

**CALCULATION-02**

**SQUARE (वर्ग)**

**CLASS NOTES**

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# Duplex Method of calculating Squares

Duplex of a single digit number (a) is its square.

$$D(a) = a^2$$

Examples:  $D(4) = 16$

$$D(7) = 49$$

$$D(2) = 4$$

$$D(8) = 64$$

$$D(9) = 81$$

## Duplex Method of calculating Squares

$$D(13) = 2 \times 1 \times 3 = 6$$

$$D(23) = 2 \times 2 \times 3 = 12$$

$$D(46) = 2 \times 4 \times 6 = 48$$

$$D(84) = 2 \times 8 \times 4 = \underline{\underline{112}}$$

$$D(94) = 2 \times 9 \times 4 = \underline{\underline{72}}$$

Duplex of a two digit number (ab) is twice of their product.

$$D(ab) = 2ab$$

Examples:

$$D(10) = 0$$

$$D(\underline{\underline{12}}) = 4$$

$$D(93) = 54$$

$$D(51) = 10$$

## Duplex Method of calculating Squares

Duplex of a three digit number (abc) is twice the product of the outer pair + the square of the middle digit

$$D(abc) = 2ac + b^2$$

$$D(134) = 2 \times 1 \times 4 + 3^2 = 17$$

$$D(512) = 2 \times 5 \times 2 + 1^2 = 21$$

$$D(234) = 2 \times 2 \times 4 + 3^2 = 34 \checkmark$$

Examples:  $D(123) = 10$

$$D(512) = 21$$

$$D(108) = 16$$

$$D(287) = 92$$

## Duplex Method of calculating Squares

Duplex of a four digit number (abcd) is twice the product of the outer pair + twice the product of the inner pair

$$D(\underline{abcd}) = 2ad + 2bc$$
$$= 2(ad + bc)$$

$$D(\overbrace{1234}) = 2(1 \times 4 + 2 \times 3)$$
$$= 2(4 + 6)$$
$$= \underline{\underline{20}}$$

Examples:

$$D(1234) = 20$$

$$D(5079) = 90$$

$$D(3841) = 16$$

$$D(287) = 92$$

$$\begin{aligned} D(\overbrace{2345}) &= 2(2 \times 5 + 3 \times 4) \\ &= 2(10 + 12) \\ &= \textcircled{44} \end{aligned}$$

$$\begin{aligned} D(\overbrace{7865}) &= 2(3 \times 5 + 4 \times 8) \\ &= 2 \times 83 \\ &= \underline{\underline{166}} \end{aligned}$$

## Square of Two-Digit Numbers

$$\underline{\underline{(ab)^2}} = D(a) / D(ab) / D(b)$$

Example

$$(23)^2 = D(2) / D(23) / D(3)$$

$$= 4 / 12 / 9$$

$$= 529$$

$$\begin{aligned}
 (23)^2 &= D(2) / D(23) / D(3) \\
 &= 4 / \underline{12} / 9 \\
 &= \underline{\underline{529}}
 \end{aligned}$$

$$\begin{aligned}
 (86)^2 &= D(8) / D(86) / D(6) \\
 &= 64 / \underline{96} / 36 \\
 &= \underline{\underline{7396}}
 \end{aligned}$$

$$\begin{array}{r}
 (23)^2 = \frac{1}{4} \quad \underline{2} \quad \underline{9} \\
 \hline
 \quad \quad \quad 529
 \end{array}$$

$$(73)^2 = \frac{49}{\quad} / \frac{42}{\quad} / \frac{9}{\quad}$$

$$= \underline{5329} \checkmark$$

$$(53)^2 =$$

$$\checkmark (77)^2 = \frac{49}{\quad} \quad \frac{98}{\quad} \quad \frac{49}{\quad}$$

$$\underline{5929}$$

$$(43)^2 = \frac{16}{\quad} / \frac{24}{\quad} / \frac{9}{\quad}$$

$$\underline{1849}$$

$$(119)^2 = \frac{49}{\frac{126}{81}}$$
$$= \underline{6241}$$

$$(88)^2 = \frac{64}{\frac{128}{64}}$$
$$= \underline{7744}$$

## Square of Three-Digit Numbers

$$(abc)^2 = D(a) / D(ab) / D(abc) / D(bc) / D(c)$$

Example

$$(123)^2 = D(1) / D(12) / D(123) / D(23) / D(3)$$

$$= 1 / 4 / 10 / 12 / 9$$

$$= 15129$$

$$(abc)^2 = D(a) / D(ab) / D(abc) / D(bc) / D(c)$$

$$\star (123)^2 = D(1) / D(12) / D(\overset{\frown}{123}) / D(23) / D(3)$$

$$= 1 / 4 / 10 / 12 / 9$$

$$= \underline{15129}$$

$$\star (234)^2 = D(2) / D(23) / D(234) / D(34) / D(4)$$

$$= 4 / 12 / 25 / 24 / 16$$

=

$$\frac{54756}{\phantom{000000}}$$

$$\star (987)^2 = 81 / 144 / 190 / 112 / 49$$

=

$$\frac{974169}{\phantom{000000}}$$

$$\checkmark (217)^2 = 4/4/29/14/49$$

$$= \underline{47089}$$

~~$$(108)^2 =$$~~

$$\checkmark (156)^2 = 1/10/37/60/36$$

$$= \underline{24336}$$

$$(283)^2 = 4/32/76/48/9$$

$$= \underline{80089}$$

$$\begin{aligned} \underline{(514)}^2 &= 25/10/41/8/16 \\ &= \underline{264196} \end{aligned}$$

$$\begin{aligned} \underline{(789)}^2 &= 49/112/190/144/81 \\ &= \underline{622521} \end{aligned}$$

## Square of Four-Digit Numbers

$$(abcd)^2 = D(a) / D(ab) / D(abc) / D(abcd) / D(bcd) / D(cd) / D(d)$$

### Example

$$\begin{aligned}(1234)^2 &= D(1) / D(12) / D(123) / D(1234) / D(234) / D(34) / D(4) \\ &= 1 / 4 / 10 / 20 / 25 / 24 / 16 \\ &= 1522756\end{aligned}$$

$$(abcd)^2 = D(a)/D(ab)/D(abc)/D(abcd)/D(bcd)/D(cd)/D(d)$$

$$(1234)^2 = D(1)/D(12)/D(\widehat{123})/D(\widehat{1234})/D(\widehat{234})/D(34)/D(4)$$

$$= 1/4/10/20/25/24/16$$

"

$$\underline{1522756}$$

$$\begin{aligned} \overline{(3456)}^2 &= 9/24/46/76/73/60/36 \\ &= \underline{11943936} \end{aligned}$$

$$\begin{aligned} \overline{(7591)}^2 &= 49/70/151/104/91/18/1 \\ &= \underline{57623281} \checkmark \end{aligned}$$

$$(2023)^2 =$$

$$(5841)^2 =$$

## Mixed Practice

$$(46)^2 =$$

$$(79)^2 =$$

$$(203)^2 =$$

$$(341)^2 =$$

$$\begin{array}{r} 9/24/22/8/1 \\ \hline 116281 \end{array}$$

**Mixed Practice**

$$(412)^2 =$$

$$(384)^2 =$$

$$(759)^2 =$$

$$(983)^2 =$$

## Special Case - 01

$$\begin{aligned}(1008)^2 &= (1008-8)(1008+8) + 8^2 \\ &= 1000 \times 1016 + 64 \\ &= \underline{1016064}\end{aligned}$$

Square of a number which is nearer to  $10^x$

$$\begin{aligned}\underline{(98)}^2 &= (98+2)(98-2) + 2^2 \\ &= 100 \times 96 + 4 = \underline{9604}\end{aligned}$$

$$\begin{aligned}\underline{(103)}^2 &= (103-3)(103+3) + 3^2 \\ &= 100 \times 106 + 9 = \underline{10609}\end{aligned}$$

$$\begin{aligned}\checkmark \underline{(993)}^2 &= (993+7)(993-7) + 7^2 \\ &= 1000 \times 986 + 49 = 986049 \checkmark\end{aligned}$$

$$\underline{(1008)}^2 =$$

# Special Case-02

Let's observe

$$3^2 = 09$$

$$33^2 = 1089$$

$$333^2 = 110889$$

$$3333^2 = 11108889$$

$$6^2 = 36$$

$$66^2 = 4356$$

$$666^2 = 443556$$

$$6666^2 = 44435556$$

$$9^2 = 81$$

$$99^2 = 9801$$

$$999^2 = 998001$$

$$9999^2 = 99980001$$

$$6^2 = 36$$

$$66^2 = \underline{4} \underline{3} \underline{5} 6$$

$$666^2 = \underline{4} \underline{4} \underline{3} \underline{5} \underline{5} 6 \checkmark$$

$$6666^2 = \underline{4} \underline{4} \underline{4} \underline{3} \underline{5} \underline{5} \underline{5} 6$$

$$3^2 = 09$$

$$33^2 = \underline{1}0\underline{8}9$$

$$333^2 = \underline{1}\underline{1}0\underline{8}\underline{8}9$$

$$3333^2 = \underline{1}\underline{1}\underline{1}0\underline{8}\underline{8}\underline{8}9$$

..

$$9^2 = 81$$

$$99^2 = \underline{9}8\underline{0}1$$

$$999^2 = \underline{9}\underline{9}8\underline{0}\underline{0}1$$

$$9999^2 = \underline{9}\underline{9}\underline{9}8\underline{0}\underline{0}\underline{0}1$$

## Special Case-03

Let's observe

$$1^2 = 1$$

$$11^2 = 121$$

$$111^2 = 12321$$

$$1111^2 = 1234321$$