EXERCISE 3.1 PAGE NO: 3.4

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 = 2×2×11×11
By grouping the prime factors in equal pairs we get,
= (2×2) × (11×11)
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 = 5×5×5×5
By grouping the prime factors in equal pairs we get,
= (5×5) × (5×5)
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 = 2×2×2×2×2×2×3×3
By grouping the prime factors in equal pairs we get,
= (2×2) × (2×2) × (2×2) × (3×3)
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 × 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 = 31×31
By grouping the prime factors in equal pairs we get,
= (31×31)
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 = 2×2×5×5×5×5
By grouping the prime factors in equal pairs we get,
= (2×2) × (5×5) × (5×5)
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 = 2×2×17×17
By grouping the prime factors in equal pairs we get,
= (2×2) × (17×17)
By observation, none of the prime factors are left out.
∴ 1156 is a perfect square.
To find the square of the given number
1156 = (2×17) × (2×17)
= 34 × 34
= $(34)^2$
∴ 1156 is a square of 34.

(ii) 2025
First find the prime factors for 2025
$2025 = 3\times3\times3\times3\times5\times5$
By grouping the prime factors in equal pairs we get,
$= (3\times3) \times (3\times3) \times (5\times5)$
By observation, none of the prime factors are left out.
∴ 2025 is a perfect square.
To find the square of the given number
$2025 = (3\times3\times5) \times (3\times3\times5)$
$= 45 \times 45$
$= (45)^2$
∴ 2025 is a square of 45.

(iii) 14641
First find the prime factors for 14641
$14641 = 11\times11\times11\times11$
By grouping the prime factors in equal pairs we get,
$= (11\times11) \times (11\times11)$
By observation, none of the prime factors are left out.
∴ 14641 is a perfect square.
To find the square of the given number
$14641 = (11\times11) \times (11\times11)$
$= 121 \times 121$
$= (121)^2$
∴ 14641 is a square of 121.

(iv) 4761
First find the prime factors for 4761
$4761 = 3\times3\times23\times23$
By grouping the prime factors in equal pairs we get,
$= (3\times3) \times (23\times23)$
By observation, none of the prime factors are left out.
∴ 4761 is a perfect square.
To find the square of the given number
$4761 = (3\times23) \times (3\times23)$
$= 69 \times 69$
$= (69)^2$
∴ 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
$23805 = 3\times3\times23\times23\times5$
By grouping the prime factors in equal pairs we get,
$= (3\times3) \times (23\times23) \times 5$
By observation, prime factor 5 is left out.
So, multiply by 5 we get,
$23805 \times 5 = (3\times3) \times (23\times23) \times (5\times5)$
$= (3\times5\times23) \times (3\times5\times23)$
$= 345 \times 345$
$= (345)^2$
∴ Product is the square of 345.

(ii) 12150
First find the prime factors for 12150
$12150 = 2\times2\times2\times2\times3\times3\times5\times5\times2$
By grouping the prime factors in equal pairs we get,
$= (2\times2) \times (2\times2) \times (3\times3) \times (5\times5) \times 2$
By observation, prime factor 2 is left out.
So, multiply by 2 we get,
$12150 \times 2 = (2\times2) \times (2\times2) \times (3\times3) \times (5\times5) \times (2\times2)$
$= (2\times2\times3\times5\times2) \times (2\times2\times3\times5\times2)$
$= 120 \times 120$
$= (120)^2$
∴ Product is the square of 120.

(iii) 7688
First find the prime factors for 7688
$7688 = 2\times2\times31\times31\times2$
By grouping the prime factors in equal pairs we get,
$= (2\times2) \times (31\times31) \times 2$
By observation, prime factor 2 is left out.
So, multiply by 2 we get,

$7688 \times 2 = (2\times2) \times (31\times31)\times (2\times2)$
$= (2\times31\times2) \times (2\times31\times2)$
$= 124 \times 124$
$= (124)^2$
∴ 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) 12283
(ii) 1800
(iii) 2904
Solution:
(i) 12283
First find the prime factors for 12283
$12283 = 3\times3\times3\times23\times23$
By grouping the prime factors in equal pairs we get,
$= (3\times3) \times (23\times23) \times 3$
By observation, prime factor 3 is left out.
So, divide by 3 to eliminate 3 we get,
$12283/3 = (3\times3) \times (23\times23)$
$= (3\times23) \times (3\times23)$
$= 69 \times 69$
$= (69)^2$
∴ Resultant is the square of 69.

(ii) 1800
First find the prime factors for 1800
$1800 = 2\times2\times5\times5\times3\times3\times2$
By grouping the prime factors in equal pairs we get,
$= (2\times2) \times (5\times5) \times (3\times3) \times 2$
By observation, prime factor 2 is left out.
So, divide by 2 to eliminate 2 we get,
$1800/2 = (2\times2) \times (5\times5) \times (3\times3)$
$= (2\times5\times3) \times (2\times5\times3)$
$= 30 \times 30$
$= (30)^2$
∴ Resultant is the square of 30.

(iii) 2904
First find the prime factors for 2904
$2904 = 2\times2\times11\times11\times2\times3$
By grouping the prime factors in equal pairs we get,
$= (2\times2) \times (11\times11) \times 2 \times 3$
By observation, prime factor 2 and 3 are left out.
So, divide by 6 to eliminate 2 and 3 we get,
$2904/6 = (2\times2) \times (11\times11)$
$= (2\times11) \times (2\times11)$
$= 22 \times 22$
$= (22)^2$
∴ 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
$225 = (5\times5) \times (3\times3)$
Since 225 has equal pair of factors. ∴ It is a perfect square.

2048 prime factors are
$2048 = (2\times2) \times (2\times2) \times (2\times2) \times (2\times2) \times (2\times2) \times 2$
Since it does not have equal pair of factors 2048 is not a perfect square.

343 prime factors are
$343 = (7\times7) \times 7$
Since it does not have equal pair of factors 2048 is not a perfect square.

441 prime factors are
$441 = (7\times7) \times (3\times3)$
Since 441 has equal pair of factors. ∴ It is a perfect square.

2961 prime factors are
$2961 = (3\times3) \times (3\times3) \times (3\times3) \times (2\times2)$
Since 2961 has equal pair of factors. ∴ It is a perfect square.

11025 prime factors are
$11025 = (3\times3) \times (5\times5) \times (7\times7)$
Since 11025 has equal pair of factors. ∴ It is a perfect square.

3549 prime factors are

3549 = (13×13) × 3 × 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 by 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 = 2×2×3×3×7×7×5
By grouping the prime factors in equal pairs we get,
= (2×2) × (3×3) × (7×7) × 5
By observation, prime factor 5 is left out.
So, multiply by 5 we get,
8820 × 5 = (2×2) × (3×3) × (7×7) × (5×5)
= (2×3×7×5) × (2×3×7×5)
= 210 × 210
= $(210)^2$
∴ Product is the square of 210.

(ii) 3675
First find the prime factors for 3675
3675 = 5×5×7×7×3
By grouping the prime factors in equal pairs we get,
= (5×5) × (7×7) × 3
By observation, prime factor 3 is left out.
So, multiply by 3 we get,
3675 × 3 = (5×5) × (7×7) × (3×3)
= (5×7×3) × (5×7×3)
= 105 × 105
= $(105)^2$
∴ Product is the square of 105.

(iii) 605
First find the prime factors for 605
$605 = 5\times11\times11$
By grouping the prime factors in equal pairs we get,
$= (11\times11) \times 5$
By observation, prime factor 5 is left out.
So, multiply by 5 we get,
$605 \times 5 = (11\times11) \times (5\times5)$
$= (11\times5) \times (11\times5)$
$= 55 \times 55$
$= (55)^2$
∴ Product is the square of 55.

(iv) 2880
First find the prime factors for 2880
$2880 = 5\times3\times3\times2\times2\times2\times2\times2\times2$
By grouping the prime factors in equal pairs we get,
$= (3\times3) \times (2\times2) \times (2\times2) \times (2\times2) \times 5$
By observation, prime factor 5 is left out.
So, multiply by 5 we get,
$2880 \times 5 = (3\times3) \times (2\times2) \times (2\times2) \times (2\times2) \times (5\times5)$
$= (3\times2\times2\times2\times5) \times (3\times2\times2\times2\times5)$
$= 120 \times 120$
$= (120)^2$
∴ Product is the square of 120.

(v) 4056
First find the prime factors for 4056
$4056 = 2\times2\times13\times13\times2\times3$
By grouping the prime factors in equal pairs we get,
$= (2\times2) \times (13\times13) \times 2 \times 3$
By observation, prime factors 2 and 3 are left out.
So, multiply by 6 we get,
$4056 \times 6 = (2\times2) \times (13\times13) \times (2\times2) \times (3\times3)$
$= (2\times13\times2\times3) \times (2\times13\times2\times3)$
$= 156 \times 156$
$= (156)^2$
∴ Product is the square of 156.

(vi) 3468
First find the prime factors for 3468
$3468 = 2\times2\times17\times17\times3$
By grouping the prime factors in equal pairs we get,
$= (2\times2) \times (17\times17) \times 3$
By observation, prime factor 3 is left out.
So, multiply by 3 we get,
$3468 \times 3 = (2\times2) \times (17\times17) \times (3\times3)$
$= (2\times17\times3) \times (2\times17\times3)$
$= 102 \times 102$
$= (102)^2$
∴ Product is the square of 102.

(vii) 7776
First find the prime factors for 7776
$7776 = 2\times2\times2\times2\times3\times3\times3\times3\times2\times3$
By grouping the prime factors in equal pairs we get,
$= (2\times2) \times (2\times2) \times (3\times3) \times (3\times3) \times 2 \times 3$
By observation, prime factors 2 and 3 are left out.
So, multiply by 6 we get,
$7776 \times 6 = (2\times2) \times (2\times2) \times (3\times3) \times (3\times3) \times (2\times2) \times (3\times3)$
$= (2\times2\times3\times3\times2\times3) \times (2\times2\times3\times3\times2\times3)$
$= 216 \times 216$
$= (216)^2$
∴ 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
$16562 = 7\times7\times13\times13\times2$
By grouping the prime factors in equal pairs we get,
$= (7\times7) \times (13\times13) \times 2$

By observation, prime factor 2 is left out.
So, divide by 2 to eliminate 2 we get,
$16562/2 = (7\times7) \times (13\times13)$
$= (7\times13) \times (7\times13)$
$= 91 \times 91$
$= (91)^2$
∴ Resultant is the square of 91.

(ii) 3698
First find the prime factors for 3698
$3698 = 2\times43\times43$
By grouping the prime factors in equal pairs we get,
$= (43\times43) \times 2$
By observation, prime factor 2 is left out.
So, divide by 2 to eliminate 2 we get,
$3698/2 = (43\times43)$
$= (43)^2$
∴ Resultant is the square of 43.

(iii) 5103
First find the prime factors for 5103
$5103 = 3\times3\times3\times3\times3\times3\times7$
By grouping the prime factors in equal pairs we get,
$= (3\times3) \times (3\times3) \times (3\times3) \times 7$
By observation, prime factor 7 is left out.
So, divide by 7 to eliminate 7 we get,
$5103/7 = (3\times3) \times (3\times3) \times (3\times3)$
$= (3\times3\times3) \times (3\times3\times3)$
$= 27 \times 27$
$= (27)^2$
∴ Resultant is the square of 27.

(iv) 3174
First find the prime factors for 3174
$3174 = 2\times3\times23\times23$
By grouping the prime factors in equal pairs we get,
$= (23\times23) \times 2 \times 3$
By observation, prime factor 2 and 3 are left out.
So, divide by 6 to eliminate 2 and 3 we get,

3174/6 = (23×23)

= $(23)^2$

∴ Resultant is the square of 23.

(v) 1575

First find the prime factors for 1575

1575 = 3×3×5×5×7

By grouping the prime factors in equal pairs we get,

= (3×3) × (5×5) × 7

By observation, prime factor 7 is left out.

So, divide by 7 to eliminate 7 we get,

1575/7 = (3×3) × (5×5)

= (3×5) × (3×5)

= 15 × 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

```
   9
9 |99
  |81
  |18
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∴ 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

```
   10
1 |100
  |1
2 |0
```

∴ 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 = 3×3×7×7×11
By grouping the prime factors in equal pairs we get,
= (3×3) × (7×7) × 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 = 2×2×3×3×3×17×17
By grouping the prime factors in equal pairs we get,
= (2×2) × (3×3) × (17×17) × 3
∴ 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
28812 = 2×2×2×2×2×2×2×3×3
By grouping the prime factors in equal pairs we get,
= (2×2) × (2×2) × (2×2) × (3×3) × 3
∴ 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 = 2×2×2×2×2×2×3×3
By grouping the prime factors in equal pairs we get,
= (2×2) × (2×2) × (2×2) × (3×3)
= $2^6 \times 3^2$
= 24^2
∴ The resulting number is the square of 24.