Squaring using the Duplex Method

Simply by mental multiplication, the sub-sutra dwandwah yogah (the duplex combination) is used to find the squares of numbers that contain any number of digits.

We have already written a short section on how to find the duplex of a number and the reader is advised to visit the Duplex sub-section of the Fundamentals section. Alternatively, download Duplex-info and read at your leisure.

Please note that we will use the operator D(n) to denote the duplex of a number, n. For instance: D(43) means duplex of 43. Or, D(642) means duplex of 642 etc.

Now, let us find the square of a number using the duplex method:

eg.(1) $14^2 = D(1) / D(14) / D(4)$
$= 1 / 8 / {}_{1}6$
$= 1 / 9 / 6$
$= 1\ 9\ 6$

eg.(2) $53^2 = D(5) / D(53) / D(3)$
$= 25 / {}_{3}0 / 9$
$= 28 / 0 / 9$
$= 2\ 8\ 0\ 9$

eg.(3) $345^2 = D(3) / D(34) / D(345) / D(45) / D(5)$
$= 9 / {}_{2}4 / {}_{4}6 / {}_{4}0 / {}_{2}5$
$= 11 / 9 / 0 / 2 / 5$
$= 1\ 1\ 9\ 0\ 2\ 5$

If any digits in the number are greater than 5, the number can be converted to an equivalent Vinculum form, thus avoiding large multipkications.

eg.(4) $399^2 = D(3) / D(39) / D(399) / D(99) / D(9)$
$= 9 / {}_{5}4 / {}_{13}5 / {}_{16}2 / {}_{8}1$
$= 15 / 9 / 2 / 0 / 1$

but 3 9 9 is also equal to $4\ 0\ \bar{1}$

So, $4\ 0\ \bar{1}^2 = D(4) / D(40) / D(40\bar{1}) / D(0\bar{1}) / D(\bar{1})$
$= 16 / 0 / \bar{8} / 0 / 1$
$= 1\ 5\ 9\ 2\ 0\ 1$

A much easier calculation!

eg.(5) $97865^2 = D(9) / D(97) / D(978) / D(9786) / D(98765) / D(7865) / D(865) / D(65) / D(5)$

$= 81 / {}_{12}6 / {}_{19}3 / {}_{22}0 / {}_{23}8 / {}_{16}6 / {}_{11}6 / {}_{6}0 / {}_{2}5$

$= 95 / 7 / 7 / 5 / 5 / 8 / 2 / 2 / 5$

$= 9\ 5\ 7\ 7\ 5\ 5\ 8\ 2\ 2\ \ 5$

but 9 7 8 6 5 is also equal to: $1\ 0\ \bar{2}\ \bar{1}\ \bar{4}\ 5$

So, $1\ 0\ \bar{2}\ \bar{1}\ \bar{4}\ 5^2 = D(1) / D\ (1\ 0) / D\ (1\ 0\ \bar{2}) / D(1\ 0\ \bar{2}\ \bar{1}) / D(1\ 0\ \bar{2}\ \bar{1}\ \bar{4}) / D(1\ 0\ \bar{2}\ \bar{1}\ \bar{4}\ 5)$
$/ D(0\ \bar{2}\ \bar{1}\ \bar{4}\ 5) / D(\bar{2}\ \bar{1}\ \bar{4}5) / D(\bar{1}\ \bar{4}\ 5) / D(\bar{4}\ 5) / D(5)$

$= 1 / 0 / \bar{4} / \bar{2} / \bar{4} / {}_1 4 / {}_1 7 / {}_{\bar{1}}\bar{2} / 6 / {}_{\bar{4}} 0 / {}_2 5$

$= 1 / 0 / \bar{4} / \bar{2} / \bar{3} / 5 / 6 / \bar{2} / 2 / 2 / 5$

$= 9\ 9\ 5\ 7\ 7\ 5\ 5\ 6\ 2\ 2\ 5$

We can clearly see that using the Vinculum form reduces the computation that we have to do.