

Squares And Square Roots Ex 3.1

EXERCISE - 3.1

I which of the following numbers are perfect squares?

i) 484

Resolving 484 into prime factors, we get

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

Now grouping the factors into pairs of equal factors, we get.

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

we observe that all are paired, so

484 is a perfect square.

$$\begin{array}{r} 2 \overline{) 484} \\ 2 \overline{) 242} \\ 11 \overline{) 121} \\ 11 \end{array}$$

ii) 625

Resolving 625 into prime factors, we get

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

Now grouping the factors into pairs of equal factors, we get.

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

we observe that all are paired, so

625 is a perfect square

$$\begin{array}{r} 5 \overline{) 625} \\ 5 \overline{) 125} \\ 5 \overline{) 25} \\ 5 \end{array}$$

iii) 576

Resolving 576 into prime factors, we get

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

Now grouping the factors into pairs of equal factors, we get

$$\begin{array}{r} 2 \overline{) 576} \\ 2 \overline{) 288} \\ 2 \overline{) 144} \\ 2 \overline{) 72} \\ 2 \overline{) 36} \\ 2 \overline{) 18} \\ 3 \overline{) 9} \\ 3 \end{array}$$

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

we observe that all are paired, so 576 is a perfect square.

v) 941

Resolving 941 into prime factors, we get

As 941 itself a prime number
it does not have a perfect square

$$941 \overline{) 941}$$

v) 961

Resolving 961 into prime factors, we get.

$$961 = (31 \times 31) = 31^2$$

$$31 \overline{) 961} \\ 31$$

\therefore 961 is a perfect square.

vi) 2500

Resolving 2500 into prime factors, we get

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

Now grouping the factors into pairs of equal factors, we get.

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

we observe that all are paired, so

2500 is a perfect square.

$$\begin{array}{r} 2500 \\ 5 \overline{) 2500} \\ 5 \overline{) 500} \\ 5 \overline{) 100} \\ 5 \overline{) 20} \\ 2 \overline{) 4} \\ 2 \end{array}$$

- 3
② show that each number is a perfect square. Also, find the number whose square is given number.

① 1156

Resolving 1156 into prime factors, we get.

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

Now, grouping factors into pairs of equal factors, we get.

$$\begin{array}{r} 2 \overline{) 1156} \\ \underline{2312} \\ 289 \\ \underline{289} \\ 0 \end{array}$$

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

As all factors are paired, 1156 is a perfect square.

$$\text{Again, } 1156 = (2 \times 17) \times (2 \times 17)$$

$$= 34 \times 34 = 34^2$$

Thus, 1156 is the square of 34.

② 2025

Resolving 2025 into prime factors, we get

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

Now, grouping factors into pairs of equal factors, we get

$$\begin{array}{r} 3 \overline{) 2025} \\ \underline{6075} \\ 225 \\ \underline{225} \\ 0 \end{array}$$

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

As all factors are paired, 2025 is a perfect square.

$$\text{Again, } 2025 = (3 \times 5) \times (3 \times 5) \times (3 \times 5)$$

$$= 45^2$$

Thus 2025 is the square of 45.

(iii)

14641

Resolving 14641 into prime factors, we get

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

As the factors can be paired into equal factors, we get to know that

14641 is a perfect square

$$\text{Again } 14641 = (121) \times (121) = 121^2$$

\therefore 14641 is the square of 121

$$\begin{array}{r} 11 \overline{) 14641} \\ \underline{1331} \\ 1121 \\ \underline{11} \end{array}$$

(iv)

4761

Resolving 4761 into prime factors, we get

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

As the factors, can be paired into equal factors, 4761 is a perfect square.

$$\text{Again } 4761 = 69 \times 69 = 69^2$$

\therefore 4761 is the square of 69.

$$\begin{array}{r} 3 \overline{) 4761} \\ \underline{1587} \\ 23 \overline{) 529} \\ \underline{23} \end{array}$$

(v) Find the smallest number by which given number must be multiplied so that product is a perfect square.

i)

23805

Resolving 23805 into prime factors, we get

$$23805 = (3 \times 3) \times (\cancel{5}) \times (23 \times 23) \times 5$$

Given obtained factors can be paired into equal factors, except for 5.

$$\begin{array}{r} 5 \overline{) 23805} \\ \underline{11902} \\ 3 \overline{) 4761} \\ \underline{1587} \\ 23 \overline{) 529} \\ \underline{23} \end{array}$$

To pair it equally multiply the number 5 with 5.

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

$$\text{Again } 23805 \times 5 = (3 \times 23 \times 5) \times (3 \times 23 \times 5) \\ = 345^2$$

\therefore Product is the square of 345.

⑩ 12150

Resolving 12150 into prime factors, we get

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

obtained factors can be paired into equal factors, 12150 is a except for 2.

so multiply given number with 2 to pair it.

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

$$\text{Again } 12150 \times 2 = (5 \times 3 \times 2 \times 2 \times 2) \times (5 \times 3 \times 2 \times 2 \times 2) \\ = 120^2$$

\therefore Product is the square of 120

⑪ 7688

Resolving 7688 into prime factors, we get

$$7688 = (2 \times 2) \times (21 \times 31) \times 2$$

obtained factors can be paired into equal factors except for 2.

$$\begin{array}{r} 2 \overline{) 7688} \\ \underline{2384} \\ 2 \overline{) 1922} \\ \underline{31} \\ 31 \end{array}$$

So multiply given number with 2 to 6

Pair it.

$$768 \times 2 = (2 \times 2) \times (31 \times 31) \times (2 \times 2)$$

$$\text{Again } 768 \times 2 = (2 \times 31 \times 2) \times (2 \times 31 \times 2) \\ = 124^2$$

\therefore The product is the square of 124.

⑥ Find the smallest number by which given number must be divided so that resulting number is perfect square.

① 14283

Resolving 14283 into prime factors, we get

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

Obtained factors can be paired into equal factors, except for 3

So eliminate 3 by dividing the number with 3.

$$\frac{14283}{3} = (3 \times 3) \times (23 \times 23)$$

$$\text{Again } \frac{14283}{3} = (3 \times 23) \times (3 \times 23) \\ = 69^2$$

\therefore The resultant is square of 69.

② 1800

Resolving 1800 into prime factors, we get

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

$$\begin{array}{r} 2 \overline{) 1800} \\ \underline{2 } 900 \\ 2 \overline{) 900} \\ \underline{2 } 450 \\ 5 \overline{) 450} \\ \underline{5 } 90 \\ 3 \overline{) 90} \\ \underline{3 } 30 \\ 3 \overline{) 30} \\ \underline{3 } 10 \\ 2 \overline{) 10} \\ \underline{2 } 5 \end{array}$$

Obtained factors can be paired into equal factors except for 2.

So, eliminate 2 by dividing the number with 2.

$$\frac{1800}{2} = (2 \times 2) \times (5 \times 5) \times (3 \times 3)$$

$$\text{Again } \frac{1800}{2} = (2 \times 5 \times 3) \times (2 \times 5 \times 3) \\ = 30^2$$

\therefore The resultant is square of 30

(ii) 2904.

Resolving 2904 into prime factors, we get

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

Obtained factors can be paired into equal factors except for 2 and 3.

So eliminate it by dividing the number with 6.

$$\frac{2904}{6} = (2 \times 2) \times (11 \times 11)$$

$$\text{Again } \frac{2904}{6} = (2 \times 11) \times (2 \times 11) \\ = 22^2$$

\therefore Resultant is square of 22

$$\begin{array}{r} 2 \overline{) 2904} \\ 2 \overline{) 1452} \\ 2 \overline{) 726} \\ 3 \overline{) 363} \\ 11 \overline{) 121} \\ 11 \end{array}$$

⑤ which of the following numbers are perfect squares

11 \rightarrow prime number, not a perfect square

12 \rightarrow Ending with 2, not a perfect square

16 $\rightarrow 4^2 \rightarrow$ perfect square

32 \rightarrow Ending with 2, not a perfect square

36 $\rightarrow 6^2 \rightarrow$ perfect square

50 $\rightarrow 5^2 \times 2 \rightarrow$ not a perfect square

64 $\rightarrow 8^2 \rightarrow$ perfect square

79 \rightarrow Prime number, cannot be a perfect square

81 $\rightarrow 9^2 \rightarrow$ perfect square

111 \rightarrow Prime number, cannot be a perfect square

121 $\rightarrow 11^2 \rightarrow$ perfect square

⑥ using prime factorization method, find which of the following numbers are perfect squares.

Ⓐ 189

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

Cannot be written as pair of two equal factors, so 189 is not a perfect square

$$\begin{array}{r} 3 \overline{)189} \\ 3 \overline{)63} \\ 3 \overline{)21} \\ 7 \end{array}$$

225

$$\therefore 225 = (3 \times 5)^2 \times (3 \times 5)$$

Can be written as pair of two equal factors, so 225 is a perfect square

$$\begin{array}{r} 5 \overline{)225} \\ 5 \overline{)45} \\ 3 \overline{)9} \\ 3 \end{array}$$

2048

$$2048 = \cancel{(2 \times 2)} \times \cancel{(2 \times 2)} \times \cancel{(2 \times 2)} \times \cancel{(2 \times 2)} \times \cancel{(2 \times 2)} \times 2$$

All the factors can not be written
as pair of equal factors, so 2048
is not a perfect square

$$\begin{array}{r} 2 \overline{) 2048} \\ \underline{2} \\ 0 \\ 2 \\ \underline{2} \\ 0 \\ 2 \\ \underline{2} \\ 0 \\ 2 \\ \underline{2} \\ 0 \\ 2 \\ \underline{2} \\ 0 \\ 2 \\ \underline{2} \\ 0 \\ 2 \\ \underline{2} \\ 0 \end{array}$$

343

$$343 = \cancel{(7 \times 7)} \times 7$$

All the factors cannot be written
as pair of equal factors, so 343 is not perfect square

$$\begin{array}{r} 7 \overline{) 343} \\ \underline{7} \\ 0 \\ 4 \\ \underline{7} \\ 0 \end{array}$$

441

$$441 = \cancel{(7 \times 7)} \times \cancel{(3 \times 3)}$$

All the prime factors can be written
as pair of equal factors, so 441 is a perfect square

$$\begin{array}{r} 7 \overline{) 441} \\ \underline{7} \\ 0 \\ 4 \\ \underline{7} \\ 0 \\ 1 \\ \underline{3} \\ 0 \end{array}$$

2916

$$2916 = \cancel{(3 \times 3)} \times \cancel{(3 \times 3)} \times \cancel{(3 \times 3)} \times \cancel{(2 \times 2)}$$

All the prime factors can be
written as pair of equal factors, so
2916 is a perfect square

$$\begin{array}{r} 3 \overline{) 2916} \\ \underline{3} \\ 0 \\ 9 \\ \underline{3} \\ 0 \\ 3 \\ \underline{3} \\ 0 \\ 1 \\ \underline{3} \\ 0 \\ 3 \\ \underline{3} \\ 0 \\ 1 \\ \underline{2} \\ 0 \end{array}$$

11025

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

All the prime factors can be written as pair of two equal factors so 11025 is a perfect square.

$$\begin{array}{r} 5 \overline{)11025} \\ \underline{2205} \\ 5 \overline{)441} \\ \underline{330} \\ 3 \overline{)147} \\ \underline{147} \\ 7 \overline{)49} \\ \underline{49} \\ 7 \end{array}$$

3549

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

All the factors obtained cannot be written as pair of two equal numbers, so 3549 is not a perfect square.

$$\begin{array}{r} 3 \overline{)3549} \\ \underline{1183} \\ 7 \overline{)169} \\ \underline{169} \\ 13 \end{array}$$

- 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 new number.

(i) ⑧ 8820

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

only 5 in obtained factors is unpaired, so multiply the number with 5, to make it paired.

$$\begin{aligned} \text{Again } (8820 \times 5) &= (2 \times 3 \times 7 \times 5) \times (2 \times 3 \times 7 \times 5) \\ &= (210)^2 \end{aligned}$$

So the product is the square of 210.

$$\begin{array}{r} 2 \overline{)8820} \\ \underline{4410} \\ 2 \overline{)4410} \\ \underline{2205} \\ 5 \overline{)441} \\ \underline{330} \\ 3 \overline{)147} \\ \underline{147} \\ 7 \overline{)49} \\ \underline{49} \\ 7 \end{array}$$

ii) 3675

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

only 3 in obtained factor is unpaired, so multiply the number with 3, to make it paired.

$$\begin{aligned} \text{Again } (3675) \times 3 &= (5 \times 5) \times (7 \times 7) \times (3 \times 3) \\ &= (5 \times 7 \times 3) \times (5 \times 7 \times 3) \\ &= (105)^2 \end{aligned}$$

Product is square of 105.

$$\begin{array}{r} 5 \overline{) 3675} \\ \underline{5 735} \\ 3 147 \\ \underline{7 49} \\ 7 \end{array}$$

iii) 605

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

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

$$5 \times 605 = 55^2$$

Product is the square of 55.

$$\begin{array}{r} 5 \overline{) 605} \\ \underline{11 21} \\ 11 \end{array}$$

iv) 2880

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

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

Product is square of 120.

$$\begin{array}{r} 5 \overline{) 2880} \\ \underline{3 576} \\ 3 192 \\ \underline{3 192} \\ 2 64 \\ \underline{2 64} \\ 2 32 \\ \underline{2 32} \\ 2 16 \\ \underline{2 16} \\ 2 8 \\ \underline{2 8} \\ 2 \end{array}$$

(v) ⑥ 4056

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

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

$$4056 \times 6 = (2 \times 13 \times 2 \times 3) \times (2 \times 13 \times 2 \times 3) \\ = 156^2$$

Product is square of 156.

$$\begin{array}{r} 2 \overline{) 4056} \\ \underline{2028} \\ 2 \overline{) 1014} \\ \underline{1014} \\ 3 \overline{) 507} \\ \underline{1506} \\ 13 \overline{) 169} \\ \underline{156} \\ 13 \end{array}$$

(vi) 7776

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

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

$$(7776) \times 6 = (2 \times 2 \times 3 \times 3 \times 2 \times 3) \times (2 \times 2 \times 3 \times 3 \times 2 \times 3) \\ = 216^2$$

Product is the square of 216

$$\begin{array}{r} 2 \overline{) 7776} \\ \underline{3888} \\ 3 \overline{) 1296} \\ \underline{432} \\ 3 \overline{) 432} \\ \underline{144} \\ 2 \overline{) 144} \\ \underline{72} \\ 2 \overline{) 72} \\ \underline{36} \\ 2 \overline{) 36} \\ \underline{18} \\ 3 \overline{) 18} \\ \underline{6} \\ 3 \overline{) 6} \\ \underline{0} \\ 2 \end{array}$$

⑧ By what number should each of the following numbers be divided to get a perfect square, find the number.

① 16562

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

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

$$\frac{16562}{2} = (7 \times 13) \times (7 \times 13) \\ = 91^2$$

Resultant is the square of the 91.

$$\begin{array}{r} 2 \overline{) 16562} \\ \underline{8281} \\ 7 \overline{) 1183} \\ \underline{169} \\ 13 \overline{) 169} \\ \underline{169} \\ 13 \end{array}$$

⑪ 3698

13

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

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

$$\begin{array}{r} 2 \overline{) 3698} \\ 43 \overline{) 1849} \\ 43 \end{array}$$

number must be divided by 2 and Resultant is square of 43.

⑫ 5103

$$5103 = (3 \times 3) \times (3 \times 3) \times (3 \times 3) \times 7$$

$$\frac{5103}{7} = (3 \times 3 \times 3) \times (3 \times 3 \times 3)$$

$$= 27^2$$

$$\begin{array}{r} 3 \overline{) 5103} \\ 3 \overline{) 1701} \\ 3 \overline{) 567} \\ 3 \overline{) 189} \\ 3 \overline{) 63} \\ 7 \overline{) 21} \\ 7 \end{array}$$

number must be divided by 7 and resultant is square of 27.

⑬ 3174

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

$$\frac{3174}{6} = 23 \times 23 = 23^2$$

$$\begin{array}{r} 2 \overline{) 3174} \\ 3 \overline{) 1587} \\ 23 \overline{) 529} \\ 23 \end{array}$$

number must be divided by 6 and the resultant is square of 23

Squares And Square Roots Ex 3.2

EXERCISE - 3.2.

14

- Q1) The following numbers are not perfect squares. Give reason.

Numbers ending with 2, 3, 4 or 8 are not perfect squares, so

(i) 1567

(ii) 45743

(iii) 8948

(iv) 333333

are not perfect squares

- Q2) Show that following numbers are not perfect squares.
As the numbers

① 9327 ② 4058 ③ 22453 ④ 743522

have 7, 8, 3, 2 as ending numbers respectively.
As mentioned above, numbers ending with 2, 3, 7, 8 are not perfect squares. These given numbers are also not perfect squares.

- Q3) The square of which of the following numbers would be an odd number.

Square of an odd number is an odd number.

Square of an even number is an even number.

- (i) 731 \rightarrow odd number \rightarrow square is odd number.

11) 3656 \rightarrow Even number \rightarrow so square is even number.

15

12) 5559 \rightarrow odd number \rightarrow so square is odd number

13) 42008 \rightarrow Even number \rightarrow so square is even number.

4) what will be the units digit of squares of the following numbers.

i) 52

$$\text{units digit of } (52)^2 = \text{units digit of } (2)^2 = 4.$$

ii) 977

$$\text{units digit of } (977)^2 = \text{units digit of } (7)^2 = 9.$$

iii) 4583

$$\text{units digit of } (4583)^2 = \text{units digit of } (3)^2 = 9.$$

iv) 78367

$$\text{units digit of } (78367)^2 = \text{units digit of } (7)^2 = 9.$$

v) 52698

$$\text{units digit of } (52698)^2 = \text{units digit of } (8)^2 = 4$$

vi) 99880

$$\text{units digit of } (99880)^2 = \text{units digit of } (0)^2 = 0$$

vii) 12796

$$\text{units digit of } (12796)^2 = \text{units digit of } 6^2 = 6$$

viii) 55555

$$\text{units digit of } (55555)^2 = \text{units digit of } (5)^2 = 5$$

ix) 53924

$$\text{units digit of } (53924)^2 = \text{units digit of } 4^2 = 6.$$

⑤ In every line value of R.H.S is the ¹²
square of number of terms in L.H.S

$$\therefore 1+3+5+\dots+n \text{ terms} = n^2 \quad \left[\because \text{As there are } n \text{ terms} \right]$$

⑥ i) $100^2 - 99^2$

$$= 100 + 99 = 199$$

ii) $11^2 - 109^2$

$$= 111^2 - 110^2 + 110^2 - 109^2$$

$$= (111+110) + (110+109)$$

$$= 440$$

iii) $99^2 - 96^2$

$$= 99^2 - 98^2 + 98^2 - 97^2 + 97^2 - 96^2$$

$$= (99+98) + (98+97) + (97+96)$$

$$= 585$$

⑦ which of the following triplets are pythagorean?

⑧ (8, 15, 17) If (m, n, p) form tripythagorean, then $m^2 + n^2 = p^2$.

i) $(8, 15, 17)$

$$\text{L.H.S} = 8^2 + 15^2 = 289$$

$$\text{R.H.S} = 17^2 = 289$$

$$\text{L.H.S} = \text{R.H.S}, \text{ so it is pythagorean.}$$

ii) 18, 80, 82.

$$L.H.S = 18^2 + 80^2 = 6724$$

$$R.H.S = 82^2 = 6724.$$

$L.H.S = R.H.S$, It is Pythagorean

iii) 14, 48, 51

$$L.H.S = 14^2 + 48^2 = 2500$$

$$R.H.S = 51^2 = 2601$$

$L.H.S \neq R.H.S$, It is not Pythagorean.

iv) (10, 24, 26)

$$L.H.S = 10^2 + 24^2 = 676$$

$$R.H.S = 26^2 = 676$$

$L.H.S = R.H.S$ It is Pythagorean

v) (16, 63, 65)

$$L.H.S = 16^2 + 63^2 = 4225$$

$$R.H.S = 65^2 = 4225$$

$L.H.S = R.H.S$, It is Pythagorean.

vi) (12, 35, 38)

$$L.H.S = 12^2 + 35^2 = 1369$$

$$R.H.S = 38^2 = 1444$$

$L.H.S \neq R.H.S$, It is not Pythagorean.

⑧ From observation

$$(1 \times 2) + (2 \times 3) + (3 \times 4) + (4 \times 5) + (5 \times 6) = \frac{5 \times 6 \times 7}{3} \\ = 70.$$

⑨ $R.H.S = \frac{1}{2} [\text{no. of terms in L.H.S} \times (\text{no. of terms} + 1)]$
 $\therefore \text{only when L.H.S starts with 1}$

\therefore (i) $1 + 2 + 3 + \dots + 50 = \frac{1}{2} [50 \times (50 + 1)]$

(ii) $= \frac{1}{2} 25 \times 51 = 1275$

(iii) $34 + 32 + \dots + 50$

$$= (1 + 2 + 3 + \dots + 50) - (1 + 2 + \dots + 30)$$

$$= 1275 - \left(\frac{1}{2} (30 \times (30 + 1)) \right)$$

$$= 1275 - 465 = 810.$$

⑩ $R.H.S = \frac{1}{6} [\text{no. of terms in L.H.S} \times (\text{no.} + 1) \times (2 \times \text{no.} + 1)]$

(i) $1^2 + 2^2 + 3^2 + 4^2 + \dots + 10^2 = \frac{1}{6} [10 \times (10 + 1) \times (2 \times 10 + 1)]$
 $= \frac{1}{6} [2310] = 385$

(ii) $5^2 + 6^2 + \dots + 12^2 = 1^2 + 2^2 + \dots + 12^2 - (1^2 + 2^2 + 3^2 + 4^2)$
 $= \frac{1}{6} (12 \times (12 + 1) \times (2 \times 12 + 1)) - \frac{1}{6} (4 \times (4 + 1) \times (2 \times 4 + 1))$

$$= 650 - 30 = 620$$

- ⑪ which of the following numbers are squares of even numbers.

only even numbers be the squares of even numbers

so, 256, 324, 1296, 5184, 373758 ^{can be} ~~are~~ squares of even numbers, but 373758 is not a perfect square
so, 256, 324, 1296, 5184 are answers.

- ⑫ Numbers ending with 2, 3, 7, 8 can not be perfect squares, so

ii) 1028, iv) 1022, v) 1023, vi) 1027 cannot be whole squares

- ⑬ i) F, because 169 is square number with odd digit

ii) F, Square of 3 (prime) is 9 (not prime)

iii) F, sum of 2^2 and 3^2 is 13 which is not square no.

iv) F, Difference of 3^2 and 2^2 is 5, which is not square number.

~~Sol~~ All remaining (Cases) are verified.

Squares And Square Roots Ex 3.3

EXERCISE-3.3.

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I find squares of following numbers using column method. verify it by multiplication.

① 25.

Here $a=2$, $b=5$.

Column I	Column II	Column-III
a^2	$2ab$	b^2
4	20	25
+ 2	+ 2	
<u>6</u>	<u>22</u>	
6	2	5

$$25^2 = 625.$$

$$\text{and } 25^2 = 25 \times 25 = 625.$$

② 37.

Here $a=3$, $b=7$.

Column I	Column II	Column-III
a^2	$2ab$	b^2
9	42	49
+ 4	+ 4	
<u>13</u>	<u>46</u>	
13	6	9

$$37^2 = 1369$$

$$\text{and } 37^2 = 37 \times 37 = 1369.$$

(iii) 54.

21

Here $a=5, b=4$.

Column I

Column II

Column III

$$a^2$$

$$2ab$$

$$b^2$$

$$25$$

$$40$$

$$16$$

$$4$$

$$1$$

$$\underline{29}$$

$$\underline{41}$$

$$\underline{6}$$

$$29$$

$$1$$

$$6$$

$$54^2 = 2916$$

$$54^2 = 54 \times 54 = 2916$$

(iv) 71

Here $a=7, b=1$

Column I

Column II

Column III

$$a^2$$

$$2ab$$

$$b^2$$

$$49$$

$$14$$

$$01$$

$$1$$

$$0$$

$$\underline{49}$$

$$\underline{14}$$

$$\underline{1}$$

$$49$$

$$14$$

$$1$$

$$71^2 = 4941$$

$$71^2 = 71 \times 71 = 4941$$

① 96.

Here $a=9$, $b=6$.

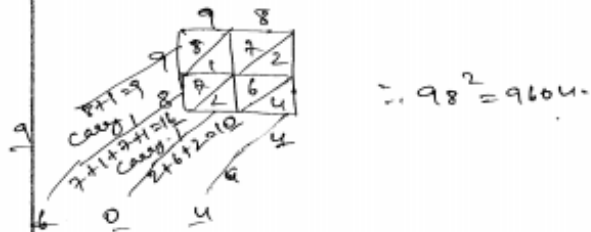
Column I	Column II	Column III
a^2	$2ab$	b^2
81	108	36
11	3	
<u>92</u>	<u>111</u>	
92	1	6

$$96^2 = 9216$$

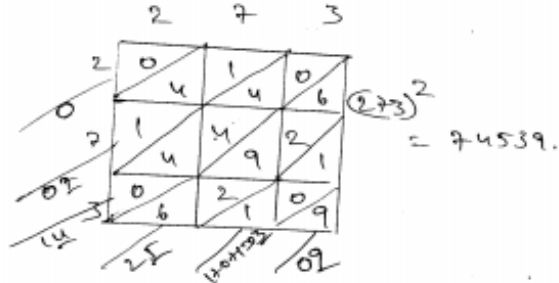
$$\text{and } 96 \times 96 = 9216.$$

② Find squares of following numbers using diagonal method.

(i) 98.



(ii) 273



(iii)

348

23

			3	4	8
3	0	9	1	2	2
14	1	2	1	6	3
18	2	3	3	6	4
108	4	2	6	4	
108					
14					
10					
04					

$$348^2 = 120704$$

(iv)

295

			2	9	5
2	0	1	1	0	
0	1	8	4	5	
9	8	1	2	5	
085	0	4	5	5	
22					
12					
12					
05					

$$(295)^2 = 87025$$

(v)

171

			1	7	1
01	0	0	0	1	
2	0	4	0	2	
02	7	9	0	2	
12	0	0	0	1	
12					
14					
01					

$$(171)^2 = 29241$$

③ Find the squares of following numbers.

24

① $(127)^2 = 127 \times 127 = 16129$

② $(503)^2 = 503 \times 503 = 253009$

③ $(451)^2 = 451 \times 451 = 203401$

④ $(862)^2 = 862 \times 862 = 743044$

⑤ $(265)^2 = 265 \times 265 = 70225$

⑤ Find squares of following numbers using Identity $(a+b)^2 = a^2 + 2ab + b^2$.

① 405.

$$\begin{aligned} \text{we have } (405)^2 &= (400+5)^2 = (400)^2 + 5^2 + 2(400)(5) \\ &= 160000 + 25 + 4000 \\ &= 164025. \end{aligned}$$

② 510

$$\begin{aligned} \text{we have } (510)^2 &= (500+10)^2 = (500)^2 + 10^2 + 2(500)(10) \\ &= 250000 + 100 + 10000 \\ &= 260100. \end{aligned}$$

③ 1001

$$\begin{aligned} \text{we have } (1000+1)^2 &= (1000)^2 + 1 + 2(1000) \\ &= 1000000 + 1 + 2000 \\ &= 1002001. \end{aligned}$$

(v) 209.

25

$$\begin{aligned}(209)^2 &= (200+9)^2 = (200)^2 + 9^2 + 2(200)(9) \\&= 40000 + 81 + 3600 \\&= 43681.\end{aligned}$$

(vi) 605

$$\begin{aligned}(605)^2 &= (600+5)^2 = (600)^2 + 5^2 + 2(600)(5) \\&= 360000 + 25 + 6000 \\&= 366025.\end{aligned}$$

(b) Find squares of following using $(a-b)^2 = a^2 - 2ab + b^2$.

$$\begin{aligned}(1) \quad 395 &= (400-5)^2 = (400)^2 + 5^2 - 2(400)(5) \\&= 160000 + 25 - 4000 \\&= 156025.\end{aligned}$$

$$\begin{aligned}(2) \quad 995 &= (1000-5)^2 = (1000)^2 + 5^2 - 2(1000)(5) \\&= 1000000 + 25 - 10000 \\&= 990025.\end{aligned}$$

$$\begin{aligned}(3) \quad 495 &= (500-5)^2 = (500)^2 + 5^2 - 2(500)(5) \\&= 250000 + 25 - 5000 \\&= 245025.\end{aligned}$$

$$\begin{aligned}(4) \quad 498 &= (500-2)^2 = (500)^2 + 2^2 - 2(500)(2) \\&= 250000 + 4 - 2000 \\&= 248004.\end{aligned}$$

$$\begin{aligned} 99^2 &= (100-1)^2 = (100)^2 - 1^2 - 2(100) \\ &= 10000 - 1 - 200 \\ &= 9799. \end{aligned}$$

7. find squares of following numbers by visual method.

$$\begin{aligned} \textcircled{1} \quad 52, \quad (52)^2 &= (50+2)^2 = 50^2 + 2^2 + 2(50 \times 2) \\ &= 2500 + 4 + 200 \\ &= 2704. \end{aligned}$$

$$\begin{aligned} \textcircled{2} \quad 95, \quad (95)^2 &= (100-5)^2 = 100^2 + 5^2 - 2(5)(100) \\ &= 10000 + 25 - 1000 \\ &= 9025. \end{aligned}$$

$$\begin{aligned} \textcircled{3} \quad 505, \quad (505)^2 &= (500+5)^2 = (500)^2 + 5^2 + 2(500)(5) \\ &= 250000 + 25 + 5000 \\ &= 255025. \end{aligned}$$

$$\begin{aligned} \textcircled{4} \quad 702, \quad (702)^2 &= (700+2)^2 = (700)^2 + 2^2 + 2(700)(2) \\ &= 490000 + 4 + 2800 \\ &= 492804. \end{aligned}$$

$$\begin{aligned} \textcircled{5} \quad 99, \quad (99)^2 &= (100-1)^2 = (100)^2 + 1 - 2(100) \\ &= 10000 + 1 - 200 \\ &= 9801. \end{aligned}$$

Squares And Square Roots Ex 3.4

EXERCISE 3.4.

12

- ① write the possible unit's digits of square root of following numbers. which of these are odd square roots.

① 9801

units digit = 1

units digit of square root = 1 or 9.

As no. is odd, square root is also odd.

② 99856.

units digit = 6

units digit of square root = 4 or 6

As no. is even, square root is also even.

③ 998001

units digit = 1

units digit of square root is 1 or 9.

As no. is odd, square root is also odd.

④ 657666025.

units digit = 5.

units digit of square root = 5.

As no. is odd, square root is also odd.

- ② Find square root of each of the following by prime factorization 28

(i) 441

$$441 = 3^2 \times 7^2$$

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

$$\begin{array}{r} 3 \overline{) 441} \\ \underline{3} \\ 149 \\ \underline{147} \\ 21 \end{array}$$

(ii) 196

$$196 = 2^2 \times 7^2$$

$$\sqrt{196} = 2 \times 7 = 14$$

$$\begin{array}{r} 2 \overline{) 196} \\ \underline{2} \\ 98 \\ \underline{98} \\ 0 \end{array}$$

(iii) 529

$$529 = 23^2$$

$$\sqrt{529} = 23$$

$$\begin{array}{r} 23 \overline{) 529} \\ \underline{23} \\ 0 \end{array}$$

(iv) 1264

$$1264 = 2^2 \times 3^2 \times 7^2$$

$$\sqrt{1264} = 2 \times 3 \times 7 = 42$$

$$\begin{array}{r} 2 \overline{) 1264} \\ \underline{2} \\ 864 \\ \underline{862} \\ 21 \end{array}$$

(v) 1156

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

$$\sqrt{1156} = 2 \times 17 = 34$$

$$\begin{array}{r} 2 \overline{) 1156} \\ \underline{2} \\ 956 \\ \underline{952} \\ 4 \end{array}$$

(vi) 4096

$$4096 = 2^{12}$$

$$\sqrt{4096} = 2^6 = 64.$$

$$\begin{array}{r} 2 \overline{) 4096} \\ \underline{2048} \\ 2 \overline{) 1024} \\ \underline{512} \\ 2 \overline{) 256} \\ \underline{128} \\ 2 \overline{) 64} \\ \underline{32} \\ 2 \overline{) 16} \\ \underline{8} \\ 2 \overline{) 4} \\ \underline{2} \\ 2 \overline{) 2} \\ \underline{2} \\ 0 \end{array}$$

29

(vii) 7056

$$7056 = 2^2 \times 2^2 \times 21^2$$

$$\sqrt{7056} = 2 \times 2 \times 21 = 84.$$

$$\begin{array}{r} 2 \overline{) 7056} \\ \underline{3528} \\ 2 \overline{) 1764} \\ \underline{882} \\ 2 \overline{) 441} \\ \underline{21} \\ 21 \end{array}$$

(viii) 8281

$$8281 = 91^2$$

$$\sqrt{8281} = 91$$

$$\begin{array}{r} 91 \overline{) 8281} \\ \underline{81} \\ 181 \\ \underline{181} \\ 0 \end{array}$$

(ix) 11664

$$11664 = 2^2 \times 2^2 \times 3^2 \times 3^2 \times 3^2$$

$$\sqrt{11664} = 2 \times 2 \times 3 \times 3 \times 3 = 108.$$

$$\begin{array}{r} 2 \overline{) 11664} \\ \underline{5832} \\ 2 \overline{) 2916} \\ \underline{1458} \\ 2 \overline{) 729} \\ \underline{364} \\ 3 \overline{) 243} \\ \underline{81} \\ 2 \overline{) 81} \\ \underline{40} \\ 3 \overline{) 27} \\ \underline{9} \\ 2 \overline{) 9} \\ \underline{9} \\ 0 \end{array}$$

(x) 47089

$$47089 = (217)^2$$

$$\sqrt{47089} = 217$$

$$\begin{array}{r} 217 \overline{) 47089} \\ \underline{2354} \\ 23549 \end{array}$$

30

(xi)

24336

$$24336 = 2^2 \times 2^2 \times 3^2 \times 13^2$$

$$\sqrt{24336} = 2 \times 2 \times 3 \times 13 = 156$$

$$\begin{array}{r} 2 \overline{) 24336} \\ \underline{12168} \\ 2 \overline{) 12168} \\ \underline{6084} \\ 2 \overline{) 6084} \\ \underline{3042} \\ 2 \overline{) 3042} \\ \underline{1521} \\ 3 \overline{) 1521} \\ \underline{507} \\ 3 \overline{) 507} \\ \underline{169} \\ 13 \overline{) 169} \\ \underline{13} \\ 15 \end{array}$$

(xii)

190969

$$190969 = 23^2 \times 19^2$$

$$\sqrt{190969} = 23 \times 19 = 437$$

$$\begin{array}{r} 23 \overline{) 190969} \\ \underline{8303} \\ 23 \overline{) 8303} \\ \underline{361} \\ 19 \overline{) 361} \\ \underline{19} \\ 19 \end{array}$$

(xiii)

586756

$$586756 = 2^2 \times 383^2$$

$$\sqrt{586756} = 2 \times 383 = 766$$

$$\begin{array}{r} 2 \overline{) 586756} \\ \underline{293378} \\ 2 \overline{) 293378} \\ \underline{146689} \\ 383 \overline{) 146689} \\ \underline{4889} \\ 383 \overline{) 4889} \\ \underline{383} \\ 10669 \end{array}$$

(xiv)

3013696

$$3013696 = 2^2 \times 2^2 \times 2^2 \times 217^2$$

$$\sqrt{3013696} = 1736$$

$$\begin{array}{r} 2 \overline{) 3013696} \\ \underline{1506848} \\ 2 \overline{) 1506848} \\ \underline{753424} \\ 2 \overline{) 753424} \\ \underline{376712} \\ 2 \overline{) 376712} \\ \underline{188356} \\ 2 \overline{) 188356} \\ \underline{94178} \\ 2 \overline{) 94178} \\ \underline{47089} \\ 217 \overline{) 47089} \\ \underline{217} \\ 244 \end{array}$$

③

$$180 = 2^2 \times 3^2 \times 5$$

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

$$\begin{array}{r} 2 \overline{)180} \\ \underline{2} \\ 90 \\ \underline{5} \\ 45 \\ \underline{3} \\ 9 \\ \underline{3} \\ 0 \end{array}$$

To make the unpaired 5 into paired, multiply the number with 5.

$$\therefore 180 \times 5 = 2^2 \times 3^2 \times 5^2$$

$$\therefore \text{Square root of number} = \sqrt{180 \times 5} = 2 \times 3 \times 5 = 30$$

④

$$147$$

$$147 = 7^2 \times 3$$

$$\begin{array}{r} 3 \overline{)147} \\ \underline{7} \\ 49 \\ \underline{2} \\ 2 \end{array}$$

To make the unpaired 3 into paired, multiply the number with 3.

$$\therefore 147 \times 3 = 7^2 \times 3^2$$

$$\therefore \text{Square root of number} = \sqrt{147 \times 3} = 7 \times 3 = 21$$

⑤

$$3645$$

$$3645 = 5 \times (3 \times 3) \times (3 \times 3) \times (3)$$

Here 5 and 3 are unpaired so eliminate them we have to divide 3645 with 5×3 , i.e. 15

$$\therefore \frac{3645}{15} = 3^2 \times 3^2$$

$$\therefore \text{Square root of number} = \sqrt{\frac{3645}{15}} = 3 \times 3 = 9$$

$$\begin{array}{r} 5 \overline{)3645} \\ \underline{5} \\ 29 \\ \underline{3} \\ 243 \\ \underline{3} \\ 81 \\ \underline{3} \\ 27 \\ \underline{3} \\ 9 \\ \underline{3} \\ 0 \end{array}$$

⑥ 1152

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

All factors are paired except 2,
to eliminate it we have to divide
the no. with 2.

$$\therefore \frac{1152}{2} = 2 \times 2 \times 2 \times 2 \times 3$$

$$\sqrt{\frac{1152}{2}} = 2 \times 2 \times 2 \times 3 = 24$$

$$\begin{array}{r} 2 \overline{) 1152} \\ \underline{2276} \\ 2 \overline{) 288} \\ \underline{2144} \\ 2 \overline{) 72} \\ \underline{236} \\ 2 \overline{) 18} \\ \underline{29} \\ 0 \end{array}$$

⑦ Let a and b be two numbers

$$a \times b = 1296$$

$$a = 16b \Rightarrow 16b \times b = 1296$$

$$b^2 = 81$$

$$b = \sqrt{81}$$

$$b = 9$$

$$\therefore a = 144, b = 9$$

$$\begin{array}{r} 3 \overline{) 81} \\ \underline{327} \\ 3 \overline{) 9} \\ \underline{33} \\ 0 \end{array}$$

⑧ Let total residents be a .

\therefore Each paid a Rs.

$$\therefore \text{Total collection} = a(a) = a^2 = 202500$$

$$a = \sqrt{202500}$$

$$a = 5 \times 5 \times 6 = 150$$

$$\therefore \text{Total residents} = 150$$

$$\begin{array}{r} 5 \overline{) 202500} \\ \underline{54500} \\ 5 \overline{) 900} \\ \underline{5180} \\ 5 \overline{) 36} \\ \underline{66} \\ 0 \end{array}$$

⑨ Let there were a members.

33

∴ Each attributed a paise.

∴ $a(a)$, i.e. total amt collected = 9216 paise

$$a^2 = 9216$$

$$a = \sqrt{9216}$$

$$a = 2 \times 2 \times 2 \times 12$$

$$= 96.$$

∴ There were 96 members, each contributed 96 paise.

$$\begin{array}{r} 2 \overline{) 9216} \\ \underline{4608} \\ 2 \overline{) 2304} \\ \underline{1152} \\ 2 \overline{) 576} \\ \underline{288} \\ 2 \overline{) 288} \\ \underline{144} \\ 12 \overline{) 144} \\ \underline{12} \\ 24 \\ \underline{24} \\ 0 \end{array}$$

⑩ Let a be number of school students

∴ each student contributed a paise,

total money obtained = a^2 paise = 230400 paise

$$a = \sqrt{230400} = \sqrt{2304 \times 100} = 10\sqrt{2304}$$

$$a = 10 \times 2 \times 2 \times 12$$

$$a = 480$$

∴ there were 480 students.

$$\begin{array}{r} 2 \overline{) 230400} \\ \underline{1152} \\ 2 \overline{) 576} \\ \underline{288} \\ 2 \overline{) 288} \\ \underline{144} \\ 12 \overline{) 144} \\ \underline{12} \\ 24 \\ \underline{24} \\ 0 \end{array}$$

⑪ Let a be side of square field.

$$\therefore a^2 = 5184 \text{ m}^2$$

$$a = \sqrt{5184} \text{ m}$$

$$a = 2 \times 2 \times 2 \times 9 = 72 \text{ m}$$

$$\text{Perimeter of sq} = 4a = 288 \text{ m}$$

$$\text{Perimeter of rectangle} = 2(l+b) = 288 \text{ m}$$

$$\begin{array}{r} 2 \overline{) 5184} \\ \underline{2592} \\ 2 \overline{) 1296} \\ \underline{648} \\ 2 \overline{) 648} \\ \underline{324} \\ 2 \overline{) 324} \\ \underline{162} \\ 2 \overline{) 162} \\ \underline{81} \\ 9 \overline{) 81} \\ \underline{81} \\ 0 \end{array}$$

$$2(2b+b) = 288$$

$$b = 48, l = 96.$$

$$\begin{aligned} \text{area of rectangle} &= 96 \times 48 \text{ m}^2 \\ &= 4608 \text{ m}^2. \end{aligned}$$

(12) (i) 6, 9, 15 and 20

LCM of given 4 numbers is 180

$$180 = 2^2 \times 3^2 \times 5$$

To make it a perfect square, we have to multiply the number with 5.

$$\therefore 180 \times 5 = 2^2 \times 3^2 \times 5^2$$

900 is the least square number, divisible by 6, 9, 15 and 20.

$$\begin{array}{r} 2 \overline{)180} \\ 2 \overline{)90} \\ 5 \overline{)45} \\ 3 \overline{)9} \\ 3 \end{array}$$

(ii) 8, 12, 15 and 20

LCM of given 4 numbers is 360.

$$360 = 2^3 \times 3^2 \times 5$$

To make it a perfect square, multiply it with 2×5 , i.e. 10

$$3600 = 2^3 \times 3^2 \times 2 \times 5^2$$

$\therefore 3600$ is the least square number, divisible by 8, 12, 15 and 20.

$$\begin{array}{r} 2 \overline{)360} \\ 2 \overline{)180} \\ 2 \overline{)90} \\ 5 \overline{)45} \\ 3 \overline{)9} \\ 3 \end{array}$$

(13)

$$121 - 1 = 120$$

$$120 - 3 = 117$$

$$117 - 5 = 112$$

$$112 - 7 = 105$$

$$105 - 9 = 96$$

$$96 - 11 = 85$$

$$85 - 13 = 72$$

$$72 - 15 = 57$$

$$57 - 17 = 40$$

$$40 - 19 = 21$$

$$21 - 21 = 0$$

clearly we have performed operation 11 times

$$\therefore \sqrt{121} = 11$$

$$169 - 1 = 168$$

$$168 - 3 = 165$$

$$165 - 5 = 160$$

$$160 - 7 = 153$$

$$153 - 9 = 144$$

$$144 - 11 = 133$$

$$133 - 13 = 120$$

$$120 - 15 = 105$$

$$105 - 17 = 88$$

$$88 - 19 = 69$$

$$69 - 21 = 48$$

$$48 - 23 = 25$$

$$25 - 25 = 0$$

clearly we have performed subtraction 13 times

$$\therefore \sqrt{169} = 13$$

(14)

① 7744

$$7744 = 2^2 \times 2^2 \times 2^2 \times 11^2$$

$$\sqrt{7744} = 2 \times 2 \times 2 \times 11 = 88$$

$$\begin{array}{r} 2 \overline{) 7744} \\ \underline{23872} \\ 2 \overline{) 1936} \\ \underline{2968} \\ 2 \overline{) 484} \\ \underline{262} \\ 2 \overline{) 262} \\ \underline{1121} \\ 11 \end{array}$$

② 9604

$$9604 = 2^2 \times 7^2 \times 7^2$$

$$\sqrt{9604} = 2 \times 7 \times 7 = 98$$

$$\begin{array}{r} 2 \overline{) 9604} \\ \underline{24802} \\ 7 \overline{) 2401} \\ \underline{7343} \\ 7 \overline{) 49} \\ \underline{7} \end{array}$$

③ 5929

$$5929 = 11^2 \times 7^2$$

$$\sqrt{5929} = 11 \times 7 = 77$$

$$\begin{array}{r} 11 \overline{) 5929} \\ \underline{11539} \\ 7 \overline{) 49} \\ \underline{7} \end{array}$$

④ 7056

$$7056 = 2^2 \times 2^2 \times 7^2 \times 3^2$$

$$\sqrt{7056} = 2 \times 2 \times 7 \times 3 = 84$$

$$\begin{array}{r} 2 \overline{) 7056} \\ \underline{23528} \\ 2 \overline{) 1764} \\ \underline{2882} \\ 7 \overline{) 441} \\ \underline{763} \\ 7 \overline{) 63} \\ \underline{39} \\ 3 \end{array}$$

(15)

Let 'a' be number of students.

37

∴ each student donated a rupees.

∴ Total amount collected = a × a rupees = 2401

$$a^2 = 2401$$

$$a = \sqrt{2401}$$

$$a = 49$$

$$\begin{array}{r} 7 \overline{) 2401} \\ \underline{7343} \\ 7 \overline{) 49} \\ \underline{7} \end{array}$$

∴ There are 49 students in the class.

(16)

Let a be no. of rows

∴ no. of columns = a.

Total no. of students who sat in field = a^2 Total students = $a^2 + 71 = 6000$

$$a^2 = 5929$$

$$a = \sqrt{5929}$$

$$a = 11 \times 7 = 77$$

∴ no. of rows = 77.

$$\begin{array}{r} 11 \overline{) 5929} \\ \underline{11539} \\ 7 \overline{) 49} \\ \underline{7} \end{array} \quad \begin{array}{r} 2 \overline{) 5928} \\ \underline{2964} \\ 2 \overline{) 1482} \\ \underline{241} \\ 3 \overline{) 241} \\ \underline{241} \end{array}$$

Squares And Square Roots Ex 3.6

EXERCISE - 3.6.

38

① Find the square root of

i) $\frac{441}{961}$

$$\Rightarrow \sqrt{\frac{441}{961}} = \frac{\sqrt{441}}{\sqrt{961}} = \frac{21}{31}$$

$$\left[\because \sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}} \right]$$

ii) $\sqrt{\frac{324}{841}} = \frac{\sqrt{324}}{\sqrt{841}} = \frac{18}{29}$

iii) $4 \cdot \frac{29}{49} = \frac{225}{49}$

$$\sqrt{4 \cdot \frac{29}{49}} = \sqrt{\frac{225}{49}} = \frac{\sqrt{225}}{\sqrt{49}} = \frac{15}{7}$$

iv) $2 \cdot \frac{14}{25} = \frac{64}{25}$

$$\sqrt{2 \cdot \frac{14}{25}} = \sqrt{\frac{64}{25}} = \frac{\sqrt{64}}{\sqrt{25}} = \frac{8}{5}$$

v) $2 \cdot \frac{137}{196} = \frac{529}{196}$

$$\sqrt{2 \cdot \frac{137}{196}} = \sqrt{\frac{529}{196}} = \frac{\sqrt{529}}{\sqrt{196}} = \frac{23}{14}$$

vi) $23 \cdot \frac{26}{121} = \frac{2809}{121}$

$$\sqrt{23 \cdot \frac{26}{121}} = \sqrt{\frac{2809}{121}} = \frac{\sqrt{2809}}{\sqrt{121}} = \frac{53}{11}$$

vii) $25 \cdot \frac{564}{729} = \frac{18769}{729}$

$$\sqrt{25 \cdot \frac{564}{729}} = \sqrt{\frac{18769}{729}} = \frac{\sqrt{18769}}{\sqrt{729}} = \frac{137}{27}$$

$$\textcircled{\text{viii}} 75 \cdot \frac{46}{49} = \frac{3721}{49}$$

$$\sqrt{75 \cdot \frac{46}{49}} = \sqrt{\frac{3721}{49}} = \frac{61}{7}$$

$$\textcircled{\text{ix}} 3 \cdot \frac{942}{2209} = \frac{7569}{2209}$$

$$\sqrt{3 \cdot \frac{942}{2209}} = \sqrt{\frac{7569}{2209}} = \frac{\sqrt{7569}}{\sqrt{2209}} = \frac{87}{47}$$

$$\textcircled{\text{x}} 3 \cdot \frac{834}{3025} = \frac{9609}{3025}$$

$$\sqrt{3 \cdot \frac{834}{3025}} = \sqrt{\frac{9609}{3025}} = \frac{\sqrt{9609}}{\sqrt{3025}} = \frac{97}{55}$$

$$\textcircled{\text{xi}} 21 \cdot \frac{2797}{3364} = \frac{73041}{3364}$$

$$\sqrt{21 \cdot \frac{2797}{3364}} = \sqrt{\frac{73041}{3364}} = \frac{\sqrt{73041}}{\sqrt{3364}} = \frac{271}{58}$$

$$\textcircled{\text{xii}} 38 \cdot \frac{11}{25} = \frac{961}{25}$$

$$\sqrt{38 \cdot \frac{11}{25}} = \sqrt{\frac{961}{25}} = \frac{\sqrt{961}}{\sqrt{25}} = \frac{31}{5}$$

$$\textcircled{\text{xiii}} 23 \cdot \frac{394}{729} = \frac{17161}{729}$$

$$\sqrt{23 \cdot \frac{394}{729}} = \sqrt{\frac{17161}{729}} = \frac{\sqrt{17161}}{\sqrt{729}} = \frac{131}{27}$$

$$\textcircled{\text{xiv}} 21 \cdot \frac{51}{169} = \frac{3600}{169}$$

$$\sqrt{21 \cdot \frac{51}{169}} = \sqrt{\frac{3600}{169}} = \frac{\sqrt{3600}}{\sqrt{169}} = \frac{60}{13}$$

$$\textcircled{\text{xv}} 10 \cdot \frac{151}{225} = \frac{2401}{225}$$

$$\sqrt{10 \cdot \frac{151}{225}} = \sqrt{\frac{2401}{225}} = \frac{\sqrt{2401}}{\sqrt{225}} = \frac{49}{15}$$

② Find the value of

i) $\frac{\sqrt{80}}{\sqrt{405}}$

we know that $\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{\frac{a}{b}}$

$$\Rightarrow \frac{\sqrt{80}}{\sqrt{405}} = \sqrt{\frac{80}{405}} = \sqrt{\frac{16}{81}} \quad (\because \text{cancelling numerator and denominator with 5})$$

$$= \frac{\sqrt{16}}{\sqrt{81}} = \frac{4}{9} \quad [\because \sqrt{16} = 4, \sqrt{81} = 9]$$

ii) $\frac{\sqrt{441}}{\sqrt{625}}$

$$= \frac{\sqrt{441}}{\sqrt{625}} = \frac{21}{25} \quad [\because \sqrt{441} = 21, \sqrt{625} = 25]$$

iii) $\frac{\sqrt{1587}}{\sqrt{1228}} = \frac{\sqrt{1587}}{\sqrt{1228}} = \sqrt{\frac{529}{376}} \quad (\because \text{cancelling numerator and denominator with 3})$

$$= \frac{\sqrt{529}}{\sqrt{376}} = \frac{23}{24} \quad [\because \sqrt{529} = 23, \sqrt{376} = 24]$$

iv) $\sqrt{72} \times \sqrt{338}$

$$= \sqrt{72} \times \sqrt{338}$$

v) $\sqrt{72} \times \sqrt{338}$

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

we know that $\sqrt{a} \times \sqrt{b} = \sqrt{a \times b}$

$$\Rightarrow \sqrt{2^4 \times 3^2 \times 13^2} = 2^2 \times 3 \times 13 = 156$$

$$\textcircled{v} \sqrt{45} \times \sqrt{20}$$

$$= \sqrt{5 \times 9} \times \sqrt{5 \times 2^2}$$

$$= \sqrt{5^2 \times 9 \times 2^2} = 5 \times 9 \times 2$$

$$= 90$$

$$\textcircled{3} \text{ Given area} = 80 \cdot \frac{240}{729} \text{ m}^2$$

$$= \frac{58560}{729} \text{ m}^2$$

If L is length of each side

$$\therefore L^2 = \frac{58560}{729}$$

$$L = \frac{\sqrt{58560}}{\sqrt{729}} \quad \left[\because \sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}} \right]$$

$$= \frac{242}{27}$$

$$\textcircled{4} \text{ Given, area} = 30 \cdot \frac{1}{4} \text{ m}^2$$

$$= \frac{121}{4} \text{ m}^2$$

If L is length of each side

$$\text{then } L^2 = \frac{121}{4}$$

$$L = \sqrt{\frac{121}{4}} = \frac{\sqrt{121}}{\sqrt{4}} = \frac{11}{2} \quad \left[\because \sqrt{121} = 11 \right]$$

$$\therefore \text{length} = \frac{11}{2}$$

$$\textcircled{5} \text{ Area of rectangular field} = l \times b$$

$$= 72 \times 338 \text{ m}^2$$

$$= 24336 \text{ m}^2$$

$$\text{Area of square} = L^2 = 24336 \text{ m}^2$$

$$L = \sqrt{24336} = 156 \text{ m. is the}$$

length of side of square play ground.

Squares And Square Roots Ex 3.7

EXERCISE - 3.7

43

Find the square root of the following.

① 84.8241

$$\begin{array}{r} 9.21 \\ 9 \overline{) 84.8241} \\ \underline{81} \\ 382 \\ 182 \\ \underline{364} \\ 244 \\ \underline{184} \\ 184 \\ \underline{184} \\ 0 \end{array}$$

$$\therefore \sqrt{84.8241} = 9.21$$

② 0.7225

$$\begin{array}{r} .85 \\ .85 \overline{) 0.7225} \\ \underline{0} \\ 72 \\ \underline{64} \\ 825 \\ \underline{825} \\ 0 \end{array}$$

$$\sqrt{0.7225} = 0.85$$

③ 0.813604

$$\begin{array}{r} 0.902 \\ 0.902 \overline{) 0.813604} \\ \underline{0} \\ 81 \\ \underline{81} \\ 36 \\ \underline{36} \\ 0 \\ 3604 \\ \underline{3604} \\ 0 \end{array}$$

$$\sqrt{0.813604} = 0.902$$

④ 0.00002025

$$\begin{array}{r}
 0.0045 \\
 \hline
 0.00002025 \\
 \hline
 0 \\
 4 \quad 20 \\
 \hline
 16 \\
 95 \quad 425 \\
 \hline
 425 \\
 \hline
 0
 \end{array}$$

$= 0.0045$

⑤ 150.0625

$$\begin{array}{r}
 12.25 \\
 \hline
 150.0625 \\
 \hline
 1 \\
 22 \quad 050 \\
 \hline
 44 \\
 242 \quad 606 \\
 \hline
 484 \\
 2445 \quad 12225 \\
 \hline
 0
 \end{array}$$

$= 12.25$

⑥ 225.6004

$$\begin{array}{r}
 15.02 \\
 \hline
 225.6004 \\
 \hline
 1 \\
 25 \quad 125 \\
 \hline
 125 \\
 300 \quad 060 \\
 \hline
 0 \\
 3002 \quad 6004 \\
 \hline
 6004 \\
 \hline
 0
 \end{array}$$

$= 15.02$

⑦ 3600.720036

215

$$\begin{array}{r}
 60.006 \\
 6 \overline{) 3600.720036} \\
 \underline{36} \\
 120 000 \\
 \underline{0} \\
 1200 072 \\
 \underline{1200} \\
 1240 000 \\
 7200 \\
 0000 \\
 12006 720036 \\
 \underline{12006} \\
 0
 \end{array}$$

= 60.006.

⑧ 236.144689

$$\begin{array}{r}
 15.367 \\
 1 \overline{) 236.144689} \\
 \underline{1} \\
 25 136 \\
 \underline{125} \\
 303 1114 \\
 \underline{969} \\
 366 205468 \\
 \underline{18396} \\
 3027 2150907 \\
 \underline{3015097} \\
 0
 \end{array}$$

= 15.367.

⑨ 0.00059049

46

$$\begin{array}{r}
 0.0243 \\
 0 \overline{) 0.00059049} \\
 \underline{0} \\
 0 000 \\
 \underline{0} \\
 2 005 \\
 4 \\
 44 190 \\
 \underline{176} \\
 483 1449 \\
 \underline{1449} \\
 0
 \end{array}$$

= 0.0243.

⑩ 176.252176

$$\begin{array}{r}
 13.276 \\
 1 \overline{) 176.252176} \\
 \underline{1} \\
 136 076 \\
 \underline{69} \\
 262 125 \\
 \underline{125} \\
 2647 20121 \\
 \underline{18529} \\
 26546 159276 \\
 \underline{159276} \\
 0
 \end{array}$$

= 13.276

⑪

$$\begin{array}{r}
 99.99 \\
 9 \overline{) 9998.0001} \\
 \underline{81} \\
 189 \\
 \underline{1801} \\
 1989 \\
 \underline{19700} \\
 12901 \\
 1998 \\
 \underline{179901} \\
 129901 \\
 \underline{0}
 \end{array}$$

$$= 99.99$$

⑫

$$\begin{array}{r}
 0.0192 \\
 0 \overline{) 0.00088809} \\
 \underline{0} \\
 0 \\
 \underline{000} \\
 0 \\
 1 \\
 \underline{03} \\
 1 \\
 29 \\
 \underline{288} \\
 261 \\
 287 \\
 \underline{2709} \\
 2709 \\
 \underline{0}
 \end{array}$$

$$= 0.0192$$

⑬ If α the fraction, then given is $\alpha^2 = 227.798649$

$$\alpha = \sqrt{227.798649}$$

$$\begin{array}{r}
 15.093 \\
 1 \overline{) 227.798649} \\
 \underline{227} \\
 1 \\
 25 \\
 \underline{127} \\
 125 \\
 300 \\
 \underline{279} \\
 0 \\
 3009 \\
 \underline{27986} \\
 27081 \\
 30183 \\
 \underline{90549} \\
 90549 \\
 \underline{0}
 \end{array}$$

$$\alpha = 15.093$$

14) Given area = $L^2 = 256.6404 \text{ m}^2$.

$$L = \sqrt{256.6404}$$

$$\therefore L = 16.02 \text{ m}$$

$$\begin{array}{r} 16.02 \\ 81 \overline{) 256.6404} \\ \underline{1} \\ 26 \\ \underline{156} \\ 320 \\ \underline{320} \\ 0004 \\ \underline{0004} \\ 0 \end{array}$$

15) If \bar{a} is the fraction then given is

$$a^2 = 0.00053361$$

$$\therefore a = 0.0231$$

$$\begin{array}{r} 0.0231 \\ 0 \overline{) 0.00053361} \\ \underline{0} \\ 000 \\ \underline{0} \\ 2 005 \\ \underline{4} \\ 461 \\ \underline{133} \\ 129 \\ \underline{461} \\ 461 \\ \underline{461} \\ 0 \end{array}$$

(16) (i)

$$\frac{\sqrt{59.29} - \sqrt{5.29}}{\sqrt{59.29} + \sqrt{5.29}}$$

first we find $\sqrt{59.29}$ and $\sqrt{5.29}$

$$\begin{array}{r} 77 \\ 7 \overline{) 5929} \\ \underline{49} \\ 1029 \\ 1029 \\ \hline 0 \end{array} = 77$$

$$\begin{array}{r} 23 \\ 23 \overline{) 529} \\ \underline{48} \\ 49129 \\ 49129 \\ \hline 0 \end{array} = 23$$

$$\therefore \sqrt{59.29} = \sqrt{\frac{5929}{100}} = \frac{77}{10}, \quad \sqrt{5.29} = \sqrt{\frac{529}{100}} = \frac{23}{10}$$

$$\therefore \frac{\frac{77}{10} - \frac{23}{10}}{\frac{77}{10} + \frac{23}{10}} = 0.54$$

$$(ii) \frac{\sqrt{0.2304} + \sqrt{0.1764}}{\sqrt{0.2304} - \sqrt{0.1764}}$$

$$\begin{array}{r} 48 \\ 4 \overline{) 2304} \\ \underline{16} \\ 804 \\ 804 \\ \hline 0 \end{array} = 48$$

$$\begin{array}{r} 42 \\ 4 \overline{) 1764} \\ \underline{16} \\ 82164 \\ 82164 \\ \hline 0 \end{array} = 42$$

$$\therefore \text{Given } \frac{\sqrt{\frac{2304}{10000}} + \sqrt{\frac{1764}{10000}}}{\sqrt{\frac{2304}{10000}} - \sqrt{\frac{1764}{10000}}} = \frac{48+42}{48-42} = \frac{90}{6} = 15$$

$$\textcircled{12} \quad \sqrt{50625} = \begin{array}{r} \overline{225} \\ 2 \overline{) 50625} \\ \underline{4} \\ 106 \\ \underline{84} \\ 2225 \\ \underline{2225} \\ 0 \end{array} \quad \approx 225$$

$$\sqrt{506.25} = \sqrt{\frac{50625}{100}} = \frac{\sqrt{50625}}{10} = \frac{225}{10}$$

$$\sqrt{5.0625} = \sqrt{\frac{50625}{10000}} = \frac{\sqrt{50625}}{100} = \frac{225}{100}$$

$$\sqrt{506.25} + \sqrt{5.0625} = \frac{225}{10} + \frac{225}{100} = \frac{2475}{100} = 24.75$$

$$\textcircled{13} \quad \sqrt{103.0225} = \begin{array}{r} \overline{10.15} \\ 1 \overline{) 103.0225} \\ \underline{1} \\ 003 \\ \underline{00} \\ 302 \\ \underline{301} \\ 1025 \\ \underline{10125} \\ 0 \end{array} \quad \approx 10.15$$

$$\textcircled{i} \quad \sqrt{10302.25} = \sqrt{103.0225 \times 100} = 10 \times 10.15 = 101.5$$

$$\textcircled{ii} \quad \sqrt{1.030225} = \sqrt{\frac{103.0225}{100}} = \frac{10.15}{10} = 1.015$$

Squares And Square Roots Ex 3.8

EXERCISE - 3.8

51

I find the square root of following correct to three places of decimal.

(i) 5

$$\begin{array}{r}
 2.236 \\
 \hline
 5.00000000 \\
 4 \\
 \hline
 100 \quad = 2.236 \\
 84 \\
 \hline
 1600 \\
 1329 \\
 \hline
 27100 \\
 26796 \\
 \hline
 304
 \end{array}$$

(ii) 7

$$\begin{array}{r}
 2.646 \\
 \hline
 7.00000000 \\
 4 \\
 \hline
 300 \quad = 2.646 \\
 276 \\
 \hline
 2400 \\
 2096 \\
 \hline
 30400 \\
 30316 \\
 \hline
 84
 \end{array}$$

(iii) 17

$$\begin{array}{r}
 4.123 \\
 \hline
 17.00000000 \\
 4 \\
 \hline
 16 \\
 \hline
 100 \\
 81 \\
 \hline
 1900 \\
 1644 \\
 \hline
 26600 \\
 24729 \\
 \hline
 1871
 \end{array}$$

④ 20

$$\begin{array}{r}
 4472 \\
 \hline
 20 \overline{) 00 \ 00 \ 00} \\
 \underline{16} \\
 100 \\
 \underline{336} \\
 6400 \\
 \underline{6209} \\
 8942 \\
 \underline{19100} \\
 \underline{17834} \\
 1216
 \end{array}$$

≈ 4.492

⑤ 66

$$\begin{array}{r}
 8.124 \\
 \hline
 66 \overline{) 00 \ 00 \ 00} \\
 \underline{66} \\
 161 \\
 \underline{161} \\
 1622 \\
 \underline{3900} \\
 \underline{3244} \\
 16244 \\
 \underline{65600} \\
 \underline{64976} \\
 624
 \end{array}$$

≈ 8.124

⑥ 427

$$\begin{array}{r}
 20.664 \\
 \hline
 427 \overline{) 00 \ 00 \ 00 \ 00} \\
 \underline{4} \\
 406 \\
 \underline{027} \\
 0 \\
 406 \\
 \underline{2700} \\
 \underline{2436} \\
 4124 \\
 \underline{26400} \\
 \underline{24756} \\
 41324 \\
 \underline{164400} \\
 \underline{164296} \\
 104
 \end{array}$$

≈ 20.664

VII) 1.7

$$\begin{array}{r}
 1.304 \\
 \hline
 1.70 \ 00 \ 00 \\
 \hline
 1 \\
 \hline
 23 \ 0.70 \\
 \hline
 69 \\
 \hline
 260 \ 1 \ 00 \\
 \hline
 0 \\
 \hline
 2604 \ 10000 \\
 \hline
 10416 \\
 \hline
 -416.
 \end{array}$$

= 1.304.

VIII) 2.3.1

$$\begin{array}{r}
 4.806 \\
 \hline
 23.10 \ 00 \ 00 \\
 \hline
 16 \\
 \hline
 28 \ 710 \\
 \hline
 704 \\
 \hline
 960 \ 6 \ 00 \\
 \hline
 0 \\
 \hline
 9606 \ 60000 \\
 \hline
 57636 \\
 \hline
 2364
 \end{array}$$

= 4.806.

IX) 2.5

X) 2.5

$$\begin{array}{r}
 1.5818 \\
 \hline
 2.50 \ 00 \ 00 \\
 \hline
 1 \\
 \hline
 25 \ 1250 \\
 \hline
 125 \\
 \hline
 308 \ 2500 \\
 \hline
 2464 \\
 \hline
 3161 \ 3600 \\
 \hline
 2464 \\
 \hline
 1136 \ 439
 \end{array}$$

= 1.581

⊗

$$237 \div 615$$

$$\begin{array}{r} 15.415 \\ 237 \overline{) 237.615000} \\ \underline{237} \\ 1 \\ 25 \underline{137} \\ 125 \\ 304 \underline{1261} \\ 1216 \\ 3081 \underline{4550} \\ 3081 \\ 30625 \underline{146900} \\ 154125 \\ 7225 \end{array} \quad = 15.415$$

⊗

$$15.3215$$

$$\begin{array}{r} 3.914 \\ 15 \overline{) 15.321500} \\ \underline{15} \\ 83 \underline{9} \\ 69 \underline{682} \\ 621 \\ 781 \underline{1115} \\ 781 \\ 7824 \underline{33400} \\ 31296 \\ 2104 \end{array} \quad = 3.914$$

⊗

$$0.9$$

$$\begin{array}{r} 0.949 \\ 0 \overline{) 0.900000} \\ \underline{0} \\ 9 \underline{090} \\ 81 \\ 184 \underline{900} \\ 736 \\ 1889 \underline{18400} \\ 17001 \\ 601 \end{array} \quad = 0.949$$

(XIII)

0.1

$$\begin{array}{r}
 0.316 \\
 0 \overline{) 0.100000} \\
 \underline{0} \\
 10 \\
 \underline{9} \\
 100 \\
 \underline{61} \\
 3900 \\
 \underline{3756} \\
 144
 \end{array}
 \quad \approx 0.316$$

(XIV)

0.016

$$\begin{array}{r}
 0.126 \\
 0 \overline{) 0.016000} \\
 \underline{0} \\
 1 \\
 \underline{1} \\
 060 \\
 \underline{44} \\
 1600 \\
 \underline{124} \\
 124
 \end{array}
 \quad \approx 0.126$$

(XV)

0.00064

$$\begin{array}{r}
 0.025 \\
 0 \overline{) 0.000640} \\
 \underline{0} \\
 0 \\
 \underline{0} \\
 2 \\
 \underline{2} \\
 45 \\
 \underline{45} \\
 15
 \end{array}
 \quad \approx 0.025$$

(xvi) 0.019

$$\begin{array}{r}
 0.138 \\
 \hline
 0.019000 \\
 0 \\
 \hline
 01 \\
 1 \\
 \hline
 090 \\
 69 \\
 \hline
 2100 \\
 2144 \\
 \hline
 44
 \end{array}$$

last digit is approximated.
 $= 0.138$

(xvii) $\frac{7}{8} = 0.875$

$$\begin{array}{r}
 0.935 \\
 \hline
 0.875000 \\
 0 \\
 \hline
 087 \\
 81 \\
 \hline
 650 \\
 549 \\
 \hline
 10100 \\
 9325 \\
 \hline
 775
 \end{array}$$

$= 0.935$

(xviii) $\frac{5}{12} = 0.416666$

$$\begin{array}{r}
 0.645 \\
 \hline
 0.416666 \\
 0 \\
 \hline
 41 \\
 36 \\
 \hline
 566 \\
 496 \\
 \hline
 7066 \\
 6245 \\
 \hline
 641
 \end{array}$$

$= 0.645$

(xix) $2\frac{1}{2} = 2.5$

$$\begin{array}{r}
 1.521 \\
 \hline
 2.500000 \\
 1 \\
 \hline
 150 \\
 125 \\
 \hline
 2500 \\
 2464 \\
 \hline
 3600 \\
 3461 \\
 \hline
 439
 \end{array}$$

$= 1.521$