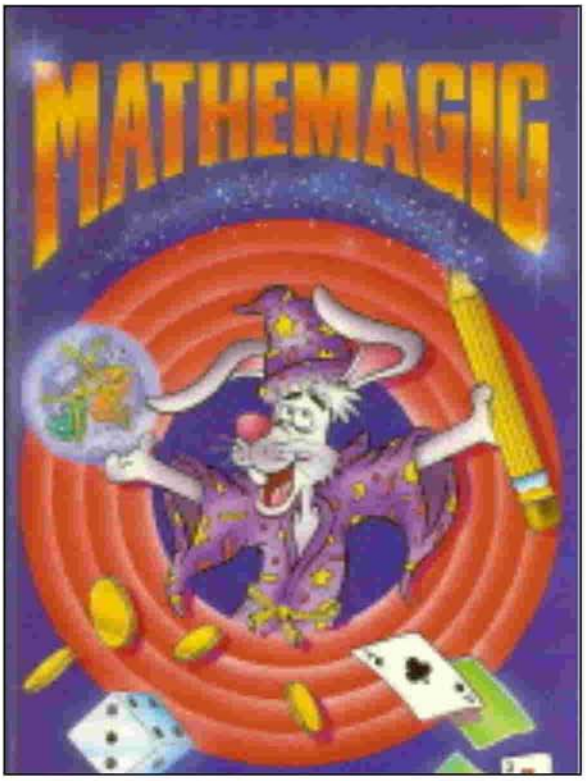
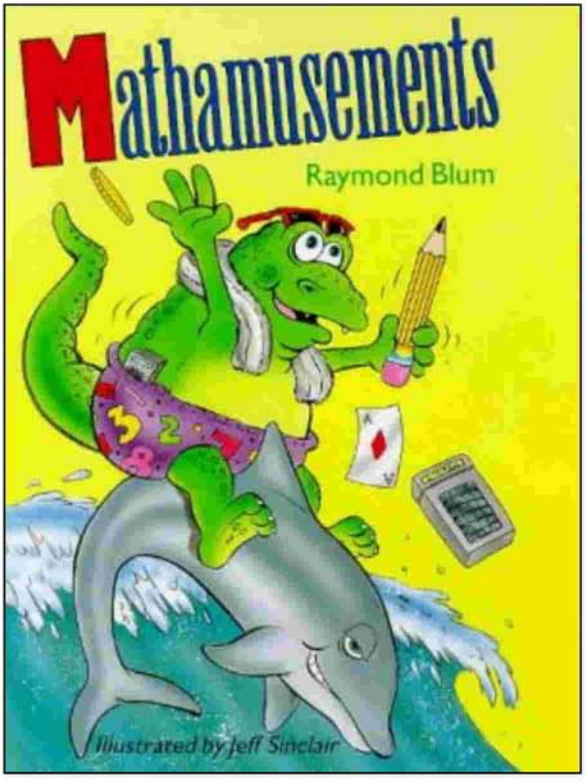
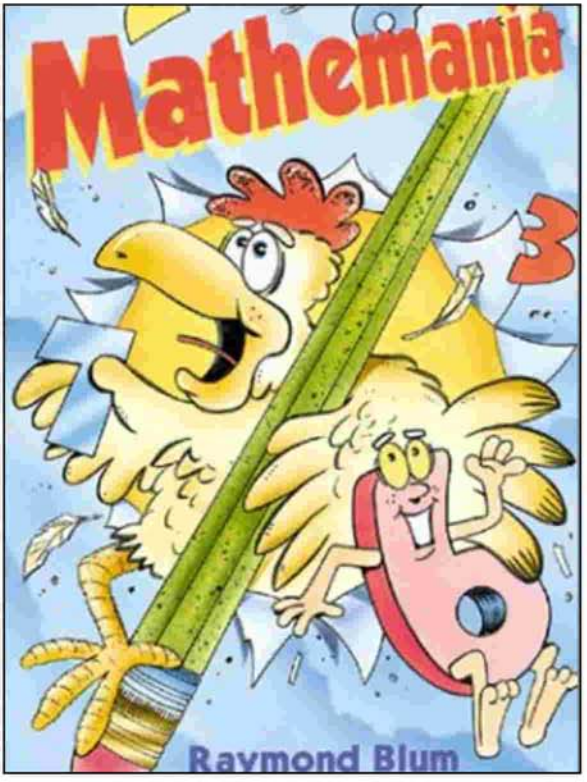

MATHEMAGIC


Mathamazing
6
2
Raymond Blum


Mathamusements
Raymond Blum
Illustrated by Jeff Sinclair


Mathemania
3
Raymond Blum

1.
CARD TRICKS

Card tricks are the most popular of all magic tricks. They can be performed anywhere and a regular deck of cards is all that is needed.

These card tricks are easy to learn and perform. No sleight of hand is required and, if you carefully follow the steps, they practically work themselves.

The tricks are organized from the easiest to the hardest, so choose those that are right for you. Even though the tricks are easy to learn, be sure to practice them by yourself first. When you have worked a trick through successfully two or three times, you are ready to perform it for others.

Never repeat a card trick for the same person or they might figure out the trick's secret. Perform a second trick instead, and everyone will have twice as much fun!

SWITCHEROO

A deck of cards is divided into two piles. Your friend secretly takes a card from each pile and places it in the opposite pile. Even though each pile is thoroughly shuffled, you are able to find your friend's two cards!

Materials

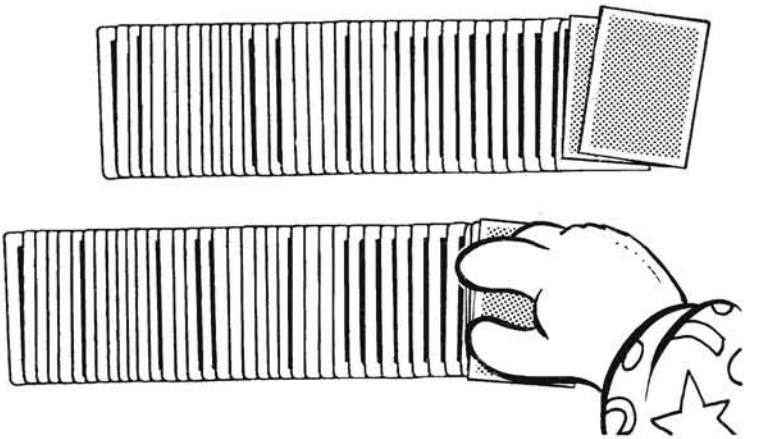
A deck of playing cards without Jokers

Preparation

Put all the even cards in one pile (2, 4, 6, 8, 10, Queen) and all the odd cards in another pile (Ace, 3, 5, 7, 9, Jack, King). Shuffle each pile so that it is well mixed.

Presentation

1. Have your friend shuffle each pile separately without looking at the cards. Spread both piles face down on the table.



2. Tell her to choose one card from the group at the top, look at it, and place it in the group on the bottom. Then have her choose a different card from the group at the bottom, look at it, and place it in the group on the top.

3. Have her shuffle each pile, put one pile on top of the other, and hand you the deck of cards. Within seconds, you are able to reveal her two cards!

How to Do It

The odd card that is chosen will be surrounded by even cards, and the even card that is chosen will be surrounded by odd cards.

Example: The ♡4 and ♢K are chosen.

<u>odd cards</u> ♡4 <u>odd cards</u> <u>even cards</u> ♢K <u>even cards</u>

MAGIC SPELL

Your friend secretly chooses a card from a deck of cards. When a magical phrase is spelled out, your friend's secret card mysteriously appears!

What You Need

A deck of playing cards

What to Do

1. Cut the deck into seven piles and place them facedown on the table.
2. Ask your friend to point to one of the piles. (It doesn't matter which one she chooses.) Gather together all the piles she did not choose into one pile and then put her chosen pile on the top.
3. Tell her to secretly look at the top card, memorize it, and return it to the top of the deck.
4. Ask her for any number between 20 and 30. (20 and 30 are not between.)

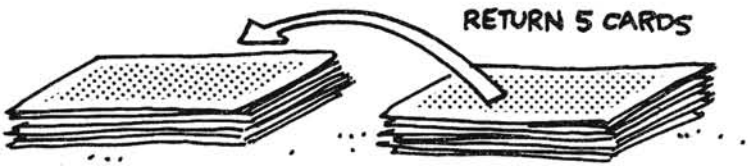
Example: 23

5. Deal that number of cards into a small pile, one card at a time. Place the rest of the deck next to the small pile.

6. Ask your friend to find the sum of the digits of her number.

$$23 \rightarrow 2 + 3 = 5$$

7. Return that many cards to the top of the big pile, one card at a time.



8. Put the small pile on top of the big pile.

Finally, hand your friend the deck. As you slowly spell the magical phrase "h-o-c-u-s p-o-c-u-s a-l-a-c-a-z-a-m," tell her to turn over one card for each letter. When she turns over the *last card*, it will be her secret card!

The Mathemagical Secret

Any number between 20 and 30 minus the sum of its digits always equals 18. "Hocus pocus alacazam" has exactly 18 letters.

SPELLING BEE

This mathemagical card trick is easy to learn and fun to perform, too. You'll amaze family and friends when you spell the names of different playing cards and those cards suddenly and mysteriously appear!

What You Will Need

A deck of playing cards

Preparing The Trick

1. Remove all 13 Hearts from the deck.
2. Arrange the Hearts in the following order (it is called the setup):

Q - 4 - A - 8 - J - 2 - 7 - 5 - 10 - K - 3 - 6 - 9

3. Put the Hearts back in the deck *in this order*. Disguise the setup by spacing these cards throughout the whole deck. Put the 9 of Hearts near the bottom of the deck and the Queen of Hearts near the top.
4. Read the directions below and then practice the trick by yourself. When you have successfully worked the trick two or three times, you are ready to perform it for others.

Performing The Trick

1. Starting at the bottom of the deck, carefully remove all the Hearts. Remove the 9 first and put it *face down* on the table. Then remove the 6 and put it *face down* on top of the 9. Continue in this way until you have removed all 13 Hearts. Make sure that you keep the Hearts *in the same order* as the setup. Put the rest of the deck aside.
2. Show your friend the pack of Hearts. Say that you are going to make each card magically appear by just spelling the card's name.
3. Hold the pack of Hearts face down in your hand. Say "O" as you put the top card *at the bottom of the pack*. Say "N" as you put the next top card at the bottom of the pack. Say "E" and then turn over the next top card. It will be a ONE (Ace)! Remove that card from the pack and put it on the table.
4. Use the same method to remove the rest of the Hearts from the pack. (Spell ELEVEN for Jack, TWELVE for Queen, and THIRTEEN for King.) Remember, when you say a letter, put the top card at the bottom of the pack. When you say the *last* letter of each word, turn over the top card and it will be the card that you just spelled!

The Secret

The setup is the secret to doing this trick. The Hearts must be arranged in exactly that order or the trick will not work.

Other Things To Do

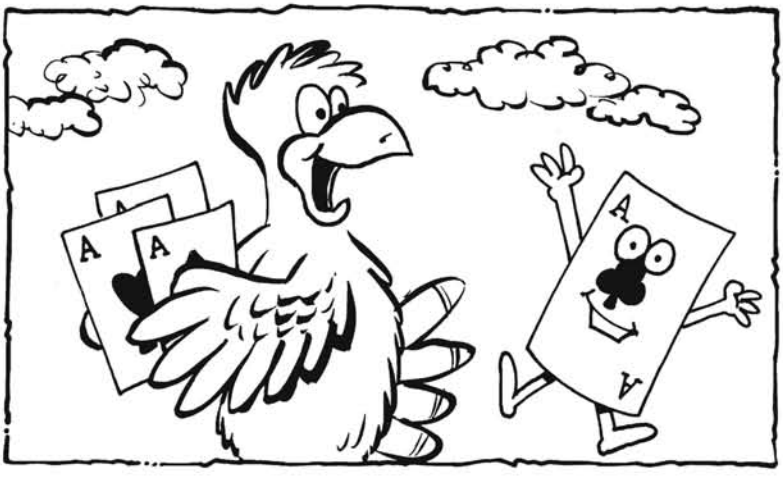
When you are setting up the deck, arrange all the Clubs, too. Then, if your friend wants you to repeat the trick, you will be ready.

There are 60 seconds in a minute, 60 minutes in an hour, 24 hours in a day and 365 ¼ days in a year. So how many seconds are in a whole year?

The answer is 12!

Jan. 2, Feb. 2, March 2, April 2, May 2, June 2, July 2, Aug. 2, Sept. 2, Oct. 2, Nov. 2 and Dec. 2

FOUR ACE BAFFLER



Three cards are randomly removed from the deck and they are all Aces! Then the "number spirits" are summoned and the fourth Ace mysteriously appears!

Materials

A deck of playing cards

Preparation

Put an 8 card in the eighth position down from the top of the deck and put the four Aces in the ninth, tenth, eleventh and twelfth positions.

Presentation

1. Ask a friend for a number *between* 10 and 20. (*Caution:* 10 will work, but 20 will not.)

Example
13

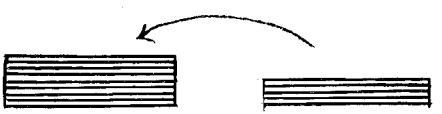
2. Deal that number of cards into a small pile one card at a time. Place the rest of the deck next to the small pile.

← 13 cards

3. Ask your friend to add the digits of that number.

13 → 1 + 3 = 4

4. Return that many cards to the top of the big pile one card at a time.



Return four cards

5. The top card of the small pile will be an Ace! Turn this card face up and show your friend.

6. Set the Ace aside and put the small pile on top of the big pile.

7. Repeat the six steps with two *different* numbers between 10 and 20 to remove two more Aces.

Finally, pretend to do some supernatural hocus pocus as you ask the "number spirits" for a sign to help you find the last Ace. Pretend that they tell you to turn over the top card. It will be an 8. Count down eight more cards and the eighth card will be the fourth Ace!

The Mathemagical Secret

After dealing out three piles three times, the chosen Any number between 10 and 20 minus the sum of Its digits always equals 9.

ABRACADABRA

Your friend mentally chooses a card from a pile of 21 cards. When the magic word "ABRACADABRA" is spelled out, your friend's chosen card suddenly appears!

Materials

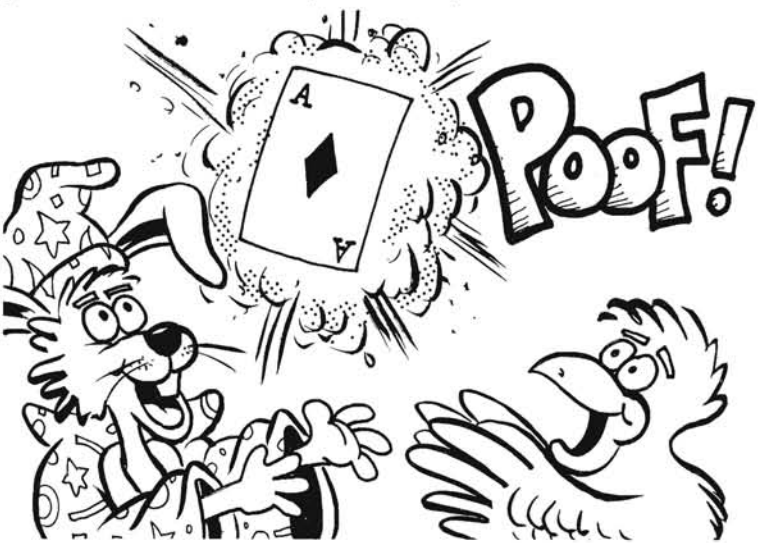
A deck of playing cards

Presentation

1. Shuffle the deck, count out 21 cards, and set the rest of the deck aside.

2. Deal out three piles of seven cards each, face down on the table. Deal the cards from left to right, one pile at a time, as if you were dealing to three players in a card game. There is no need for you ever to see the faces of any of the cards.

3. Ask your friend to choose one of the piles. Take the pile that he chose in your hand, fan out the cards to-



wards him, and ask him to mentally select any card.

4. Put the pile that he chose between the other two piles so that you again have a pack of 21 cards in your hand.

5. Once more, deal out three piles of seven cards each, face down on the table. Taking up one pile at a time, fan out the cards towards your friend and ask him which pile has his chosen card. Again, put the pile that has his chosen card between the other two piles so that you have a pack of 21 cards in your hand.

6. Repeat Step 5 one more time.

7. Tell your friend that you are going to say the magic word "ABRACADABRA" and his chosen card will magically appear. Slowly spell "ABRACADABRA," turning over one card for each letter. The last card that you turn over will be your friend's chosen card!!

The Mathemagical Secret

After dealing out three piles three times, the chosen card is mathematically moved to the fourth card down in its pile. When another pile of seven cards is put on top of that pile, the chosen card becomes the 11th card down in the pack. ABRACADABRA has exactly 11 letters.

WIZARD OF ODDS

You and your friend each select a card from your own deck of cards. The probability that you will select identical cards is 1 out of 2,704. But for some magical reason, you are able to beat the odds every time!

Materials

2 decks of playing cards without Jokers

Presentation

1. Have two decks of cards on the table, one for you and one for your friend.

2. Tell your friend to do exactly what you do. If you shuffle your deck, she should shuffle her deck. If you turn your deck around, she should turn her deck around, and so on.

3. This part of the trick is nothing more than a little hocus-pocus. Shuffle, double cut, turn, shuffle again, and triple cut your deck. Make sure that your friend does the same with her deck.

4. Flip your deck over, and then turn your deck clockwise and then counterclockwise 2 or 3 times. She should be doing the same with her deck. While you are doing this, it is very important that you *memorize your friend's bottom card*—this is your *key card.*

5. Turn your deck face down once again. Then pick out a card from near the center of your deck. Pretend that you are memorizing your card (but you only need to remember the key card on the bottom of your friend's deck) and then place it *on top of your deck.* Your friend does the same with her deck.

6. Each of you should cut your deck in half once so that the chosen cards are lost in the middle of their decks. This puts the key card on top of her chosen card.

7. Finally, exchange decks with your friend. Tell your friend to find her card and that you will find yours. Look through the cards until you see the key card. Your friend's chosen card will be the card *to the right* of the key card. Pretend that her chosen card is yours, remove it, and place it face down on the table. Your friend does the same with her card.

8. Explain to your friend that the probability of choosing identical cards is very small–1 out of 2,704 ($1/52 \times 1/52 = 1/2{,}704$). Your friend won't believe her eyes when you flip the cards over and they are identical!

WHISPERING DECK

It is easy to predict your friend's secret card when you have a deck of cards that talks!

What You Need

A deck of playing cards—exactly 52 cards

What to Do

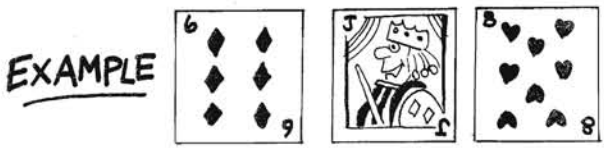
1. Have your friend shuffle the deck of cards as many times as he wants and then hand you the deck.

2. Count out exactly 26 cards from the top of the deck. Deal them *faceup* into a pile, one card at a time. While you are counting, *memorize the 10th card.* This will be your friend's secret card.

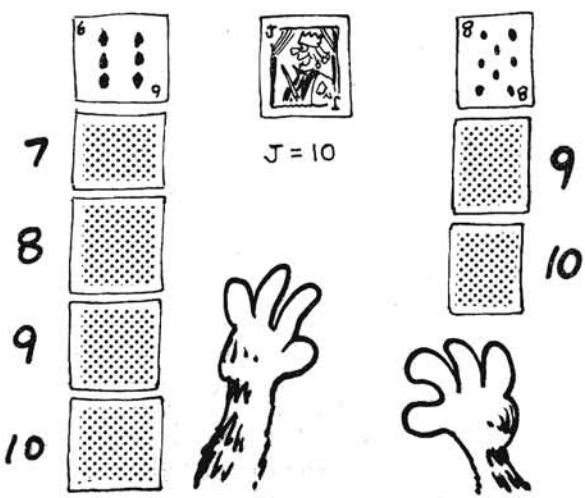
3. Turn that pile over and put it on the *bottom* of the deck.

4. Deal out six cards facedown from the top of the deck and spread them on the table. Ask your friend to turn any three of these cards faceup.

5. Put the three cards that were not chosen on the *bottom* of the deck and leave the other three cards faceup on the table.



6. Hand your friend the deck and tell him to deal cards facedown below each of these cards. He should start with the number on the faceup card (all face cards = 10 and Aces = 1) and then keep dealing cards until he gets to 10. For example, if the faceup card is a 6, he would deal four more cards to get to 10.



7. Tell him to keep the three faceup cards on the table and then put all the facedown cards on the *bottom* of the deck.

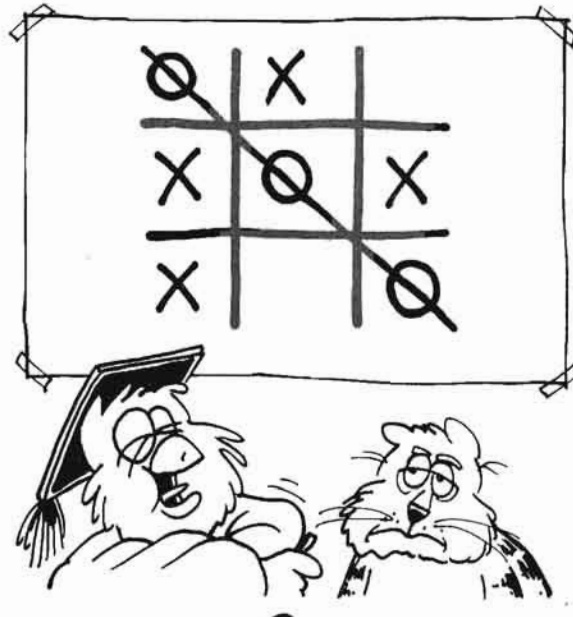
8. Ask him to find the sum of the three faceup cards.

Tell him to count that many cards down in the deck and look at the *last* card without showing you. It will be the card that you memorized.

9. Explain to your friend that you have a talking deck and that it will whisper the name of his secret card in your ear. Hold the deck up to your ear, pretend that it is whispering to you, and then tell your friend the name of his card!

The Mathemagical Secret

The value of a faceup card + the number of cards needed to count up to 10 + the card itself = 11. So three faceup cards = 3 × 11 or 33. When you add the 3 cards that were not chosen you get 36. In Step 3, the memorized card became the 36th card down from the top of the deck.



2.
GAMES FOR 2

Everybody loves to play games. They can be fun and exciting, especially if you have the advantage of knowing how to win every time! Most of the games in this chapter have a secret mathematical winning strategy that will allow you to win no matter what your opponent does.

Before you play a game against a friend, memorize the winning strategy and then play the game two or three times by yourself. With practice, you will be able to defeat the toughest opponent.

Don't play a game too many times with the same person or they might discover the winning secret. If your friend wants to keep playing, change to a different game. You will win that game too!

TRISKAIDEKAPHOBIA
(Fear of the Number 13)

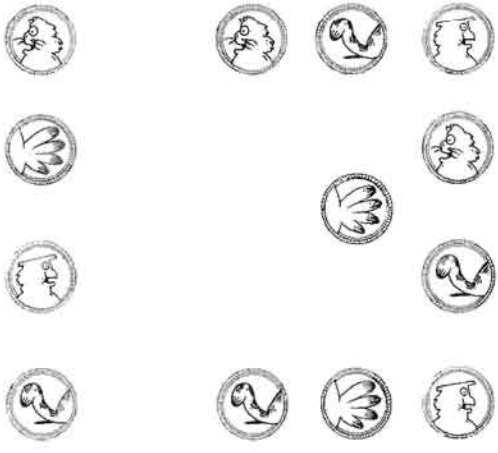
Thirteen is one of the unluckiest numbers in the world. It will be very lucky for you, however, because you will be able to force your opponent to pick up the dreaded coin number 13 every time!

Materials

13 coins

How to Play

1. Use the coins to make a figure 13 on the table.



2. Flip to see who goes first. Then each player takes turns picking up coins. A player must pick up one or two coins on each turn.

3. The player who picks up the last coin on the table loses.

Winning Strategy

Count to yourself as coins are removed. If you pick up the key coins **3**, **6**, **9**, and **12**, you will win every time. For example, your friend goes first and picks up coins 1 and 2. On your turn, you would pick up coin **3**. If your friend picks up coin 4, you would pick up coins 5 and **6**. As play continues, be sure to pick up coins **9** and **12** and your friend will be forced to pick up coin number 13!

If you go first and then your friend picks up coin **3**, don't worry. You can pick up coins **6**, **9**, and **12** and still win the game. Of course, if you want to be guaranteed of winning every time, go second!

A Variation

The number 26 (two 13's) is doubly dreaded! Start with 26 coins and see if you can figure out the new winning strategy.

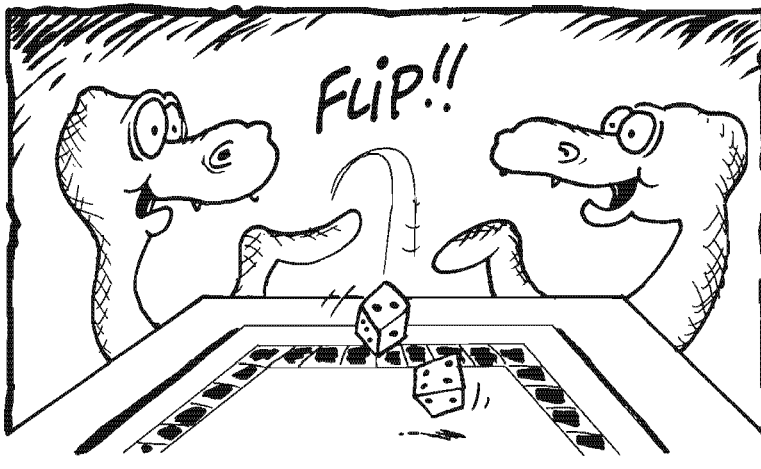
The key coins are: 1, 4, 7, 10, 13, 16, 19, 22, and 25.

RIDDLE ME

If 2's company and 3's a crowd, what's 4 and 5?

4 + 5 = 9!

SNAKE EYES



The winner is the first person to score 100 points by rolling the dice. It is not as easy as it sounds, because there is a dangerous snake waiting to steal all of your points every time you roll the dice!

Materials

A pair of dice Paper and pencil

How to Play

1. Make a score card with each player's name on a piece of paper.

2. Roll the dice to see who goes first. Then each player takes turns rolling the dice.

3. On your turn, roll the dice and find the sum of the top numbers. You can quit and write down that total or you can roll again. As you continue rolling the dice, keep a running total in your head. When you decide to quit, add that total to your score on the score card.

4. You can keep rolling as long as you want, but if a 1 comes up on one of the dice, you lose all your points for that turn. If two 1's come up (snake eyes), you lose all your points for the whole game and must start over again at 0!

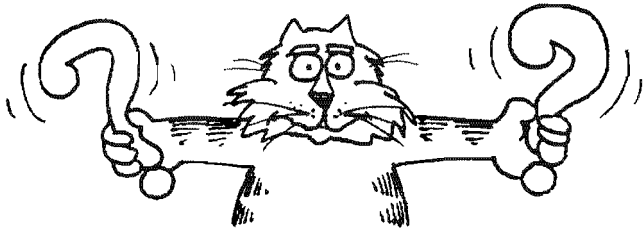
5. The first person to score 100 or more points is the winner.

Winning Strategy

The probability of getting a 1 on one of the dice is 10 out of 36. This is about one-third. The probability of getting snake eyes is 1 out of 36. Keep this in mind as you decide how many times to roll the dice on each turn.

A Variation

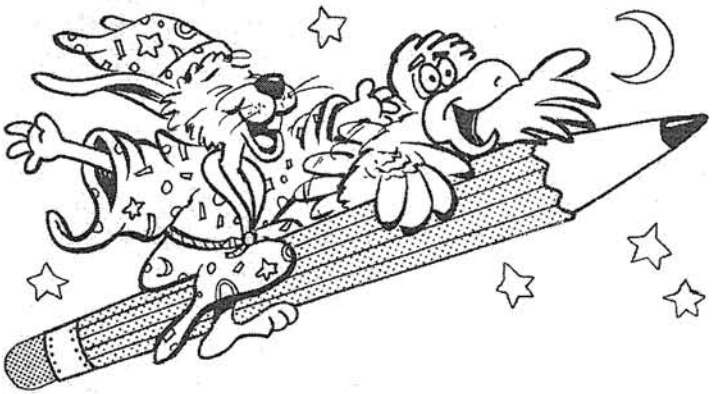
Change the winning total to 250 points and count doubles as double their sum. For example, two 6's equals 12 and double that would add 24 to your total. If a 1 comes up, you still lose your points for that turn, but you don't lose all of your points when you roll two 1's. In this game, the snake is friendly and snake eyes is worth 25 points!



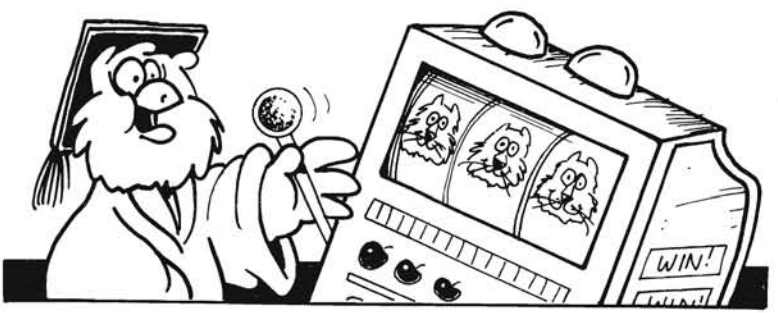
RIDDLE ME

Why was the math book so unhappy?

It had too many problems!



LAS VEGAS



Dice are rolled and cards are turned over just like in a Las Vegas gambling casino. Your odds of winning, however, are much better in this game.

Materials

A deck of playing cards 2 dice

How to Play

1. From the deck, select 22 cards—the 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack (11) and Queen (12) of Clubs and Hearts. Set the rest of the deck aside.

2. Each player picks a suit, and both lay their 11 cards face up in order in front of them.

3. Roll the dice to see who goes first. Then each player takes turns rolling the dice. On a turn, a player rolls the dice and finds the sum of the top numbers. Then he turns over his card that equals that sum. For example, if he rolls a 4 and a 3, he would turn over his 7 card.

4. He continues rolling the dice and turning over his cards. His turn continues until he rolls the number of a card that he has already turned over. For example, he rolls a 6 and 1. He has already turned his 7 card so it becomes his opponent's turn.

5. The game continues until one of the players turns over all of his or her cards.

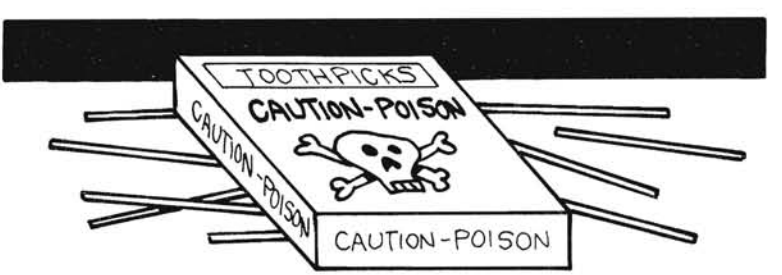
Winning Strategy

There is no winning strategy for this game, but it is a good lesson in probability. There are six different ways to get a 7, so it will come up the most. There is only one way to get a 2 (snake eyes) and there is only one way to get a 12 (boxcars), so they will come up the least.

A Variation

When all the remaining numbers are less than seven, play with only one die.

POISON TOOTHPICK



Fifteen toothpicks are lying on the table, but don't pick your teeth with any of them. One of them contains a deadly poison! That's the toothpick that your opponent will be forced to pick up!

Materials

15 toothpicks

How to Play

1. Arrange 15 toothpicks on the table as shown in the diagram.

```
   | | |
 | | | | |
| | | | | | |
```

2. You and your friend decide who goes first. Then each player takes turns removing toothpicks. You may remove as many toothpicks as you want from *any one row* on each turn.

3. The player who picks up the last toothpick loses.

Winning Strategy

Create losing patterns for your opponent. As the game progresses, leave your opponent with any of these three patterns and you will win every time!

```
|
|
|
```

a single file of toothpicks

2 equal rows of toothpicks

```
| |   | | |   | | | |   | | | | |
  or      or        or
| |   | | |   | | | |   | | | | |
```

Any combination of 1, 2, and 3 toothpicks

Examples:

```
| |   | | |   | | |
  | or |     or | |
| | |   | |       |
```

BULL'S-EYE

It's a race to see who can hit the target first by working math problems faster than their opponent.

Materials

A deck of playing cards

How to Play

1. Remove the 12 face cards from the deck and set them aside.

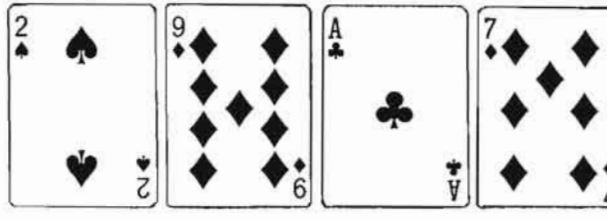
2. Shuffle the rest of the deck and deal four cards face down to each player. Turn the next card face up in the center of the table. This is the target number.

3. At the count of three, all players turn their cards over at the same time. Then they +, −, ×, or ÷ the numbers

on their cards (Aces = 1) and try to equal the target number. All four cards must be used!

Example

Target



Your Hand

$$(9 - 7) \times 2 + 1 = 5$$

4. The first player to equal the target number wins a point, and 3 points wins the game.

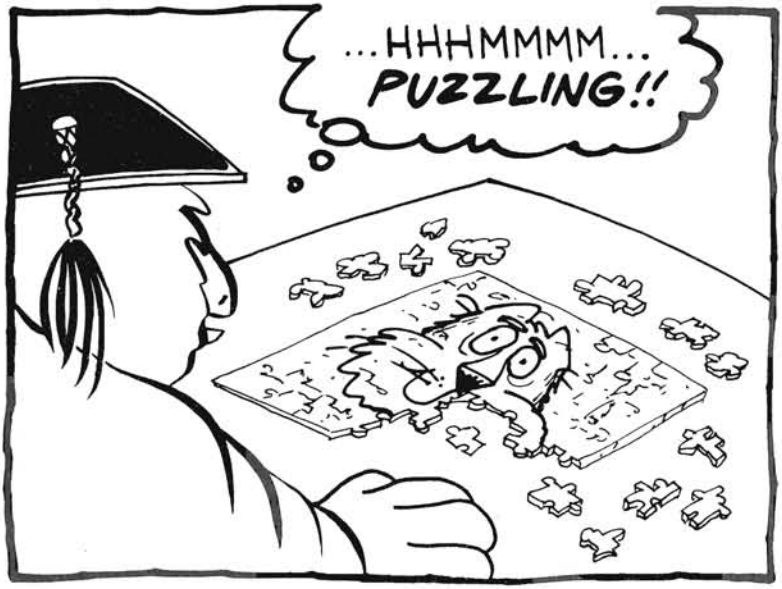
5. If no one can equal the target number, turn over another card for a new target number, or redeal.

Winning Strategy

Keep rearranging your cards until you see the right combination. Also, try to group a pair of cards together.

A Variation

If the game is too hard, put in some of the face cards. They could be wild cards and used in your hand as any number. If the four-card game is too easy, deal five cards to each player.



3.
PUZZLES

If you enjoy puzzles, this chapter is for you. There are many interesting and unusual mind benders that are fun as well as challenging. They will provide hours of pleasure for problem solvers of all abilities.

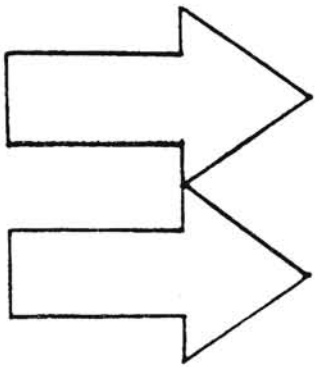
You might not be able to solve some puzzles as quickly as you think, so you must be patient. If you are having trouble getting an answer, turn the page upside down, look at the hint, and try again. Some puzzles might have more than one correct solution. So your answer might be different from the one in the back of the book and still be correct.

As soon as you find some paper, a pencil, some toothpicks, and a few coins you will be ready to solve these fascinating puzzles!

LINE BOGGLERS

TWO-WAY STREET

See if you can make a third arrow that is the same size as the other two by adding only two straight lines.



The new arrow points to the left.

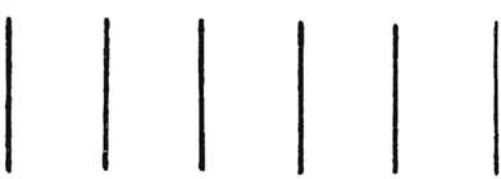
SUM TIME

Add two straight lines and divide the clock face into three parts. The sum of the numbers in each part must be the same.

The sum of the numbers in each part equals 26.

6 + 5 = 9???

Can you add five straight lines to these six and get nine?



Think about the wording: get NINE.

IN NEED OF REPAIR

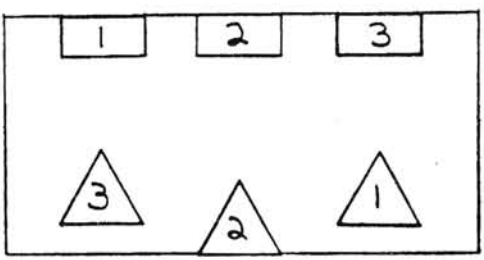
Add only one straight line to this equation so that it is correct.

$$1 + 3 + 5 = 148$$

Try adding the line to one of the plus signs.

TUNNELS

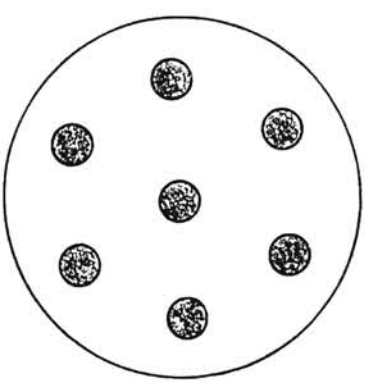
Try to connect each rectangle with the triangle that has the same number. Lines cannot cross or go outside the diagram.



Connect the two 3's with a straight line.

PEPPERONI PIZZA

Divide the pizza with three straight lines so that there is only one piece of pepperoni on each piece.

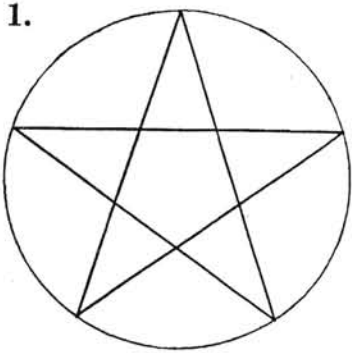


Start with a horizontal line just below the center piece of pepperoni.

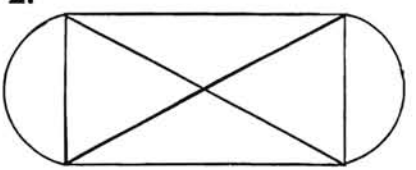
PENCIL PUZZLES

Can you draw these figures without lifting your pencil off the paper? You are not allowed to retrace any lines but you can cross over lines.

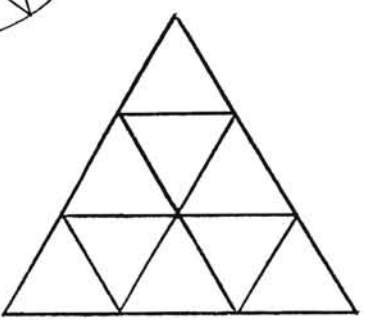
1.



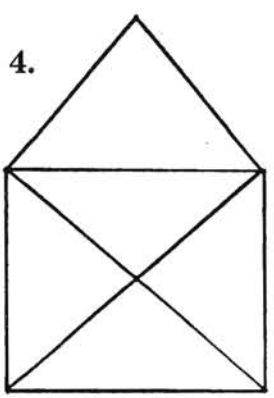
2.



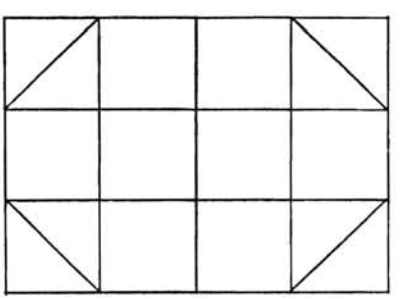
3.



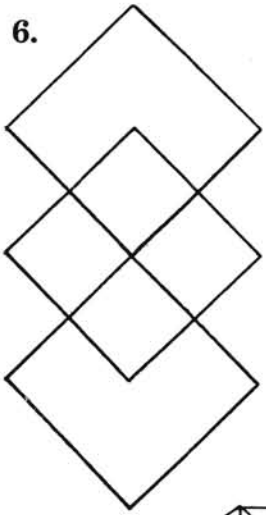
4.



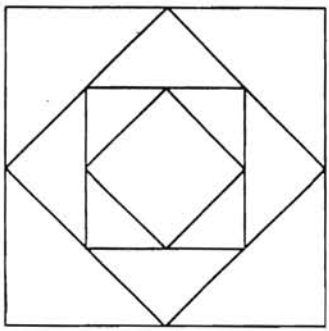
5.

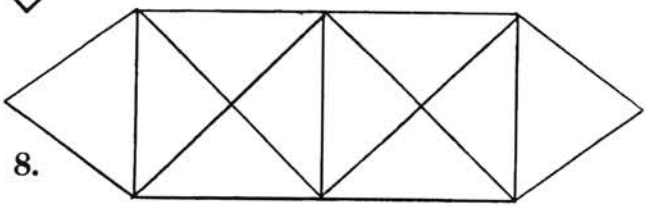


6.



7.





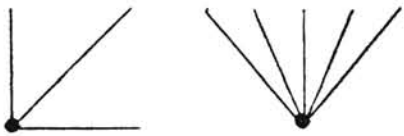
8.

The Secret

Look at the points where the lines meet. They are called vertices (pronounced ver-tis-sees). Odd vertices have an odd number of lines that meet at the point.

Examples

Odd vertices

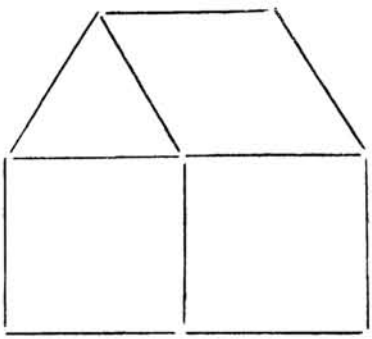


Leonard Euler (Oiler), a famous Swiss mathematician, discovered that a figure can only be traced if it has 0 or 2 odd vertices. If the figure has 0 odd vertices, start at any point and finish at that same point. If a figure has 2 odd vertices, start at one point and finish at the other.

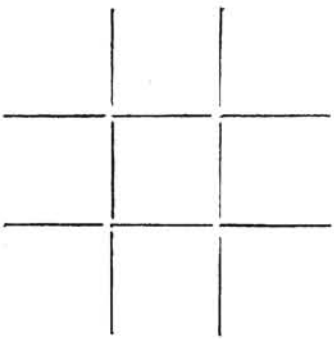
TOOTHPICK TEASERS

ARCHITECT

Build a house using 11 toothpicks as shown in the diagram. See if you can make the house face the opposite direction by moving only one toothpick.



Move one of the toothpicks in the roof.



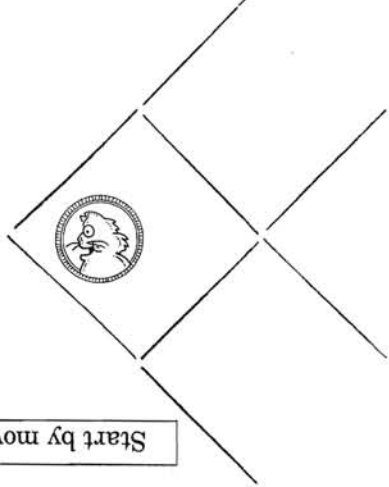
CRISSCROSS

Arrange 12 toothpicks as shown in the diagram. Can you move only three toothpicks and end up with exactly three congruent squares?

Start by moving the bottom-left toothpick.

AQUARIUM

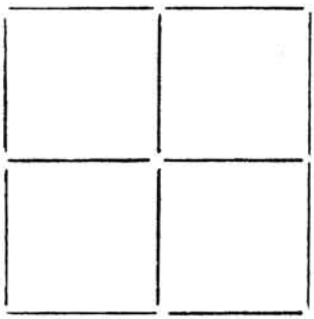
Make a fish using eight toothpicks and a coin as shown in the diagram. Move only three toothpicks and the coin so that the fish is swimming to the right.



Start by moving the bottom tail toothpick.

SQUARE DEAL

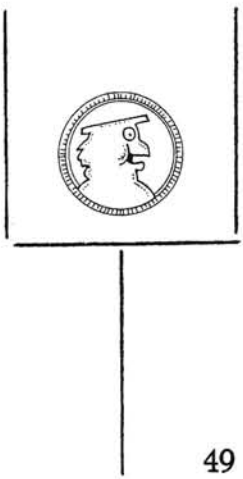
The toothpicks in this diagram have been arranged to form squares. Can you remove two of the toothpicks so that only two squares remain?



Do the squares have to be congruent?

IN AND OUT

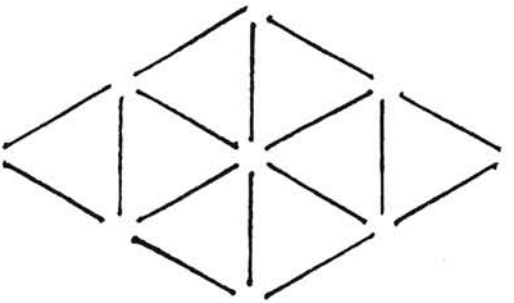
The four toothpicks in this diagram represent a wine glass with a coin inside. See if you can move two toothpicks so that the coin is *outside* the glass.



The glass will be upside down.

EQUILATERAL TRIANGLES

Arrange 16 toothpicks as shown in the diagram. Remove four toothpicks so that only four triangles remain.

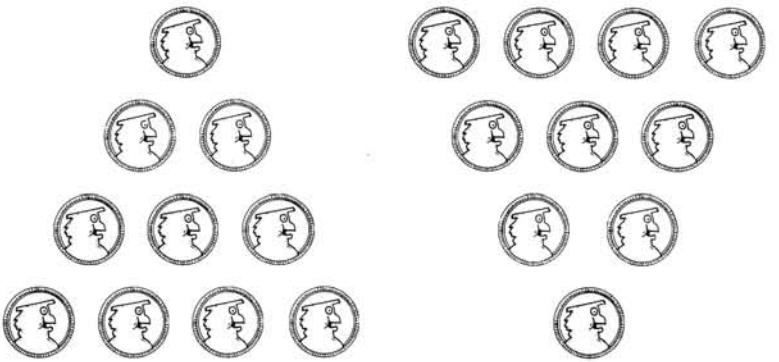


Do all the triangles have to be congruent?

COIN BAFFLERS

OVER EASY

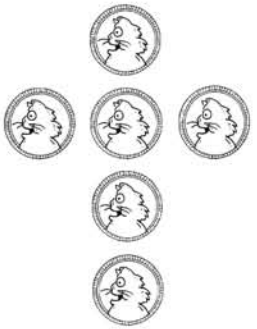
Can you make the left triangle look like the right triangle by moving only three coins?



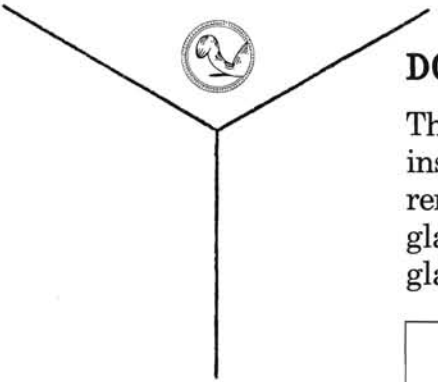
Start by moving the top coin.

FOUR ACROSS

Arrange six coins in the shape of a cross. There are four coins in one direction and three coins in the other. Try to move only one coin so that there are four coins in each direction.



Move the bottom coin.



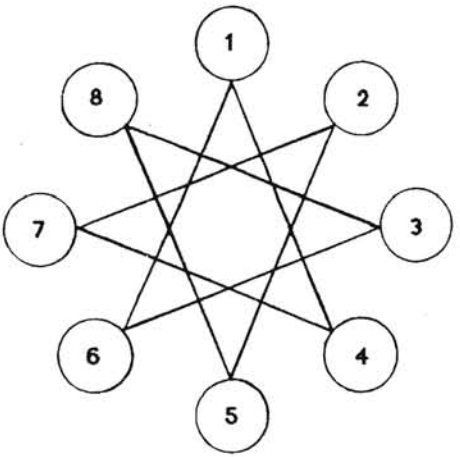
DO NOT TOUCH

This is a drawing of a coin inside a glass. Can you remove the coin from the glass without touching the glass or the coin?

Look at the glass from a different angle.

CONSTELLATION

Draw a constellation puzzle on a piece of paper. Make it much larger than the diagram so that four coins can freely move from one circle to the next. Put two like coins on circles 2 and



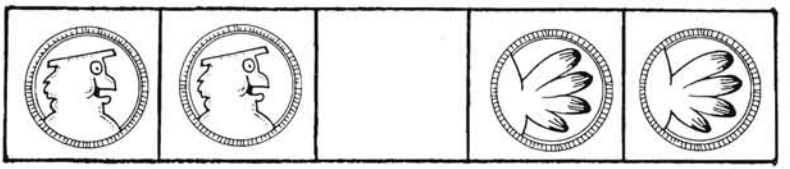
8, and put two other like coins on circles 4 and 6.

The object is to make the two top coins change places with the two bottom coins by sliding them, one at a time, along the lines from circle to circle. You can slide a coin as many times as you like, but coins can only be moved to open circles.

Start by moving 2 to 7. Then move 8 to 5 to 2.

COIN CHECKERS

Draw a coin checkers puzzle on a piece of paper. Make it large enough so that four coins can freely move from space to space. Place the four coins on the puzzle as shown in the diagram, heads on the left and tails on the right.



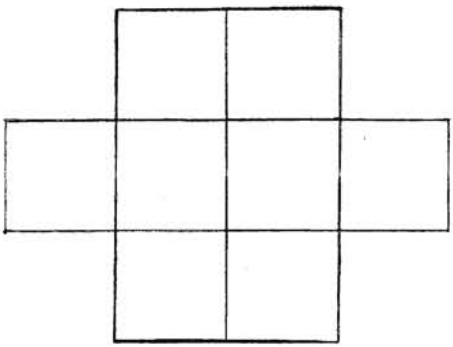
See if you can make the heads and tails change places. The moves for this puzzle are like the moves in checkers. You can slide any coin to an open space next to it, or you can jump any coin over the coin next to it into an open space. The record for this puzzle is *8 moves*. If it takes you more than 8 moves, keep trying and see if you can get it.

Start by moving a heads into the empty space and then jump it with a tails.

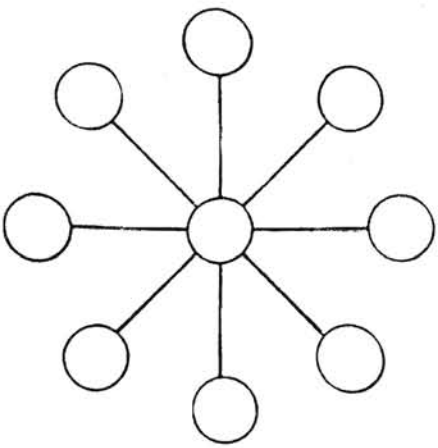
NUMBER JUGGLING

BOX SCORE

Use each of the numbers from 1 through 8. See if you can put a different number in each box so that no two consecutive numbers are touching—*not even at their corners*. For example, the box with the 5 cannot touch the box with the 4 or the 6.



Put the 1 in one of the two center boxes.



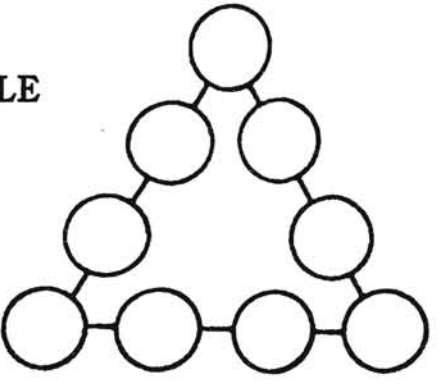
WHEEL NUMBERS

Use each of the numbers from 1 through 9. Put a different number in each circle so that the sum of each straight row of three circles is 15.

Find the center number first.

BERMUDA TRIANGLE

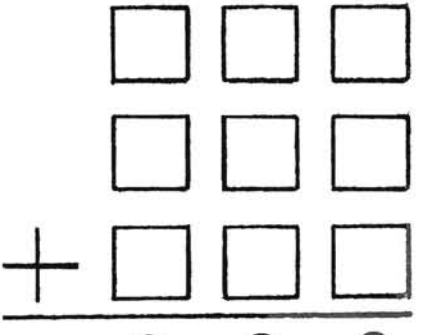
Use each of the numbers from 1 through 9. Can you put a different number in each circle so that the sum of each side of the triangle is 17?



Put the 1 in one of the corners.

TROUBLESUM

Use each of the numbers from 1 through 9. See if you can put a different number in each box so that the total is 900.



You will carry 2 each time.

RIDDLE ME

How many feet are in a yard?

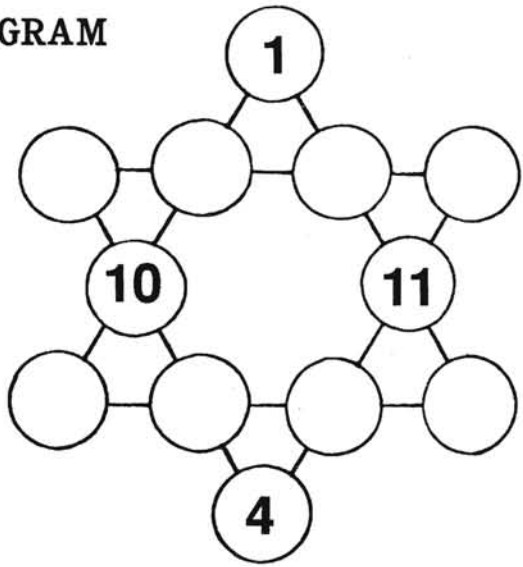
It depends on how many kids are playing in the yard at the time!

MAGIC SQUARE

Use each of the numbers from 1 through 9. Can you put a different number in each box so that the sum of each row, column, and diagonal is 15?

Find the center number first.

HEXAGRAM



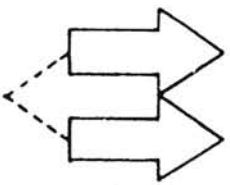
Use each of the numbers from 1 through 12. Put a different number in each circle so that the sum of each straight row of four circles is 26. Four numbers have been filled in to get you started.

ANSWERS

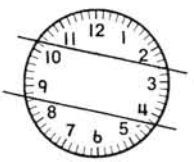
3. PUZZLES

LINE BOGGLERS

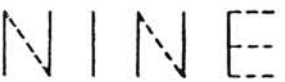
Two-way Street



Sum Time



6 + 5 = 9???



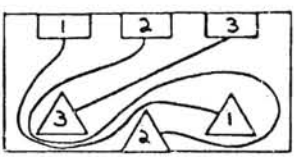
In Need of Repair

$1 + 3 + 5 = 148$

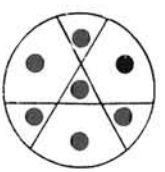
OR

$1 + 3 + 5 \neq 148$

Tunnels

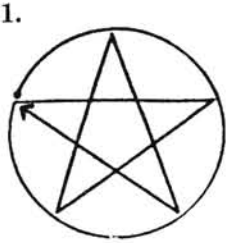


Pepperoni Pizza

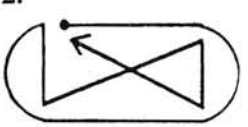


PENCIL PUZZLERS

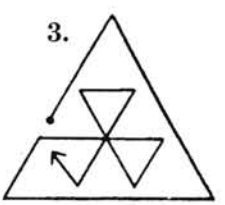
1.



2.



3.



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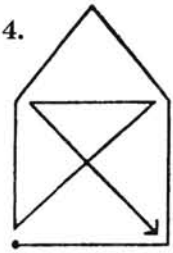

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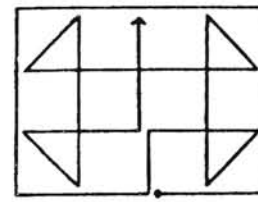

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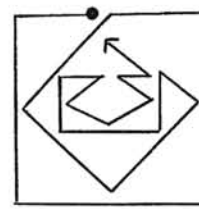
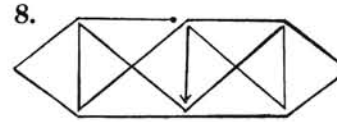
7.

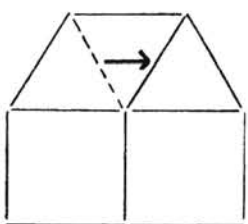


8.

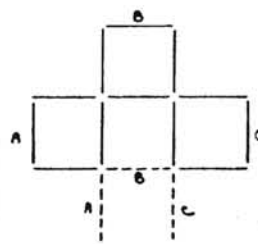


TOOTHPICK TEASERS

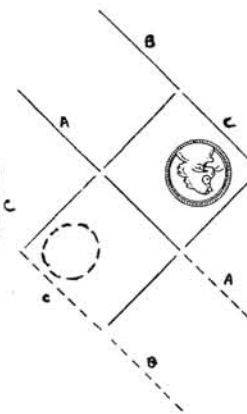
Architect



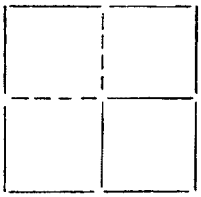
Crisscross



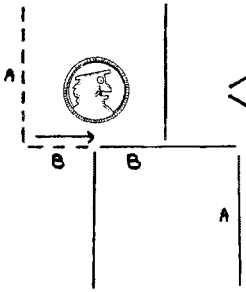
Aquarium



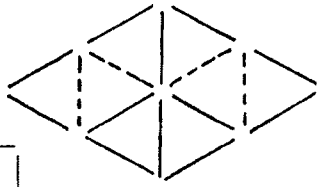
Square Deal



In and Out

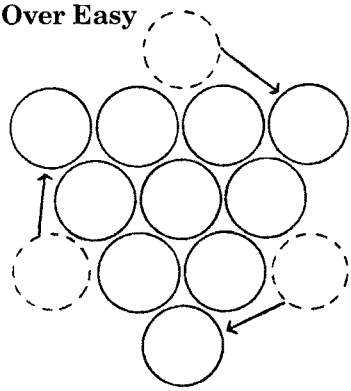


Equilateral Triangles

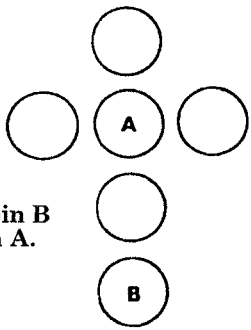


COIN BAFFLERS

Over Easy



Four Across



Place coin B on coin A.

Do Not Touch

You can remove the coin from the glass by just turning the page a third of a turn to the right.

Constellation

2 to 7
8 to 5 to 2
6 to 3 to 8 to 5
4 to 1 to 6 to 3 to 8
7 to 4 to 1 to 6
2 to 7 to 4
5 to 2

Coin Checkers

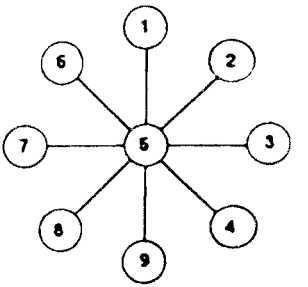
1. Slide H (heads) into empty space.
2. Jump H with a T (tails).
3. Slide T into new empty space.
4. Jump T with an H.
5. Jump other T with other H.
6. Slide T into empty space.
7. Jump H with a T.
8. Slide H just jumped into empty space.

NUMBER JUGGLING

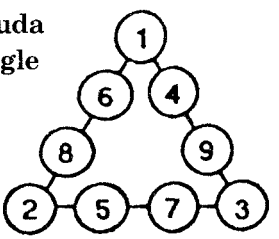
Box Score

	3	5	
7	1	8	2
	4	6	

Wheel Numbers



Bermuda Triangle



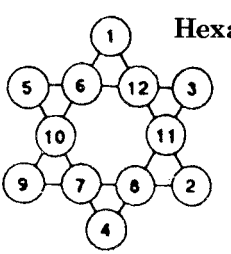
Troublesum

	4	8	9
	2	7	6
+	1	3	5
	9	0	0

Magic Square

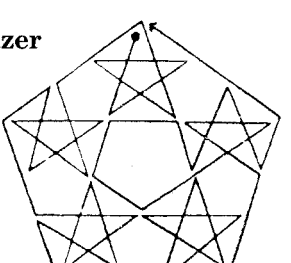
6	7	2
1	5	9
8	3	4

Hexagram



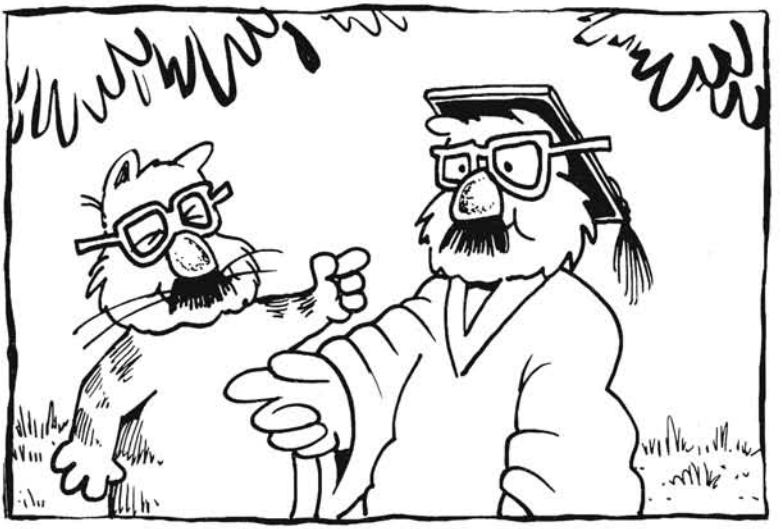
BRAIN BUSTERS

Stargazer



Box Score II

	7	4	
5	1	10	2
11	3	12	8
	9	6	



4.
FUNNY BUSINESS

Here are some silly pranks that you can use to fool your family, friends, and math teacher. These amusing tricks can be performed by themselves or used as follow-up jokes when someone asks you to repeat a card trick, an arithmetrick, or a calculator trick. Either way, they will be a lot of fun for everyone!

Try this one for starters.

MULTIPLICATION MADNESS

Did you know that $6 \times 5 = 8 \times 4$? Your friends won't believe it either, but you can prove it for them. Here's how.

$6 \times 5 = 30$ and $8 \times 4 = 32$ (it's 30 too!)

MATH WITH MUSCLE

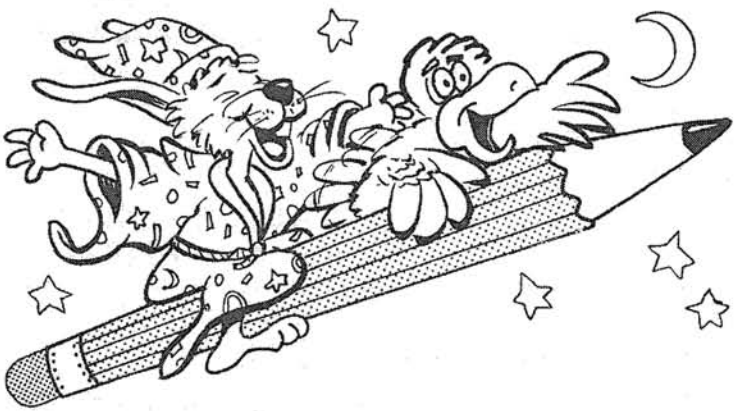
This number trick will show you how to do hundreds of situps in just a few seconds!

Materials

A watch or clock

Presentation

Tell your friends that you are going to do between "two and three hundred situps" in less than one minute. Be careful that you don't say, "between two hundred and three hundred situps"! Have a friend time you and when he says, "Go," just sit down and do five situps. After all, 5 is between 2 and 300!

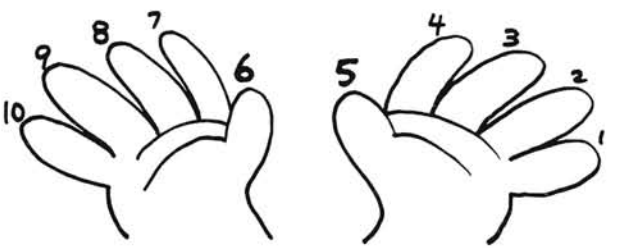


I'VE GOT 11 FINGERS!?!

Your friends will think that they have lost their minds when you prove to them that you have eleven fingers!

Hold up both of your hands in front of your friend and ask, "How many fingers do you see?" She, of course, will say, "10."

You reply, "10? Let's see." Count backwards from 10, one finger at a time, on your right hand. Then add the five fingers on your left hand and you will get a total of 11 fingers!



"10, 9, 8, 7, **6**, plus **5** on my left hand equals **11**!?!"

SIMPLE MATH

1 + 9 + 1 + 9 + 1

Give your friend exactly 30 seconds to figure out what simple operation can be performed on these numbers so that they will equal 15. Tell him that he cannot cross off or add any new numbers. It's easy. Just turn the page upside down!

LAST LAUGH

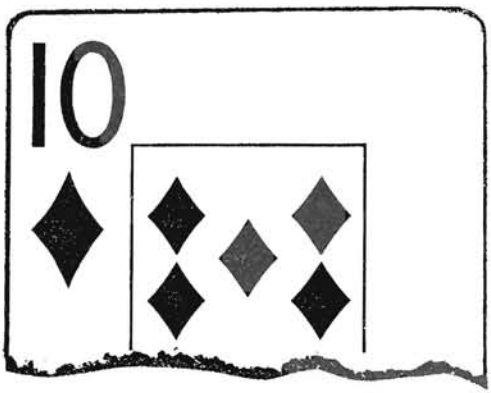
A card from a second deck is sealed in an envelope. You predict that this card will match your friend's chosen card. At the end it appears as though you have made a mistake, but you always end up getting the last laugh!

Materials

A calculator
An envelope
2 decks of playing cards

Preparation

Tear off the top half of the 10 of Diamonds from an old deck of cards so that only five of the ten diamonds are showing. Seal this card in an envelope.



Put the 5 of Diamonds in the eleventh position down from the top of the deck.

Presentation

Tell your friend that he will randomly select a card from the deck and that the card in the envelope will match his selected card.

Hand your friend the calculator and have him:

	Example
1. Enter his address or any other counting number that is easy to remember. (This number must be less than 7 digits.)	**41**
2. Multiply that number by 100.	**41 × 100 = 4100**
3. Subtract his original number from that answer.	**4100 − 41 = 4059**

4. Divide that total by his original number. **4059 ÷ 41 = 99**

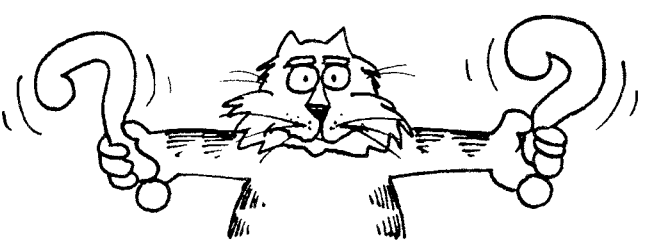
5. Divide that result by 9. **99 ÷ 9 = 11**

Finally, remind your friend that he was free to choose any number. Then ask him for his final total. Have him count down that many cards in the deck and turn over the eleventh card, the 5 of Diamonds.

Open up the envelope and slowly slide out the 10 of Diamonds, being careful not to show the missing bottom. Your friend will think that you have made a mistake. Then slide the card all the way out and have him count the diamonds. Your prediction is correct after all because there are only 5 diamonds!

The Secret

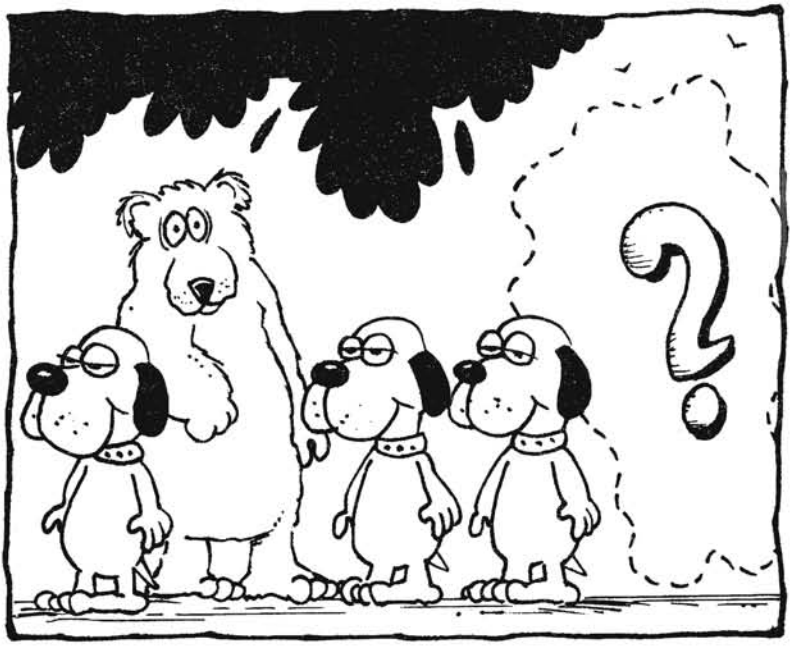
Multiplying any counting number by 100, subtracting the number, and then dividing by the number always equals 99. Finally, dividing by 9 results in 11 for the final total.



DOUBLE TROUBLE

Pick any 1- , 2- , or 3-digit number. See what happens when you multiply that number by 7, then by 11, and finally by 13. After you get the answer, clear your calculator. Then multiply 7 × 11 × 13 and you will see why it works.

QUICKLY, WHAT COMES NEXT?



What comes after 157? The answer is obviously 158. Most people would have no problem answering that question. However, when you ask your friends a simple "what comes next" question, they will get the answer wrong almost every time!

What To Do

Tell your friend that you are going to *quickly* read ten numbers. After each number, your friend is to *immediately* say the next higher number. For example, if you say "twenty-eight," your friend should say "twenty-nine."

Here is the list of numbers:

seventy-two
one hundred twenty-eight
thirteen
five
eight hundred fifty-six
two thousand eight hundred sixty-five
seven hundred eighty-one
thirty-four
five hundred seventy-three
four thousand ninety-nine

Did your friend answer "five thousand" after the last number? The next number after 4,099 is not 5,000. It is 4,100! Tell your friend not to feel too badly because most people answer incorrectly. Be sure to read this list to your family too, and see how good they are at taking a simple math quiz!

The Secret

You are not giving your friend much time to think, and it is very natural to say five thousand after you hear the number four thousand in 4,099.

Other Things To Do

What comes next in the sequence of letters below?

O, T, T, F, F, S, S, ___, ___

Check your answer in the back of the book.

Hint: The answer is as easy as 1, 2, 3!

HALF AND HALF

Hand your friend a dollar and tell her she can have it if she can fold it in half seven times by alternately folding the length in half and then the width. Don't worry about losing that dollar. No matter how hard she tries, she will not be able to make that seventh fold.

The Secret

The dollar will be half as big every time it is folded. So, after the sixth fold, it will be very small and hard to handle. Also, the number of layers doubles with every fold. After six folds, your friend will be trying to fold 64 layers of paper!

RIDICULOUS REDUCING

$\frac{1\cancel{9}}{\cancel{9}5} = \frac{1}{5}$ $\frac{1\cancel{6}}{\cancel{6}4} = \frac{1}{4}$ $\frac{2\cancel{6}}{\cancel{6}5} = \frac{2}{5}$ $\frac{4\cancel{9}}{\cancel{9}8} = \frac{4}{8} = \frac{1}{2}$

Warning: These four fractions are special cases and this ridiculous method of reducing only works for them! If you reduce the fractions on your homework this way, you will get them all wrong!

??7 × 13 = 28??

Your friends are thoroughly confused when you "prove" to them that $7 \times 13 = 28$!

Materials

Paper and pencil

Presentation

Only a number magician could prove that $7 \times 13 = 28$. Here are three different ways to prove it. If you talk fast enough, you will be able to fool your friends.

FIRST WAY—MULTIPLICATION

7 times 3 equals 21 and
7 times 1 equals 7.
$21 + 7 = 28$

So: $7 \times 13 = 28$!!

$$\begin{array}{r} 13 \\ \times\ 7 \\ \hline 21 \\ +\ 7 \\ \hline 28 \end{array}$$

SECOND WAY—DIVISION

7 does not divide into 2, but it does divide into 8 one time. Put down the 1 and subtract 7. That leaves 21. 7 divides into 21 three times.

You multiply to check division.

$$\begin{array}{r} 13 \\ 7\,\overline{)\,28} \\ \underline{7} \\ 21 \\ \underline{21} \end{array}$$

If $2\,\overline{)\,8}$ (4) then $2 \times 4 = 8$

So, if $7\,\overline{)\,28}$ (13) then $7 \times 13 = 28$!!

THIRD WAY—ADDITION

Multiplication is repeated addition so 7×13 is seven thirteens added together.

Add up the column of 3's and get 21. Then add down the column of 1's and get 7 more ($21 + 7 = 28$).

So: $7 \times 13 = 28$!!

(22)	13	*(21)*
(23)	13	*(18)*
(24)	13	*(15)*
(25)	13	*(12)*
(26)	13	*(9)*
(27)	13	*(6)*
(28)	+ 13	*(3)*
	28	

COME FORTH

Your friend will be astonished when you command his chosen card to come forth, and it rises up out of the deck!

Materials

A complete deck of 52 playing cards with no Jokers

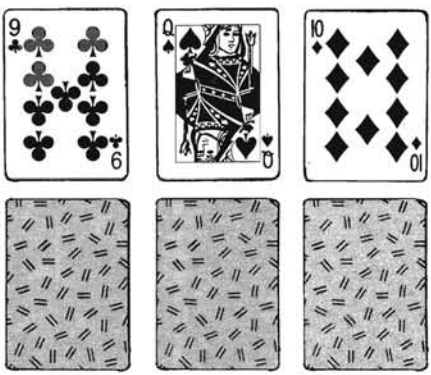
Presentation

1. Have your friend shuffle the cards as many times as he wants. When he is finished, tell him to memorize the *bottom card.* **Example: Ace of Hearts**

2. Ask him to put the deck on the table and turn over the top 3 cards.

3. Tell your friend to deal cards face down below each of these 3 cards. He should start with the number on the face-up card (Aces = 1, Jacks = 11, Queens = 12, and Kings = 13), and then keep dealing cards until he gets to 15. For example, if the face-up card is a 9, he would deal 6 more cards to get to 15.

Example



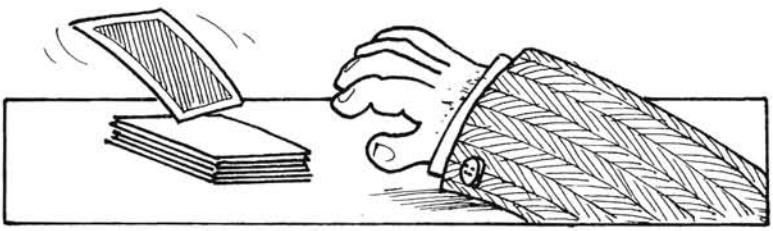
6 more cards **3 more cards** **5 more cards**

4. Ask him to keep the 3 face-up cards on the table, and then put all the face-down cards on the *bottom* of the deck.

(12)

5. Have him find the sum of the 3 face-up cards. (**9 + Q + 10 = 31**) Tell him to deal out that many cards, and then put them on the *bottom* of the deck.

6. Explain that you have supernatural powers and that you can force any card to come out of the deck on your command. Ask your friend for the name of his card so that you can command it to come out. He says, "It was the Ace of Hearts."



7. Pretend to do some hocus-pocus as you say, "Ace of Hearts, come forth!" Repeat your command, and then look pleased with the result.

8. Your friend, of course, won't see anything happen, but you insist that his card did come forth. Turn over cards off the top of the deck one at a time and say, "Here's the first card, here's the second, here's the third, and the Ace of Hearts comes FOURTH!" Turn over the fourth card and it will be your friend's card!

The Secret

Each face-up card + counting up to 15 + the value of the card = 16. So 16 × 3 face-up cards = 48. Then 48 + 4 (come fourth) = 52 cards in the deck.

5. ARITHMETRICKS

These amazing number tricks are fun to watch and even more fun to perform for others. They are easy to learn and, if you follow the steps carefully, they practically work themselves.

Practice a trick until you have successfully worked it through two or three times. Then you are ready to perform it for your friends. Be sure to work the trick *slowly* so that you don't make careless errors.

Remember, magicians never reveal their secrets. When someone asks you how you did a trick, just say, "Very well!" Also, don't repeat a trick for the same person. They might figure out how you did the trick if they see it a second time. Show them another trick instead and they will be even more amazed!

WHAT'S THE DIFFERENCE?

Your friend will be amazed when you correctly predict the answer to a subtraction problem. Then, when she works a different problem, you are able to read her mind and reveal that answer, too!

Materials

A calculator

Paper and pencil

Preparation

Secretly write a prediction (198) on a piece of paper, fold it several times, and put it aside until later.

Presentation

	Example
1. Ask your friend to write down any three-digit number whose digits are in decreasing order.	**765**
2. Then tell her to reverse this number and write it below the first number.	**– 567**
3. Finally, have her subtract the two numbers on a calculator.	**198**

The answer will always be 198!

When your prediction is opened, it matches her answer!

Example

4. Next, tell your friend to follow the same directions with any four-digit number whose digits are in decreasing order. Tell her not to show you the answer.

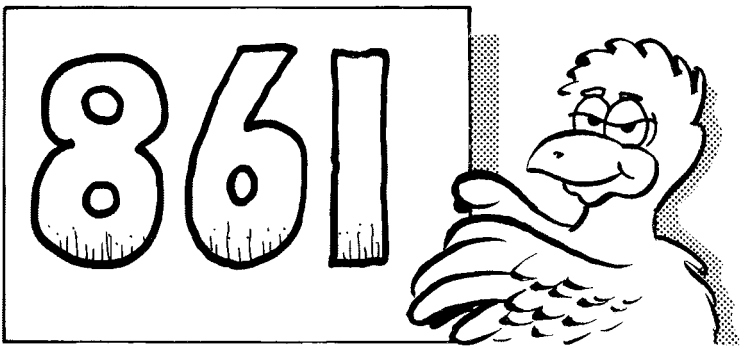
$$\begin{array}{r} 3210 \\ -\,0123 \\ \hline 3087 \end{array}$$

The answer will always be 3087!

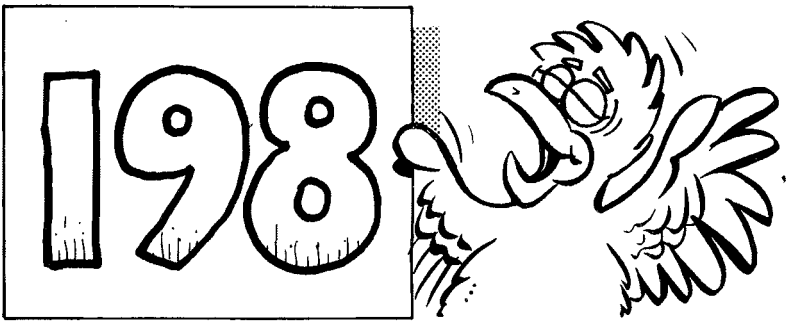
Ask your friend to concentrate on the entire answer. Pretend that you are reading her mind as you reveal that the answer is 3087!

A Variation

A humorous variation on the three-digit trick is to open your prediction upside down.



Your friend will think that you have made a mistake until you turn the answer over and it reads:



ESP

Your friends will think you have extrasensory perception when you predict the final answer to a problem before any numbers are chosen!

What You Need

Paper and pencil A calculator A ruler

Preparation

Carefully copy ESP Chart I onto a piece of paper.

ESP Chart I

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

What to Do

1. Tell your friend you're going to make a prediction. Then secretly write this on a piece of paper:

   The sum of the 4 numbers you choose will be 34!

   Fold your prediction several times and put it aside until later.

2. Hand your friend ESP Chart I and tell him to circle any number. Then tell him to cross off all other numbers in that same row and column. So he would cross off all the numbers to the left and right of his circled number and all numbers above and below it.

Example: He circles the 6.

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

3. Ask him to circle any other number that isn't already circled or crossed off. Tell him to cross off all the numbers in that same row and column as he did in Step 2.

Example: He circles the 4.

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

4. Tell him to follow these same directions until four numbers have been circled and all the other numbers have been crossed off. After he circles the 4th number, there should be no numbers left to cross off.

Example: He circles the 9 and then the 15.

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

5. Have your friend find the sum of the four numbers he circled and announce the total. This total will always be 34.

Finally, unfold your prediction and show your friend it matches his total!

The Mathemagical Secret

In any square array of consecutive numbers, the sum of the circled numbers equals the sum of the numbers in either diagonal. ESP Chart I is a 4 × 4 array, and the sum of each diagonal is 34.

Other Things to Do

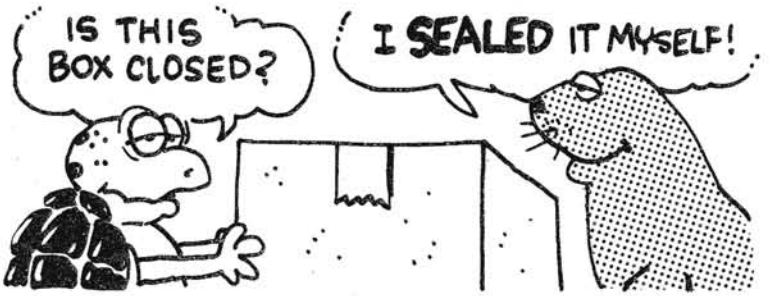
1. If your friend wants you to repeat the trick, use ESP Chart II. If you follow the same procedure and have your friend circle five numbers, the sum will always be 65. This trick works because the sum of each diagonal is 65.

ESP Chart II

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

2. Make larger charts of consecutive numbers. The sum of the circled numbers will be the sum of the numbers in either diagonal.

TOPSY-TURVY



You will amaze your friends when a randomly chosen number matches the sum of three cards that are upside down inside a sealed box!

What You Need

A deck of playing cards and its box
Paper and pencil A calculator (optional)

Preparation

Remove any three cards from a deck of cards whose sum = 18 (example: 3 of Hearts, 9 of Clubs, and 6 of Diamonds). Put the three cards *upside down* in the deck, put the deck back inside its box, and then close the lid.

What to Do

Hand your friend the box of cards and ask her to keep it until the end of the trick. Then have her:

	Example
1. Write down any 3-digit number on a piece of paper without letting you see it. Tell her all 3 digits must be different.	358

2. Reverse her number and write it next to her first number.	358 853
3. Subtract the smaller number from the larger number.	$\begin{array}{r} 853 \\ -\underline{358} \\ 495 \end{array}$
4. Mentally find the sum of the digits of her answer.	4 + 9 + 5 = 18

Finally, remind your friend that she was free to choose any 3-digit number and that the box of cards has not been touched since the trick started. Ask her for her final total and then tell her to open the box of cards. Ask her to spread the cards faceup on the table and notice three cards are upside down. Have her turn them over and find their sum. Your friend will be amazed that the sum of the three cards matches her final total!

The Mathemagical Secret

If you take any 3-digit number whose digits are all different, reverse the number, and then subtract the smaller number from the larger, the difference will always be one of the following answers: 99, 198, 297, 396, 495, 594, 693, 792, or 891. The sum of its digits will always be 18.

NUMBER SPIRITS

Your friend randomly chooses any 3-digit number, and then works a few problems on a calculator. When the Number Spirits' magic dust is rubbed on your lower arm, his final total mysteriously appears!

Materials

A calculator	Paper and pencil
Ground cinnamon	A glue stick

Preparation

Put a small amount of cinnamon or any dark spice in a small container. This is the Number Spirits' magic dust.

Write the number 1089 on the inside of your lower arm with a glue stick. The number should be invisible yet remain sticky.

Presentation	Example
1. Tell a friend to write any 3-digit number on a piece of paper without letting you see it. Tell him that the first digit must be *at least 2 greater* than the last digit.	**831**
2. Ask him to reverse the 3 digits and write this new number (138) below the first number. Have him subtract the two numbers on a calculator.	**831** **− 138** **693**
3. Tell him to reverse this difference and add this new number (396) to the calculator total.	**693** **+ 396** **1089**

4. Remind your friend that he was free to choose any 3-digit number, and then ask him for his final total. Then summon the Number Spirits. Ask them to make your friend's final total magically appear as you sprinkle their magic dust on your lower arm. Perform some hocus-pocus as you rub the magic dust around. Blow off the excess dust and, like magic, the number 1089 mysteriously appears!

The Secret

It does not matter which 3-digit number your friend starts with. If he does the arithmetic correctly, the final total will always be 1089!

MATHEMATICAL ODDITY

Which sum is greater? Don't use a calculator.

987654321		123456789
87654321		12345678
7654321		1234567
654321		123456
54321	or	12345
4321		1234
321		123
21		12
+ 1		+1

Believe it or not, they both equal 1,083,676,269!

ABRACADABRA

Magic tricks that use numbers are called mathemagic tricks. This number trick is easy to learn and fun to perform for others. You will amaze your family and friends with your supernatural powers when you mysteriously reveal the number that has been secretly chosen!

What You Will Need

5 index cards

Pencil or marker

Preparing the Trick

First, copy the following numbers onto five index cards. Write the numbers exactly as shown here:

Card 1

1	3	5	7
9	11	13	15
17	19	21	23
25	27	29	31

Card 2

2	3	6	7
10	11	14	15
18	19	22	23
26	27	30	31

Card 3

4	5	6	7
12	13	14	15
20	21	22	23
28	29	30	31

Card 4

8	9	10	11
12	13	14	15
24	25	26	27
28	29	30	31

Card 5

16	17	18	19
20	21	22	23
24	25	26	27
28	29	30	31

Next, read the directions and practice the trick by yourself. When you have successfully worked it two or three times, you are ready to perform it for others.

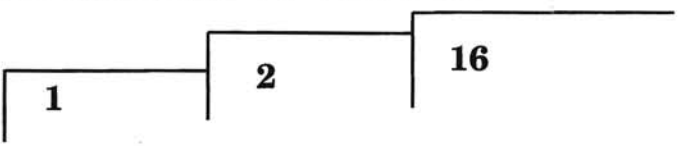
What To Do

1. Ask your friend to secretly think of a number from 1 to 31.
2. Give her the 5 index cards and ask her to hand you each card that has her secret number on it.
3. As your friend hands you each card, glance at the number in the top left-hand corner.
4. Mentally add up these numbers. Their sum will be her secret number.

5. Finally, hold these cards to your forehead, close your eyes, and pretend that the cards are speaking to you as you reveal your friend's secret number!

Example

Suppose your friend chooses 19 as the secret number. She would hand you each card that has a 19 on it. The sum of the numbers in the top left-hand corner of each card (1 + 2 + 16) is 19.



The Secret

This trick uses the binary number system that is based on the number 2. Look at the number in the top left-hand corner of each card: 1, 2, 4, 8, and 16. Each number has been multiplied by 2 to get the next number. They are called powers of 2. The rest of the numbers on each card have these powers of 2 as parts of their numbers.

For example, look at the card with the **8** in the top left-hand corner. The rest of the numbers on that card have **8** as part of their numbers:

10 = **8** + 2
13 = **8** + 4 + 1
28 = 16 + **8** + 4
31 = 16 + **8** + 4 + 2

Other Things To Do

Because the cards are numbered up to 31, you can have someone choose a secret number that is an important date, like an anniversary or a birthday.

INCREDIBLE MEMORY

Your friends are astonished when you show them you have memorized nine 9-digit numbers!

What You Need

9 index cards

Paper and pencil

Preparation

Copy these numbers onto index cards, one to each card. Circle the card numbers.

1. 774,156,178
2. 415,617,853
3. 123,583,145
4. 820,224,606
5. 538,190,998
6. 246,066,280
7. 943,707,741
8. 651,673, 033
9. 369,549,325

Example:

(8) 651,673,033

What to Do

1. Mix up the index cards so they are not in order and hand them to your friend.

2. Tell him there is a different 9-digit number written on each card and you have memorized all of the numbers. (You don't have to memorize any numbers. You just multiply to get the first two digits and then add to get the remaining seven digits.)

3. Ask him to pick any card and tell you the card number.

4. When your friend tells you the card number, mentally multiply it by 7 and then reverse your answer. The result is the first two digits of the 9-digit number.

Example: Card #8

$8 \times 7 = 56$ and 56 reversed is 65

So write down the first two digits of the number. 65

5. To get the next digit, mentally find the sum of the first two digits. If this sum is less than 10, write it down. If it is 10 or greater, only write down the number that is in the ones place.

$6 + 5 = 1\underline{1}$ 65$\underline{1}$

6. Continue adding the last two digits to get the next digit until you have written down all nine digits.

$5 + 1 = \underline{6}$	651,$\underline{6}$
$1 + 6 = \underline{7}$	651,6$\underline{7}$
$6 + 7 = 1\underline{3}$	651,67$\underline{3}$
$7 + 3 = 1\underline{0}$	651,673,$\underline{0}$
$3 + 0 = \underline{3}$	651,673,0$\underline{3}$
$0 + 3 = \underline{3}$	651,673,03$\underline{3}$

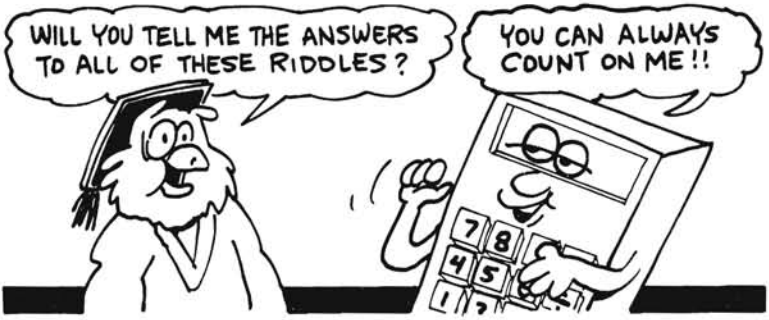
The number on card #8 is 651,673,033.

An Exception

If your friend picks card #1, $1 \times 7 = 7$, which is only one digit. So just repeat the digit 7 to get the first two digits. The number on card #1 is 774,156,178.

Other Things to Do

If you really want to impress your friends, prepare cards that have more than 9 digits.



6. CALCULATOR RIDDLES

The calculator that you own is a remarkable little machine. You've always known that it can perform mathematical calculations faster and with more accuracy than most humans, but did you know that it can also talk?

Yes, it's true! Your calculator will talk to you if you push the right buttons. For example, your calculator will tell you its name if you push clear and then *carefully* push **353 × 9 × 100 + 18 =** . Just turn your calculator *upside down*, and it will tell you!

Now that you and your calculator have been properly introduced, it's time to have some fun! Use the calculator alphabet below to help you find the answers to the math jokes and math riddles in this section. If you don't understand an answer, look at the explanation in the back of the book or just ask your calculator!

THE CALCULATOR ALPHABET

Upside-down numbers:	0	1	2	3	4	5	6	7	8	9
Letters:	O	I	Z	E	h	S	g	L	B	G

1. What is the only thing that gets larger the more you take away?

$$25{,}000 - 68 - 952 - 8{,}956 - 11{,}320 =$$

2. Which has fewer legs, a goose or no goose?

$$25.009 \div .001 + 10{,}000 =$$

3. Picture these U.S. coins: a nickel, a penny, and a dime. OK? Ellie's parents have 3 children. One is Nick and another is Penny. Who is the third?

$$.05 \div .01 \div .10 \times 3 \times 211 + 123 =$$

4. How many legs does a barbershop quartet have?

$$2 \times 2 \times 2 \times 10 \times 70 + 338 - .09 =$$

5. A pet store owner has 17 eels. All but 9 were sold. How many eels does the owner have left?

$$337.8 \times 17 - 9 =$$

6. Who weighs more, Lee the 5-foot (152 cm) butcher or Bob the 7-foot (213 cm) wrestler?

$$5 \times 7 \times 10 - 13 =$$

7. A doctor gave you three pills and said to take one every half hour. How long will the pills last?

$$3 \times .5 + 2.6 =$$

8. Which would you rather have, an old one-hundred-dollar bill or a brand-new one?

$$100 \times 77 + 118.001 - 100 =$$

9. Bob and Bill took a dividing test in school. Bob wore glasses and Bill did not. Who got a higher score on the test?

$$10 \times 10 \times 10 - 200 + 8 =$$

10. How many seconds are in a year?

$$31{,}557{,}600 \div 1{,}000{,}000 - 26.3476 =$$

11. A barrel of water weighed 100 kilograms, but after somebody put something in it, it weighed only 25 kilograms. What was put in the barrel?

$$500 \times 100 + 4{,}000 - 300 + 4 =$$

12. Bill subtracted numbers for 20 minutes, Bess multiplied them, and Leslie added them.

Who was more exhausted when they finished?

9 + 57 + 868 + 7,920 + 93,208 + 215,475 =

Who went into debt when they were finished?

17,865 − 9,438 − 607 − 95 − 7 =

Who got the most work done in 20 minutes?

.3 × 2 × 2.6 × 20 × 7.1 × 25 =

13. What number did the math teacher bring the student who fainted?

222 × .2 ÷ 2 − .2 − 20 =

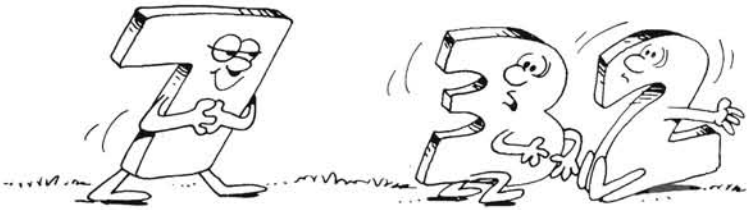
14. What is the largest number that will fit in your calculator's display?

99,999,999 ÷ 9 − 11,058,162 + 656,060 =

15. Bob says that only one month has 28 days. His boss says that there are more. Who is right?

28 × 29 × 30 + 31 − 18,882.486 =

16. What did seven do that made all the other numbers afraid of it?



$$7 \times .07 \div .7 \times 7 + 1.9 =$$

17. What number never tells the truth when it is resting?

$$223{,}314 \div 7 \div 2 \div 3 =$$

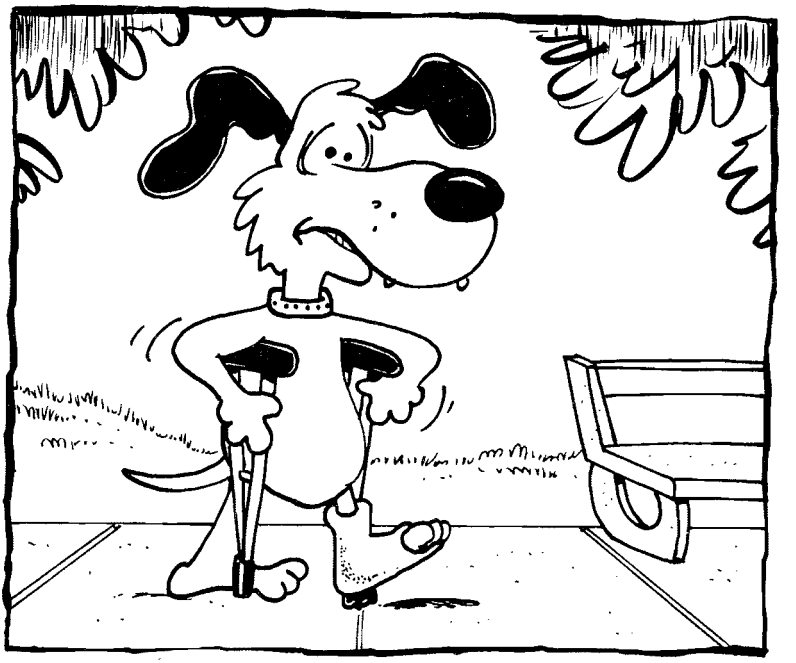
18. How much dirt is in a hole that is 5-feet deep, 2-feet wide, and 3-feet long?

$$5 \times 2 \times 3 - 30 =$$

19. Take two eggs from three eggs and what do you have?

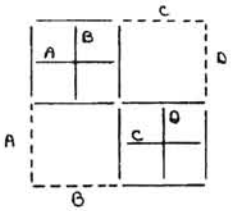
$$9{,}992 \times .2 \times 3 - 2 =$$

20. What part of a lame dog reminds you of what happens when you start adding 37 and 26?

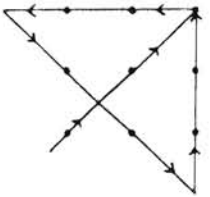


$$224 \times 25 - 25.486 + 37 + 26 =$$

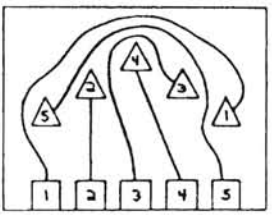
Windowpanes



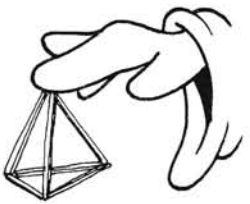
Dot to Dot



Tunnels II



Tetrahedron



6. CALCULATOR RIDDLES

1. A hole. When you take away more dirt, the hole gets larger!
2. A goose. A goose has 2 legs but no goose has 4 legs!
3. Ellie. They are her parents, so she must be one of their children!
4. 16 legs (the decimal point separates numbers and words). One of the four singers is a *ten*or and 10 + 2 + 2 + 2 = 16!
5. 9 eels, because 9 eels were *not* sold!
6. Lee, the butcher. He weighs meat all day long!
7. 1 h (hour). The third pill will be taken one hour after the first pill!
8. ($)100 bill. It is worth $99 more than the new one ($1)!

9. Bob scored higher on the math test because glasses improve di *vision*!
10. 12s (seconds). January second, February second, March second, etc.!
11. Holes, so 75 kilograms of water leaked out!
12. Leslie. She was more exhausted because of all the numbers that she had to carry!
    Bill, because of all of the borrowing that he had to do!
    Bess, because she was so *product*ive!
13. 2. The math teacher brought the student to!
14. A googol. It has 101 digits!
15. His boss is right. *All* of the months have at least 28 days!
16. 8.9 (seven ate nine)!
17. The number 5,317. It *lies* when it is resting on its back!
18. 0. No matter how you turn the calculator, there is no dirt in a hole!
19. 2 eggs. You *took* 2 eggs so you *have* 2 eggs!
20. His legs, because he puts down 3 and carries 1!

7. WORDLES

1. seventeen (7 TEEN)
2. rounding up
3. circle graph
4. triangle (3 ANGLES)
5. long division
6. estimating (S TIMATING)
7. times table
8. number line
9. percent (PER cent)
10. odd ball
11. Oh gross! (144 = a gross)
12. reduced to lowest terms
13. sequence (C QUENCE)
14. positive integer (POSITIVE in TEGER)
15. counting backwards
16. rectangle (wrecked angle)
17. exponent (X PONENT)
18. 10% interest (10% in TEREST)

WEAR
LONG

7.
WORDLES

Above is an example of a wordle. Wordles are fun puzzles that represent a familiar word or phrase. Notice that the word LONG is under the word WEAR, so this wordle is "Long Underwear!"

Here is another example:

HOROBOD

Notice that there are two words mixed together. The word ROB is in the word HOOD so this wordle is "Robin Hood!"

Now that you know how to solve wordles, you are ready to start. Each wordle in this section represents a common math word or math phrase. Have fun solving each puzzle, and then check in the back of the book to see if you are right. And, once you know the answers, add to your fun by sharing the wordles with your family and friends!

1.

```
77777 7777 7777 7   7
  7   7    7    77  7
  7   77   77   7 7 7
  7   7    7    7  77
  7   7777 7777 7   7
```

2.

g
n
i
d
n
u
o
r

3.

G

H R

P A

4.

angle
angle
angle

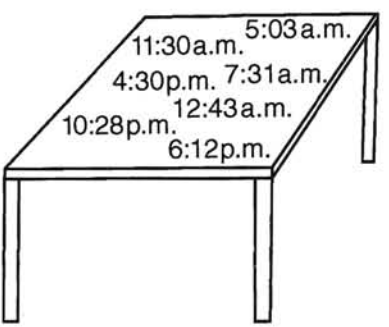
5.

DIVISION

6.

IT
M
A
T
I
G N

7.



8.

NUMBERNUMBERNUMBERNUMBER

9.

PER PER PER PER PER PER PER PER PER PER PER PER PER PER PER PER

10.

1 43 37 5 25 81 11 63 9 55 31 13 17 75 41 29 19 3

11.

0-144

12.

TERMS
TERMS
TERMS
TERMS
TERMS

13.

E U Q
N C E

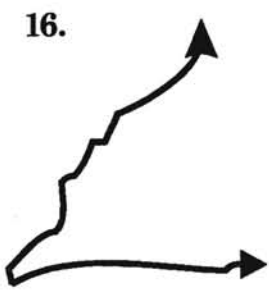
14.

TPOESIGTIEVER

15.

GNITNUOC

16.



17.

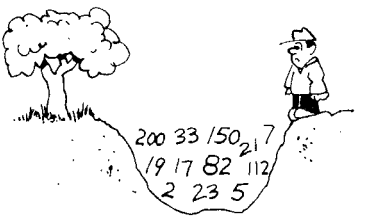
P T
O N
N E
N E
O N
P T

18. **TER10%EST**

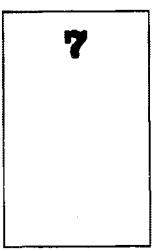
19.

```
Q QUAL
U
 QUAL
A
L QUAL
```

20.



21.



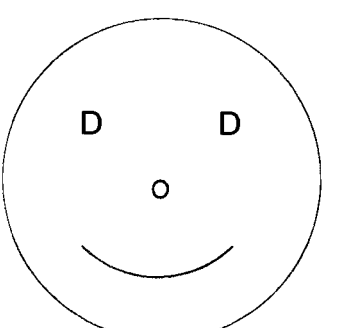
22.

```
 D DD   DDD     DDDDD  DDDDD  DDDD
D    D  D   D   D      D      D
D       D    D  D      DDDDD  DDDD
D   DD  DD D    DDDDD  D           D
D    D  D    D  D      D           D
D    D  D     D D      D           D
DDDD    D      D DDDDD DDDDD  DDDD
```

23.

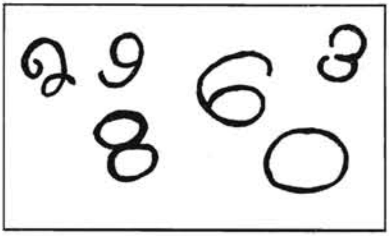
```
      D
R        I
     PERP   C
A
      L   U
```

24.



25. “DECIMAL” “DECIMAL” “DECIMAL”

26.



27.

one another
one another
one another
one another
one another
one another

28.

allel lines allel lines

29.

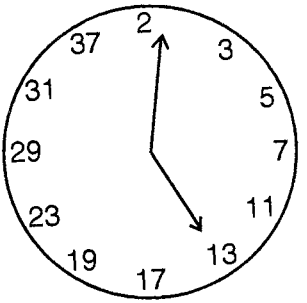
4 4 4 4 4 4 4
4
4
4
4

30.

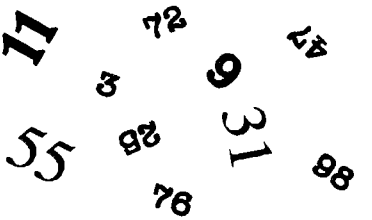
31.

zzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzz

32.



33.



34.

0
10°
87°
46°

35.

R O
T O

36. HEIFAIRGHT

37.

PLY PLY PLY PLY PLY
PLY PLY PLY PLY PLY
PLY PLYPLY PLY PLY
PLY PLY PLY PLY PLY
PLY PLY PLY PLYPLY
PLY PLY PLY PLY PLY
PLY PLY PLY PLY PLY

38.

SECT SECT

9. Bob scored higher on the math test because glasses improve di *vision*!
10. 12s (seconds). January second, February second, March second, etc.!
11. Holes, so 75 kilograms of water leaked out!
12. Leslie. She was more exhausted because of all the numbers that she had to carry!
    Bill, because of all of the borrowing that he had to do!
    Bess, because she was so *product*ive!
13. 2. The math teacher brought the student to!
14. A googol. It has 101 digits!
15. His boss is right. *All* of the months have at least 28 days!
16. 8.9 (seven ate nine)!
17. The number 5,317. It *lies* when it is resting on its back!
18. 0. No matter how you turn the calculator, there is no dirt in a hole!
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20. His legs, because he puts down 3 and carries 1!

7. WORDLES

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3. circle graph
4. triangle (3 ANGLES)
5. long division
6. estimating (S TIMATING)
7. times table
8. number line
9. percent (PER cent)
10. odd ball
11. Oh gross! (144 = a gross)
12. reduced to lowest terms
13. sequence (C QUENCE)
14. positive integer (POSITIVE in TEGER)
15. counting backwards
16. rectangle (wrecked angle)
17. exponent (X PONENT)
18. 10% interest (10% in TEREST)

19. equal (E QUAL)
20. whole numbers (hole numbers)
21. Seven Up
22. degrees (D GREES)
23. perpendicular (PERP in DICULAR)
24. division (D vision)
25. repeating decimal
26. rounded numbers
27. six of one, half a dozen of another
28. parallel lines (pair ALLEL LINES)
29. forty (4 T)
30. one in a million
31. zero (Z row)
32. prime time
33. mixed numbers
34. three degrees below zero
35. square root
36. Fahrenheit (FAIR in HEIGHT)
37. multiply (multi PLY)
38. bisect (bi SECT)

8. BRAINTEASERS

1. Bottoms Up

1. Turn over glass 1 and glass 2.
2. Turn over glass 1 and glass 3.
3. Turn over glass 1 and glass 2.

See if you can find another solution.

2. Checkmate

The two friends were not playing each other. Each one was playing another friend.

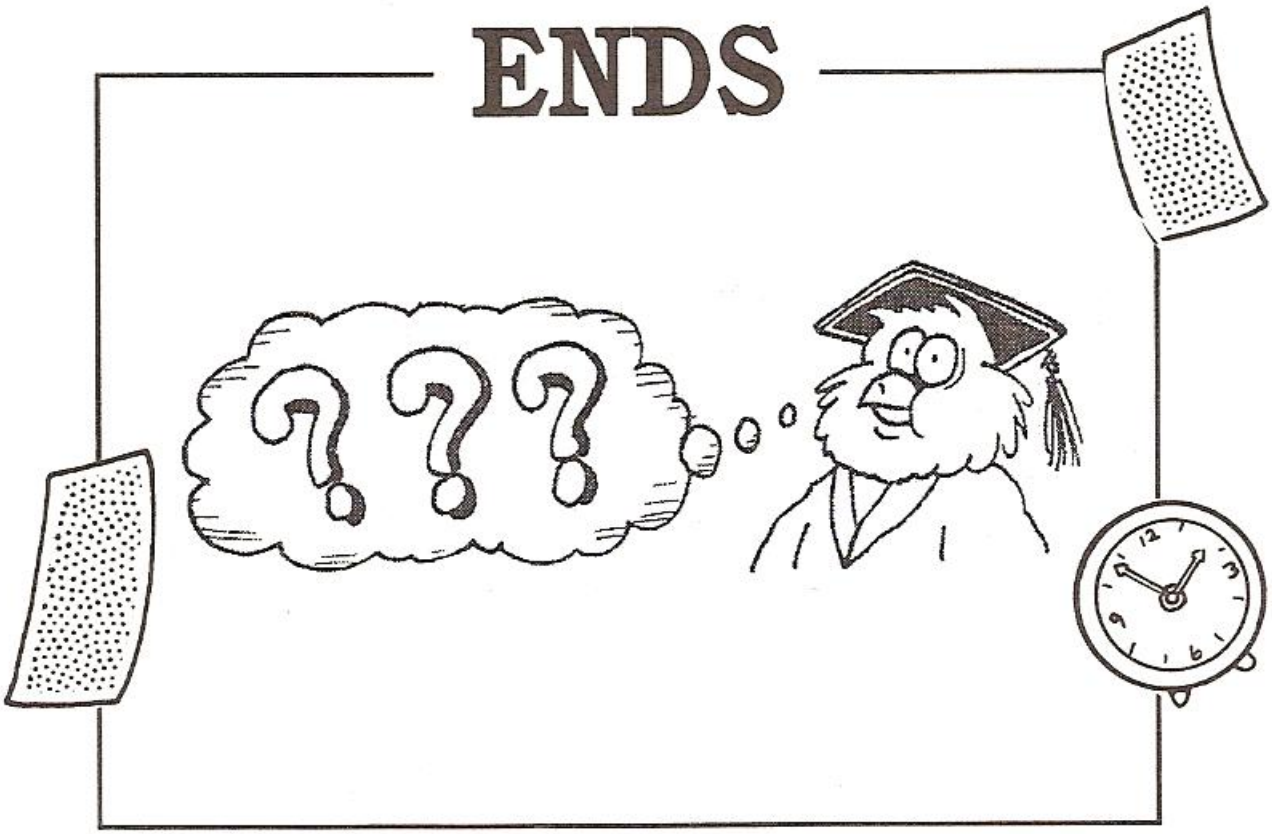
3. On Edge

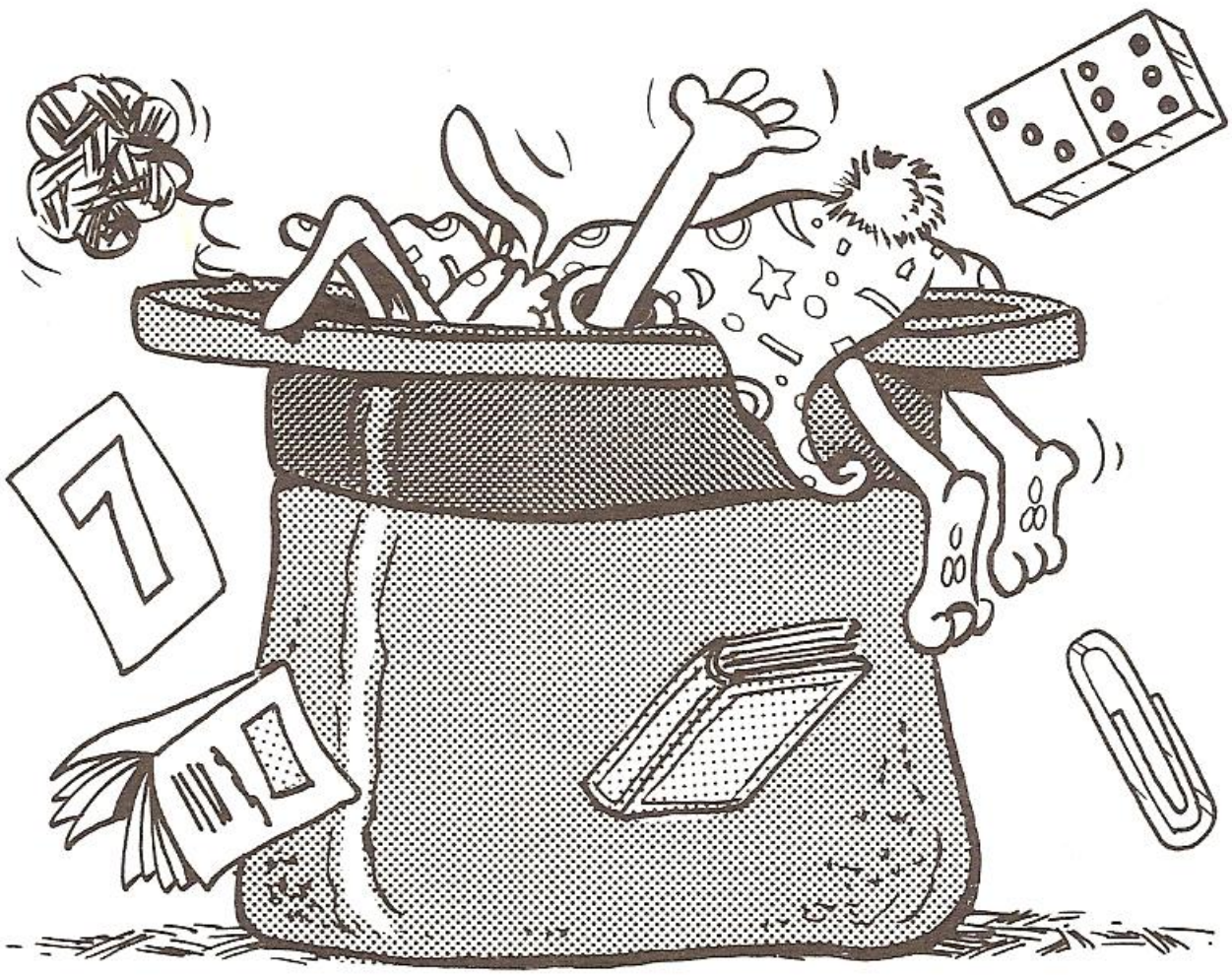
Before you drop the toothpick, make a right angle by folding it in the middle.

4. Killer

Run in a circular pattern just out of reach of the dog. Since he follows your every move, he will wind his chain tighter and tighter around the tree. When he runs out of chain, walk over and safely pick up your basketball.

8. ODDS AND ENDS





INFINITY

A piece of paper has exactly two sides—a front side and a back side. It's impossible to create a piece of paper that has only one side. Or is it? Actually, it's easy when you know the mathemagical secret!

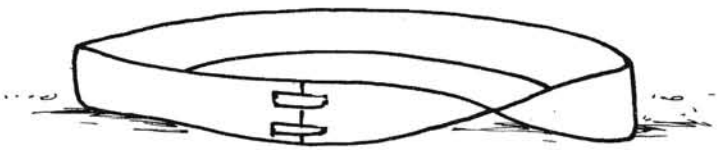
What You Need

An 8½ in × 11 in (21.5cm × 28cm) sheet of plain paper

A pair of scissors
A pencil
Cellophane tape

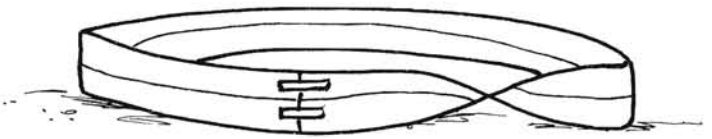
Preparation

1. Cut a strip of paper that is about one inch (2.5cm) wide from the longest edge of a plain piece of paper.
2. Give the strip a *half twist* and then tape the two ends together.



What to Do

1. Hold the strip of paper in one hand and start drawing a line straight down the middle.
2. Continue drawing the line until you get back to where you started.



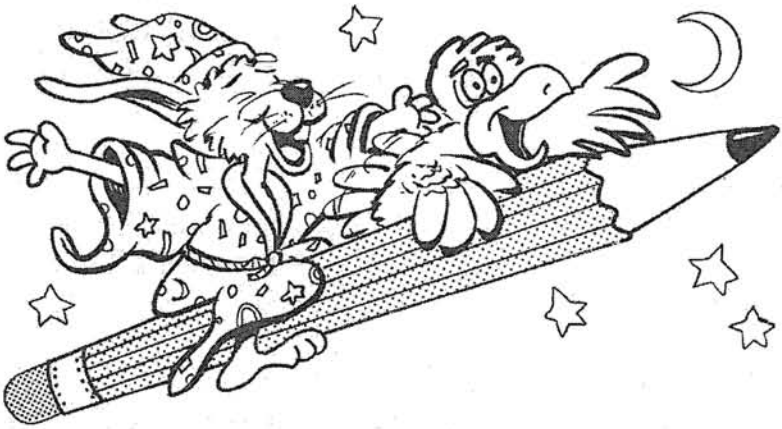
Now look at the strip of paper. Notice you drew one continuous line all the way around the paper, and you never crossed over an edge. On a piece of paper that has two sides, you would have to cross over an edge to draw one continuous line from one side to the other. Therefore, this strip of paper only has only one side!

The Mathemagical Secret

This trick uses a kind of mathematics called topology. Topology is the study of shapes and what happens to those shapes when they are folded, pulled, bent, or stretched out of shape. The strip of paper is called a Möbius Strip, and it is named after August Ferdinand Möbius, a 19th-century German mathematician and astronomer. The twist in the strip of paper connects what was once the front side to the back side so there is only one big surface.

Other Things to Do

Cut the strip of paper along your pencil mark until you get back to where you started. If you cut carefully, you will end up with one large circle.



MAGICAL LINKING PAPER CLIPS

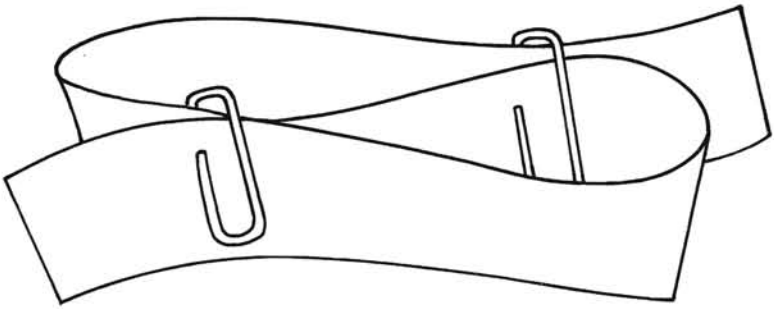
Two paper clips are magically joined together without anyone touching them. And, when a rubber band is added, all three become linked together by some mysterious mathematical force!

Materials

4 paper clips
A 3-inch (7.5 cm) rubber band
A strip of paper—3 × 11 inches (7.5cm × 27.5 cm)

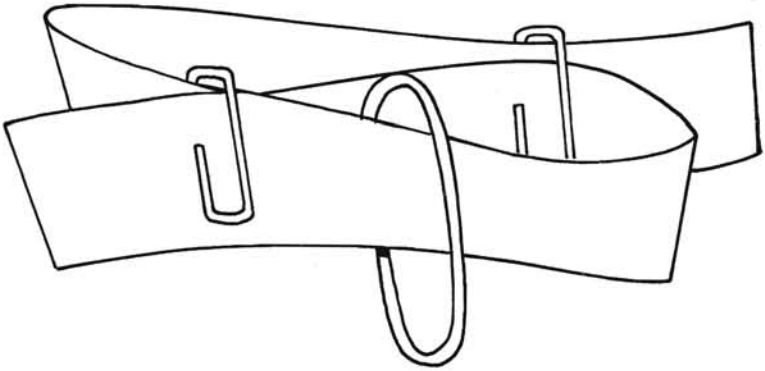
Presentation

Curve a strip of paper into an S-shape. Then attach two paper clips so that it looks like this:

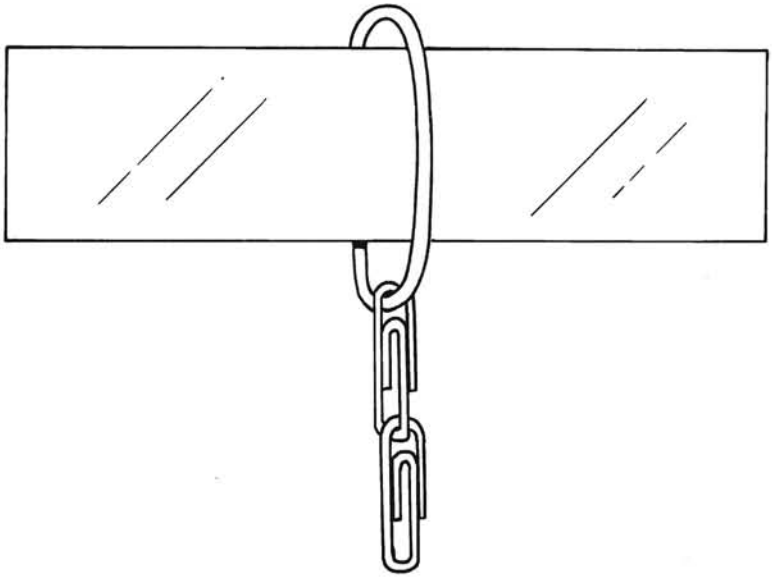


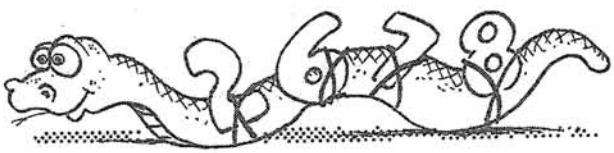
Slowly pull the ends of the paper apart in the direction of the arrows. When the two paper clips are almost touching, pull harder and they will magically join together!

Next, loop a rubber band around the strip of paper before attaching two more paper clips so that it looks like this:



When you pull the ends of the strip of paper apart, the paper clips will be linked together and hanging from the rubber band, which is still attached to the strip of paper!





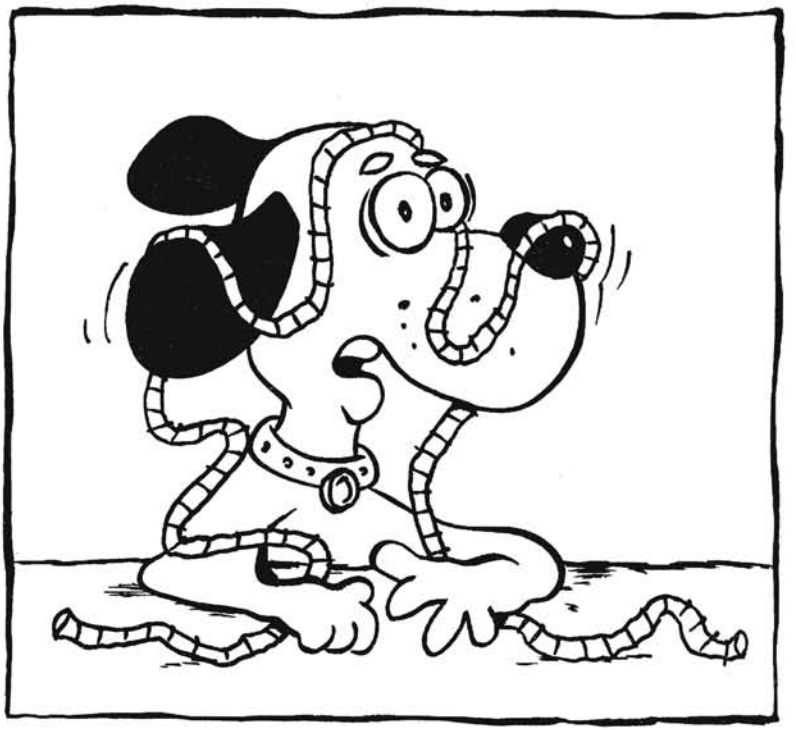
Variations

Attach two paper clips on each side of the strip of Paper and you end up with four paper clips joined together. Try other variations and see what happens.

The Mathemagical Secret

This trick uses a kind of mathematics called topology. Topology is the study of shapes and what happens when they are folded, pulled, bent or stretched.

IMPOSSIBLE KNOT



Can you pick up one end of a piece of rope in each hand and tie a knot in the rope *without letting go of the ends*? Impossible! Or is it? Actually it is easy to do, but first you have to know the mathemagical secret!

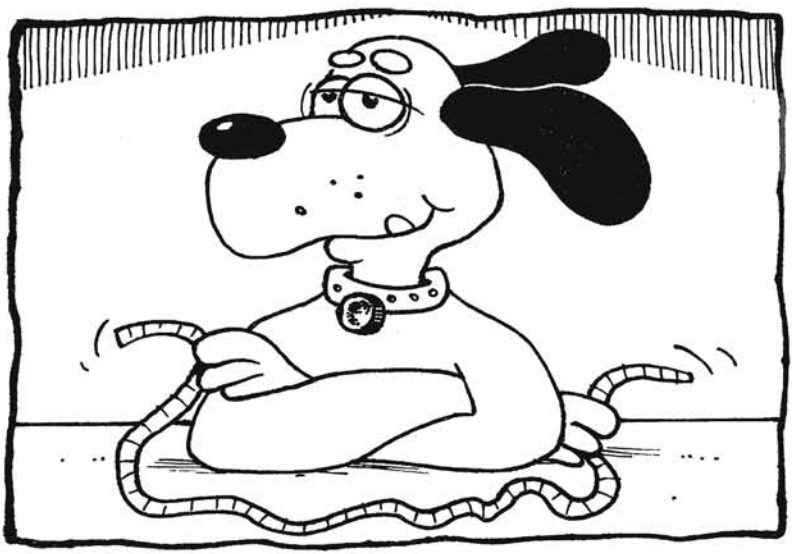
What You Will Need

A long piece of string, cord, or rope
(about 30 in/75 cm)

What To Do

1. Place the piece of rope on a table.

2. Tie a knot in your arms by crossing them.
3. Bend over the piece of rope and pick up one end of the rope in each hand.



4. Straighten up and carefully uncross your arms without letting go of the ends. The knot that was in your arms has been transferred to the piece of rope!

The Secret

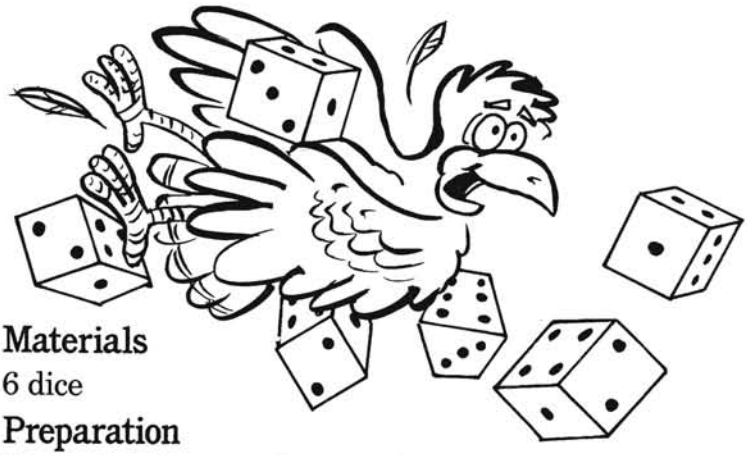
This trick uses a special kind of mathematics called topology. Topology is the study of shapes and what happens to those shapes when they are folded, pulled, bent, or stretched out of shape. Topology also helps us perform amazing tricks that appear to be impossible!

Other Things To Do

Try this topological trick on your family and friends. Wait until they get themselves all tied up in knots before you show them the mathemagical secret.

X-RAY VISION

You throw 6 dice on the table. Before your friend can add the top numbers, you are able to add those numbers *plus* the bottom numbers that no one can see!



Materials

6 dice

Preparation

Memorize these multiples of 7:

$1 \times 7 = 7$	$6 \times 7 = 42$
$2 \times 7 = 14$	$7 \times 7 = 49$
$3 \times 7 = 21$	$8 \times 7 = 56$
$4 \times 7 = 28$	$9 \times 7 = 63$
$5 \times 7 = 35$	$10 \times 7 = 70$

Presentation

1. Tell your friend that you are going to have a contest to see who can add faster. Say that you are going to throw six dice on the table and that she should add the top numbers. Explain that you will add those numbers *plus* the hidden bottom numbers before she gets her answer.

2. Throw six dice on the table, wait two or three seconds as you pretend to add the top numbers, and then say "42!"

3. Check to see if you're correct by slowly adding the top numbers. Then carefully flip over the dice and add the bottom numbers. The total will be 42! Your friend will think that you have X-ray vision!

How to Do It

On any die, the top number plus the bottom number equals seven. So, if six dice are thrown, the total of all the tops and bottoms is:

$$\underset{\text{dice}}{6} \times 7 = \underset{\text{total}}{42}$$

Variations

When you repeat the trick use a different number of dice, so that you get a different total. The total will equal the number of dice × 7.

Example: 8 dice $\quad \underset{\text{dice}}{8} \times 7 = \underset{\text{total}}{56}$

HAND CALCULATOR

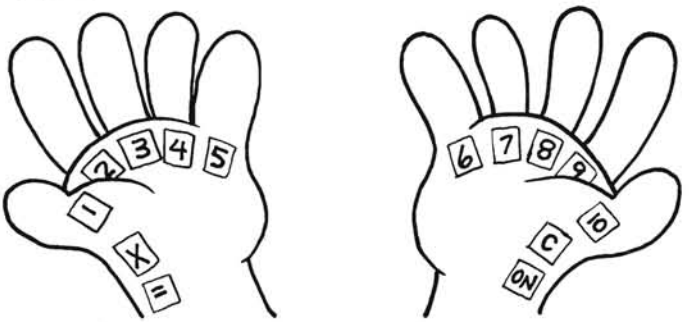
Your friends are amazed when you magically transform your hands into a calculator and multiply on your fingers!

Materials

Pen

Preparation

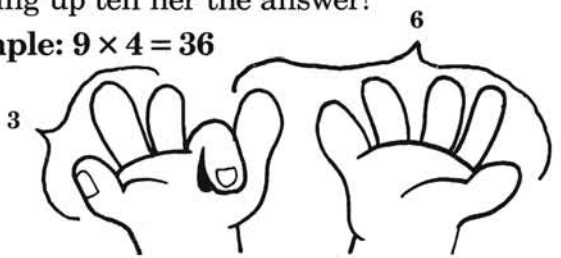
Draw these calculator keys on your palms with a ball-point pen.



Presentation

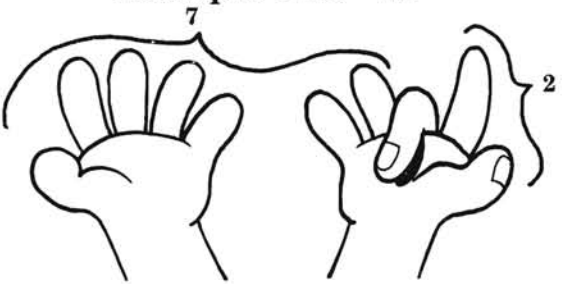
Tell your friend that she can multiply *by 9* on your hands just as she would on a regular calculator. After she enters the numbers and pushes [=], just bend over the finger that is multiplied by 9. The fingers that are standing up tell her the answer!

Example: 9 × 4 = 36



Bend over finger #4

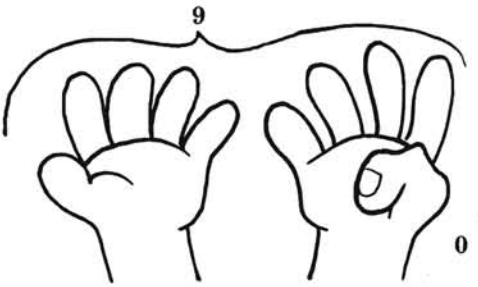
Example: $9 \times 8 = 72$



Bend over finger #8

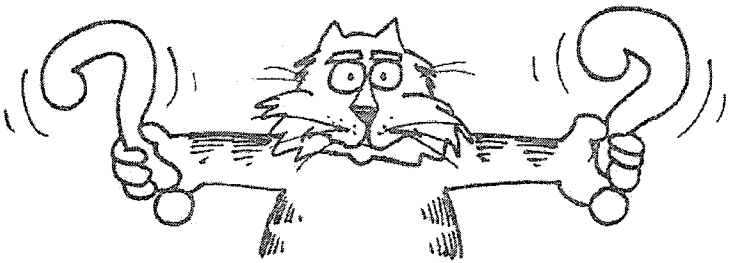
An Exception

Example: $9 \times 10 = 90$



Bend over finger #10

9 fingers on the left and 0 fingers on the right = 90.



2 HALVES = 1 HOLE

You show your friend how to cut a large band of paper into 2 separate loops. This is very easy to do, but when your friend tries, she ends up with something entirely different!

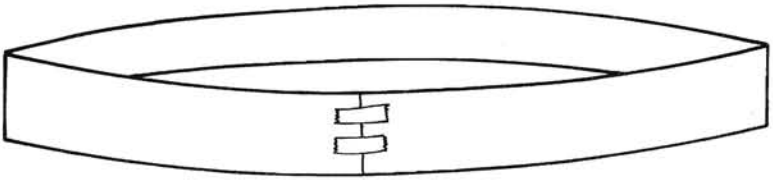
Materials

A pair of scissors
A newspaper
Cellophane tape

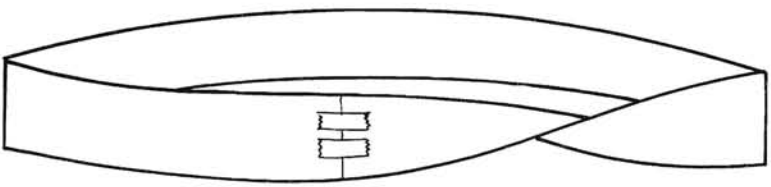
Preparation

Cut out four-inch-wide strips of newspaper. Tape them together to make two seven-foot strips.

Take one of the seven-foot strips of paper and tape the ends together to make one large band.

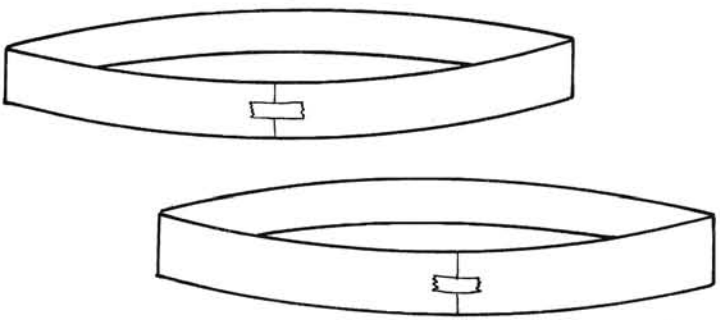


Do the same with the second seven-foot strip, but give one end of the strip a half twist before taping the ends together.



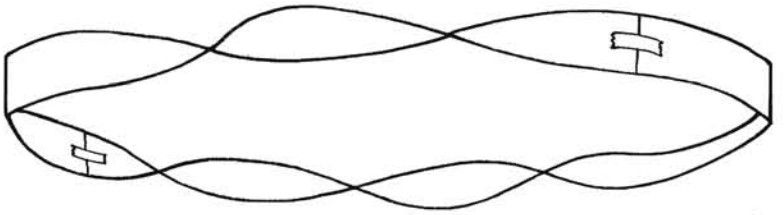
Presentation

Show your friend how easy it is to cut a band of paper into two separate loops. Use the band that does not have the half twist. Carefully cut straight down the middle until you get back to where you started and you will end up with two separate pieces.



Give your friend the pair of scissors and the band with the half twist. She won't notice the half twist if you lay the band in a small pile on a table in front of her. Tell her

to carefully cut straight down the middle until she ends up with two separate loops. It looked so easy when you did it, but she won't be as lucky. It's impossible to cut this band into two separate pieces. A band with a half twist actually has only one side, so it stays in one piece when cut in half. She'll end up with a giant 14-foot loop!



Variations

Here are some other tricks that you can try by yourself. Use shorter strips of paper that are about three inches by 28 inches.

1. Give one end of a strip of paper *two* half twists (1 full twist) before taping the ends together. Cut straight down the middle of the band until you get back to where you started. If you cut carefully, you will end up with 2 loops!

2. Give one end of a strip of paper a half twist before taping the ends together. Instead of cutting down the middle as before, cut one inch in from the right edge of the band. Keep cutting until you go around the band *twice* and get back to where you started. You will end up with two loops again, but the result will surprise you!

3. Experiment with more twists and different cuts and see what happens. What do you think would happen if you cut your friend's 14-foot loop straight down the middle? Try it and see!

The Mathemagical Secret

Same as Magical Linking Paper Clips.

UNBELIEVABLE MAGIC

This is an unbelievable magic trick that you can perform for your family and friends. It is an easy trick to learn and it will leave everyone completely baffled.

What You Will Need

A flat washer with a diameter of at least 1⅜ in (3.5 cm) with a large hole in the center

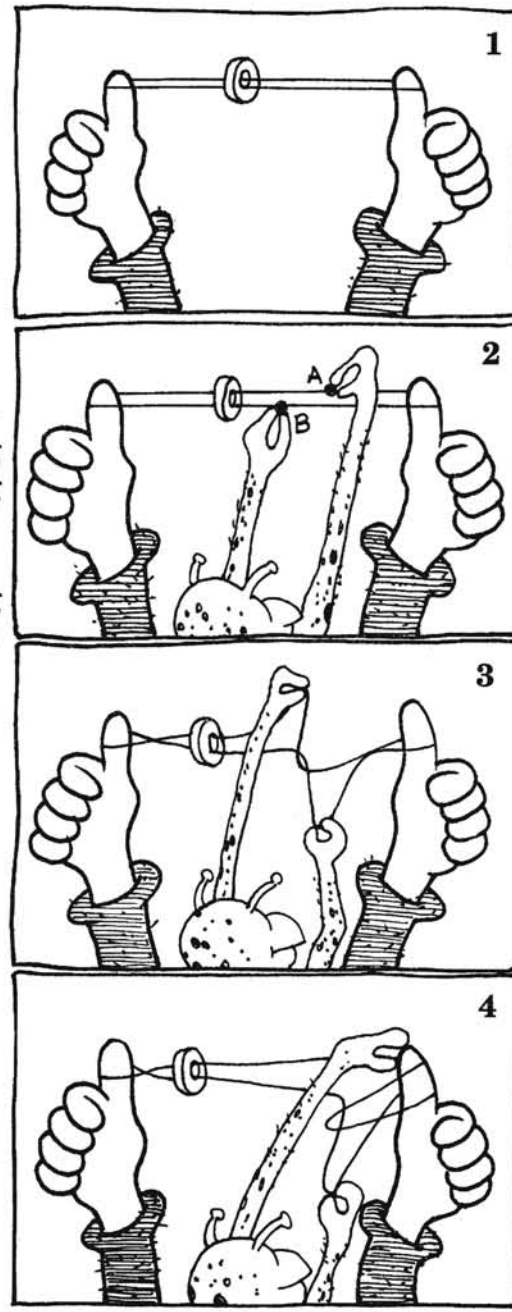
A 55-in (140 cm) piece of string

Preparing the Trick

1. Tie the two ends of the string together. Snip off the extra little pieces of string at the end of the knot.
2. Read the directions below and then practice the trick with someone in your family. (Or sit on the floor and stretch the string between your two big toes!) When you have successfully worked the trick two or three times, you are ready to perform it for others.

What To Do

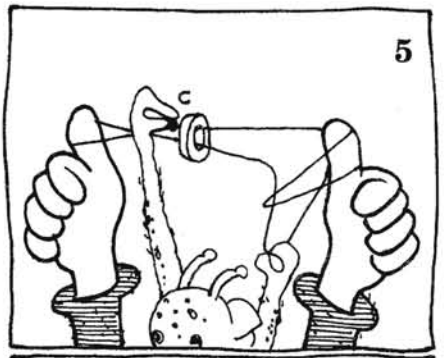
1. Slip the string through the washer and stretch it between your friend's thumbs. Then, tell your friend that you are going to remove the washer from the string without removing the string from his thumbs—and without removing his arms from his body!
2. Pinch the string at point **A** with your right hand. Pinch the string at point **B** with your left hand.
3. Pull your right hand toward you and push your left hand away from you.
4. Loop the string that is in your left hand over your

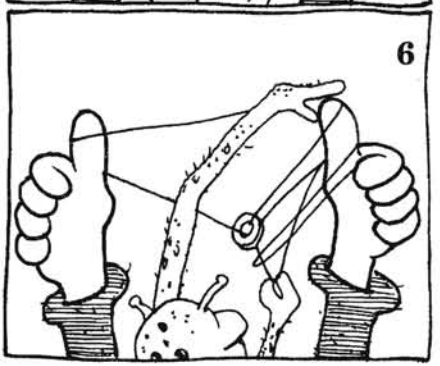


friend's left thumb and let go. Do not let go of the right-hand pinch.

5. With your left hand, pinch the string at point C.

6. Loop the string that is in your left hand over your friend's left thumb as in step 4. Your friend will have to move his thumbs a little closer together so that you can do this. Again, do not let go of the right-hand pinch.





Then, ask your friend to pinch each thumb and index finger together so that the string will not slide off over the tops of his thumbs. Finally, release the right-hand pinch and tell your friend to *slowly* pull his hands apart. Unbelievably, the washer will fall to the ground and the string will still be looped around your friend's thumbs!

The Secret

You take the string off your friend's thumb with the first loop. The second loop puts the string back on his thumb *on the other side of the washer*. So, when the string is stretched out, it stays on his thumb but the washer slides off the end. Just as in the Impossible Knot, topology helps you perform an amazing trick that at first seems impossible.

9. CALCULATOR CONJURING

Did you know that your calculator is a talented magician? If you enter the correct numbers, it will perform many magic tricks for you!

All of the magic tricks in this chapter are performed on an ordinary calculator. The tricks are organized from the easiest to the hardest, so choose those that are right for you. They are easy to learn and perform but you still need to practice them by yourself first. You should work a trick through successfully two or three times before you perform it for others.

You have to be very careful, however, and make sure you push the right buttons or the trick will not work. Perform each trick *slowly* so that you don't make careless errors.

Finally, remember that magicians never reveal their secrets. If someone asks you how you did a trick, just say, "Very carefully!" If they still question you, tell them to ask your calculator!

BEWITCHED

Someone has placed an evil spell on your calculator. No matter which number your friend enters, it is ghoulishly transformed into the unlucky number 13!

Materials

A calculator

Presentation

Have a friend:

	Example
1. Enter in the calculator any number that is easy to remember —address, age, phone number, etc. (This number must be less than 8 digits.)	**77**
2. Double that number.	**$77 \times 2 = 154$**
3. Add 15 to that answer.	**$154 + 15 = 169$**
4. Triple that result.	**$169 \times 3 = 507$**
5. Add 33 to that total.	**$507 + 33 = 540$**
6. Divide that answer by 6.	**$540 \div 6 = 90$**
7. Subtract her original number.	**$90 - 77 = 13$**

This is a trick that can be repeated several times with the same friend. The final answer always ends up "unlucky"!

The Mathemagical Secret

This trick was written using a kind of mathematics called algebra. Doubling and then tripling a number is the same as multiplying by 6. Dividing by 6 cancels those operations. The other operations eliminate your friend's original number and guarantees the final total will always be 13.

PAIR-A-DICE

Your friend rolls 2 dice when you are not looking. After he works a few problems on a calculator, you are able to reveal the two top numbers on the dice!

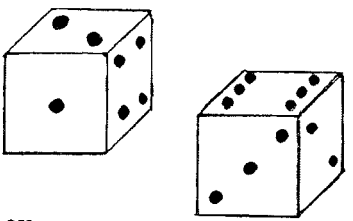
Materials

2 dice A calculator
Paper and pencil

Presentation

When your back is turned, have a friend:

Example



1. Roll two dice.
2. Multiply the top number on the first die by 5, using a calculator or paper and pencil. $\underline{2} \times 5 = 10$
3. Add 12 to that answer. $10 + 12 = 22$
4. Double that total. $22 \times 2 = 44$
5. Add that result to the top number on the second die. $44 + \underline{6} = 50$
6. Add 15 to that answer. $50 + 15 = 65$

Finally, ask your friend for his final total. Just subtract 39 and the top numbers on the dice will magically appear!

$$\begin{array}{r} 65 \\ -\underline{39} \\ \underline{2}\,\underline{6} \end{array}$$

1st die 2nd die

The Secret

Multiplying by 5 and then doubling is just like multiplying by 10. This puts the number on the first die in the tens place. Adding the number on the second die puts that number in the ones place. Every other operation is mathematical hocus-pocus and adds an extra 39 to the total. Subtracting this 39 reveals the two top numbers on the dice.

SECRET CODE

Your friend thinks of an important date in his life, and then works a few problems on a calculator. When he is finished, you enter a magical secret code and his date suddenly appears in the display!

Materials

A calculator

Paper and pencil

Preparation

Write this month chart on a piece of paper.

1-Jan.	4-April	7-July	10-Oct.
2-Feb.	5-May	8-Aug.	11-Nov.
3-March	6-June	9-Sept.	12-Dec.

Presentation

Ask a friend to think of any important date in his life—his birthday, for instance, or a favorite holiday.

Hand him the calculator and tell him to:

	Example Sept. 10
1. Enter the number of the month from the month chart without letting you see it. (September = 9)	**9**
2. Multiply that number by 5.	**9 × 5 = 45**
3. Add 6 to that total.	**45 + 6 = 51**
4. Multiply that answer by 4.	**51 × 4 = 204**
5. Add 9 to that total.	**204 + 9 = 213**
6. Multiply that answer by 5.	**213 × 5 = 1,065**
7. Add the number of the day. (Sept. 10)	**1,065 + 10 = 1,075**
8. Add 700 to that total.	**1,075 + 700 = 1,775**

Finally, tell your friend to hand you the calculator with the final total. Just enter the secret code (minus 865 equals) and the important date that he thought of will magically appear! The first digit is the number of the month, and the last two digits are the number of the day.

$$\begin{array}{r} 1775 \\ -\ \ 865 \\ \hline 9\,10 \\ \uparrow\ \ \uparrow \\ \text{Sept. } 10 \end{array}$$

An Exception

When you subtract 865 and get four digits, the first two digits are the number of the month.

Examples **1031 = 10 31 = Oct. 31**
1205 = 12 05 = Dec. 5

The Mathemagical Secret

This trick was written using a kind of mathematics called algebra. Multiplying the number of the month by 5, 4 and 5 is the same as multiplying by 100. This moves that number over to and to the left of the hundreds place. Adding the day puts that number in the tens and ones place. The other operations add an extra 865 to the total. Subtracting 865 reveals your friend's date.

BIRTHDAY SURPRISE

You will be able to divulge anyone's age and the year they were born by simply performing some number magic on a calculator!

Materials

A calculator

Presentation

Hand someone a calculator and ask her to:	**Example** **Year Born: 1955** **Age: 39**
1. Enter the year that she was born, without letting you see it.	**1955**
2. Multiply that year by 2.	**1955 × 2 = 3,910**
3. Add the number of months in a year.	**3,910 + 12 = 3,922**
4. Multiply that total by 50.	**3,922 × 50 = 196,100**
5. Add her age to that result.	**196,100 + 39 = 196,139**
6. Add the number of days in a year.	**196,139 + 365 = 196,504**

Finally, tell her to hand you the calculator with the final total. Just subtract 965, and the year that she was born and her age will magically appear!

$$\begin{array}{r} 196504 \\ -\quad 965 \\ \hline 1955\,39 \end{array}$$

Year Born **Age**

Exceptions

If the person's age is less than 10, the tens place will be 0.

Example: 198905 = 1 9 8 9 0 5, so age = 5

If it happens to be a leap year, add 366 in Step 6 and then subtract 966 from the final total.

The Secret

Multiplying the year by 2 and then by 50 is just like multiplying by 100. This moves the year over to and to the left of the hundreds place. Adding the age puts that number in the last two places. Every other operation is mathematical hocus-pocus and adds an extra 965 to the total. Subtracting this 965 reveals the year born and age.

SUBTRACTION SORCERY

You ask a friend to work a subtraction problem on a calculator. After she tells you just one digit of the answer, you are able to divulge the entire answer!

Materials

A calculator

Paper and pencil

Presentation

Example

Ask a friend to:

1. Write any 3-digit number on a piece of paper without letting you see it. Tell her that all three digits must be different. **427**

2. Reverse this number and write it below the first number. **724**

3. Subtract the two numbers on a calculator. Tell her to enter the larger number first.

$$\begin{array}{r} 724 \\ -\,427 \\ \hline 297 \end{array}$$

Finally, ask her to tell you either the first digit or the last digit of the total. You are now able to divulge the entire answer!

How to Do It

Here are all the possible answers when you subtract two 3-digit numbers as described.

99 198 297 396 495 594 693 792 891
(<u>0</u>99)

Notice that the middle digit is always 9 and that the sum of the first digit and the last digit is 9. So just subtract what your friend tells you from 9 to get the missing digit.

Example

She tells you the first digit is 2.

<u>2</u> 9 7

Always 9 **9 − <u>2</u> = 7**

or

She tells you the last digit is 7.

2 9 <u>7</u>

9 − <u>7</u> = 2 **Always 9**

An Exception

If your friend tells you that the first digit or last digit is 9, her answer will be 99.

HIDE-AND-SEEK

Your friend secretly works a subtraction problem and then tries to conceal one of the digits of his answer. Within seconds, you are able to reveal the missing digit!

What You Need

A calculator Paper and pencil

What to Do

	Example
1. Have your friend write down any 3-digit number without letting you see it. Tell him that all three digits must be different.	394
2. Tell him to rearrange the three digits in any order and write this new number next to his first number.	394 943
3. Ask him to subtract the smaller number from the larger number.	943 −394 549
4. Tell him to circle one digit in his answer that is *not* a 0.	(5)49
5. Ask him to read off the remaining digits in any order.	9, 4
6. Mentally add the digits he reads to you.	9 + 4 = 13

If the answer has more than one digit, add those digits together until only one is left. — $13 \rightarrow 1 + 3 = 4$

7. Mentally subtract that number from 9 and the missing digit is magically revealed! — $9 - 4 = \mathbf{5}$

Exceptions

Example

1. If the sum of the remaining digits is 9, the missing digit is 9.

$$\begin{array}{r} 674 \\ \underline{-476} \\ 198 \end{array}$$

2. When your friend ends up with a 2-digit number, he will read only one digit. Just subtract it from 9 to get the missing digit.

$$\begin{array}{r} 561 \\ \underline{-516} \\ 45 \end{array}$$

$9 - 5 = \mathbf{4}$

3. When your friend ends up with a 1-digit number, he won't read any digits. The missing digit will be 9.

$$\begin{array}{r} 965 \\ \underline{-956} \\ 9 \end{array}$$

The Mathemagical Secret

This trick uses a mathematical procedure called casting out nines, and it will work for any number of digits. The difference between the two numbers is always a multiple of 9, so the sum of its digits always equals 9.

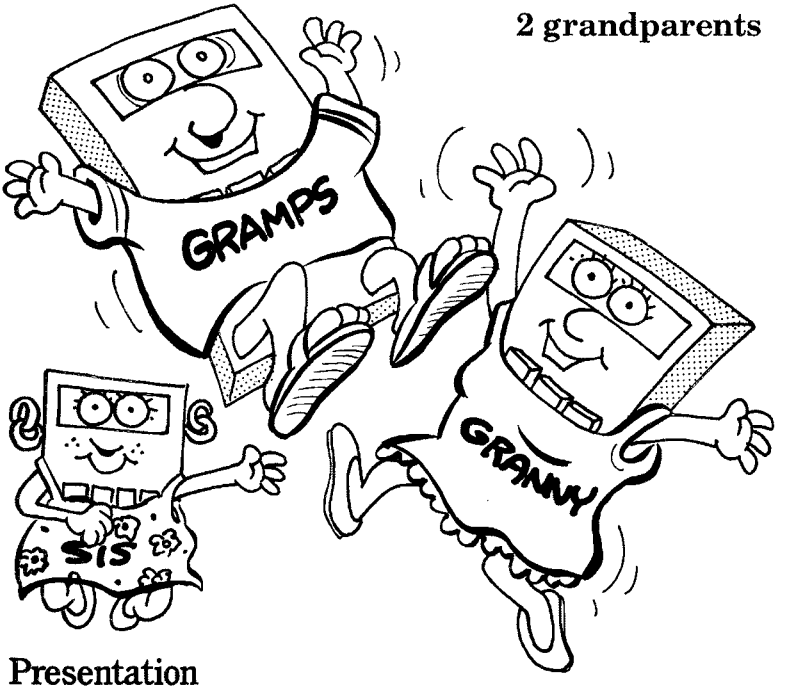
FAMILY SECRETS

After a friend works a few problems on a calculator, you are able to divulge how many brothers, sisters, and grandparents she has!

Materials

A calculator

Example
4 brothers
3 sisters
2 grandparents



Presentation

Have a friend:

1. Enter her number of brothers in the calculator. **4**
2. Multiply that number by 2. **$4 \times 2 = 8$**
3. Add 3 to that total. **$8 + 3 = 11$**

4. Multiply that answer by 5.	**$11 \times 5 = 55$**
5. Add her number of sisters to that total.	**$55 + 3 = 58$**
6. Multiply that answer by 10.	**$58 \times 10 = 580$**
7. Add her number of grandparents to that total.	**$580 + 2 = 582$**
8. Add 125 to that answer.	**$582 + 125 = 707$**

Finally, tell her to hand you the calculator with the final total. Just subtract 275 and her number of brothers, sisters, and grandparents magically appear!

$$\begin{array}{rr} & \mathbf{707} \\ & \underline{\mathbf{-275}} \\ \textbf{brothers} \rightarrow & \underline{\mathbf{4}}\underline{\mathbf{3}}\underline{\mathbf{2}} \quad \leftarrow \textbf{grandparents} \\ & \uparrow \\ & \textbf{sisters} \end{array}$$

Exceptions

When you subtract 275 and get only two digits, your friend has no brothers.

Example: 12 = $\underline{0}\,\underline{1}\,\underline{2}$ so number of brothers = 0.

When you subtract 275 and get only one digit, your friend has no brothers and no sisters.

Example: 2 = $\underline{0}\,\underline{0}\,\underline{2}$ so number of brothers = 0 and number of sisters = 0.

The Mathemagical Secret

This trick was written using a kind of mathematics called algebra. Multiplying the number brothers by 2, 5 and 10 is the same as multiplying by 100. This puts that number in the hundreds place. Multiplying the number of sisters by 10, puts that number in the tens place. Adding the number of grandparents puts that number in ones place. The other operations add an extra 865 to the total. Subtracting 865 reveals your friend's family.