Squares and Square Roots

Exercise 3.1

1.

i. 729

Prime factorisation

3	729
3	243
3	81
3	27
3	9
3	3
	1

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

$= 3^2\times3^2\times3^2$

$729 = 27^2$

∴ 729 is perfect square because 729 can be expressed as product of pairs of equal prime factors.

ii. 5488

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

$5488 = 2\times2\times2\times2\times7\times7\times7$

Since '7' left unpaired 5488 is not a perfect square.

iii. 1024

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

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$1024 = 2\times2\times2\times2\times2\times2\times2\times2\times2\times2$

Since 1024 is expressed as the product of pairs of equal prime numbers ~~it~~ so it is a perfect square.

iv. 243

3	243
3	81
3	27
3	9
3	3
	1

$243 = 3\times3\times3\times3\times3$

As '3' left unpaired. So 243 is not a square (perfect)

2.

i. 1296

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

$1296 = 2\times2\times2\times2\times3\times3\times3\times3$

Since 1296 is expressed as the product of pairs of equal prime numbers so it is a perfect square.

$1296 = 2^2\times2^2\times3^2\times3^2$

$1296 = (2\times2\times3\times3)^2 = 36^2$

$\therefore$ 1296 is square of 36

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ii. 1784

2	1784
2	892
2	446
223	223
	1

$1784 = 2 \times 2 \times 2 \times 223$

As 1784 can not be expressed as products of pairs of equal prime factors, so 1784 is not a perfect square

iii) 3025

5	3025
5	605
11	121
11	11
	1

$3025 = 5 \times 5 \times 11 \times 11$

Since 3025 can be expressed as the product of pairs of equal prime factors.

$3025 = (5 \times 11)^2 = 55^2$

Hence, 55 is a number whose square is 3025

iv) 3969

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

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$3969 = 3\times3\times3\times3\times7\times7$

3969 can be expressed as product of pairs of equal prime numbers

$3969 = 3^2\times3^2\times7^2$

$3969 = (3\times3\times7)^2$

$3969 = 63^2$

Hence, 63 is the number whose square is 3969

3. 1008

2	1008
2	504
2	252
2	126
7	63
3	9
3	3
	1

$1008 = 2\times2\times2\times2\times7\times3\times3$

Since '7' is left unpaired, so to make 1008 a perfect square it should be multiplied by '7'

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4. 5808

2	5808
2	2904
2	1452
2	726
3	363
11	121
11	11
	1

$5808 = 2\times2\times2\times2\times3\times11\times11$

Since '3' left unpaired. To make 5808 a perfect square it should be divided by '3'.

So divide 5808 by '3'

$\frac{5808}{3} = \frac{2\times2\times2\times2\times3\times11\times11}{3}$

$1936 = (2\times2\times11)^2 = (44)^2$

So 44 is a number whose square is 1936

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Exercise - 3.2

1. i. 2
   ii. 13
   iii. 27
   iv. 88
   v. 243

2. i) 1
   ii) 4
   iii) 1
   iv) 9
   v) 6
   vi) 5
   vii) 9
   viii) 4
   ix) 0
   x) 6

3. i. 567

567 has '7' in it's unit's place. But a perfect square should have 1,4,5,6,9,0 in it's unit's place.

So 567 is not a perfect square.

ii. 2453

2453 has '3' in it's unit's place. But a perfect square should have 0,1,4,5,6,9 in it's unit's place.

So 2453 is not a perfect square.

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iii) 5298

5298 has '8' in it's unit's place. But a perfect square should have 0, 1, 4, 5, 6, 9, in it's unit's place.

So 5298 is not a perfect square.

iv) 46292

46292 has '2' in it's unit's place. But a perfect square should have 0, 1, 4, 5, 6, 9 in it's unit's place

So 46292 is not a perfect square.

v) 74000

74000 has '0' in it's unit's place but it has odd no. of zero's and '740' is not a perfect square

So 74000 is not a perfect square.

4.

i) 573

Square of 573 is a odd number because, If a number has '3' in it the unit's place, then its square ends in '9'.

ii) 4096

Square of 4096 is a even number because, If a number has '6' in the units place, then its square ends in '6'

iii) 8267

Square of 8267 is a odd number because, If a number has '7' in the units place, then its square ends in '9'

iv) 37916

Square of 37916 is a even number because, If a number has '6' in the units place, then its square ends in '6'

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5.

i. 12 and 13

There are $2n$ non-square numbers between the squares of two consecutive numbers n and $n+1$

$\therefore$ natural numbers between 12 and $(12+1) = 2\times12 = 24$

Hence, There are 24 natural numbers between 12^2 and 13^2

ii. 90 and 91

There are $2n$ non-square numbers between the squares of two consecutive numbers n and $n+1$

$\therefore$ Natural numbers between 90 and $91 = 2\times90 = 180$

Hence, There are 180 natural numbers between 90^2 and 91^2

6.

i. $1+3+5+7+9+11+13 = 7^2 = 49$

ii. $1+3+5+7+9+11+13+15+17+\cdots+29 = 15^2 = 225$

Sum of first 'n' odd numbers $= n^2$

7. i) 64

$64-1=63$; $63-3=60$; $60-5=55$

$55-7=48$; $48-9=39$; $39-11=28$

$28-13=15$; $15-15=0$

$\therefore 64 = 1+3+5+7+9+11+13+15 = 8^2$

ii) 121

$121-1=120$; $120-3=117$; $117-5=112$; $112-7=105$;

$105-9=96$; $96-11=85$; $85-13=72$; $72-15=57$;

$57-17=40$; $40-19=21$; $21-21=0$

$\therefore 121 = 1+3+5+7+9+11+13+15+17+19+21 = 11^2$

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8.

i. $19^2 = 361$

A perfect square canbe

"We can express the square of any odd number greater than 1 as the sum of two consecutive natural numbers."

$$\text{First number} = \frac{19^2-1}{2} = 180$$

$$\text{Second number} = \frac{19^2+1}{2} = 181$$

ii. $33^2 =$

$$19^2 = 361 = 180 + 181$$

ii. $33^2 = 1089$

$$\text{First number} = \frac{33^2-1}{2} = 544$$

$$\text{Second number} = \frac{33^2+1}{2} = 545$$

$$33^2 = 1089 = 544 + 545$$

iii) $47^2 = 2209$

$$\text{First number} = \frac{47^2-1}{2} = 1104$$

$$\text{Second number} = \frac{47^2+1}{2} = 1105$$

$$47^2 = 2209 = 1104 + 1105$$

9.

i) $31^2 = (30+1)^2 = (30+1)(30+1)$

$$= 30(30+1) + 1(30+1)$$

$$= 900 + 30 + 30 + 1$$

$$31^2 = 961$$

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ii) $42^2 = (40+2)^2 = (40+2)(40+2)$

$= 40(40+2) + 2(40+2)$

$= 1600 + 80 + 80 + 4$

$42^2 = 1764$

iii) $86^2 = (80+6)^2 = (80+6)(80+6)$

$= 80(80+6) + 6(80+6)$

$= 6400 + 480 + 480 + 36$

$86^2 = 7396$

iv) $94^2 = (90+4)^2 = (90+4)(90+4)$

$= 90(90+4) + 4(90+4)$

$= 8100 + 360 + 360 + 16$

$94^2 = 8836$

10.

i) 45

Comparing with $a5$ where $a = 4$

$(a5)^2 = a(a+1)$ hundreds $+ 25$

$45^2 = 4(4+1)$ hundreds $+ 25$

$= 20$ hundreds $+ 25$

$45^2 = 2025$

ii) 305

Comparing $a5$ where $a = 30$

$(a5)^2 = a(a+1)$ hundreds $+ 25$

$(305)^2 = 30(30+1)$ hundreds $+ 25$

$= 930$ hundreds $+ 25$

$(305)^2 = 93025$

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iii) 525

Comparing with a5 where a = 52

$(a5)^2 = a(a+1)$ hundreds + 25

$(525)^2 = 52(52+1)$ hundreds + 25

= 2756 hundreds + 25

$(525)^2 = 275625$

11. i) 8

Given number = 8

Let us assume $m^2 - 1 = 8$

$m^2 = 9$

$m = 3$

Remaining two numbers of Pythagorean triplet are

m^2+1 , $2m$

3^2+1 , 2×3

10 , 6

∴ The required triplet (6, 8, 10) with one number '8'

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ii) 15

Given number = 15

Let us assume $m^2 - 1 = 15$

$m^2 = 16$

$m = 4$

Remaining two numbers of Pythagorean triplet are

m^2+1 , $2m$

16+1   2×4

17   8

∴ The required triplet (8, 15, 17) with one number as 15.

iii) 63

Given number 63

Let us assume $m^2 - 1 = 63$

$m^2 = 64$

$m = 8$

Remaining two numbers of Pythagorean triplet are

m^2+1 , $2m$

8^2+1 2×8

65 16

∴ The required triplet (16, 63, 65) with one number '63'

iv) 80

Given number 80

Let us assume $m^2 - 1 = 80 \Rightarrow m^2 = 81$

$m = 9$

Remaining two numbers of Pythagorean triplet are

m^2+1 , $2m$

9^2+1 , 2×9

82 , 18

∴ The required triplet (18, 80, 82) with one number '80'

12.

$21^2 = 441$

$201^2 = 40401$

$2001^2 = 4004001$

$20001^2 = 400040001$

$200001^2 = 40000400001$

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13.

$9^2 = 81$

$99^2 = 9801$

$999^2 = 998001$

$9999^2 = 99980001$

$99999^2 = 9999800001$

$999999^2 = 999998000001$

14.

$7^2 = 49$

$67^2 = 4489$

$667^2 = 444889$

$6667^2 = 44448889$

$66667^2 = 4444488889$

$666667^2 = 444444888889$

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Exercise 3.5

i. 121

given number = 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

∴ 121 is a perfect Square

We have done '11' Substractions

Hence, Square root of 121 is 11 ⇒ $\sqrt{121} = 11$

ii. 55

Given number = 55

55 − 1 = 54 ; 54 − 3 = 51 ; 51 − 5 = 46 ; 46 − 7 = 39

39 − 9 = 30 ; 30 − 11 = 29 ; 29 − 13 = 16 ; 16 − 15 = 1

1 − 17 = −16

∴ 55 is not a perfect Square.

iii). 36

Given number = 36

36 − 1 = 35 ; 35 − 3 = 32 ; 32 − 5 = 27 ; 27 − 7 = 20

20 − 9 = 11 ; 11 − 11 = 0

∴ 36 is a perfect Square

We have done 6 Subtractions

Hence, Square root of 36 i.e $\sqrt{36} = 6$.

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iv) 90

Given number = 90

90 − 1 = 89 ; 89 − 3 = 86 ; 86 − 5 = 81 ; 81 − 7 = 74 ; 74 − 9 = 65

65 − 11 = 54 ; 54 − 13 = 41 ; 41 − 15 = 25 ; 25 − 15 = 10 ; 10 − 17 = −7

∴ 90 is not a perfect square.

2.

i. 784

Given number = 784

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

$784 = 2 \times 2 \times 2 \times 2 \times 7 \times 7$

$\sqrt{784} = \sqrt{2^2 \times 2^2 \times 7^2}$

$\sqrt{784} = 2 \times 2 \times 7 = 28$

ii). 441

Given number = 441

3	441
3	147
7	49
7	7
	1

$441 = 3 \times 3 \times 7 \times 7$

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

$\sqrt{441} = 3 \times 7 = 21$

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iii) 1849

Given number = 1849

43	1849
43	43
	1

$1849 = 43 \times 43$

$\sqrt{1849} = \sqrt{43 \times 43}$

$\sqrt{1849} = 43$

iv) 4356

Given number = 4356

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

$4356 = 2 \times 2 \times 3 \times 3 \times 11 \times 11$

$\sqrt{4356} = \sqrt{2^2 \times 3^2 \times 11^2}$

$\sqrt{4356} = 2 \times 3 \times 11 = 66$

v) 6241

Given number = 6241

79	6241
79	79
	1

$6241 = 79 \times 79$

$\sqrt{6241} = \sqrt{79^2} = 79$

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vi) 8836

Given number = 8836

2	8836
2	4418
47	2209
47	47
	1

$8836 = 2 \times 2 \times 47 \times 47$

$\sqrt{8836} = \sqrt{2^2 \times 47^2}$

$\sqrt{8836} = 2 \times 47 = 94$

vii) 8281

Given number = 8281

7	8281
7	1183
13	169
13	13
	1

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

$\sqrt{8281} = \sqrt{7^2 \times 13^2}$

$\sqrt{8281} = 7 \times 13 = 91$

viii) 9025

5	9025
5	1805
19	361
19	19
	1

$9025 = 5 \times 5 \times 19 \times 19$

$\sqrt{9025} = \sqrt{5^2 \times 19^2}$

$\sqrt{9025} = 95$

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3.

i. $9\frac{67}{121} = \frac{1156}{121}$

$9\frac{67}{121} = \frac{2\times2\times17\times17}{11\times11}$

$\sqrt{9\frac{67}{121}} = \sqrt{\frac{2\times2\times17\times17}{11\times11}}$

$= \frac{2\times17}{11}$

$\sqrt{9\frac{67}{121}} = \frac{34}{11}$

2	1156
2	578
17	289
17	17
	1

$1156 = 2\times2\times17\times17$

ii) $17\frac{13}{36} = \frac{625}{36}$

$17\frac{13}{36} = \frac{5\times5\times5\times5}{6\times6}$

$\sqrt{17\frac{13}{36}} = \sqrt{\frac{5\times5\times5\times5}{6\times6}}$

$= \frac{5\times5}{6}$

$\sqrt{17\frac{13}{36}} = \frac{25}{6}$

5	625
5	125
5	25
5	5
	1

$625 = 5\times5\times5\times5$

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

$1.96 = \frac{2\times2\times7\times7}{10\times10}$

$\sqrt{1.96} = \sqrt{\frac{2\times2\times7\times7}{10\times10}}$

$\sqrt{1.96} = \frac{2\times7}{10} = 1.4$

2	196
2	98
7	49
7	7
	1

$196 = 2\times2\times7\times7$

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iv) 0.0064

$$0.0064 = \frac{64}{10000}$$

$$0.0064 = \frac{2\times2\times2\times2\times2\times2}{10\times10\times10\times10}$$

$$\sqrt{0.0064} = \sqrt{\frac{2\times2\times2\times2\times2\times2}{10\times10\times10\times10}}$$

$$= \frac{2\times2\times2}{10\times10} = 0.08$$

$$\sqrt{0.0064} = 0.08$$

2	64
2	32
2	16
2	8
2	4
2	2
	1

4)

i. Given number = 588

Expressing in prime factors

$$588 = 2\times2\times7\times7\times3$$

Since '3' left unpaired, so to make $\sqrt{}$ 588 it should multiplied by '3'

$$588\times3 = 2\times2\times7\times7\times3\times3$$

$$1764 = 2^2\times7^2\times3^2$$

$$\sqrt{1764} = \sqrt{2^2\times7^2\times3^2}$$

$$\sqrt{1764} = 2\times7\times3 = 42$$

2	588
2	294
7	147
3	21
7	7
	1

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ii) Given number = 720

Expressing in prime factors

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

$720 = 2\times2\times2\times2\times3\times3\times5$

Since 5 left unpaired, to make 720 a perfect square, it should be multiplied by 5

$720\times5 = 2\times2\times2\times2\times3\times3\times5\times5$

$3600 = 2^2\times3^2\times5^2\times2^2$

$\sqrt{3600} = \sqrt{2^4\times3^2\times5^2}\ \sqrt{2^2\times2^2\times3^2\times5^2}$

$\sqrt{3600} = 2\times2\times3\times5 = 60$

iii) Given number 2178

Expressing in prime factors

2	2178
3	1089
3	363
11	121
11	11
	1

$2178 = 2\times3\times3\times11\times11$

Since '2' left unpaired, to make 2178 a perfect square, it should be multiplied by 2

$2178\times2 = 2\times2\times3\times3\times11\times11$

$4356 = 2^2\times3^2\times11^2$

$\sqrt{4356} = \sqrt{2^2\times3^2\times11^2}$

$= 2\times3\times11$

$\sqrt{4356} = 66$

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iv) Given number = 3042

Expressing in prime factors

2	3042
3	1521
3	507
13	169
13	13
	1

$3042 = 2 \times 3 \times 3 \times 13 \times 13$

Since '2' left unpaired, so to make 3042 a perfect square, it should be multiplied by '2'

$3042 \times 2 = 2 \times 2 \times 3 \times 3 \times 13 \times 13$

$6084 = 2^2 \times 3^2 \times 13^2$

$\sqrt{6084} = \sqrt{2^2 \times 3^2 \times 13^2}$

$\sqrt{6084} = 2 \times 3 \times 13 = 78$

v) 6300

Given number = 6300

Expressing in prime factors

2	6300
2	3150
5	1575
5	315
7	63
3	9
3	3
	1

$6300 = 2 \times 2 \times 5 \times 5 \times 7 \times 3 \times 3$

Since '7' left unpaired, so to make 6300 a perfect square, it should be multiplied by '7'

$6300 \times 7 = 2 \times 2 \times 5 \times 5 \times 7 \times 7 \times 3 \times 3$

$\sqrt{44100} = \sqrt{2^2 \times 5^2 \times 7^2 \times 3^2}$

$\sqrt{44100} = 2 \times 5 \times 7 \times 3$

$\sqrt{44100} = 210$

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5.

i. Given number 1872

Expressing in prime factors

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

~~1872~~ $1872 = 2\times2\times2\times2\times3\times3\times13$

Since 13 left unpaired, so to make 1872 a perfect square, it should be divided by 13

$$\frac{1872}{13} = \frac{2\times2\times2\times2\times3\times3\times13}{13}$$

$$144 = 2\times2\times2\times2\times3\times3$$

$$\sqrt{144} = \sqrt{2^2\times2^2\times3^2}$$

$$\sqrt{144} = 2\times2\times3 = 12$$

ii) Given number 2592

Expressing in prime factor

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

$2592 = 2\times2\times2\times2\times2\times3\times3\times3\times3$

Since '2' left unpaired, so to make 2592 a prefect square, it should be divided '2'

$$\frac{2592}{2} = \frac{2\times2\times2\times2\times2\times3\times3\times3\times3}{2}$$

$$1296 = 2\times2\times2\times2\times3\times3\times3\times3$$

$$\sqrt{1296} = \sqrt{2^2\times2^2\times3^2\times3^2}$$

$$= \sqrt{2\times2\times3\times3}\ 2\times2\times3\times3$$

$$\sqrt{1296} = 36$$

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iii) Given number 3380

Expressing in terms of prime factors

$3380 = \underbrace{2 \times 2} \times 5 \times \underbrace{13 \times 13}$

2	3380
2	1690
5	845
13	169
13	13
	1

Since '5' is left unpaired, so to make a perfect square, it should be divided by '5'

$3380 \div 5 = \frac{2 \times 2 \times 5 \times 13 \times 13}{5}$

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

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

$\sqrt{676} = 2 \times 13 = 26$

iv) 16244

Expressing in terms of prime factors

16244

2	16244
2	8122
	4061

2	16244
2	8122
11	4061
3	371
3	117
3	39
13	13
	1

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8. Let breadth of rectangle = x m. (b)

given

length of rectangle is equal to 4 times the breadth

$\therefore\ l = 4 \cdot x$

Area of the rectangle = 1936 sq.m

$l \times b = 1936$

$4x \times x = 1936$

$x^2 = \frac{1936}{4}$

$x^2 = 484$

$\boxed{x = 22\text{ m}}$

Hence, breadth of rectangle $= x = 22$m

length of rectangle $= 4x = 4 \times 22 = 88$m

9. Let the no.of columns = x

given no.of rows equal to no.of column

$\therefore$ no.of rows = x

Total students equal to 2000 but 64 students could not be accomndated in these rows & columns

$\therefore\ x \times x = 2000 - 64$

$x^2 = 1936$

$x = \sqrt{1936}$

$x = 44$

Hence, no.of rows = 44

2	1936
2	868
2	434
2	242
11	121
11	11
	1

$1936 = 2 \times 2 \times 2 \times 2 \times 11 \times 11$

$\sqrt{1936} = 2 \times 2 \times 11 = 44$

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v) Given number 61347

Expressing interms of prime numbers factors

$61347 = 3 \times 11 \times 11 \times 13 \times 13$

3	61347
11	20449
11	1859
13	169
13	13
	1

Since '3' left unpaired, so to make 61347 a perfect square, it should be divided by '3'

$61347 \div 3 = \frac{3 \times 11 \times 11 \times 13 \times 13}{3}$

$20449 = 11 \times 11 \times 13 \times 13$

$\sqrt{20449} = \sqrt{11^2 \times 13^2}$

$\sqrt{20449} = 11 \times 13 = \underline{143}$

6. Let no. of rows of plants in garden $= x$

given each row contains as many plants as the no. of rows.

$\therefore$ no. of plants in each row $= x$.

Total no. of plants $= x \times x = x^2$

given Total no. of plants in garden $= 4225$

$\therefore x^2 = 4225$

$x = \sqrt{4225}$

$x = 65$

$\therefore$ Hence, no. of rows in garden $= 65$

no. of plants in a row $= 65$.

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10. Let no. of Students = x

given Contribution of each Student = no. of students

∴ Contribution of each Student = ₹ x

Total Collected for picnic = ₹ 2304

∴ $x \times x = 2304$ ₹ 2304

$x^2 = 2304$

$x = \sqrt{2304}$

$x = 48$

11. Let one number to be 'x'

given one number is 15 times the other

∴ Second number = $15x$.

Product of two numbers = 7260

$15x \cdot x = 7260$

$x^2 = \frac{7260}{15}$

$x^2 = 484$

$x = \sqrt{484}$

$\boxed{x = 22}$

2	484
2	242
11	121
11	11
	1

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

$\sqrt{484} = 2 \times 11 = 22$

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12. given numbers are in ratio of 2:3:5

Let numbers be $2x, 3x, 5x$

given sum of squares of numbers = 950

$$(2x)^2 + (3x)^2 + (5x)^2 = 950$$

$$4x^2 + 9x^2 + 25x^2 = 950$$

$$x^2 = \frac{950}{38}$$

$$x^2 = 25$$

$$\boxed{x = 5}$$

Hence,

Numbers are $2x, 3x, 5x$

$10, 15, 25$

13. Perimeters of two squares = 60m, 144m

$P_1 = 60m$; $P_2 = 144m$

~~Perim~~ Let lengths of sides of squares are $= x_1, x_2$

$\therefore P_1 = 4x_1$ $\qquad$ $P_2 = 4x_2$

$60 = 4x_1$ $\qquad$ $144 = 4x_2$

$\boxed{x_1 = 15m}$ $\qquad$ $\boxed{x_2 = 36m}$

Area $A_1 = x_1^2$ $\qquad$ Area $A_2 = x_2^2$

$A_1 = 15^2$ $\qquad$ $A_2 = 36^2$

$A_1 = 225\ m^2$ $\qquad$ $A_2 = 1296\ m^2$

Let a square of side x with area '$A_1 + A_2$'

$$A = A_1 + A_2$$

$$x^2 = 225 + 1296$$

$$x^2 = 1521$$

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$x^2 = 1521$

$x = \sqrt{1521}$

$x = 39m$

3	1521
3	507
13	169
13	13
	1

$1521 = 3 \times 3 \times 13 \times 13$

$\sqrt{1521} = 3 \times 13 = 39$

Perimeter of square

$P = 4x$

$= 4 \times 39$

$P = 156m$

$\therefore$ Hence, Perimeter $= 156m$

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Exercise 3.4

1.

i) Given number 2401

```
     49
   -----
 4 | 24 01
   |-16
   ------
89 |  801
   | -801
   ------
   |    0
```

$\therefore \sqrt{2401} = 49$

ii) 4489

```
      67
    ------
 6  | 44 89
    | 36
    -------
127 |   889
    | (-)889
    -------
    |     0
```

$\therefore \sqrt{4489} = 67$

iii) 106929

```
       327
     --------
 3   | 10 69 29
     | -9
     ---------
62   |  1 69
     |  1 24
     ---------
647  |    4529
     | (-)4529
     ---------
     |       0
```

$\therefore \sqrt{106929} = 327$

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iv) given number 167281

	409
4	$\overline{16}\,\overline{72}\,\overline{81}$
	−16
80	072
	00
809	7281
	(−) 7281
	0

$\therefore \sqrt{167281} = 409$

v) given number 53824

	232
2	$\overline{5}\,\overline{38}\,\overline{24}$
	−4
43	138
	(−) 129
462	924
	(−) 924
	0

$\therefore \sqrt{53824} = 232$

vi) given number 213444

	462
4	$\overline{21}\,\overline{34}\,\overline{44}$
	(−) 16
86	534
	(−) 516
922	1844
	(−) 1844
	0

$\therefore \sqrt{213444} = 462$

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2.

i) Given number 81 = 2 (even)

The number of digits in its square root = $\frac{2}{2} = 1$

ii) Given number 169 = 3 (odd)

The number of digits in its square root = $\frac{3+1}{2} = 2$

iii) Given number 4761 = 4 (even)

The number of digits in its square root = $\frac{4}{2} = 2$

iv) Given number 27889 = 5 (odd)

$\therefore$ The number of digits in its square root = $\frac{5+1}{2} = 3$

v) Given number 525625 = 6 (even)

$\therefore$ The number of digits in its square root = $\frac{6}{2} = 3$

3.

i. Given number 51.84

	7.2
7	51.84
	(−) 49
142	284
	(−) 284
	0

$\therefore \sqrt{51.84} = 7.2$

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ii) 42.25

	6.5
6	42.25
	−36
125	625
	(−) 625
	0

$\sqrt{42.25} = 6.5$

iii) given number 18.4041

	4.29
4	18.40 41
	−16
82	2 40
	−1 64
849	7641
	−7641
	0

$\sqrt{18.4041} = 4.29$

iv) Given number 5.774409

	2.403
2	5.77 44 09
	−4
44	1.77
	(−) 1 76
480	144
	(−) 000
4803	14409
	(−) 14409
	0

$\therefore \sqrt{5.774409} = 2.403$

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4.

i) 645.8

	25.412
2	645.800000
	4
45	245
	(−) 225
504	2080
	(−) 2016
5081	6400
	5081
50822	131900
	(−) 101644
	30300

$\therefore \sqrt{645.8} = 25.412 \approx 25.41$ (correct to 2 decimals)

ii) 107.45

	10.365
1	107.45 00 00
	(−) 1
20	007
	000
203	745
	− 609
2066	13600
	− 12396
20725	120400
	− 103625
	16775

$\sqrt{107.45} = 10.365 \approx 10.36$

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iii) Given number 5.462

	2.337
2	5.46 20 00
	-4
43	146
	(-)129
463	1720
	1389
4667	33100
	- 32669
	431

$\therefore \sqrt{5.462} = 2.337 \approx 2.34$ (corrected to '2' decimals)

iv) Given number 2

	1.414
1	2.00 00 00
	1
24	100
	- 96
281	400
	- 281
2824	11900
	- 11296
	7804

$\sqrt{2} = 1.414 \approx 1.41$

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v) Given number 3

$$\begin{array}{r|l} & 1.732 \\ \hline 1 & \overline{3}.\overline{00}\,\overline{00}\,\overline{00} \\ & 1 \\ \hline 27 & 200 \\ & -189 \\ \hline 343 & 1100 \\ & 1029 \\ \hline 3462 & 7100 \\ & -6924 \\ \hline & 176 \end{array}$$

$\sqrt{3} = 1.732 \approx 1.73$ (Corrected to 2 decimals)

5.

i. $\frac{841}{1521}$

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

$$\begin{array}{r|l} & 29 \\ \hline 2 & \overline{8}\,\overline{41} \\ & 4 \\ \hline 49 & 441 \\ & 441 \\ \hline & 0 \end{array} \qquad \begin{array}{r|l} & 39 \\ \hline 3 & \overline{15}\,\overline{21} \\ & 9 \\ \hline 69 & 621 \\ & -621 \\ \hline & 0 \end{array}$$

ii) $8\frac{257}{529} = \frac{4489}{529}$

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

$$\sqrt{8\frac{257}{529}} = \frac{67}{23}$$

$$\begin{array}{r|l} & 67 \\ \hline 6 & \overline{44}\,\overline{89} \\ & 36 \\ \hline 127 & 889 \\ & -889 \\ \hline & 0 \end{array} \qquad \begin{array}{r|l} & 23 \\ \hline 2 & \overline{5}\,\overline{29} \\ & 4 \\ \hline 43 & 129 \\ & 129 \\ \hline & 0 \end{array}$$

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iii) $16\frac{169}{441} = \frac{7225}{441}$

	85
8	$\overline{72}\,\overline{25}$
	−64
165	825
	−825
	0

	21
2	$\overline{4}\,\overline{41}$
	4
41	041
	41
	0

$$\sqrt{16\frac{169}{441}} = \frac{\sqrt{7225}}{\sqrt{441}} = \frac{85}{21}$$

6.

i) Given number 2000

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

Hence, the least number that must be subtracted from 2000 so as to make it a perfect square is 64.

∴ Required perfect square number = 2000 − 64 = 1936 = 44^2

ii) Given number 984

	31
3	$\overline{9}\,\overline{84}$
	9
61	84
	61
	23

Hence, the least number that must be subtracted from 984 so as to make it a perfect square is 23.

∴ Required perfect square number = 984 − 23 = 961 = 31^2

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iii) Given number 8934

```
        94
    ---------
 9  | 89 34
    | 81
    ---------
184 |  834
    | -736
    ---------
    |   98
```

Hence, the least number that must be subtracted from 8934 so as to make it a perfect square is 98

∴ The required square number $8934 - 98 = 8836 = 94^2$

iv) Given number 11021

```
         104
     ----------
  1  | 1 10 21
     | 1
     ----------
 20  | 0 10
     |   00
     ----------
204  |  1021
     |   816
     ----------
     |   205
```

Hence, the least number that must be subtracted from 11021 so as to make it a perfect square is 205

∴ The required square number $11021 - 205 = 10816 = 104^2$

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7.

i) Given number 1750

$$\begin{array}{r|l} & 41 \\ \hline 4 & \overline{17}\,\overline{50} \\ & 16 \\ \hline 81 & 150 \\ & -81 \\ \hline & 69 \end{array}$$

$1750 > (41)^2 \Rightarrow$ Remainder $= 69$

$(42)^2 = 1764$

$\therefore$ Required number $= 1764 - 1750 = 14$

Hence, the least number that must be added to 1750 so as to make it a perfect square is 14

ii) Given number 6412

$$\begin{array}{r|l} & 80 \\ \hline 8 & \overline{64}\,\overline{12} \\ & 64 \\ \hline 160 & 012 \\ & 00 \\ \hline & 12 \end{array}$$

$6412 > (80)^2$

$81^2 = 6561$

$\therefore$ Required number $= 6561 - 6412 = 149$

Hence, the least number that must be added to 6412 so as to make it a perfect square is 149

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iii) Given number 6598

	81
8	$\overline{65}\,\overline{98}$
	−64
161	198
	−161
	37

$6598 > (81)^2$

$(82)^2 = 6724$

$\therefore$ Required number $= (82)^2 - 6598 = 126$

Hence, the minimum number that must be added to 6598 so as to make it a perfect square is 126

iv) Given number 8000

	89
8	$\overline{80}\,\overline{00}$
	−64
169	1600
	1521
	79

$8000 > 89^2$

$90^2 = 8100$

$\therefore$ Required number $= 90^2 - 8000 = 100$

Hence, the minimum number that must be added to 8000 so as to make it a perfect square is 100

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8. Smallest four digit number = 1000

```
      31
   ------
3  | 10 00
   |  9
   ------
61 |  1 00
   |    61
   ------
   |    39
```

$1000 > 31^2$

32^2 will be next perfect square

$32^2 = 1024$

$\therefore$ Hence, 1024 is smallest four digit number which perfect square

9. Greatest ~~four~~ six digit number = 999999

```
        9 9 9
     ----------
9    | 99 99 99
     | 81
     ----------
189  | 18 99
     | 17 01
     ----------
1989 |  1 98 99
     |  1 79 01
     ----------
     |    19 98
```

To make 999999 a perfect square, we have to substract 1998 from 999999

$\therefore$ the required number = 998001

Hence, 998001 is greatest six digit number which is a perfect square

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10. $\triangle ABC$, $\angle B = 90°$

i. $AB = 14$ cm

$BC = 48$ cm

According to Pythagorus Theorem

$AC^2 = AB^2 + BC^2$

$= 14^2 + 48^2$

$AC^2 = 2500$

$AC = \sqrt{2500}$

$AC = 50$ cm.

ii) $AC = 37$ cm, $BC = 35$ cm, $AB = ?$

According to Pythagorus Theorem

$AC^2 = AB^2 + BC^2$

$37^2 = AB^2 + 35^2$

$1369 = AB^2 + 1225$

$AB^2 = 144$

$AB = 12$ cm.

	12
1	144
	1
22	044
	44
	0

11. Total plants = 1400

Let no. of rows = x

no. of rows = no. of columns

no. of columns = x

$x^2 = 1400$

~~so to~~ $1400 > (37)^2$

$38^2 = 1444$

	37
3	1400
	9
67	500
	469
	31

So To make 1400 a perfect square, we have add minimum of 44

$\therefore$ 44 plants needed more.

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12) Total no. of Students = 1000

Let no. of row = no. of columns = x.

Total Students rows × columns = 1000

$x \times x = 1000$

$x^2 = 1000$

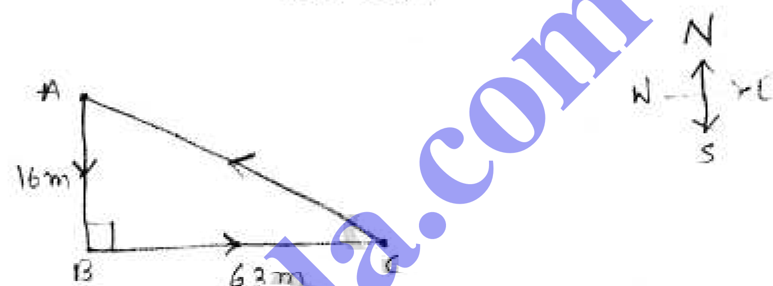
$x = \sqrt{1000}$

So Remainder = 39

	31
3	$\overline{1}\,\overline{00}\,\overline{0}$
	9
61	100
	61
	39

Hence, 39 children will be left out.

13)



Distance that Amit walk while returning

= AC

In ΔABC

According to Pythagorus theorem

$AC^2 = AB^2 + BC^2$

$AC^2 = 16^2 + 63^2$

$AC^2 = 4225$

$AC = 65$ m.

Hence, Amit walks 65m while returning to his house

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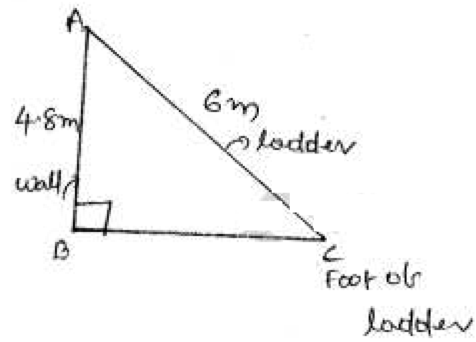
14. Length of ladder (AC) = 6m

Height of wall (AB) = 4.8m

In △ABC

According Pythagorus theorem



$AC^2 = AB^2 + BC^2$

$6^2 = 4.8^2 + BC^2$

$BC^2 = 12.96$

$BC = \sqrt{12.96}$

$BC = 3.6m$

∴ Hence, Distance between wall and Foot of ladder is 3.6m

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