Chapter-3

Squares and square roots

Exercise 3-1

Q-1 Which of the following is a perfect squares.

(i) 484 (ii) 625 (iii) 576 (iv) 941

(v) 961 (vi) 2500

Solution (i) $484 = 2 \times 2 \times 11 \times 11$

∴ Yes, It is a perfect square.

2	484
2	242
11	121
11	11
	1

(ii) $625 = 5 \times 5 \times 5 \times 5$

∴ Yes, It is a perfect square.

5	625
5	125
5	25
5	5
	1

(iii) $576 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3$

∴ these 2 and 3 are complete in pairs.

hence 576 is a perfect square

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

(IV) $941 = 29 \times 29$

∴ Yes, it is a perfect square.

29	941
29	29
	1

(V) $961 = 31 \times 31$

∴ Yes, it is a perfect square.

31	961
31	31
	1

(VI) $2500 = 2 \times 2 \times 5 \times 5 \times 5 \times 5$

∵ 2 and 5 are in pairs.

Yes, it is a perfect square.

2	2500
2	1250
5	625
5	125
5	25
5	5
	1

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Q.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) $1156 = 2 \times 2 \times 17 \times 17$

here 2 and 17 are complete in pairs.

2	1156
2	578
17	289
17	17
	1

∴ Yes 1156 is a perfect square.

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

$= (34)^2$

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

here prime factors 3 and 5 are complete in pairs.

3	2025
3	675
3	225
3	75
5	25
5	5
	1

∴ Yes, 2025 is a perfect square.

Also $2025 = (3 \times 3 \times 5)^2$

$= (45)^2$

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

∵ here Prime number 11 is complete in pair

Thus, it is a perfect square.

11	14641
11	1331
11	121
11	11
	1

Also $14640 = (11 \times 11)^2$

$= (121)^2$

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

∵ 3 and 23 are complete in pairs.

3	4761
3	1587
23	529
23	23
	1

Hence, 4761 is a perfect square.

Also, $4761 = (3 \times 23)^2$

$= (69)^2$

Q.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

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

3	23805
3	7935
5	2645
23	529
23	23
	1

here prime factors 3 and 23 are complete in pairs. but '5' is not in pairs.

To make it perfect square 23805 must be multiplied by 5.

(ii) $12150 =$

$2 \times 3 \times 3 \times 3 \times 3 \times 3 \times 5 \times 5$

$\therefore$ ~~12~~ $12150 = 2 \times (3 \times 3) \times (3 \times 3) \times 3 \times (5 \times 5)$

2	12150
3	6075
3	2025
3	675
3	225
3	75
5	25
5	5
	1

here prime factors 2 and 3 are not in complete pairs.

To make it perfect square it should be multiplied by $2 \times 3 = 6$.

(iii) $7688 = (2 \times 2) \times (31 \times 31) \times 2$

here prime factor 2 is not in pairs.

So, number should be multiplied by 2.

2	7688
2	3844
2	1922
31	961
31	31
	1

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Q.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: $14283 = 3 \times 3 \times 3 \times 23 \times 23$

3	14283
3	4761
3	1587
23	529
23	23
	1

here Prime factor 3 is not in pairs.

To make it perfect square the number should be divided by 3.

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

2	1800
2	900
2	450
3	225
3	75
5	25
5	5
	1

here prime factor 2 is not in complete pair.

So, 1800 must be divided by 2 to make it perfect square

(iii) $2904 = (2 \times 2) \times 2 \times 3 \times (11 \times 11)$

2	2904
2	1452
2	726
3	363
11	121
11	11
	1

here prime factors 2 and 3 are not in complete pairs.

So it should be divided by (2×3) ie. 6.

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

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

Solution: 11 is not a perfect square as it is a prime number.

12 is not a perfect square as it is ending with 2.

16, Yes it is a perfect square of 4.

32, No, as it is ending with digit 2.

36, Yes, it is a perfect square of 6.

50, No as it is ending with odd number of zeroes.

79, No, it is a prime number.

81 - Yes it is a perfect square of 9.

$111 = 3 \times 37$, it is not a perfect square.

121 - Yes it is a perfect square of 11.

Q6 Using prime factorisation method, find which of the following numbers are perfect squares.

189, 225, 2048, 343, 441, 2901, 11025, 3549

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(i)

3	189
3	63
3	21
7	7
	1

$189 = (3 \times 3) \times 3 \times 7$

here 3 and 7 are not in Complete pairs.

∴ 189 is not a perfect square.

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

here 3 and 5 are complete in pairs.

∴ 225 is a perfect square.

(iii) 2048

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

here prime number 2 is not in pairs.

∴ 2048 is not a perfect square.

2	2048
2	1024
2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

(iv) 343,

It is not a perfect square as it is ending with digit 3.

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

Yes, it is a perfect square.

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$2961 = 3 \times 3 \times 7 \times 47$

$\therefore$ It is not a perfect square.

3	2961
3	987
7	329
	47

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

3	11025
3	3675
5	1225
5	245
7	49
7	7
	1

here 3, 5 and 7 are not in complete in pairs.

$\therefore$ 11025 is a perfect square.

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

$\therefore$ 3 and 7 are not in Complete pairs.

Hence 3549 is not a perfect square.

Q.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

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Solution.

(i) $8820 = 2\times2\times3\times3\times7\times7\times5$

2	8820
3	4410
3	1470
7	490
7	70
2	10
5	5
	1

By grouping we observe that

$8820 = (2\times2)\times(3\times3)\times(7\times7)\times5$

here prime factor 5 is not in complete group.

$\therefore$ 8820 must be multiplied by 5

$8820\times5 = (2\times2)\times(3\times3)\times(7\times7)\times(5\times5)$

$= (2\times3\times7\times5)^2$

$44100 = (210)^2$

(ii) $3675 = 3\times(5\times5)\times(7\times7)$

3	3675
5	1225
5	245
7	49
7	7
	1

here we see that prime factor 3 is not in groups.

$\therefore$ 3675 should be multiplied by 3.

$\therefore 3675\times3 = (3\times3)\times(5\times5)\times(7\times7)$

$= (3\times5\times7)^2$

$= (105)^2$

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(iii) 605

By Prime factorisation, we get

5	605
11	121
11	11
	1

$605 = 5 \times (11 \times 11)$

here 5 is not in Complete pairs.

∴ It should be multiplied by 5

hence $605 \times 5 = (5 \times 5) \times (11 \times 11)$

$\Rightarrow 3025 = (5 \times 11)^2$

$= 55^2$

(iv) $2880 = (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (3 \times 3) \times (5)$

here 5 is not in Complete pairs.

hence 2880, must be multiplied by 5.

2	2880
2	1440
2	720
2	360
2	180
2	90
3	45
3	15
5	5
	1

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

$14400 = (2 \times 2 \times 2 \times 3 \times 5)^2$

$14400 = 120^2$

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(v) $4056 = (2\times2)\times2\times3\times(13\times13)$

these prime factors 2 and 3 are not in complete pairs.

It should be multiplied by $2\times3=6$

2	4056
2	2028
2	1014
3	507
13	169
13	13
	1

$4056\times6 = (2\times2)\times(2\times2)\times(3\times3)\times(13\times13)$

$= (2\times2\times3\times13)^2$

$24336 = (156)^2$

(vi) $\underline{3468} = (2\times2)\times3\times(17\times17)$

2	3468
2	1734
3	867
17	289
17	17
	1

these prime factor 3 is not in complete pairs.

∴ It should be multiply by 3

$3468\times3 = (2\times2)\times(3\times3)\times(17\times17)$

$= (2\times3\times17)^2$

$= (102)^2$

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(vii) 7776

$= (2\times2)\times(2\times2)\times2\times(3\times3)$

$\times(3\times3)\times3$

2	7776
2	3888
2	1944
2	972
2	486
3	243
3	81
3	27
3	9
3	3
	1

here, Prime factors 2 and 3 are not in complete pairs.

∴ It should be multiplied by 2×3

i.e 6.

$7776 = (2\times2)\times(2\times2)\times(2\times2)$

$\times(3\times3)\times(3\times3)\times(3\times3)$

$= (2\times2\times2\times3\times3\times3)^2$

$= (216)^2$

Q.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

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Solution (i)

2	16562
7	8281
7	1183
13	169
13	13
	1

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

here prime factor 2 is not in pairs.

$\therefore$ 16562 should be divisible by 2

hence $\frac{16562}{2} = \frac{2 \times (7 \times 7) \times (13 \times 13)}{2}$

$\Rightarrow 8281 = 7 \times 7 \times 13 \times 13$

$= (7 \times 13)^2 = (91)^2$

(ii) $3698 = 2 \times 43 \times 43$

2	3698
43	1849
43	43
	1

here Prime factor 2 is not in pairs.

$\therefore$ 3698 should be divided by 2

$\frac{3698}{2} = \frac{2 \times 43 \times 43}{2}$

$\Rightarrow 1849 = 43 \times 43$

$= (43)^2$

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(iii) $5103 = (3\times3)\times(3\times3)\times(3\times3)\times7$

here, prime factor 7 is not in pairs.

∴ 5103 should be divided by 7.

$$\frac{5103}{7} = \frac{3\times3\times3\times3\times3\times3\times7}{7}$$

3	5103
3	1701
3	567
3	189
3	63
3	21
7	7
	1

$\Rightarrow 729 = 3\times3\times3\times3\times3\times3$

$= (3\times3\times3)^2 = (27)^2$

(iv) $3174 = 2\times3\times(23\times23)$

here prime factors 2 and 3 are not in pairs.

∴ 3174 is divided by 2×3 i.e 6

$$\frac{3174}{6} = \frac{2\times3\times23\times23}{6}$$

2	3174
3	1587
23	529
23	23
	1

$\Rightarrow 529 = 23\times23 = (23)^2$

(v) $\underline{1575} = (3\times3)\times(5\times5)\times7$

these prime factors 7 not in pairs.

3	1575
3	525
5	175
5	35
7	7
	1

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∴ 1575 divided by 7 to make it perfect square.

$$\frac{1575}{7} = \frac{3\times3\times5\times5\times7}{7}$$

$$\Rightarrow 225 = 3\times3\times5\times5$$

$$= (3\times5)^2 = (15)^2$$

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

Solution: greatest two digit number = 99

	9
9	99
+9	−81
81	18

∴ required number = 99 − 18

= 81

Q.10 Find the least number of 3 digits which is a perfect square.

Solution: least no. of 3 digits = 100

	1
1	100
+1	1
2	0

required number = 100 itself

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

Sol: By prime factorisation, we get

$4851 = (3\times3)\times(7\times7)\times11$

3	4851
3	1617
7	539
7	77
11	11
	1

here prime factor not in pairs.

∴ 4851 must be multiplied by 7, to make it perfect square.

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

Solution

$28812 = 2\times2\times3\times7\times7\times7\times7$

here prime factor 3 is not in pairs.

∴ 28812 should be divided by 3.

2	28812
2	14406
3	7203
7	2401
7	343
7	49
7	7
	1

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Q.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.

Sol:

$1152 = (2\times2)\times(2\times2)\times(2\times2)\times2 \times(3\times3)$

here, we should divide by 2

$\frac{1152}{2} = \frac{2\times2\times2\times2\times2\times2\times2\times2\times3\times3}{2}$

2	1152
2	576
2	288
2	144
2	72
2	36
2	18
3	9
3	3
	1

$\Rightarrow 576 = 2\times2\times2\times2\times2\times2\times3\times3$

$= (2\times2\times2\times3)^2$

$= (24)^2$

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