## Math Tricks

## The simplest multiplication tricks:

## 12 3 4 56 7 8

## 12 = 3 x 4 56 = 7 x 8

## The 11 Rule

**You probably know the 10 rule (to multiply by 10, just add a 0 behind the number) but do you know the 11 rule? It is as easy! You should be able to do this one in your head for any two digit number.**

**To multiply any two digit number by 11:**

* **For this example we will use 54.**
* **Separate the two digits in your mind (5\_\_4).**
* **Notice the hole between them!**
* **Add the 5 and the 4 together (5+4=9)**
* **Put the resulting 9 in the hole. That's it! 11 x 54=594**

**The only thing tricky to remember is that if the result of the addition is greater than 9, you only put the "ones" digit in the hole and carry the "tens" digit from the addition. For example 11 x 57 ... 5\_\_7 ... 5+7=12 ... put the 2 in the hole and add the 1 from the 12 to the 5 in to get 6 for a result of 627 ... 11 x 57 = 627**

##

## The 11 Rule Expanded

**You can directly write down the answer to any number that is multiplied by 11.**

* **Take for example the number 51236 X 11.**
* **First, write down the number with a zero in front of it.**

**051236**

**The zero is necessary so that the rules are simpler.**

* **Draw a line under the number.**
* **Bear with me on this one. It is simple if you work through it slowly. To do this, all you have to do is "Add the neighboring number". Look at the 6 in the "units" position of the number. Since there is no number to the right of it, you can't add to its "neighbor" so just write down 6 below the 6 in the unit col.**
* **For the "tens" place, add the 3 to its "neighbor" (the 6). Write the answer: 9 below the 3.**
* **For the "hundreds" place, add the 2 to its "neighbor" (the 3). Write the answer: 5 below the 2.**
* **For the "thousands" place, add the 1 to its "neighbor" (the 2). Write the answer: 3 below the 1.**
* **For the "ten-thousand" place, add the 5 to its "neighbor" (the 1). Write the answer: 6 below the 5.**
* **For the "hundred-thousand" place, add the 0 to its "neighbor" (the 5). Write the answer: 5 below the 0.
That's it ... 11 X 051236 = 563596**

## Multiply Up to 20X20 in Your Head

**In just a few minutes you should learn how to quickly multiply up to 20x20 in your head.**  With this trick, you will be able to multiply any two numbers from 11 to 19 in your head quickly, without the use of a calculator.

I will assume that you know your multiplication table reasonably well up to 10x10.

Try this:

* Take 15 x 13 for an example.
* Always place the larger number of the two on top in your mind.
* Then draw the shape of Africa mentally so it covers the 15 and the 3 from the 13 below. Those covered numbers are all what you need.
* First add 15 + 3 = 18
* Add a zero behind it (multiply by 10) to get 180.
* Multiply the covered lower 3 x the single digit above it the "5" (3x5= 15)
* Add 180 + 15 = 195.

##

## Finger Math: 9X Rule

 **To multiply by 9, try this:
(1) Spread your two hands out and place them on a desk or table in front of you.
(2) To multiply by 3, fold down the 3rd finger from the left. To multiply by 4, it would be the 4th finger and so on.
(3) The answer is 27 ... READ it from the two fingers on the left of the folded down finger and the 7 fingers on the right of it.

This works for anything up to 9x10!**

**There is an easier way though to find the answer. You just subtract 1 from the number that you are multiplying by 9 so for example to do 7x9 first subtract 1 from the 7 (not from the 9) to get 6 so now you know that the answer is sixty something. You will be able to know the ones digit if you realize that the two digits of the answer both add up to exactly 9 (1+8=9, and 2+7=9, and 3+6=9, and 4+5=9, and 5+4=9, and 6+3=9, and 7+2=9, and 8+1=9) or just by knowing which two digits are always together in the small multiples of 9:**

**18 27 36 45**

 **81 72 63 54**

##

## Square a 2 Digit Number Ending in 5

 **For this example we will use 25**

* **Take the "tens" part of the number (the 2 and add 1)=3**
* **Multiply the original "tens" part of the number by the new number (2x3)**
* **Take the result (2x3=6) and put 25 behind it. Result the answer 625.**

**Try a few more 75 squared ... = 7x8=56 ... put 25 behind it is 5625.
55 squared = 5x6=30 ... put 25 behind it ... is 3025.**

## Square 2 Digit Number: UP-DOWN Method

**Square a 2 Digit Number, for this example 37:**

* **Look for the nearest 10 boundary**
* **In this case up 3 from 37 to 40.**
* **Since you went UP 3 to 40 go DOWN 3 from 37 to 34.**
* **Now mentally multiply 34x40**
* **The way I do it is 34x10=340;**
* **Double it mentally to 680**
* **Double it again mentally to 1360**
* **This 1360 is the FIRST interim answer.**
* **37 is "3" away from the 10 boundary 40.**
* **Square this "3" distance from 10 boundary.**
* **3x3=9 which is the second interim answer.**
* **Add the two interim answers to get the final answer.**
* **Answer: 1360 + 9 = 1369**

## Multiply By 4

 **To quickly multiply by four, double the number and then double it again. (Multiply by 2 twice)
Often this can be done in your head.**

## Multiply By 5

**To quickly multiply by 5, divide the number in two and then multiply it by 10.  Often this can be done quickly in your head.**

## Magic Addition Trick #1

1. Ask your friend to pick three (3) ***different*** numbers between 1 and 9.
2. Tell him or her (or her or him) to write the three numbers down next to each other, largest first and smallest last, to form a single 3-digit number. Tell him/her not to tell you what the numbers are.
3. Next have her or him form a new 3-digit number by reversing the digits, putting the smallest first and the largest last. And write this number right underneath the first number.
4. Now have him or her subtract the lower (and smaller) 3-digit number from the upper (and larger) 3-digit number. Tell them not to tell you what the result is.
5. Now you have a choice of wrap-ups:
	1. Ask your friend to add up the three digits of the number that results from subtracting the smaller from the larger 3-digit number. Then amaze him or her by telling them what the sum of those three numbers is. The sum of the three digit answer will always be 18!
	2. Tell your friend that if she or he will tell you what the first OR last digit of the answer is, you will tell her or him what the other two digits are. This is possible because the middle digit will always be 9, and the other two digits will always sum to 9! So to get the digit other than the middle one (which is 9) and other than the digit that your friend tells you, just subtract the digit your friend tells you from 9, and that is the unknown digit.

## Magic Square #15

Every row and column sums to 15 in this magic square. So do both diagonals!

|  |  |  |
| --- | --- | --- |
| 8 | 3 | 4 |
| 1 | 5 | 9 |
| 6 | 7 | 2 |

## Magic Square #34

Every row and column sums to 34 in this magic square. So do both diagonals!

|  |  |  |  |
| --- | --- | --- | --- |
| 1 | 15 | 14 | 4 |
| 12 | 6 | 7 | 9 |
| 8 | 10 | 11 | 5 |
| 13 | 3 | 2 | 16 |

## A Recipe for Your Own 3 X 3 Magic Square

Some necessary rules and definitions:

1. Let the letters a, b, and c stand for integers (that is, whole numbers).
2. Always choose a so that it is larger than the sum of b and c. That is, a > b + c. This guarantees no entries in the magic square will have a negative number.
3. Do not let 2 X b = c. This guarantees you won't get the same number in different cells.
4. Using the formulas in the table below, you can make magic squares where the sum of the rows, columns, and diagonals are equal to 3 X whatever a is.

|  |  |  |
| --- | --- | --- |
| a + c  | a + b - c  | a - b  |
| a - b - c  | a  | a + b + c  |
| a + b  | a - b + c  | a - c  |

To create the first Magic Square #15 above, you let a be equal to 5, let b be equal to 3, and let c be equal to 1. Here are some others:

* a = 6, b = 3, c = 2
* a = 6, b = 3, c = 1
* a = 7, b = 3, c = 2
* a = 7, b = 4, c = 2
* a = 8, b = 6, c = 1
* a = 8, b = 5, c = 2
* a = 8, b = 4, c = 3

## Upside-Down Magic Square

Here's a magic square that not only adds up to 264 in all directions, but it does it even when it's upside down! If you don't believe me, look at it while you are standing on your head! (Or, just copy it out and turn it upside down.)

|  |  |  |  |
| --- | --- | --- | --- |
| 96 | 11 | 89 | 68 |
| 88 | 69 | 91 | 16 |
| 61 | 86 | 18 | 99 |
| 19 | 98 | 66 | 81 |

## Anti-magic Square

Here's a magic square with as many different totals as possible.

|  |  |  |
| --- | --- | --- |
| 5 | 1 | 3 |
| 4 | 2 | 6 |
| 8 | 7 | 9 |

This table produces 8 different totals.

## Lightning Calculator

 Have someone write down their Social Security number. Then have them rewrite it so that it is all scrambled up. (If they don't have a Social Security number, have them write down any 9 digits between 1 and 9.) If there are any zeroes, have them change them to any other number between 1 and 9. Then have them copy their nine numbers, in the same order, right next to the orginal nine numbers. This will give them a number with 18 digits in it, with the first half the same as the second half. Next change the second digit to a 7, and change the eleventh digit (this will be the same number as the second digit but in the second nine digits) to a 7 also. Then tell them that you can tell them what is left after dividing the number by 7 faster than they can figure it out by hand. The answer is 0 -- 7 divides into this new number exactly with nothing left over!

## Fun Number Tables

3 x 37 = 111 and 1 + 1 + 1 = 3

6 x 37 = 222 and 2 + 2 + 2 = 6

9 x 37 = 333 and 3 + 3 + 3 = 9

12 x 37 = 444 and 4 + 4 + 4 = 12

15 x 37 = 555 and 5 + 5 + 5 = 15

18 x 37 = 666 and 6 + 6 + 6 = 18

21 x 37 = 777 and 7 + 7 + 7 = 21

24 x 37 = 888 and 8 + 8 + 8 = 24

27 x 37 = 999 and 9 + 9 + 9 = 27

1 x 1 = 1

11 x 11 = 121

111 x 111 = 12321

1111 x 1111 = 1234321

11111 x 11111 = 123454321

111111 x 111111 = 12345654321

1111111 x 1111111 = 1234567654321

11111111 x 11111111 = 123456787654321

111111111 x 111111111=12345678987654321

1 x 9 + 2 = 11

12 x 9 + 3 = 111

123 x 9 + 4 = 1111

1234 x 9 + 5 = 11111

12345 x 9 + 6 = 111111

123456 x 9 + 7 = 1111111

1234567 x 9 + 8 = 11111111

12345678 x 9 + 9 = 111111111

123456789 x 9 +10 = 1111111111

9 x 9 + 7 = 88

98 x 9 + 6 = 888

987 x 9 + 5 = 8888

9876 x 9 + 4 = 88888

98765 x 9 + 3 = 888888

987654 x 9 + 2 = 8888888

9876543 x 9 + 1 = 88888888

98765432 x 9 + 0 = 888888888

1 x 8 + 1 = 9

12 x 8 + 2 = 98

123 x 8 + 3 = 987

1234 x 8 + 4 = 9876

12345 x 8 + 5 = 98765

123456 x 8 + 6 = 987654

1234567 x 8 + 7 = 9876543

12345678 x 8 + 8 = 98765432

123456789 x 8 + 9 = 987654321

7 x 7 = 49

67 x 67 = 4489

667 x 667 = 444889

6667 x 6667 = 44448889

66667 x 66667 = 4444488889

666667 x 666667 = 444444888889

6666667 x 6666667 = 44444448888889

etc.

4 x 4 = 16

34 x 34 = 1156

334 x 334 = 111556

3334 x 3334 = 11115556

33334 x 33334 = 1111155556

## Did You Know...?

Each and every 2-digit number that ends with a 9 is the sum of the multiple of the two digits plus the sum of the 2 digits. Thus, for example, 29= (2 X 9) + (2 + 9) = 18 + 11 = 29.

40 is a unique number because when written as "forty" it is the only number whose letters are in alphabetical order.

A **prime** number is an integer greater than 1 that cannot be divided evenly by any other integer but itself (and 1). 2, 3, 5, 7, 11, 13, and 17 are examples of prime numbers.

139 and 149 are the first consecutive primes differing by 10.

69 is the only number whose square and cube between them use all of the digits 0 to 9 once each:
692 = 4761 and 693 = 328,509.

One pound of iron contains an estimated 4,891,500,000,000,000,000,000,000 atoms.

There are some 318,979,564,000 possible ways of playing the first four moves on each side in a game of chess.

The earth travels over one and a half million miles every day.

There are 2,500,000 rivets in the Eiffel Tower.

If all of the blood vessels in the human body were laid end to end, they would stretch for 100,000 miles.

## A Math Trick for This Year

This one will supposedly only work in 1998, but actually one change will let it work for any year.

1. Pick the number of days a week that you would like to go out (1-7).

2. Multiply this number by 2.

3. Add 5.

4. Multiply the new total by 50.

5. In 1998, if you have already had your birthday this year, add 1748. If not, add 1747. In 1999, just add 1 to these two numbers (so add 1749 if you already had your birthday, and add 1748 if you haven't). In 2000, the number change to 1749 and 1748. And so on.

6. Subtract the four digit year that you were born (19XX).

Results:

You should have a three-digit number.

The first digit of this number was the number of days you want to go out each week (1-7).

The last two digits are your age.

**The Mystery of 6174 :**

6174. It is a number well known to many. Some say it is mysterious, but I would not go that far. It is, however, a very interesting number. Indeed, the number 6174 is also known as the Kaprekar constant, named after the Indian mathematician Dattaraya Ramchandra Kaprekar who studied the mystery behind 6174.

So what is all the hoopla about 6174? Well, first, if you arrange the digits such that you have the highest number (7641) and also the lowest number (1467), and then determine the difference between the two, you arrive at 6174 (7641 – 1467 = 6174).

Well you say, I suppose this is somewhat interesting. But now suppose you take the number 2355. Do what you did before with 6174 – rearrange the numbers to obtain the highest and lowest numbers, and then subtract the lowest from the highest:

2355 -> 5532, 2355
5532 – 2355 = 3177

Now continue the process with the result:

3177 -> 7731, 1377
7731 – 1377 = 6354

And again:

6354 -> 6543, 3456
6543 – 3456 = 3087

Continuing:

3087 -> 8730, 0378
8730 – 378 = 8352

8352 -> 8532, 2358
8532 – 2358 = 6174

As you can see, this process leads to a convergence to 6174. And as you saw before, performing this routine on 6174 results in an endless loop. Cool!

In fact, this same result will occur for any four digit number you choose as long as the number isn’t composed of the same digit (eg., 4444 would not work). You can even use leading zero’s for your four digit number (eg., 0007). Now that is interesting!

Let’s try another example, one with a lot of zeros – 3000:

3000 -> 3000, 0003
3000 – 3 = 2997

2997 -> 9972, 2799
9972 – 2799 = 7173

7173 -> 7731, 1377
7731 – 1377 = 6354

6354 -> 6543, 3456
6543 – 3456 = 3087

087 -> 8730, 0378
8730 – 378 = 8352

8352 -> 8532, 2358
8532 – 2358 = 6174

It is this process that was discovered by our Indian friend Kaprekar, and is known as Kaprekar’s routine. There are other similar numbers that are obtained for other n-digit numbers. For example, for three digit numbers, this process leads to a convergence to 495. Using the routine on two digit numbers results in an infinite loop:

9 -> 81 -> 63 -> 27 -> 45 -> 9

**Angel Number 421**

|  |  |
| --- | --- |
| Bottom of Form

|  |
| --- |
| **The angel number 421****Rules**   **Step 1**   Select any whole number.   **Step 2**   If it is an even number, divide by 2; if it is odd number multiply by 3 and add 1.   **Step 3**   Repeat the process mentioned in step 2 until you get the loop value 4, 2, 1 in repetition. **Example**  Whole number is 15.  15 is an odd no; so (15 × 3) + 1 = 46  46 is an even no; so 46 / 2 = 23  23 is an odd no; so (23 × 3) + 1 = 70  70 is an even no; so 70 / 2 = 35  35 is an odd no; so (35 × 3) + 1 = 106  106 is an even no; so 106 / 2 = 53  53 is an odd no; so (53 × 3) + 1 = 160  160 is an even no; so 160 / 2 = 80  80 is an even no; so 80 / 2 = 40  40 is an even no; so 40 / 2 = 20  20 is an even no; so 20 / 2 = 10  10 is an even no; so 10 / 2 = 5  5 is an odd no; so (5 × 3) + 1 = 16  16 is an even no; so 16 / 2 = 8  8 is an even no; so 8 / 2 = **4**  4 is an even no; so 4 / 2 = **2**  2 is an even no; so 2 / 2 = **1**  1 is an odd no; so (1 × 3) + 1 = **4**  4 is an even no; so 4 / 2 = **2**  2 is an even no; so 2 / 2 = **1**  So the loop 4..2..1 goes on and on.Tip: ***The angel number 421*** is the smallest prime formed by the two powers in logical order from right to left. |

 |
| Mental Math Tricks to Impress Your FriendsHow to multiply any two digits number by 11Let’s say that you want to find the product of 36 and 11. One way to find it would be to multiply 36 by 10 and then add 36 on the result. There is, however, a simple trick that’ll do the job for any two digits number. To find out the result, write the first digit followed by the addition of the first and second digit, followed by the second digit.Example:http://s3.amazonaws.com/freestylemind/math/ex1.pngWhat happens if the sum of the two numbers is bigger than 9? In this case you add 1 to the first number, followed by the last digit of the addition of the two numbers, and then again you add the second numberhttp://s3.amazonaws.com/freestylemind/math/ex2.pngSquare any two digits number that ends with 5Calculating the square of a number below 100 is extremely simple. If you want to find the square of 25 for example, you simply have to take the first digit (2), multiply it for the next higher number (3), and then add 25 to the result.http://s3.amazonaws.com/freestylemind/math/ex3.pnghttp://s3.amazonaws.com/freestylemind/math/ex4.pngMultiply any two digits numbers with the same first digit and the second digit that sums up to 10Let’s say that you want to multiply 42 and 48 together. Notice that they both start with 4, and that the sum of their second digit is 10. In this case there’s a simple rule that you can use to find their product. Simply multiply the first digit (4) for the next higher number (5) and then append the product of their second digits.http://s3.amazonaws.com/freestylemind/math/ex5.pnghttp://s3.amazonaws.com/freestylemind/math/ex6.pngNote that if the product of the second digits is below ten, you have to add a 0 in front of it.Multiply by 9To multiply by 9, simply multiply by 10 and then subtract the number itself.Quickly find percentages* To find out the 15% of a number, divide it by 10 and the add half of it.
* To find out the 20% of a number, divide it by 10 and multiply the result by two.
* To find out the 5% of a number, divide it by 10 and the divide it by two.

AdditionWhen we were at school, we have been taught how to sum two or more numbers together by using the right to left approach. With this method, you first sum the decimal part of the number, then, you move to the hundreds and so on. This works well on paper, but it’s a pain when you’re doing mental calculations. Fortunately, the solution is very easy.Left to right approachInstead of using a right to left approach, we can start from the left and move to the right. Take the following example:http://s3.amazonaws.com/freestylemind/math/ex7.pngUsually, you would first sum up 4 to 45, and then and 30 to the result. But by using the left to right approach, you first sum up 30 to 45, and then you add 4 to the result. Although this example is very simple, you’ll see the advantages of this method as you start to use it.If you’re working with three digits numbers, the process is the same.http://s3.amazonaws.com/freestylemind/math/ex8.pngThis example is a bit more complicated than the previous one, yet it’s very easy to solve using the left to right approach. You first start by adding 600 to 459, which results in 1059. Now the problem is simplified to 1049 + 37. You simplify it even further by adding 30 to 1049, and then you finally add 7 to the result.SubtractionLike with addition, you can use the left to right approach for subtracting to numbers together. This time, however, it may feel uncomfortable to keep track of borrowings (a borrowing occurs when you subtract a number to a bigger one, like 16 – 9). Let’s see an example of this.http://s3.amazonaws.com/freestylemind/math/ex9.pngIn this case, you first start by subtracting 10 to 64, resulting in 54, and now you only have to subtract 7 to 54. You can, however, subtract 20 to 64 and add 3 to the result. This way you don’t have to worry about borrowings.Using complements to simplify subtractions even moreThere is a way to easily calculate 3 or 4 digits subtractions very quickly in your head. This technique makes use of complements. For example. let’s say that you’re facing the following problem:http://s3.amazonaws.com/freestylemind/math/ex10.pngInstead of following the standard left to right approach, you could solve this problem by subtracting 400 to 674 and then add 42 back to the result. 42 is the difference from 100 and 58. A good question is: how do you find 42?http://s3.amazonaws.com/freestylemind/math/ex11.pngNote that there’s a simple pattern for calculating the second number. In particular, the sum of the first digits always sums up to 9, and the sum of the second digits always sum up to 10. The only exception is when the number ends with 0, which is simpler.You can use this technique to solve any subtraction very easily.MultiplicationIn order to solve simple multiplications, it’s helps a lot being comfortable with the multiplication table for numbers below 10.As you may have already guessed, we’re going to use the left to right approach to solve simple multiplication very easily. Take the following example:http://s3.amazonaws.com/freestylemind/math/ex12.pngWe can reduce it by first calculating 30 × 7 (which is like 3 × 7 plus a 0) and then add 6 × 7 on the result.http://s3.amazonaws.com/freestylemind/math/ex13.pngThis approach can be used for even larger numbers. Note that you can also round up instead of rounding down:http://s3.amazonaws.com/freestylemind/math/ex14.pngMultiply by 5To multiply 5 simply cut the # in half then multiply by 10.Example: 17\*51/2 of 17 = 8.58.5 \* 10 = 85Multiply numbers with multiple digitsUse this trick when multiplying numbers with multiple digitslet {a;b;c;d…} represent digits of a numberab x cd = (axc), (axd + bxc), (bxd)the commas represent separation of digits, so “axc” represents the digit in the hundreds place, etc.eg) 23 × 14 = (2×1), (2×4 + 3×1), (3×4)8 + 3= 2,11,12in the event of double digits in the same digit place, the number in the digit’s place (starting with the unit’s place) carries the ten’s place digit of the digit place to the following digit place like in this instance= 2, 11, 12 = 2, 12, 2 = 3, 2, 2the answer is 322the theory behind this is the “distribution property” of numbers commonly used with equations like (x + 1)(x + 4)=0 to make x^2 + 5x + 4=0the same principles can be applied with 3 digit numbers as wellabc x def = (axd),(axe+bxd),(axf+bxe+cxd),(bxf+cxe),(cxf)for multiplying 2 digit with 3 digit numbers, just use the 3×3 digits method but use a zero in the hundreds place of the 2 digit numberSquare a number close to 10^2Vedic mathematics provides lots of short cuts like shown here.e.g.-If you need to square a number close to 10^n, you can do so easily. Like if you want 92^2, lets take its answer as abcd.Now, 92 is 8 before 100, so subtract 8 from 92, i.e. you get ab as 84. For finding cd, square 8 i.e. 64.Hence the square of 92 comes as 8464.For square of 87, let the answer is abcd again. Here 87 is 13 short of 100, so subtract 13 from 87 You get 74 as ab. For finding cd, square 13 i.e. 169. Since cd is only of two digits, add this extra 1 to ab.So the answer becomes 7569.Square two digits ending with 5To square 2 digit numbers ending with ‘5’ eg 75 × 751. The answer will end with ‘25’2. Take the first digit ‘7’ multiply by the number after ‘7’ => 7 × 8 = 5675 × 75 = 5625Test it out with 95 × 95.Did you get 8125?Squaring any numbertake any number and find out how much to add to get it to the nearest tens subract and add that number to the orignal number multiply add the squareexample:(999+1) (999-1) + (1^2)(998) (1000) + 1999^2 + 998001Squaring a numberA math trick I noticed when I was young. If you are squaring a number it is always equal to the total of the number times 2 subtract one of the previous squared number. This is helpful if you dont want to write it out. For instance most people know that 10×10=100 or 11×11=121 even 12×12=144 so let’s say you don’t know 13×13. Its equal to (13×2)-1(plus the previous squared number which was 12×12)144=169Squaring two digit numbersSuppose AB is the number,Then arrange the number as follows,A\*A|2\*A\*B|B\*B( if A\*A or A\*B is one digit add 0 prior to that – eg: 4 should be written as 04, 5 should be 05 etc..)Take a number : 3509|30|25 ( 3\*3 | double of 3\*5 | 5\*5 )From right to left, keep the right most number as it is and add the number coming both side of | symbol.ie. Keep 5 as it is, add 2+0, add 3+91225Take another example 4316|24|09 = 1849 |
|  |