Multiplication Shortcuts

SPLIT AND MERGE

1. Simplify 5358×101

Solution:

Here distributive property $a(b + c) = ab + ac$ is made use of

$5358 \times 101 = 5358 \times (100 + 1)$

$= 535800 + 5358 = 541158$

2. Simplify 3897×999

Solution:

$3897 \times 999 = 3897 \times (1000 - 1)$

$= 3897000 - 3897 = 3893103$

3. Simplify 72519×9999

Solution:

$72519 \times 9999 = 72519 \times (10000 - 1)$

$= 725190000 - 72519 = 725117481$

4. Simplify 1397×1397

Solution:

$1397 \times 1397 = (1400 - 3)(1400 - 3)$

Here we make use of the formula

$(a - b)^2 = a^2 + b^2 - 2ab)$

$\therefore\ 1397 \times 1397 = (1400)^2 + (3^2) - 6 \times 1400$

$= 1960000 + 9 - 8400 = 1960009 - 8400 = 1951609$

5. Simplify 12345679×72

Solution:

$$12345679 \times 72 = (12345679) \times (70 + 2)$$
$$= 864197530 + 24691358 = 888888888$$

6. Simplify 839478×625

Solution:

$$839478 \times 625 = 839478 \times \left(\frac{10}{2}\right)^4$$
$$= \frac{839478 \times 10^4}{24} = \frac{8394780000}{16} = 524673750$$

MULTIPLICATION BY 5 AND 25

To multiply by 5 follow the following 2 steps

(i) Multiply by 10

(ii) Divide by 2

To multiply by 25 follow the following 2 steps.

(i) Multiply by 100

(ii) Divided by 4

1. Multiply 257892 by 5

Solution:

$257892 \times 10 = 2578920$

$2578920 \div 2 = 1289460$

$\therefore 257892 \times 5 = 1289460$

2. Multiply 984670 by 5

Solution:

$984670 \times 10 = 9846700$

$9846700 \div 2 = 4923350$

$\therefore 984670 \times 5 = 4923350$

3. Multiply 12569025 by 25

Solution:

$12569025 \times 100 = 1256902500$

$1256902500 \div 4 = 314225625$

$\therefore 12569025 \times 25 = 314225625$

4. $857609845 \times 25 = ?$

Solution:

$857609845 \times 100 = 85760984500$

$85760984500 \div 4 = 21440246125$

$\therefore 857609845 \times 25 = 21440246125$

5. Simplify 7543.572×5

Solution:

$7543.572 \times 10 = 75435.72$

$75435.72 \div 2 = 37717.86$

$\therefore 7543.572 \times 5 = 37717.86$

6. $257942.652 \times 25 = ?$

Solution:

$257942.652 \times 100 = 25794265.2$

$25794265.2 \div 4 = 6448566.3$

$\therefore 257942.652 \times 25 = 6448566.3$

MULTIPLICATION WITH 11 TO 13

(1) Multiplication by 11

Step 1: The last digit of the number is put down as the right hand figure of the answer.

Step 2: Each successive digit of the number is added to its neighbor at the right.

1. Simplify 5892×11

Solution:

Step 1: Put down the last figure 5892 as the right hand figure of the answer $\frac{5892 \times 11}{2}$

Step 2: 9 + 2 = 11 (Put 1 below the line and carry over 1) $\frac{5892 \times 11}{12}$

Step 3: $\frac{5892 \times 11}{812}$ (8 + 9 + 1 = 18, put 8 below and carry over 1)

Step 4: $\frac{5892 \times 11}{4812}$ (5 + 8 + 1 = 14, put 4 below and carry over 1)

Step 5: $\frac{5892 \times 11}{64812}$ (5 + 1 = 6, put 6 as the left hand figure)

$\therefore 5892 \times 11 = 64812$

2. Evaluate 23145×11

Solution:

Steps: $\frac{23145 \times 11}{5}(5 \times 1 = 5)$

$\frac{23145 \times 11}{95}(4 + 5 = 9)$

$\frac{23145 \times 11}{595}(1 + 4 = 5)$

$\frac{23145 \times 11}{4595}(3 + 1 = 4)$

$\frac{23145 \times 11}{54595}(2 + 3 = 5)$

$\frac{23145 \times 11}{254595}(0 + 2 = 2)$

$\therefore 23145 \times 11 = 254595$

3. Evaluate 89067×11

Solution:

Steps: $7 \times 1 = 7$

$6 + 7 = 13$ (write 3 and carry over 1)

$0 + 6 + 1 = 7$

$9 + 0 = 9$

$8 + 9 = 17$ (write 7 and carry over 1)

$0 + 8 + 1 = 9$

$\therefore 89067 \times 11 = 979737$

MULTIPLICATION BY 12

To multiply the number by 12,

Step 1: Double the right hand figure of the number

Step 2: Double each digit in turn and add to the right hand neighbour.

1. Evaluate 5324×12

Solution:

$\frac{5324 \times 12}{8}$ (Double the right hand figure $4 \times 2 = 8$ and write as the right hand figure of the answer)

$\frac{5324 \times 12}{88}$ ($2 \times 2 + 4 = 8$, write down 8)

$\frac{5324 \times 12}{888}$ ($3 \times 2 + 2 = 8$, write down 8)

$\frac{5324 \times 12}{3888}$ ($5 \times 2 + 3 = 13$, write down 3, carry over 1)

$\frac{5324 \times 12}{63888}$ ($0 \times 2 + 5 + 1 = 6$, write down 6)

$\therefore 5324 \times 12 = 63888$

2. Evaluate 22200007×12

Solution:

$\frac{22200007 \times 12}{4}$ $(7 \times 2 = 14,$ write down 4, carry over 1)

$\frac{22200007 \times 12}{84}$ $(1 + 0 + 7 = 8,$ write down 8)

$\frac{22200007 \times 12}{084}$ $(0 + 0 = 0,$ write down 0)

$\frac{22200007 \times 12}{0084}$ $(0 + 0 = 0,$ write down 0)

$\frac{22200007 \times 12}{00084}$ $(0 + 0 = 0,$ write down 0)

$\frac{22200007 \times 12}{400084}$ $(2 \times 2 + 0 = 4,$ write down 4)

$\frac{22200007 \times 12}{6400084}$ $(2 \times 2 + 2 = 6,$ write down 6)

$\frac{22200007 \times 12}{66400084}$ $(2 \times 2 + 2 = 6,$ write down 6)

$\frac{22200007 \times 12}{266400084}$ $(0 \times 2 + 2 = 2)$

$\therefore 22200007 \times 12 = 266400084$

MULTIPLICATION BY 13

To multiply the number by 13

Step 1: Multiply the right hand figure by 3.

Step 2: Table each digit in turn and add to the right neighbour.

1. Simplify 9483×13

Solution:

Step 1: $\frac{9483 \times 13}{9}$ (Treble the right hand figure and write it down)

Step 2: $\frac{9483 \times 13}{79}$ $(8 \times 3 + 3 = 27,$ write down 7 and carry over 2)

Step 3: $\frac{9483 \times 13}{279}$ $(4 \times 3 + 8 + 2 = 22,$ write down 2 and carry over 2)

Step 4: $\frac{9483 \times 13}{3279}$ $(9 \times 3 + 4 + 2 = 33,$ write down 3 and carry over 3)

Step 5: $\frac{9483 \times 13}{123279}$ $(0 \times 3 + 9 + 3 = 12,$ write down 12)

$\therefore 9483 \times 13 = 1,23,279$

2. Simplify 456789×13

Solution:

Steps: $\frac{456789 \times 13}{7}$ $(9 \times 3 = 27,$ write 7, carry over 2)

$\frac{456789 \times 13}{57}$ $(2 + 24 + 9 = 35,$ write 5, carry over 3)

$\frac{456789 \times 13}{257}$ $(3 + 21 + 8 = 32,$ write 2, carry over 3)

$\frac{456789 \times 13}{8257}$ $(3 + 18 + 7 = 28,$ write 8, carry over 2)

$\frac{456789 \times 13}{38257}$ $(2 + 15 + 6 = 23,$ write 3, carryover 2)

$\frac{456789 \times 13}{938257}$ $(2 + 12 + 5 = 19,$ write 9, carry over 1)

$\frac{456789 \times 13}{5938257}$ $(1 + 4 = 5,$ write 5)

$\therefore 456789 \times 13 = 5938257$

MULTIPLICATION: NUMBERS CLOSER TO 100

For example to find 103×104, we make use of 2 steps.

(i) Multiply the right side digits $3 \times 4 = 12$

(ii) $103 + 4 = 104 + 3 = 107$

$\therefore 103 \times 104 = 10712$

1. Simplify 107×102

Solution:

$107 + 2 = 102 + 7 = 109$

$7 \times 2 = 14$

$\therefore 107 \times 102 = 10914$

2. Simplify 109×105

Solution:

$109 + 5 = 105 + 9 = 114$

$9 \times 5 = 45$

$\therefore 109 \times 105 = 11445$

3. Simplify 98×86

Solution:

$98 = 100 - 2, 86 = 100 - 14$

$98 - 2$

$86 - 14$

$98 - 14 = 86 - 2 = 84$

$2 \times 14 = 28$

$\therefore 98 \times 86 = 8428$

4. Simplify 98×95

Solution:

$98 = 100 - 2, 95 = 100 - 5$

$98 - 2$

$95 - 5$

$98 - 5 = 95 - 2 = 93$

$2 \times 5 = 10$

$\therefore 98 \times 95 = 9310$

5. Simplify $112 \times 107 + 93 \times 96$

Solution:

$112 = 100 + 12, 107 = 100 + 7$

$112 + 7 = 119, 107 + 12 = 119$

$12 \times 7 = 84$

$\therefore 112 \times 107 = 11984$

$93 = 100 - 7, 96 = 100 - 4$

$93 - 4 = 89, 96 - 7 = 89$

$97 \times 4 = 28$

$\therefore 93 \times 96 = 8928$

$\therefore 112 \times 107 + 93 \times 96$

$= 11984 + 8928 = 20912$

MULTIPLICATION: TWO DIGIT NUMBERS

1. Simplify 17×18

Solution:

Here the vertically and crosswise formula is made use of.

There are 3 steps.

Step 1: Multiply vertically on the right $7 \times 8 = 56$

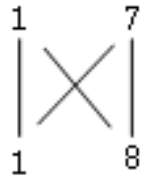
Write 6 as the last digit and carry over 5

Step 2: Multiply crosswise and add with the carry over $1 \times 8 + 1 \times 7 + 5 = 20$

Write 0 as the middle digit and carry over 2.

Step 3: Multiply vertically on the left and add with the carry over $1 \times 1 + 2 = 3$

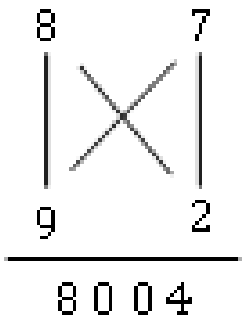
Write this as the first digit.



$\therefore 17 \times 18 = 306$

2. Find the product 87×92

Solution:



$7 \times 2 = 14 \rightarrow 4$ is the last digit

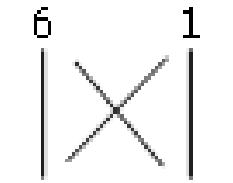
$8 \times 2 + 9 \times 7 + 1 = 80 \rightarrow 0$ is the middle digit.

$8 \times 9 + 8 = 80 \rightarrow 80$ gives the first 2 digits.

$\therefore 87 \times 92 = 8004$

3. Simplify 61×31

Solution:



1 8 9 1

$1 \times 1 = 1 \rightarrow 1$ is the last digit.

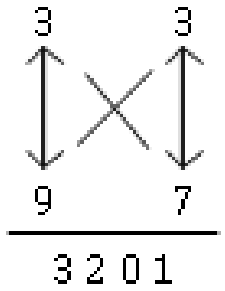
$6 \times 1 + 3 \times 1 = 9 \rightarrow 9$ is the middle digit.

$6 \times 3 = 18 \rightarrow 18$ gives the first 2 digits.

$\therefore 61 \times 31 = 1891$

4. Simplify 33×97

Solution:



$3 \times 7 = 21 \rightarrow 1$ is the last digit and carry over 2.

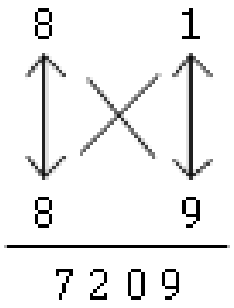
$3 \times 7 + 3 \times 9 + 2 = 50 \rightarrow 0$ is the middle digit carry over 5

$3 \times 9 + 5 = 32$

$\therefore 33 \times 97 = 3201$

5. Simplify 81×89

Solution:



$1 \times 9 = 9 \rightarrow 9$ is the last digit

$8 \times 9 + 8 \times 1 = 80 \rightarrow 0$ is the middle digit

$8 \times 8 + 8 = 72 \rightarrow 72$ is the first 2 digits

$\therefore 81 \times 89 = 7201$