

Twelve More Algebra Magic Tricks!

The number of stars after the title indicates the difficulty level.

1. Out to Dinner Magic! ***

thanks to Barry Kissane, who received this trick in an email.

1. First of all, pick the number of times next week that you would like to have dinner out.
2. Multiply this number by 2 (Just to be bold).
3. Add 5 (for Sunday).
4. Multiply it by 50 - I'll wait while you get the calculator.....
5. If you have already had your birthday this year add 1753.... If you haven't, add 1752.....
- 6.. Now subtract the four digit year that you were born. You should have a three digit number.

The first digit of this was your original number (i.e., how many times you want to have eat out each week.)

The next two numbers are... YOUR AGE!

The algebra

Let n = number of times you want to go out to dinner.

Let a = your age.

Let y = the year you were born.

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| 1. number of times a week you would like dinner out. | n |
| 2. Multiply this number by 2. | $2n$ |
| 3. Add 5 (for Sunday). | $2n + 5$ |
| 4. Multiply it by 50 - I'll wait while you get the calculator..... | $100n + 250$ |
| 5. If you have already had your birthday this year add 1753.... | $100n + 250 + 1753 = 100n + 2003$ |
| If you haven't, add 1752..... | $100n + 250 + 1752 = 100n + 2002$ |
| 6.. Now subtract the four digit year that you were born. | |
| You should have a three digit number. | $100n + (2003 - y)$ or $100n + (2002 - y)$ |

The hundreds digit gives the number of nights out. Why does the other term give your age? Notice that your age $a = 2003 - y$ if you have had your birthday, or $a = 2002 - y$ if you haven't.

This trick doesn't work for people 100 years old or older. Why not?

According to the email that Barry received, "This is the only year (2003) it will ever work, so spread it around while it lasts." As Barry points out, this isn't quite true. To make it work in 2004, change 1752 to 1753, and 1753 to 1754.

2. Mind Reading Magic! ***

This trick is a bit different to other Think of a Number tricks – it includes a random number part way through!

1. Think of a number, any positive integer (but keep it small so you can do computations in your head).
2. Square it.
3. Add the result to your original number.
4. Divide by your original number.
5. Add, oh I don't know, say 17. (i.e any random number)
6. Subtract your original number.

7. Divide by 6.
8. The number you are thinking of now is 3!

Secret: In step 7, divide by a number that divides exactly into (random number + 1). That is, divide by a number that divides exactly into 1 + random number at Step 5. If total is prime, add in another random number. The only problem is if you stick with a division at the end you may need to add in more random steps until you get a total that is divisible. It could be quite fun adding in several random numbers, eg Mary's age (12 gives 13 which is not divisible) + the number of pets Ian has (4 gives 17 still not divisible) + Tom's house number (23 gives 40. Phew.) Now divide by 10. The number you now have is 4.

The algebra

Let n = original number

Let r = the random number

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| 1. | Think of a number | n |
| 2. | Square it. | n^2 |
| 3. | Add the result to your original number. | $n^2 + n$ |
| 4. | Divide by your original number. | $\frac{n^2 + n}{n} = \frac{n(n+1)}{n} = n + 1$ |
| 5. | Add a random number. | $(n + 1) + r = n + r + 1$ |
| 6. | Subtract your original number. | $(n + r + 1) - n = r + 1$ |
| 6a. | <i>Add in more random numbers here if you wish.</i> | The sum of the random numbers is still r . |
| 7. | Divide by a factor of $(r + 1)$, i.e. $\frac{r+1}{a}$. | $\frac{\frac{r+1}{r+1}}{a}$ |
| 8. | The number you are thinking of now is a . | Since $\frac{r+1}{\frac{r+1}{a}} = a$ |

Warning!! From this point on, you will be given the secret, but not the algebra! Reason: if you are going to ask your students to do the algebra, you should do it first! Some of the problems towards the end are quite tricky and it is important that you think through the solution.

3. Three Dice Magic! *

1. Turn around so you can't see your friend. Your friend rolls three dice. Tell him to:
2. Add up the three top numbers.
3. Add the bottom number of any one of the dice to the answer.
4. Roll this die again.
5. Add this new top number to the total and remember the answer.
6. *Now turn around. Look at the dice and tell your friend his total!*

Secret: Add 7 to the total of the 3 top numbers. Your answer will be your friend's answer.

4. Birthday Magic! *

1. Write down the month and day of your birth, using numbers
2. Multiply the month number by 5.
3. Add 7.
4. Multiply by 4.
5. Add 13.

6. Multiply by 5.
7. Add the day number.
8. At this point ask for your friend's answer.

Secret: Subtract 205 from your friend's answer. The last 2 digits are the day, the first digit or first two digits are the month.

5. Card Magic! *

1. From an ordinary deck of cards, remove the face cards and the tens. Shuffle well!
2. Have a friend choose a card, without showing you.
3. Have your friend secretly:
 - Multiply the card by 2
 - Add 3 to the result
 - Multiply this latest result by 5.
4. If the card is a
 - club, add 1
 - diamond, add 2
 - heart, add 3
 - spade, add 4.
5. Your friend tells you the final answer.

Secret: Subtract 15 from your friend's answer. The 10s digit is the value of the card; the 1s digit is the suit.

6. Pick Two Numbers Trick! *

from R. Greenlee Wheaton Warrenville South High School, Wheaton IL

1. Mentally pick a single digit between 1 and 9 inclusive.
2. Mentally double your number.
3. Mentally add 3 to your number.
4. Mentally multiply your number by 5.
5. Mentally pick a single digit between 1 and 9 inclusive.
(Note: this new number can be the same as the first one)
6. Add the last number from step 5 to the number in step 4.
7. Teacher asks a student what their last answer from step 6 is.

After the student says 87, the teacher tells them that their first number must have been a 7 and that their second number must have been a 2!

Secret: Subtract 15 from the student's number ($87 - 15 = 72$). The ten's digit is the student's first number picked and the units digit is the student's second number picked. (7 and 2)

7. Division Magic! *

1. Write down a 3-digit number with the digits all the same.
2. Add the three digits.
3. Divide the answer to step 1 by the answer to step 2.
4. I will predict your answer!

Secret: The answer is always 37!

8. House Number Magic! *

1. Write down your house number
2. Double it
3. Add 5
4. Multiply by 50
5. Add your age
6. Add 365, the number of days in a year
7. Subtract 615
8. Divide by 100

Secret: The whole number is your house number, the decimal is your age.

9. Guess your Age Magic! **

Your friend must be at least 10 for this trick to work.

1. Write your age on a slip of paper.
2. Mentally add 90 (the teachers favourite number) to your number.
3. Mentally move the left-hand-most digit and add it to the units digit. For example, if your answer after step 2 was 153, you would add the 1 to the 3 and get an answer of 54.
4. Have the person tell you what the last answer is from Step 3.

Secret: Add 9 to the answer from step (3) above.

10. Find the Sums Trick! **

from R. Greenlee Wheaton Warrenville South High School, Wheaton IL

1. Write a three-digit number with all the digits different.
2. Form all the possible two-digit numbers from this number
3. Find the sum of the those two-digit numbers 308.
4. Find sum of the three original digits $2 + 5 + 7 = 14$.
5. Divide the sum in step 3 by the sum in step 4 $308/14 = 22$.

The teacher tells them that their answer is 22.

The secret: The answer is always 22!

11. Two Numbers Trick! ***

1. Write down a number less than 10, and another number between 10 and 99.
2. Add the numbers.
4. Multiply the answer by 5.
5. Add the smaller chosen number.
6. Multiply this sum by 2.
7. Subtract the smaller chosen number.
8. Tell the teacher the answer.

Secret The answer is a 3 digit number. Think of this as a 2 digit number and a 1 digit number. The 1 digit number is the original 1 digit number. Subtract this number from the 2 digit number. The answer is the original 2 digit number. For example, if the final answer is 335 then the original numbers are 5 and $33 - 5 = 28$.

12. Challenge - The 1089 Trick! *****

Before you do this trick, look up the 9th entry on page 108 of a telephone book. Write that person's name on a piece of paper, put it into an envelope and seal it. When you are ready to do the trick, give the envelope to a student for safe keeping.

1. Write down a 3 digit number, where the first and last numbers have a difference of at least 2.
2. Reverse the digits to obtain a 2nd 3 digit number.
3. Subtract the smaller from the larger.
4. Reverse the digits to obtain another 3 digit number.
5. Add the last two numbers.
6. You should have a 4 digit answer. Now in this telephone book, find the page whose page number is the first 3 digits. Find the entry whose position is the last digit. For example, if the answer was 1234, find the 4th entry on page 123.

Now open the envelope, please!

Secret: The answer is always 1089.

N.B. The underlying algebra is just adding like terms and expanding and factoring, but the problem requires borrowing and moving numbers from place to place (e.g. the 100s place to the 1s place). Figuring out how to represent these steps algebraically is a challenge!