Nimble Numbers Ned

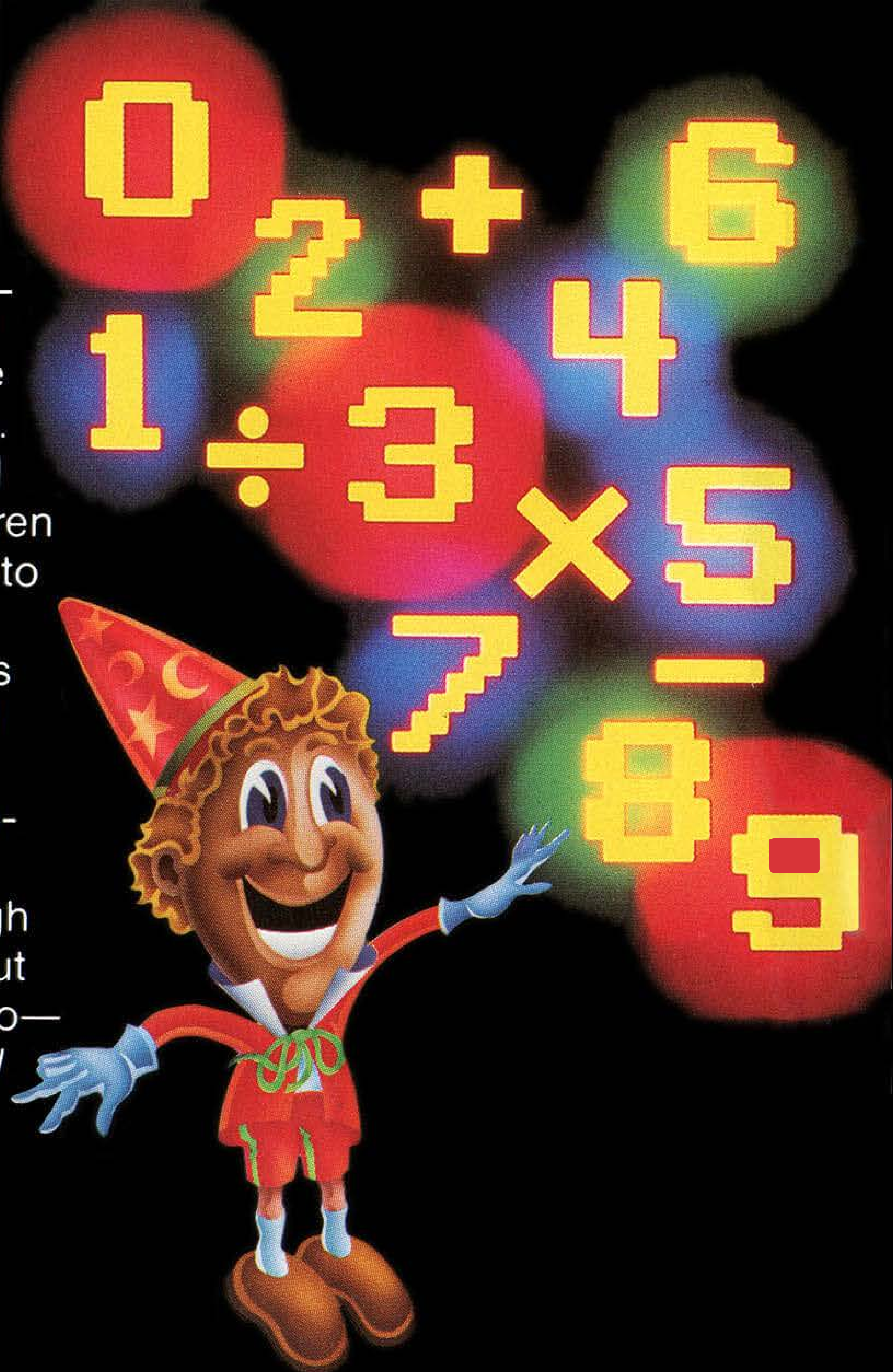
MATH WIZARDRY

Welcome

The more often you play my video games, the better you'll be at these math-a-magical tricks and puzzles. Many of them are quite simple and self-working. Some younger children might want to ask an older person to help with the other ones.

They demonstrate how numbers help some people work magic and "read minds." As you learn more at school, you'll discover how numbers help people build houses, fly planes, sail boats and travel through space. In fact, the more you find out about all the things numbers can do—the more you'll know that's the *real* magic of mathematics!

NN^n



Predicto!

You secretly write some numbers on a piece of paper and seal it in an envelope. The sum you write will be twice the number of the present year.

Example:

Present year	1983
	+1983
	3966

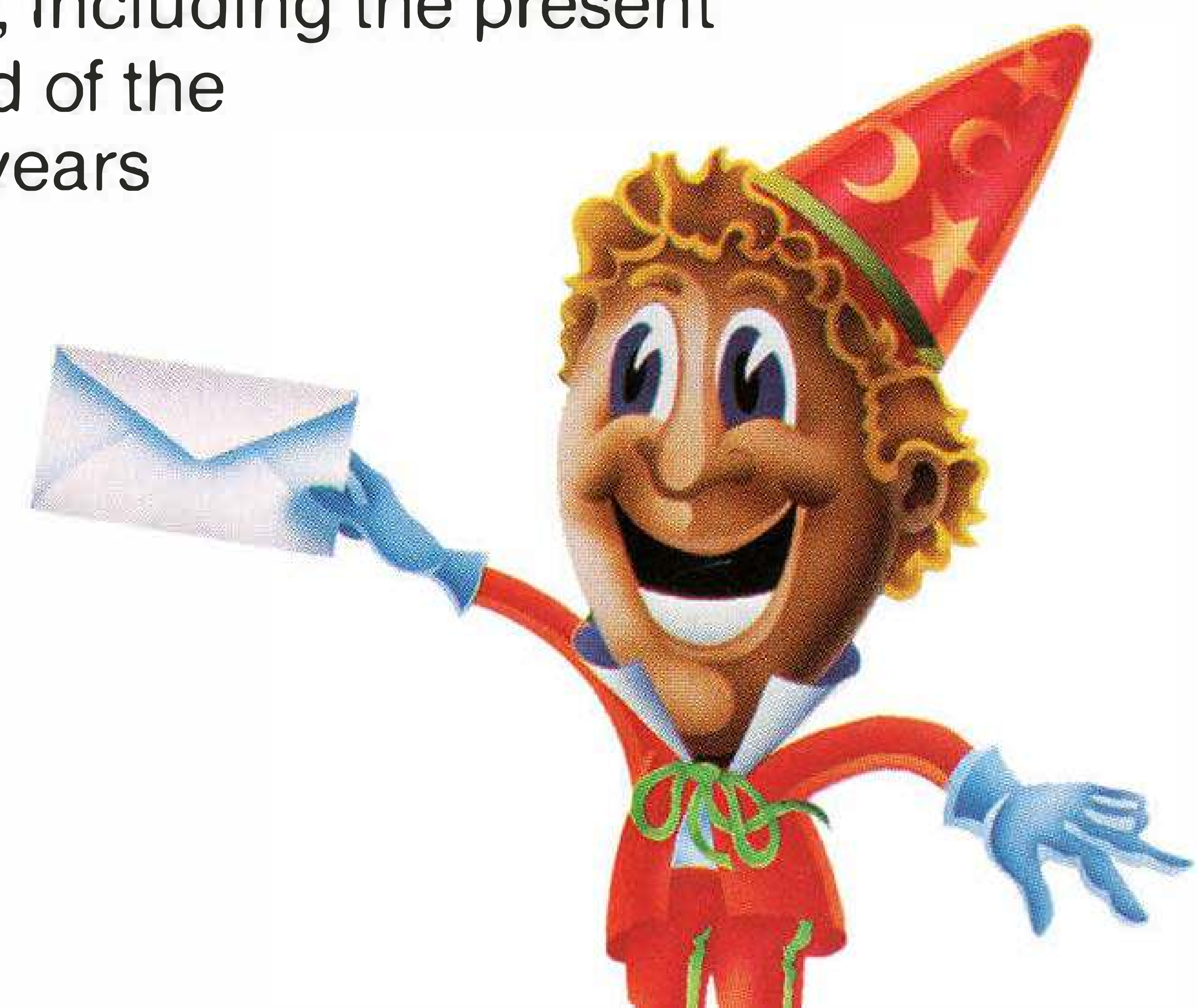
Hand the envelope to a friend. Ask your friend to add the following numbers together. (In this example, the present year is 1983 and your friend is twelve years old.)

Example:

Year of birth:	1971
First year of school	1977
Age at the end of this year	12
Number of years in school .... (including present year)	6
	3966

Now ask your friend to open the envelope. *The numbers you wrote match the total added up by your friend!*

Here's the secret. The sum will *always* be twice the number of the present year. (When you do this trick for your mom and dad, ask them to write down their first year of marriage instead of their first year of school. Then they write the number of years of marriage, including the present year, instead of the number of years in school.)



"1089"

The year 1089 was very strange. It was the year that every answer to every math problem came out exactly the same-1089.

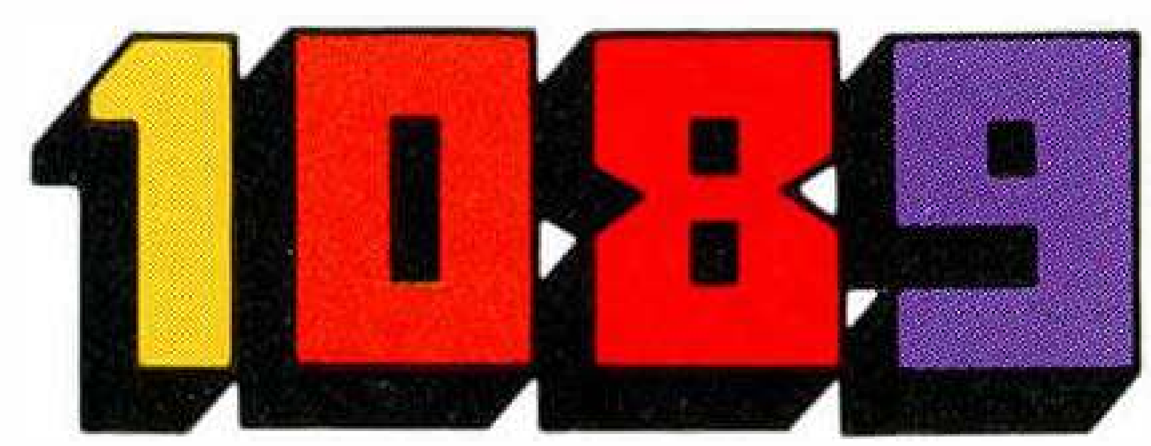
Here's how they did it.

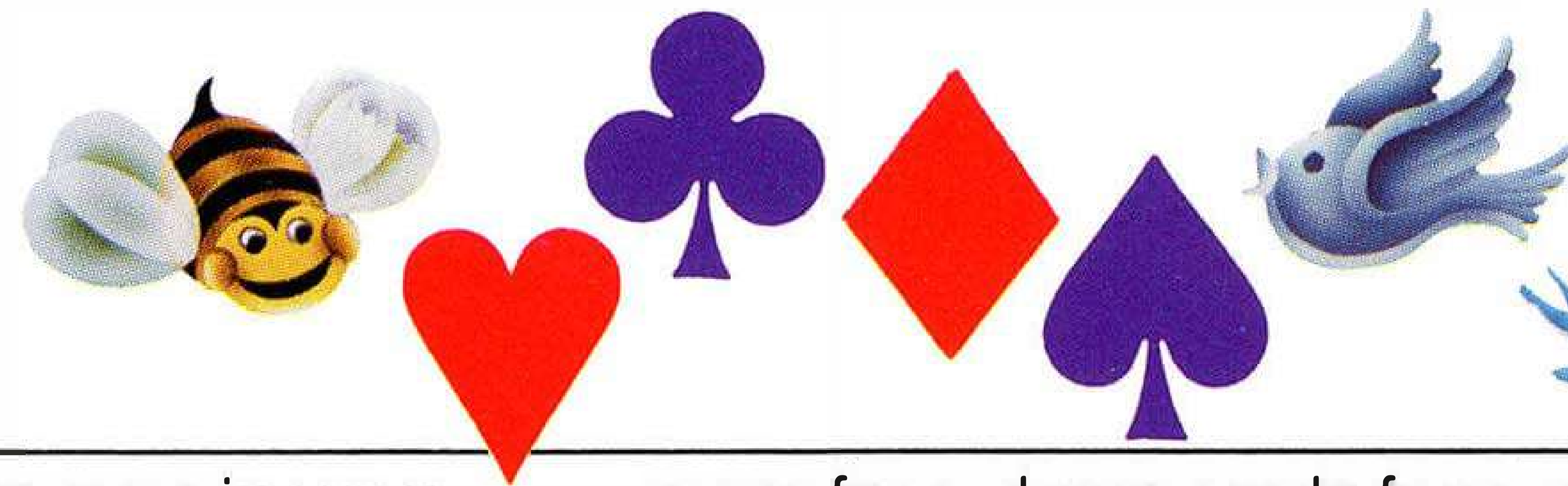
1. They picked out any three digit number. (The first and last digits differed by at least two).	571
2. They reversed the numbers	175
3. They subtracted the smaller number from the larger number	571 −175 396
4. They reversed these numbers	693
5. Then they added the two results.	396 +693 1089

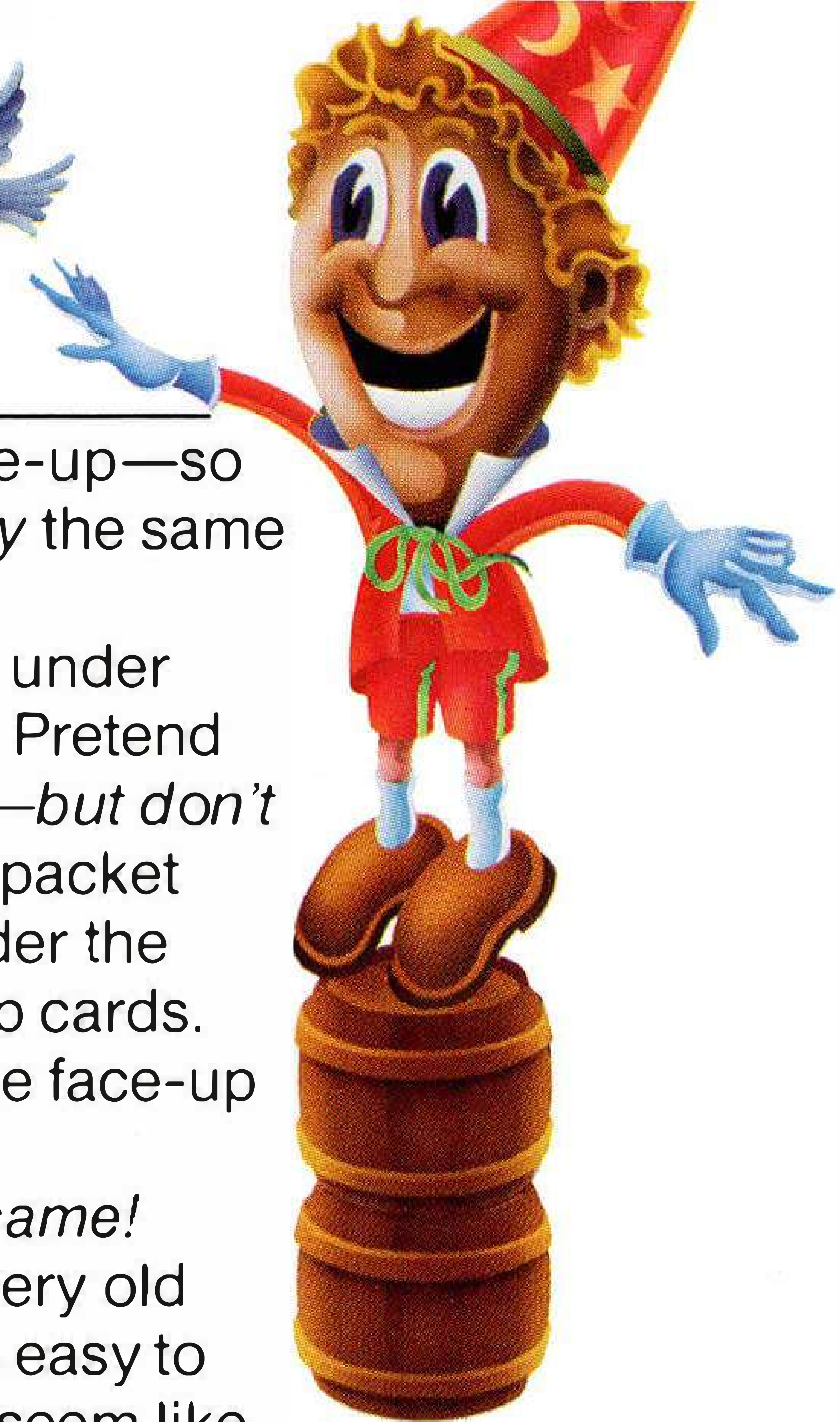
They tried it again ...... and again.

They tried it again	and again.
1. 317	1. 489
2. 713	2. 984
3. 713 −317 396	3. 984 −489 495
4. 693	4. 594
5. 396 +693 1089	5. 495 +594 1089

This was the year when children turned in their answers *before* their teachers handed out the problems. Everyone was very happy when the year 1090 came along.







The Magic Touch

Tell a friend you have eyes in your fingers and will prove it. Take a deck of 52 cards (no jokers) and turn twenty of them face-up anywhere in the pack. Give your friend the deck to shuffle. Ask your friend to hold the deck under the table—count off twenty cards from the top and hand them to you under the table. Keep the packet under the table so you can't possibly see the cards.

Now point this fact out to your friend. Neither one of you knows how many cards are reversed in your packet. But since your friend has thirty-two cards and you only have twenty, the chances are your friend has more face-up cards than you do. Tell your friend that by using the eyes in your fingers, you are going to turn a few more face-down cards face-up—so that you'll both have *exactly* the same number of face-up cards.

Pretend to *see* the cards under the table with your fingers. Pretend to turn some of them over—*but don't do it*. Just turn your whole packet over—bring it out from under the table and count the face-up cards. Ask your friend to count the face-up cards in his or her packet.

The number will be the same!

This trick is based on a very old mathematical principle. It's easy to do—works itself—and will seem like real magic—*even to you!* Spend some time playing with it and see if you can figure out why it always works.

The Whispering Dice!

Tell a friend that you've gotten so good at math you can hear the numbers talk. You can prove this with a pair of dice. Put them on the table. Turn your back and ask your friend to roll the dice and add the top values together.

Now ask your friend to pick up either one of the dice—turn it upside down and add that number to the previous sum—then roll it again and add in the next number showing on top. This is when you turn around, pick up the dice and hold them to your *ear—and tell your friend the total!*

Here's the secret!

The numbers on opposite sides of dice always add up to seven. If a 2 is on top, a 5 will be on the bottom. When you look at the dice on the table, add them up quickly—then add 7 to the total and you've got the answer.

Example: Your friend rolls a 3 and a 5 which add up to 8. He or she picks up the 3 and turns it upside down to see a 4—then adds it to the 8 to get 12. Your friend rolls the die again and gets a 6 for a total of 18. When you turn around, you see the 6 and 5 on the dice. They total 11 and you add 7 more to say, "The dice tell me your total is 18!"


THE DICE TELL ME
YOUR TOTAL IS
18

Full Circle

Pick any three digit number.	529
Write it twice to make a six digit number.	529,529
Divide the answer by 7.	$\begin{array}{r}75{,}647\\ 7\overline{)529{,}529}\end{array}$
Divide the answer by 11.	$\begin{array}{r}6{,}877\\ 11\overline{)75{,}647}\end{array}$
Divide the answer by 13.	$\begin{array}{r}529\\ 13\overline{)6{,}877}\end{array}$

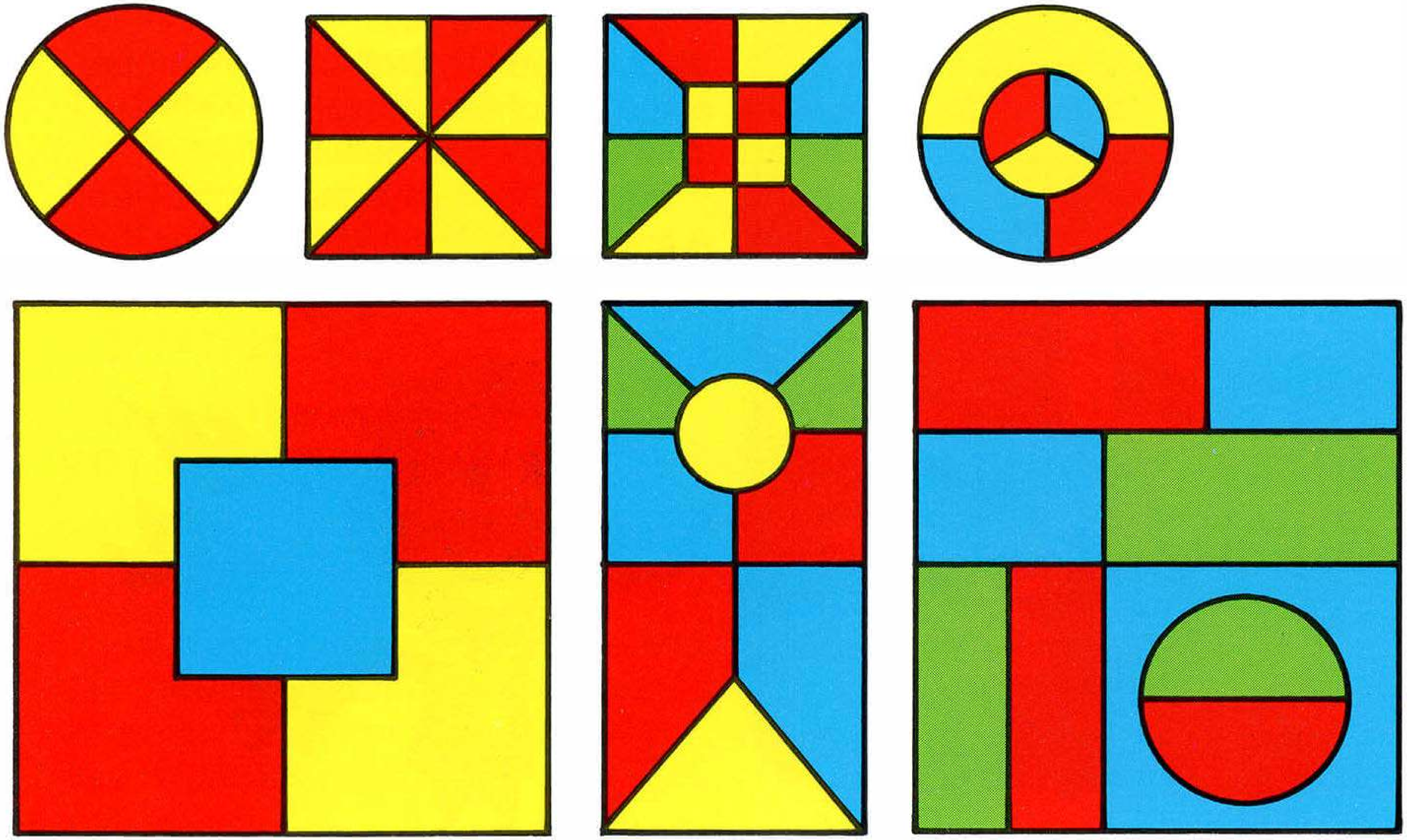
529 again? Hey! How did that happen??? Let's try this with other numbers!!! Pssssst! You'll always finish where you started.

Flying Colors

Draw a design on a piece of paper. Make it as simple or complicated as you wish. Color in any area with one color.

Use a second color in another area that shares the same border. Using the same two colors, color in the other areas in the same way. Be careful not to use the same color for two regions having the same border. (If two sections only meet at a point, you can use the same color.)

Color in any remaining areas with a third and fourth color. Now try to make a design that needs more than four colors. No one has yet.



"Trickysticks"

Cut four strips of cardboard and copy the letters and numbers on them as shown in the picture.

A	B	C	D
8	4	2	1
9	5	3	3
10	6	6	5
11	7	7	7
12	12	10	9
13	13	11	11
14	14	14	13
15	15	15	15

Ask a friend to think of one of the numbers on the cards. Then ask for the letters on all the cards on which the number appears.

If your friend says, "My number is on B,C, and D", add up the numbers at the top of each card. (4+2+1=7) Your friend's number is seven!

If your friend says the number is on A and D, add 8+1 and say, "Your number is *nine!*"

Triple Treat!

Write the number 37 on a piece of paper. Seal it in an envelope and give it to your friend.

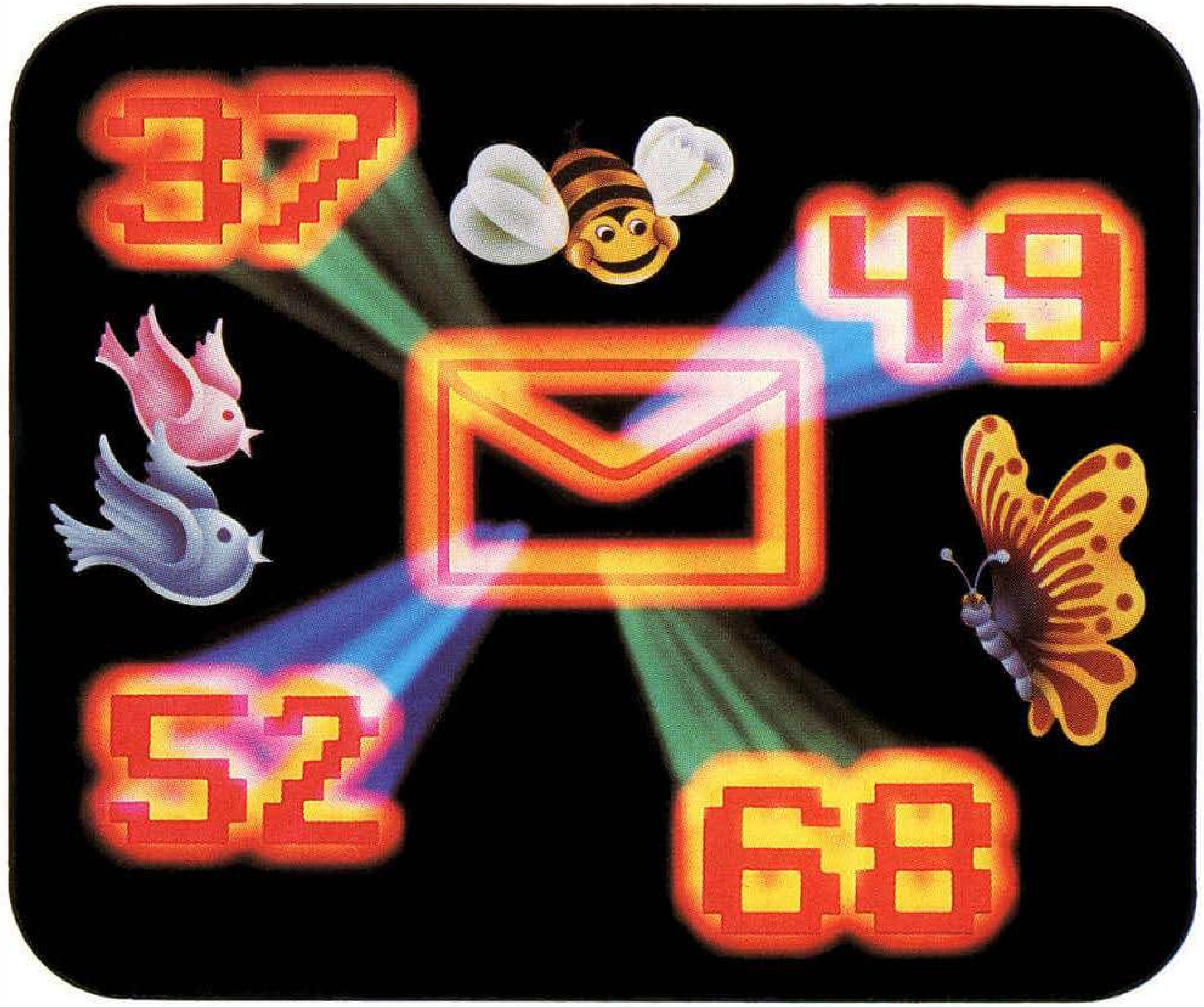
Ask your friend to pick any number with the same three digits. We'll use 777 as an example. Now add up the digits.

7+7+7=21

Divide 21 into the original three digits and guess what! 37!!!

$$21\overline{)777}\quad = 37$$

Hand your friend the envelope and say, "You're welcome!" Try this with all the numbers from one through nine. It *always* works!!!



Your Three Wishes!

Tell your friend that you did such a big favor for a genie that he granted you three wishes. You'll need three dice to prove it. Turn your back and ask your friend to roll them. Tell your friend to look at the number on the first die—then double it—add 3 and multiply by 5.

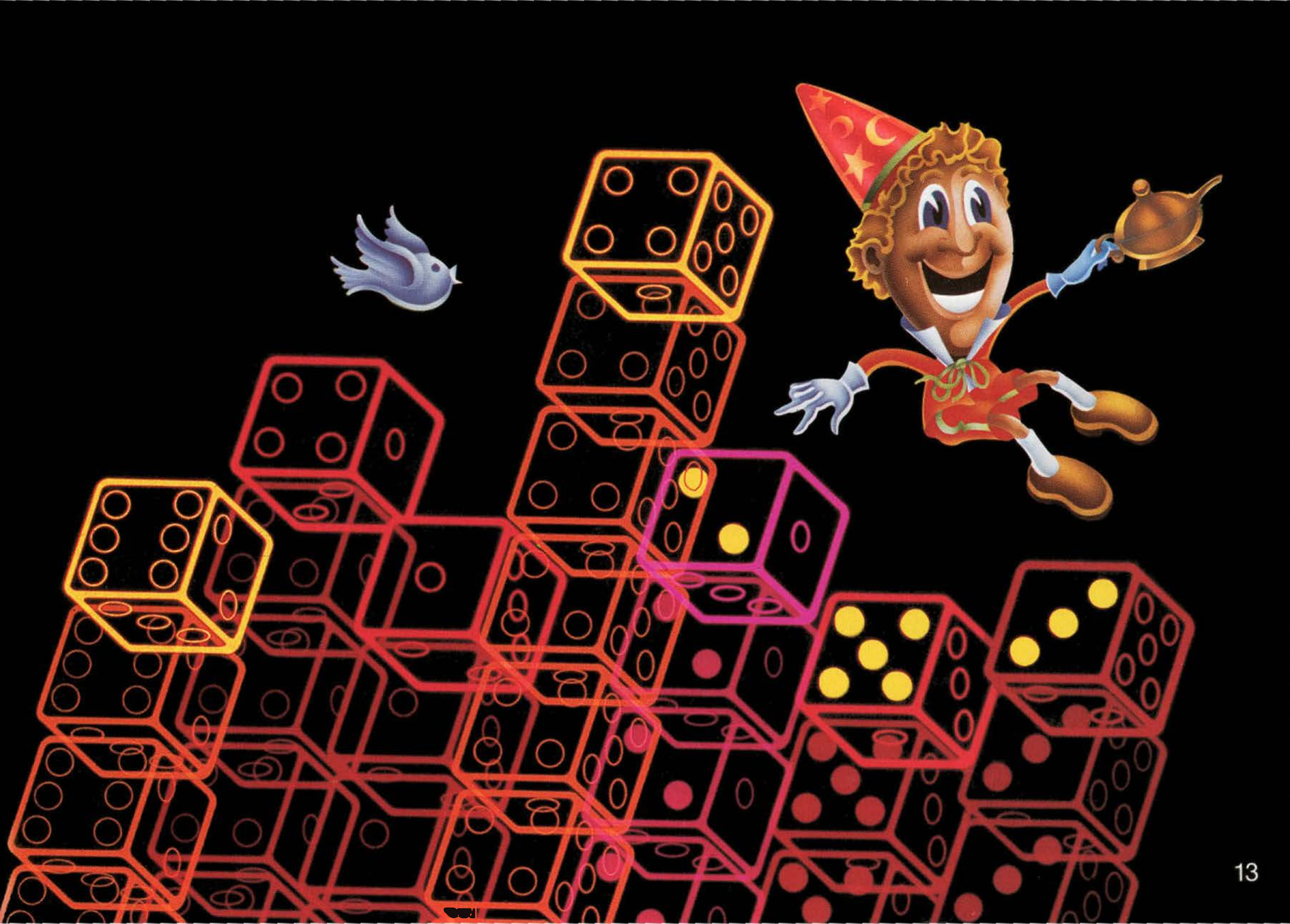
Then ask your friend to add the number on top of the second die to the total and multiply the total by ten. Now ask your friend to add in the third die and tell you the total. Subtract 150 from the total.

The first digit is the number on the first die, the second digit is the number on the second, and the last digit is the number on the third.

Here's an example:
Your friend throws a 2, a 5 and a 3.

Double the first die	2 + 2=4
Add 3	4 + 3=7
Multiply by 5	7 × 5=35
Add the second die to total	35 + 5=40
Multiply by ten	40 × 10=400
Add the last die	400 + 3=403
Subtract 150	403 −150=253

You say, "I wish your dice were a 2, a 5 and a 3!" If your friend wants to see it again, say you did the genie such a big favor you can have three more wishes any time you want and do it again!



The Magnetic Cards

Tell a friend that cards of the same color and value are like magnets. They always seem to end up together. And they do—with a little help from *you!* Ask your friend to shuffle a deck of 52 cards (no jokers)—and then place three of them face down on the table without showing them to you.

Now ask your friend for the deck and say something like this: "I am going to take out one card—and put it face-down on the table. The card you are going to pick will match it in color and value. Proof of magnetic attraction."

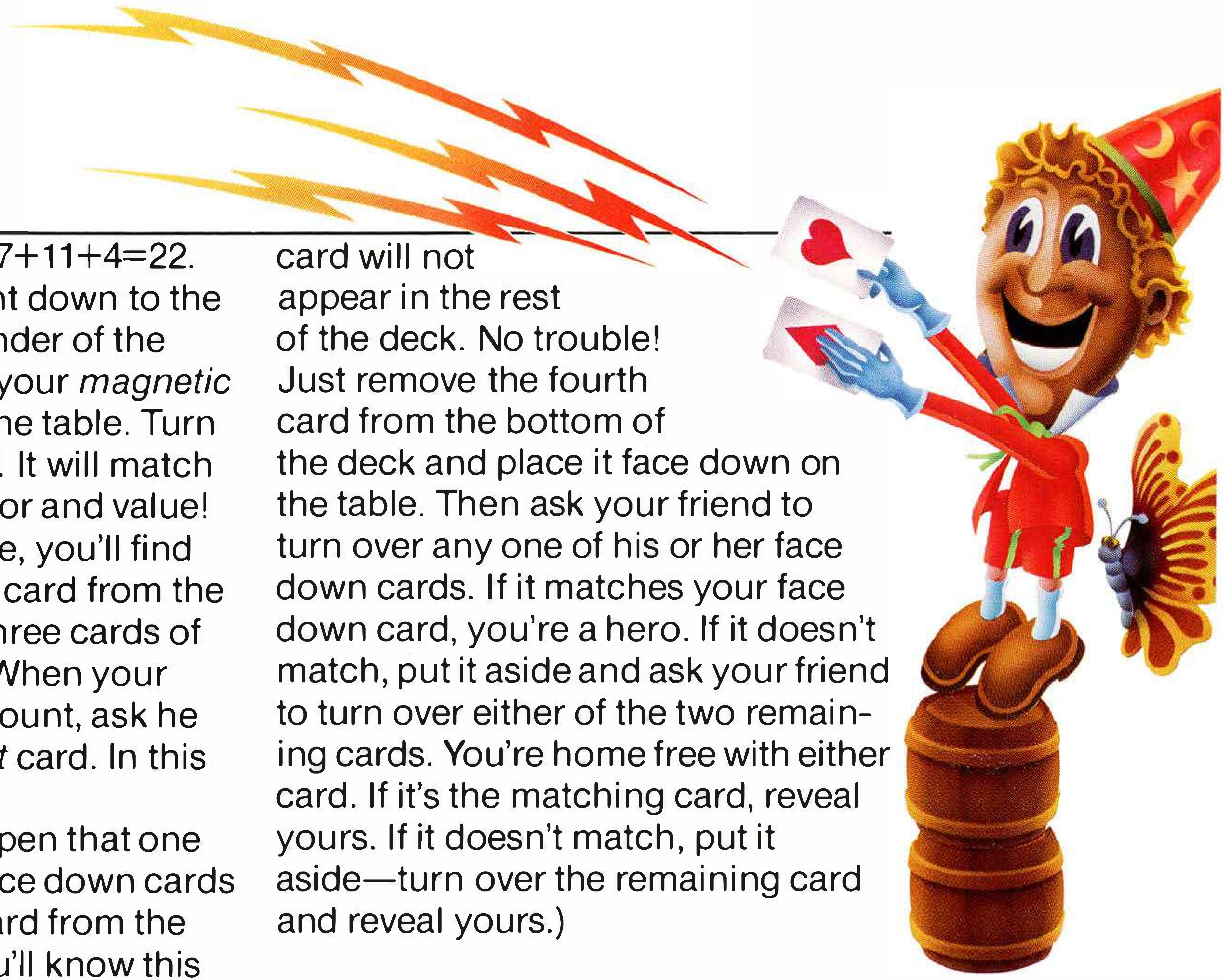
What you do is easy. First look at the fourth card from the bottom of the deck. Then look through the rest of the deck. Take the card that matches it in color and value. Put it face-down at the side of the table. (Example: If the fourth card from the bottom is the five of diamonds, you pick the five of hearts.)

Now hand the deck to your friend. Ask he or she to turn the other face-down cards face-up. Pretend they're a seven, a jack and a four. Ask your friend to start with the number on each card and add face-down cards until the number of cards reaches fifteen. Your friend should add eight cards to the seven and four cards to the jack. (Jacks count as 11, queens as 12 and kings as 13). Your friend should now count 11 cards on the four. The counting should be done out loud.

Now ask your friend to add up the values of the original face-down cards. In our example, 7+11+4=22. Ask your friend to count down to the 22nd card in the remainder of the deck and put it next to your *magnetic card* at the the side of the table. Turn over the *magnetic card*. It will match the selected card in color and value!

(Once in a great while, you'll find the match to the fourth card from the bottom in the bottom three cards of the deck. Don't worry. When your friend makes the final count, ask he or she to select the *next* card. In this case, 23 instead of 22.

It will only rarely happen that one of your friend's three face down cards will match the fourth card from the bottom of the deck. You'll know this has happened because the matching card will not appear in the rest of the deck. No trouble! Just remove the fourth card from the bottom of the deck and place it face down on the table. Then ask your friend to turn over any one of his or her face down cards. If it matches your face down card, you're a hero. If it doesn't match, put it aside and ask your friend to turn over either of the two remaining cards. You're home free with either card. If it's the matching card, reveal yours. If it doesn't match, put it aside—turn over the remaining card and reveal yours.)



The Magic Square

Secretly write the number 57 on a piece of paper, fold it and give it to a friend to put in his or her pocket without looking at it. You'll need five pennies and twenty little pieces of paper. Draw a square like the one below making each square slightly larger than a penny.

Ask your friend to pick any number in the square. Put a penny on the number and cover all the other numbers in the same row and in the same column with the paper markers.

19	8	11	25	7
12	1	4	18	0
16	5	8	22	4
21	10	13	27	9
14	3	6	20	2

Ask your friend to pick any of the uncovered numbers. Put a penny on it and cover all the others in the same row and column. Do the same thing with two more numbers. One uncovered number will remain. Cover it with the fifth penny. Ask your friend to add up all the numbers under the pennies.

The answer will be 57—the number you wrote down at the beginning of the trick and is now in your friend's pocket! The answer would be 57 no matter which numbers your friend picked.

Here's the secret—and you can use it to make up other magic squares that add up to different numbers. This square was formed by these two sets of numbers: 12, 1, 4, 18, 0 and 7, 0, 4, 9, 2. Add them up and you'll see their sum is 57. We put the first set of numbers across the top of an empty square and the second set along the side. You fill in the square by adding a top number and a side number. Put the sum in the box where they meet.

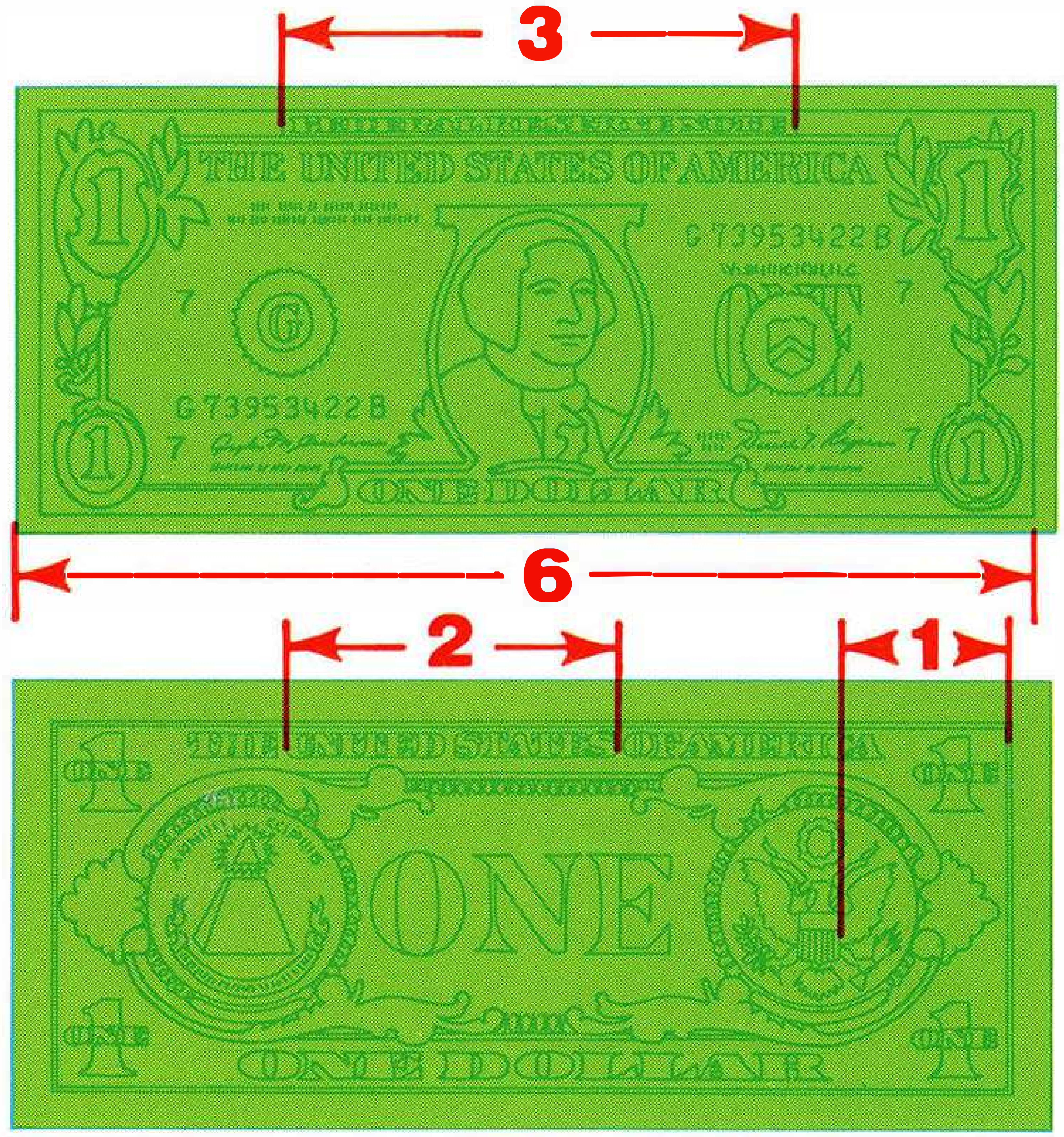
	12	1	4	18	0
7	19	8			
0					
4					
9					
2					

Add 12+7 to get the number for the box in the first column of the top row. Try it. This square should look just like the first one when you finish.

The number of sets you use will determine the size of the square. For example, a square formed by these two sets of numbers: 1, 2, 3, 4 and 0, 4, 8, 12 will look like this:

	1	2	3	4
0	1	2	3	4
4	5	6	7	8
8	9	10	11	12
12	13	14	15	16

For this square you'll need four pennies and 12 little pieces of paper.



Dollar Bill Ruler!

You can use a dollar bill to measure things. Eliminate one margin and it's almost six inches long. The right side of the eagle's shield is one inch from the right margin. The "United States" on the top of the green side is two inches wide. The rectangle which contains the words "Federal Reserve Note" at the top of the Washington side is three inches wide.

Superstar Card Finder!

Tell a friend that at one time or another you've met almost all the famous people who ever lived. You can prove it because they like to help you with your magic tricks.

Turn your back and ask your friend to take from one to twelve cards from a deck and hide them in a pocket. Then ask your friend to count down the same number of cards from the remainder of the deck and remember the last card. Now turn around and ask for the name of any person who has ever lived. (It must be more than twelve letters.)

Let's pretend your friend names George Washington. You say something like, "Super! George loves to help me with tricks!" Here's what you do. Ask your friend to take the deck and deal one card face-down on the table for each letter in George Washington's name. Pick up the pile and put it back on top of the deck. Then say, "But before you call on George, put the cards in your pocket back on top of the deck." Be sure to point out that you truthfully have no way of knowing how many cards this will be.

Now let your friend deal out one card for every letter in George Washington's name. When your friend is finished, ask he or she to look at the next card on top of the deck. *It will be the chosen card!* Play with this and see if you figure out how it works.

Crazy Eights!

Turn your back and ask a friend to write down any eight digit number. Then ask he or she to write down the same eight digits in a completely different order—and subtract the smaller number from the larger one.

Now ask your friend to cross out any one digit in the answer except the number 0 and call out the remaining numbers in any order. You write these remaining numbers down in the order given. Tell your friend that you will name the number he or she has crossed out.

Here's how you do it. You add these remaining numbers together in a special way. (Be sure to read the complete directions before starting this procedure.) The key to this game is the number 9. The first number in the sequence is added to the second number. The sum of these two numbers is then added to the third number; this sum is added to the fourth number and so on through all the remaining numbers. *If at any time the sum of any two numbers is more than 9, you must subtract 9 from that total and add the result to the next number in the sequence*. Finally, subtract the final answer from 9 and that's the crossed out number. If the final answer is 9, then do not subtract any number—you'll find that the *9* is the number your friend crossed out. Here's an example:

First number	76398204
Scrambled number	−67932840
Difference between the two numbers	8465364

Your friend crosses out the number 6. 84653~~6~~4

Your friend calls the numbers in a different order while you write them down. 485643

You add the first two numbers together. 4+8=12 (total is greater than 9)

Subtract 9 from the total of the first and second numbers (12). 12−9=3

Add the difference (3) to the third number. 3+5=8 (total is less than 10)

Add the total (8) to the fourth number. 8+6=14 (total is greater than 9)

Subtract 9 from the total of the fourth number (14). 14−9=5

Add the difference (5) to the fifth number. 5+4=9 (total is less than 10)

Add the total (9) to the sixth number. 9+3=12 (total is greater than 9)

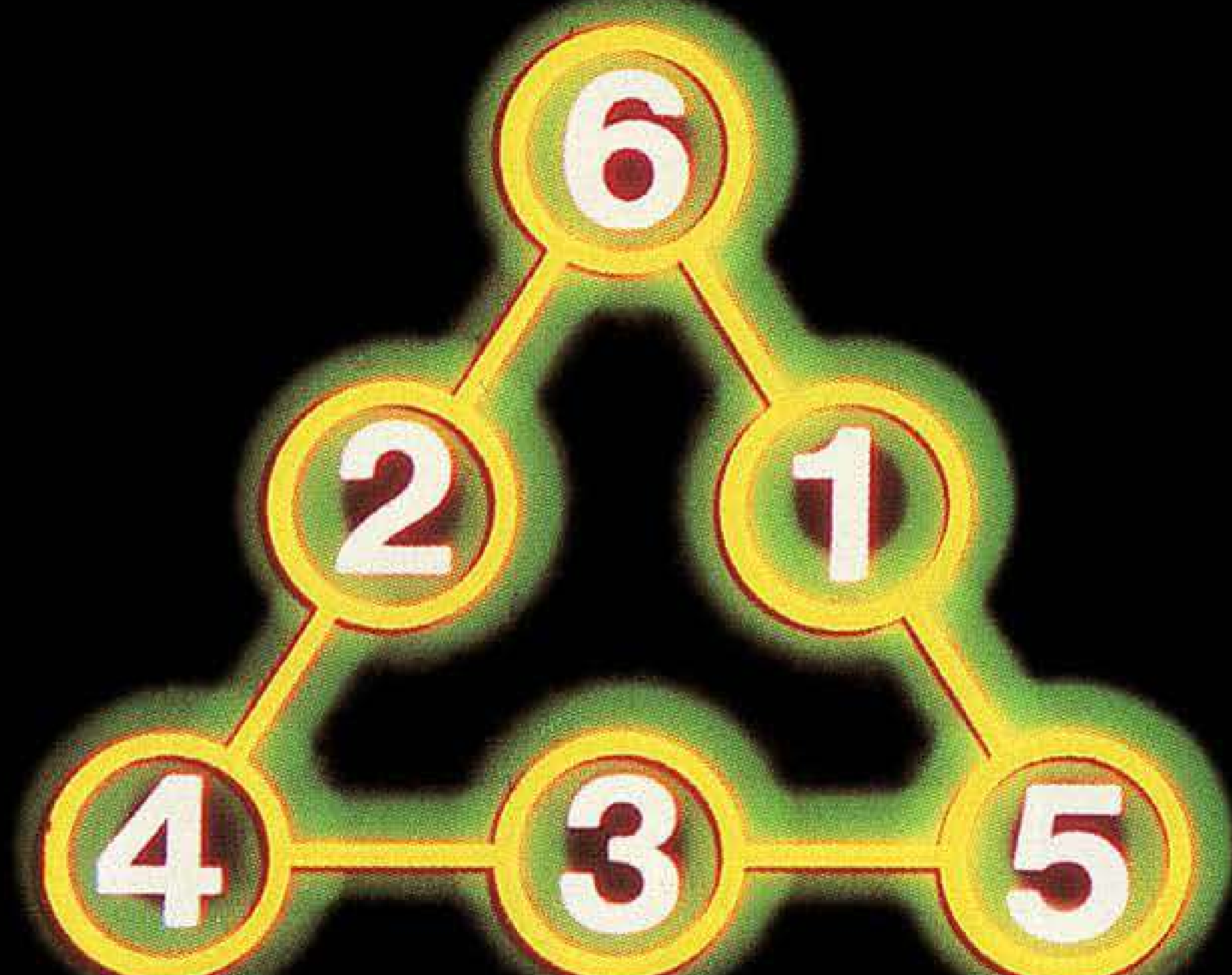
Subtract 9 from the total of the sixth number (12). 12−9=3

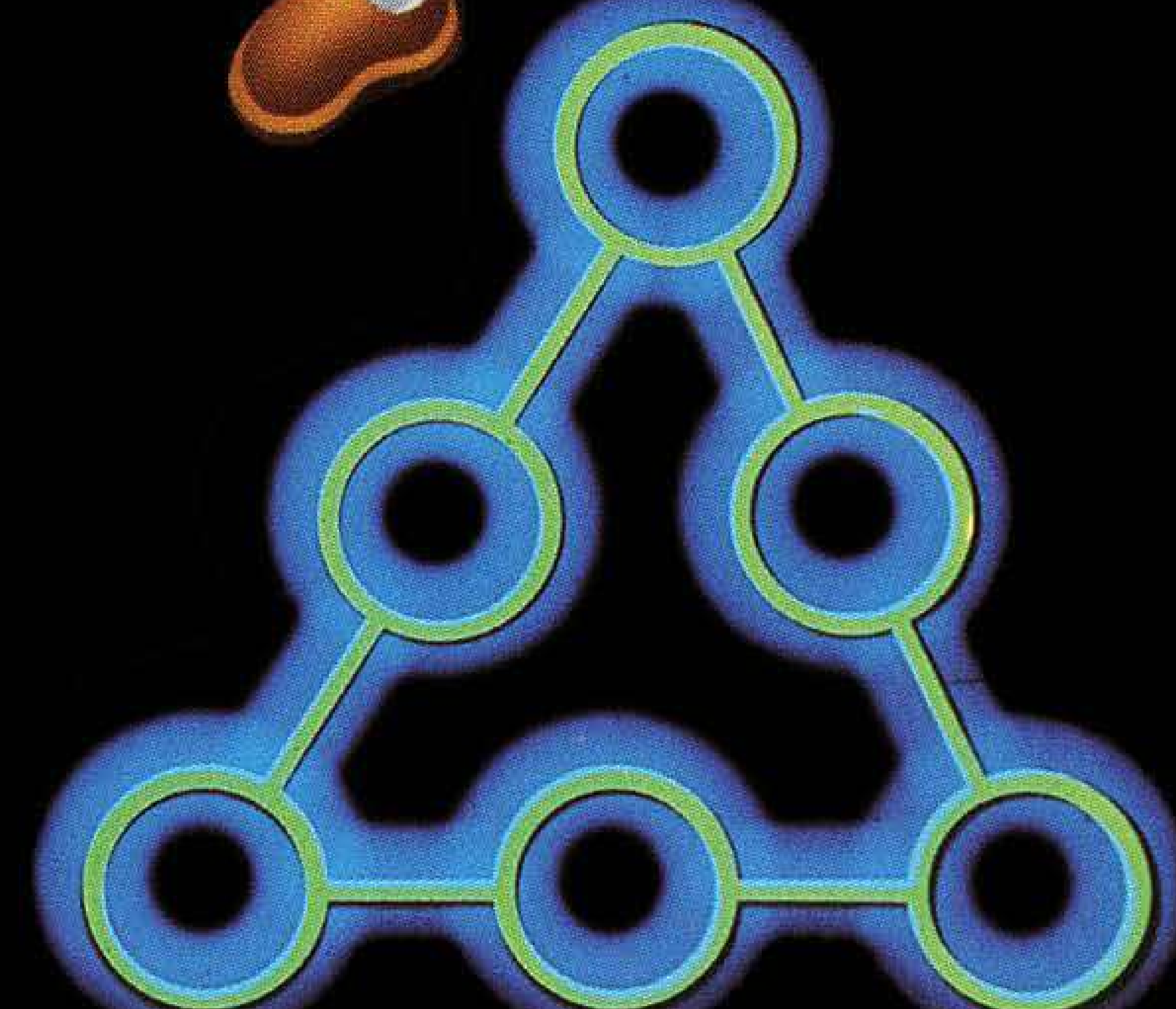
Subtract final answer (3) from 9 and you get the crossed out number! 9−3=6

The Magic Triangles

Put the numbers 1, 2, 3, 4, 5 and 6 in the circles so that each of the sides adds up to 12. Use each number only once.

Put the numbers 1, 3, 5, 7, 9 and 11 in the circles so each of the sides adds up to 21. Use each number only once.





The Magic Numbers

There is something very special about the numbers 142,857. You can multiply them by any number from 1 through 6 and the answer will be *the same number in the same order—but starting at a different place each time!* (Mathematicians call 142,857 a cyclic number.)

Look at this:

1×142,857=142,857
2×142,857=285,714
3×142,857=428,571
4×142,857=571,428
5×142,857=714,285
6×142,857=857,142

(continued on page 24)

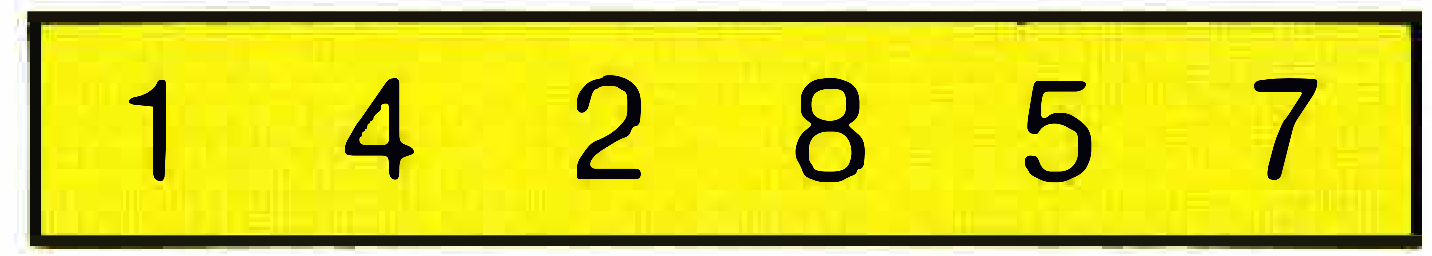
The Magic Numbers (Continued)

Think of these numbers as joined together in a circle. You can cut the circle at any point and have the answer to a multiplication problem. And this is the basis for a very mystifying bit of magic.

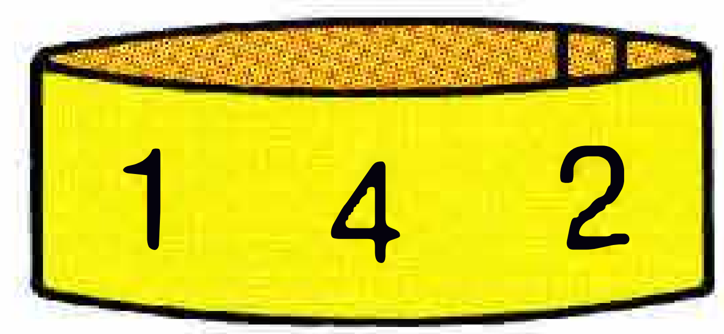
You need a deck of cards, an envelope, a strip of paper about twice as long as the envelope and a scissors. Secretly take the ace through ten of hearts from your deck of cards. Place them on the bottom of the deck so they read 1, 4, 2, 8, 5, 7 from the bottom up. The remaining cards can follow in any order. Now put a few other cards in between them. It really doesn't matter how many.

It's time to secretly write your prediction on the long strip of paper.

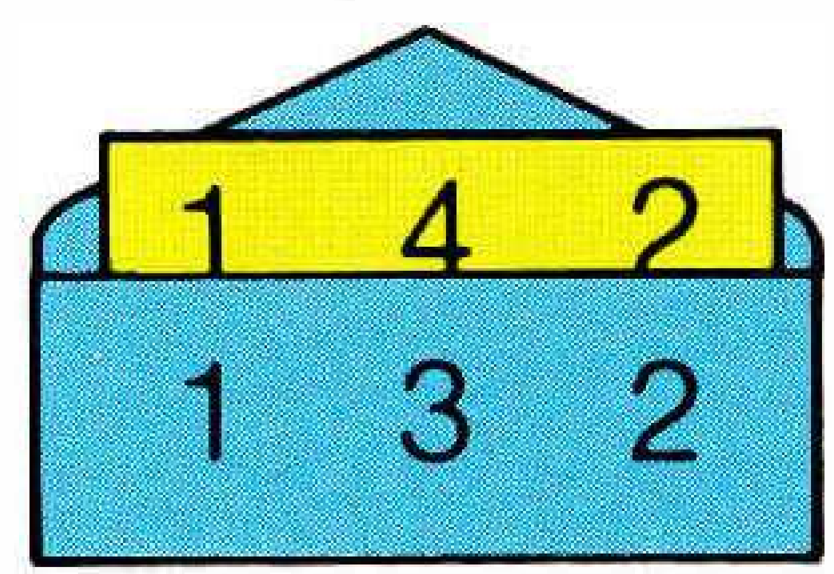
Write 142857 in large numbers.



Tape the ends of the strip together to make a band with the numbers on the outside.



Press the band flat. Put it in the envelope so that the numbers 1, 4, 2 face the flap side. Write the numbers 1 through 6 on either side of the envelope like this. Then seal the envelope.



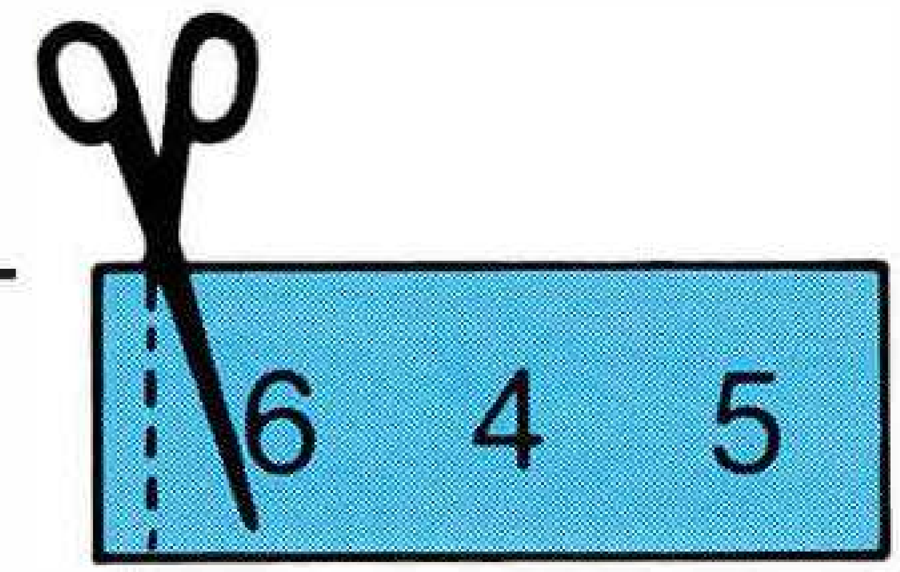
Back of envelope

Front of envelope

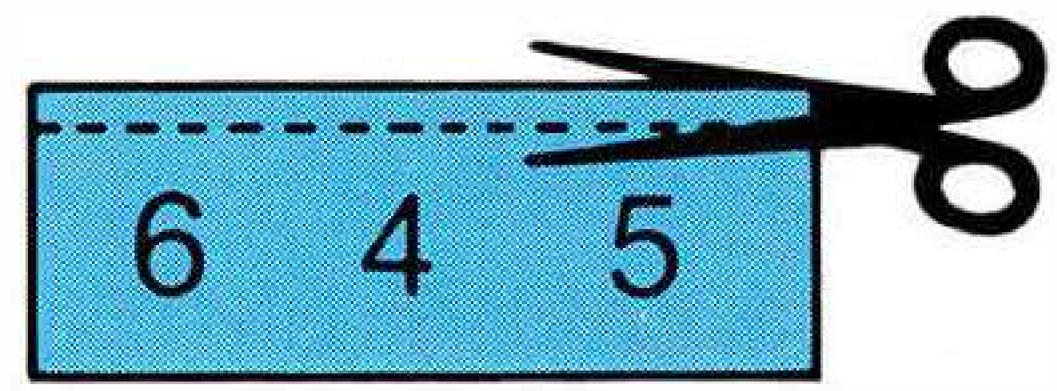
When you've finished this secret stuff, give this envelope to a friend. Tell your friend you're going to get six random numbers by dealing out the first six numbered hearts from a face-up deck of cards. Do it. Put the 1, 4, 2, 8, 5 and 7 of hearts on the table in order.

Now ask your friend to pick any number from 1 through 6 and use it to multiply 142,857. We'll pretend your friend chooses 6. 142857 × 6=857,142.

It's award time, and you ask for "The envelope, please!" Use the scissors to cut the envelope. If your friend's number was 6: cut the envelope just to the left of the 6 being sure you cut the *inside* band as well. Pull out the band and WOW! It reads 857142.



a



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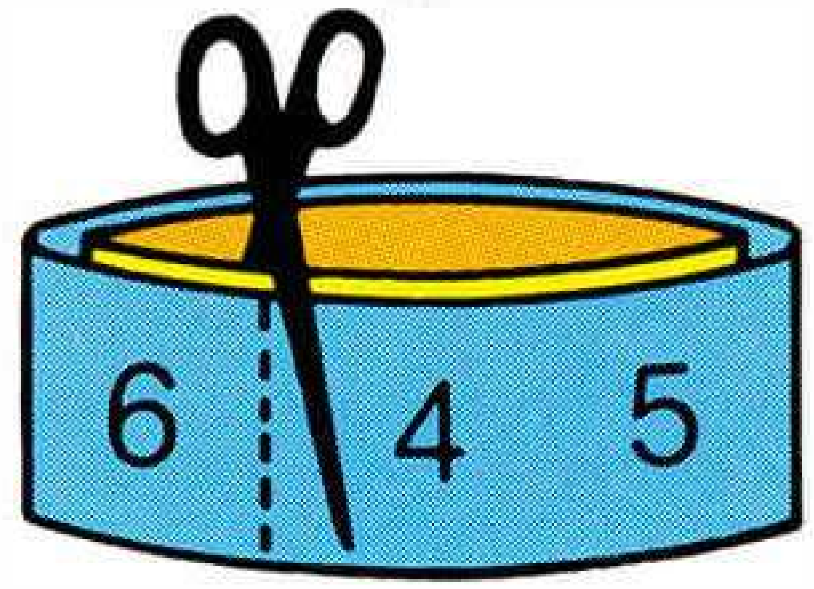


c

The rule is, always cut just to the left of the number your friend selected (a). If the number is in the middle of the envelope, first cut across the top of the envelope (b) and then cut to the left of the number, snipping the upper part of the band inside (c).

Practice this a couple of times before you do it for anyone. It's well worth it.

X-Ray Eyes!

1. Place twenty toothpicks on a table, and after turning your back, ask a friend to take between one and ten toothpicks from the pile and hide them in a pocket.
2. Ask your friend to count the left over toothpicks—add the two digits of this number—and take from the pile the number of toothpicks equal to the sum.

   Here's an example. Your friend starts by taking 5 toothpicks from the pile of 20 toothpicks. 15 toothpicks are left. Your friend adds the 1 and the 5 to get 6 and removes 6 more toothpicks.

   Tell your friend to hide these toothpicks away without showing them to you.
3. Then ask your friend to remove some of the remaining toothpicks and hold them in his or her hand without your seeing them.
4. Now you take the remaining toothpicks from the table and count the number as you put them in your pocket. (Do this in your head secretly.)
5. Tell your friend you have X-Ray eyes and are going to prove it.
6. You can now tell the number of toothpicks your friend has left in his or her closed fist—*and you do it!*

   The secret. There will always be 9 toothpicks remaining on the table before your friend takes the last toothpicks in his or her hand. When you sneak a peek at the remaining toothpicks, just subtract the number of toothpicks left from 9. That's the number of toothpicks your friend's hand is hiding.

Start with 20 toothpicks. Your friend secretly hides 5.

$$\begin{array}{r} 20 \\ -5 \\ \hline 15 \end{array}$$

Your friend adds the one and five

$$\begin{array}{r} 1 \\ +5 \\ \hline 6 \end{array}$$

He or she hides away six more toothpicks.

$$\begin{array}{r} 15 \\ -6 \\ \hline 9 \end{array}$$

Your friend removes and hides four more toothpicks in his or her fist.

$$\begin{array}{r} 9 \\ -4 \\ \hline 5 \end{array}$$

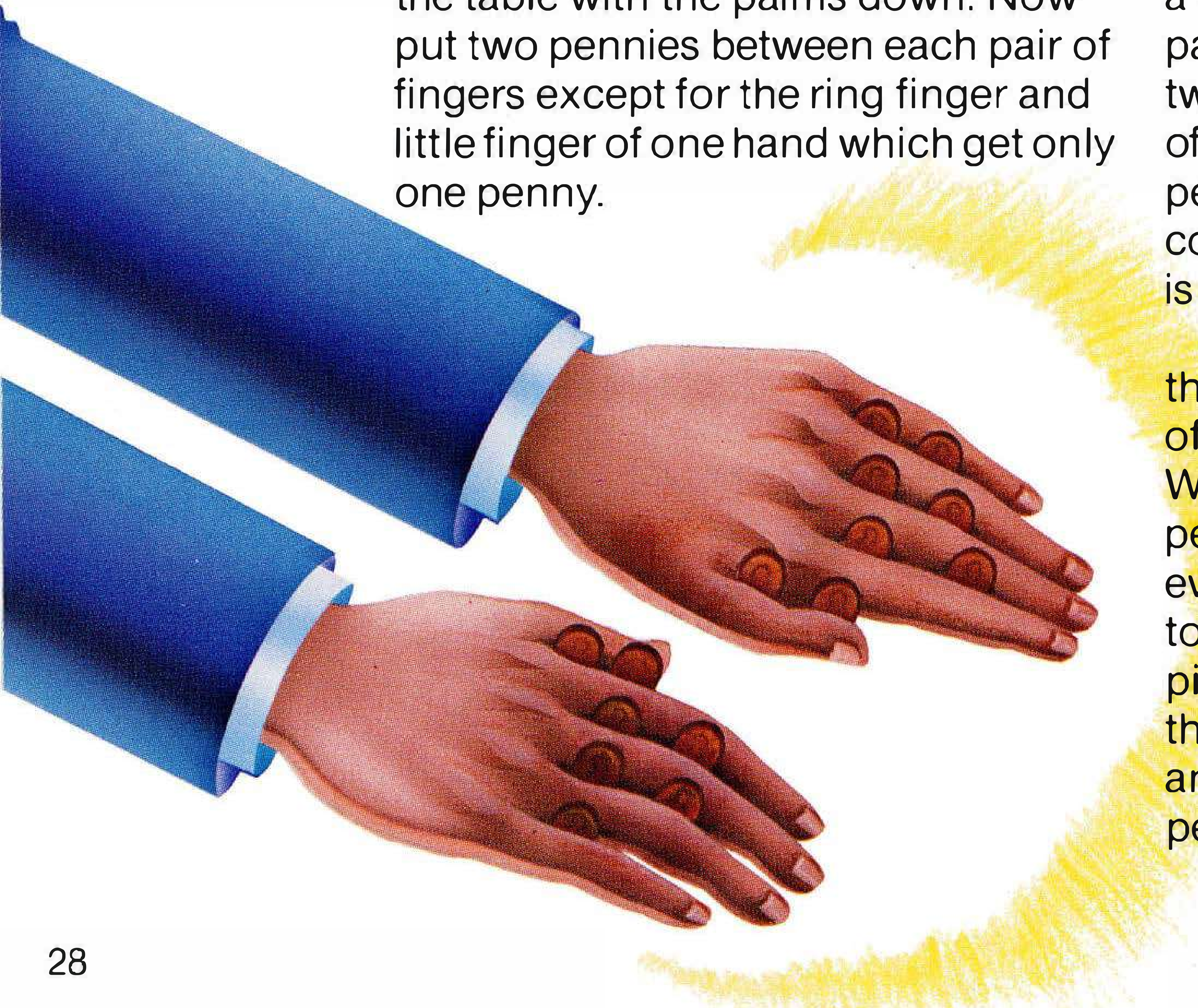
You see five toothpicks left in the pile. Subtract five from nine in your head.

$$\begin{array}{r} 9 \\ -5 \\ \hline 4 \end{array}$$

You now *know* your friend has four toothpicks hidden in his or her hand. (See if you can prove that steps one and two will always leave 9 toothpicks left in the pile.)

The Traveling Penny!

Ask a friend to put his or her hands on the table with the palms down. Now put two pennies between each pair of fingers except for the ring finger and little finger of one hand which get only one penny.

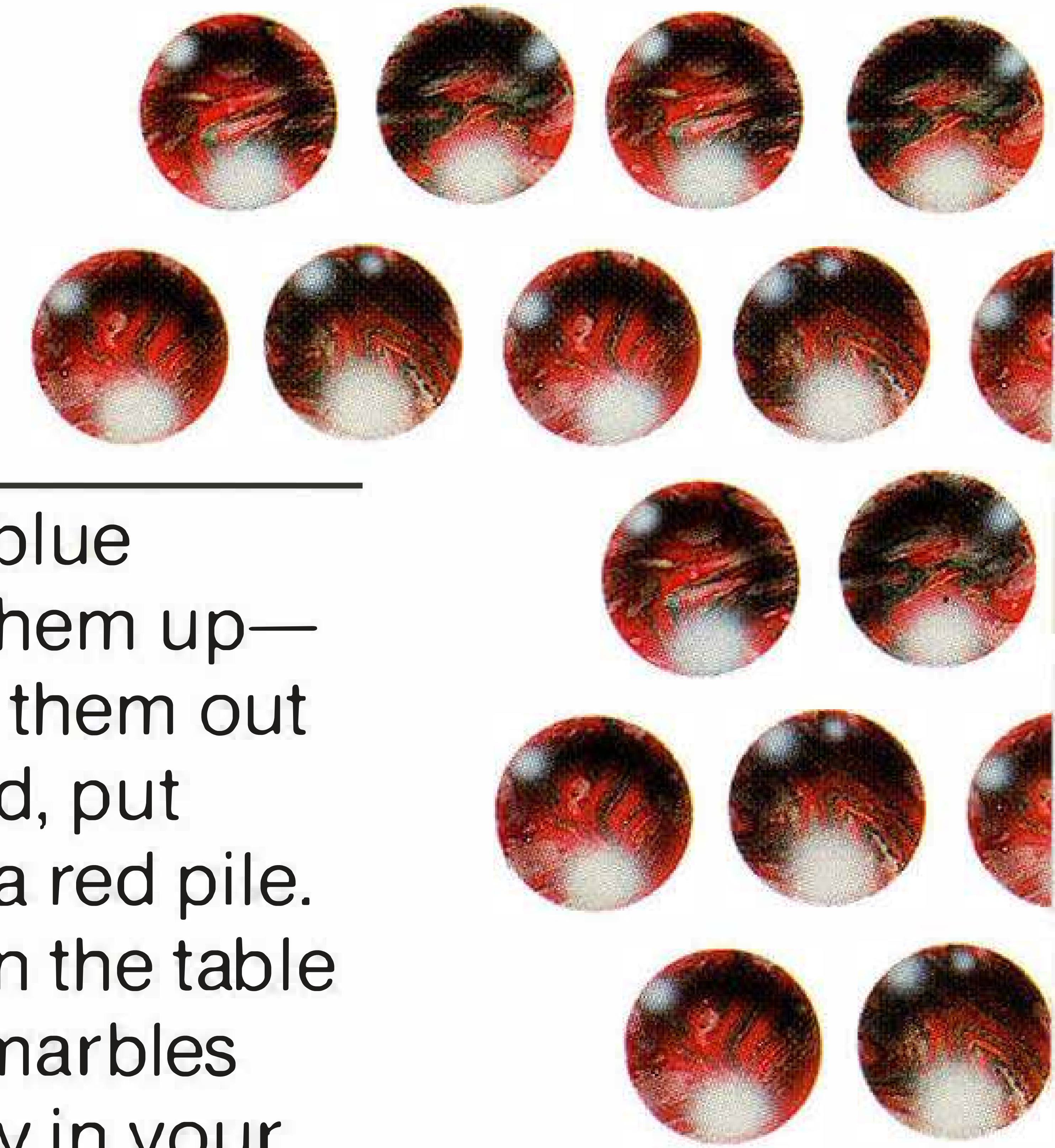


Take away one pair of pennies at a time. Separate the pennies of each pair and place them on the table in two piles—one penny in front of each of your friend's hand. Say, "Two pennies!" each time you do this and continue until only the single penny is left.

Take the single penny—hold it in the air and say, "We have two piles of pennies each formed with pairs. Which pile should get the odd penny?" Put the extra penny wherever your friend wants it placed. Point to the other pile and say, "This is a pile made up of pairs." Then point to the pile where you put the last penny and say, "And this pile has an extra penny—or does it???"

Say "Abracadabra—alakazam!" as you wave your hands over both piles. Now tell your friend you have made the extra penny travel magically from one pile to the other. Now you prove it. Go to the pile where you put the extra penny and slide two pennies at a time to one side. Each time you do this say, "Two pennies." *The extra penny is gone!*

Do the same thing with the other pile. After you slide the last pair aside—the extra penny is there. It has traveled invisibly from one pile to the other. (Can you figure out why this trick works?)



Marble Marvel!

Put 16 red marbles and 16 blue marbles into a hat. Shake them up—and without looking—take them out two at a time. If both are red, put them on the table to make a red pile. If both are blue put them on the table to make a blue pile. If two marbles don't match, put them away in your marble bag.

After you take all the marbles out of the hat, what are the chances that the number of marbles in the red pile will exactly equal the number of marbles in the blue pile?

Think twice before you answer—then try it and see what happens. (If you don't have enough marbles, use pennies and nickels or colored pieces of paper.)

Serial Number

49523094

Dizzy Dollars!

Ask someone to take one of his or her own dollar bills and look at the serial number. You then tell your friend you will be able to determine the serial number printed on his or her dollar bill (exclude the letters).

Serial Number ~~B~~49523094~~A~~

Ask your friend to give you the sum of the first and second digits, then the sum of the second and third digits, the third and fourth and so on through the end. For the eighth and final sum, your friend adds the second digit to the last digit. Be sure to label the sums as shown.

Digits:

1st & 2nd 4+9=13	5th & 6th 3+0=3
2nd & 3rd 9+5=14	6th & 7th 0+9=9
3rd & 4th 5+2=7	7th & 8th 9+4=13
4th & 5th 2+3=5	8th & 2nd 4+9=13

Place the first sum in parenthesis.

Sum of 1st & 2nd Digits (13)

Now starting with the *second* sum, you just alternately subtract and add the numbers.

14−7+5−3+9−13+13=18

Divide the answer in half and you have the second digit of the serial number.

9 (2nd digit of serial number)
2 | 18

Now cross out the sum of the eighth and second digits.

Digits:

1st & 2nd (13)	5th & 6th (3)
2nd & 3rd (14)	6th & 7th (9)
3rd & 4th (7)	7th & 8th (13)
4th & 5th (5)	8th & 2nd (13)

Subtract the second digit of the dollar bill serial number (9) from the

sum of the first and second digits of the serial number (13) to get the first digit of the serial number.

13−9=4 (1st digit of serial number)

Now subtract the second digit of the serial number (9) from the sum of the second and third digits of the serial number (14) to get the third digit of the serial number.

14−9=5 (3rd digit of serial number)

Then subtract the third digit of the serial number (5) from the sum of the third and fourth digits of the serial number (7) to get the fourth digit of the serial number.

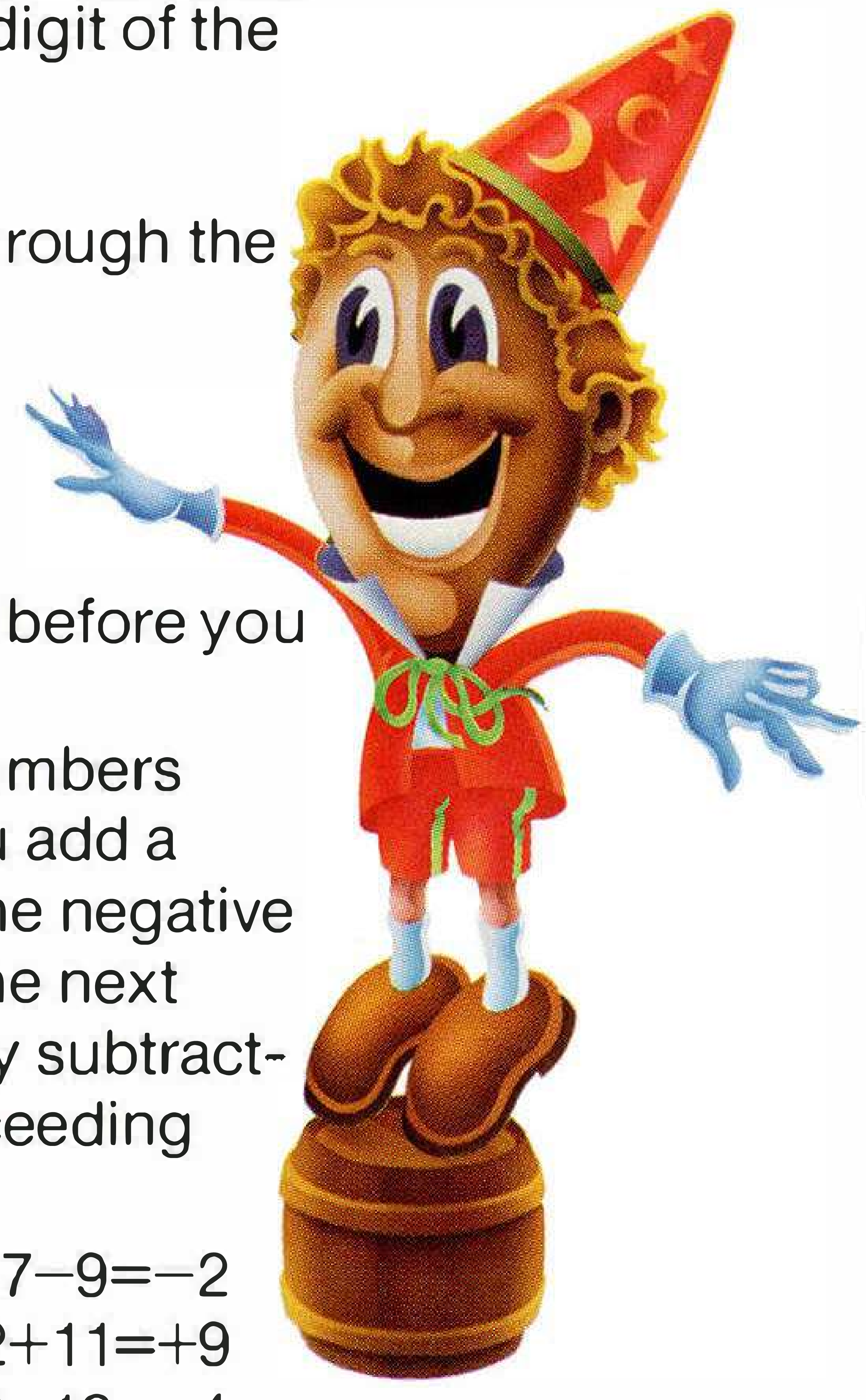
7−5=2 (4th digit of serial number)

Subtract the fourth digit of the serial number (2) from the sum of the fourth and fifth digits of the serial number (5) to get the fifth digit of the serial number.

5−2=3 (5th digit of serial number)

Continue this process through the remaining numbers:

3−3=0 (6th digit of serial number)
9−0=9 (7th digit of serial number)
13−9=4 (8th digit of serial number)



Practice this a few times before you do it for anybody.

Note: To subtract larger numbers from smaller numbers, you add a −(minus) to the answer. The negative number is then added to the next number in the sequence by subtracting its value from that succeeding number. Example:

7−9+11−13

7−9=−2
−2+11=+9
+9−13=−4

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ODYSSEY²