times 2 \times 2 \times 2$$

By grouping the prime factors in equal pairs we get,

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

By observation, prime factor 5 is left out.

So, multiply by 5 we get,

$$\begin{aligned} 2880 \times 5 &= (3 \times 3) \times (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (5 \times 5) \\ &= (3 \times 2 \times 2 \times 2 \times 5) \times (3 \times 2 \times 2 \times 2 \times 5) \\ &= 120 \times 120 \\ &= (120)^2 \end{aligned}$$

$\therefore$  Product is the square of 120.

**(v) 4056**

First find the prime factors for 4056

$$4056 = 2 \times 2 \times 13 \times 13 \times 2 \times 3$$

By grouping the prime factors in equal pairs we get,

$$= (2 \times 2) \times (13 \times 13) \times 2 \times 3$$

By observation, prime factors 2 and 3 are left out.

So, multiply by 6 we get,

$$\begin{aligned} 4056 \times 6 &= (2 \times 2) \times (13 \times 13) \times (2 \times 2) \times (3 \times 3) \\ &= (2 \times 13 \times 2 \times 3) \times (2 \times 13 \times 2 \times 3) \\ &= 156 \times 156 \\ &= (156)^2 \end{aligned}$$

$\therefore$  Product is the square of 156.

**(vi) 3468**

First find the prime factors for 3468

$$3468 = 2 \times 2 \times 17 \times 17 \times 3$$

By grouping the prime factors in equal pairs we get,

$$= (2 \times 2) \times (17 \times 17) \times 3$$

By observation, prime factor 3 is left out.

So, multiply by 3 we get,

$$3468 \times 3 = (2 \times 2) \times (17 \times 17) \times (3 \times 3)$$

$$= (2 \times 17 \times 3) \times (2 \times 17 \times 3)$$

$$= 102 \times 102$$

$$= (102)^2$$

∴ Product is the square of 102.

**(vii) 7776**

First find the prime factors for 7776

$$7776 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 2 \times 3$$

By grouping the prime factors in equal pairs we get,

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

By observation, prime factors 2 and 3 are left out.

So, multiply by 6 we get,

$$7776 \times 6 = (2 \times 2) \times (2 \times 2) \times (3 \times 3) \times (3 \times 3) \times (2 \times 2) \times (3 \times 3)$$

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

$$= 216 \times 216$$

$$= (216)^2$$

∴ Product is the square of 216.

**8. By What numbers should each of the following be divided to get a perfect square in each case? Also, find the number whose square is the new number.**

**(i) 16562**

**(ii) 3698**

**(iii) 5103**

**(iv) 3174**

**(v) 1575**

**Solution:**

**(i) 16562**

First find the prime factors for 16562

$$16562 = 7 \times 7 \times 13 \times 13 \times 2$$

By grouping the prime factors in equal pairs we get,

$$= (7 \times 7) \times (13 \times 13) \times 2$$

By observation, prime factor 2 is left out.

So, divide by 2 to eliminate 2 we get,

$$\begin{aligned} 16562/2 &= (7 \times 7) \times (13 \times 13) \\ &= (7 \times 13) \times (7 \times 13) \\ &= 91 \times 91 \\ &= (91)^2 \end{aligned}$$

∴ Resultant is the square of 91.

**(ii)** 3698

First find the prime factors for 3698

$$3698 = 2 \times 43 \times 43$$

By grouping the prime factors in equal pairs we get,

$$= (43 \times 43) \times 2$$

By observation, prime factor 2 is left out.

So, divide by 2 to eliminate 2 we get,

$$\begin{aligned} 3698/2 &= (43 \times 43) \\ &= (43)^2 \end{aligned}$$

∴ Resultant is the square of 43.

**(iii)** 5103

First find the prime factors for 5103

$$5103 = 3 \times 3 \times 3 \times 3 \times 3 \times 7$$

By grouping the prime factors in equal pairs we get,

$$= (3 \times 3) \times (3 \times 3) \times (3 \times 3) \times 7$$

By observation, prime factor 7 is left out.

So, divide by 7 to eliminate 7 we get,

$$\begin{aligned} 5103/7 &= (3 \times 3) \times (3 \times 3) \times (3 \times 3) \\ &= (3 \times 3 \times 3) \times (3 \times 3 \times 3) \\ &= 27 \times 27 \\ &= (27)^2 \end{aligned}$$

∴ Resultant is the square of 27.

**(iv)** 3174

First find the prime factors for 3174

$$3174 = 2 \times 3 \times 23 \times 23$$

By grouping the prime factors in equal pairs we get,

$$= (23 \times 23) \times 2 \times 3$$

By observation, prime factor 2 and 3 are left out.

So, divide by 6 to eliminate 2 and 3 we get,

$$3174/6 = (23 \times 23) \\ = (23)^2$$

∴ Resultant is the square of 23.

(v) 1575

First find the prime factors for 1575

$$1575 = 3 \times 3 \times 5 \times 5 \times 7$$

By grouping the prime factors in equal pairs we get,

$$= (3 \times 3) \times (5 \times 5) \times 7$$

By observation, prime factor 7 is left out.

So, divide by 7 to eliminate 7 we get,

$$1575/7 = (3 \times 3) \times (5 \times 5)$$

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

$$= 15 \times 15$$

$$= (15)^2$$

∴ Resultant is the square of 15.

**9. Find the greatest number of two digits which is a perfect square.**

**Solution:**

We know that the two digit greatest number is 99

$$\begin{array}{r} 9 \\ 9 \overline{) 99} \\ \underline{81} \\ 18 \end{array}$$

∴ Greatest two digit perfect square number is  $99 - 18 = 81$

**10. Find the least number of three digits which is perfect square.**

**Solution:**

We know that the three digit greatest number is 100

To find the square root of 100

$$\begin{array}{r} 10 \\ 1 \overline{) 100} \\ \underline{1} \\ 20 \end{array}$$

∴ the least number of three digits which is a perfect square is 100 itself.

**11. Find the smallest number by which 4851 must be multiplied so that the product becomes a perfect square.**

**Solution:**

First find the prime factors for 4851

$$4851 = 3 \times 3 \times 7 \times 7 \times 11$$

By grouping the prime factors in equal pairs we get,

$$= (3 \times 3) \times (7 \times 7) \times 11$$

∴ The smallest number by which 4851 must be multiplied so that the product becomes a perfect square is 11.

**12. Find the smallest number by which 28812 must be divided so that the quotient becomes a perfect square.**

**Solution:**

First find the prime factors for 28812

$$28812 = 2 \times 2 \times 3 \times 7 \times 7 \times 7 \times 7$$

By grouping the prime factors in equal pairs we get,

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

∴ The smallest number by which 28812 must be divided so that the quotient becomes a perfect square is 3.

**13. Find the smallest number by which 1152 must be divided so that it becomes a perfect square. Also find the number whose square is the resulting number.**

**Solution:**

First find the prime factors for 1152

$$1152 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3$$

By grouping the prime factors in equal pairs we get,

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

∴ The smallest number by which 1152 must be divided so that the quotient becomes a perfect square is 2.

The number after division,  $1152/2 = 576$

prime factors for  $576 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3$

By grouping the prime factors in equal pairs we get,

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

$$= 2^6 \times 3^2$$

$$= 24^2$$

∴ The resulting number is the square of 24.