BRAIN TEASERS

SIX CLASSIC TRICK QUESTIONS AND LOGIC PUZZLES, WITH ANSWERS

EASY TO HARD | 6 PUZZLES | ANSWERS INCLUDED

Six puzzles where the answer is hiding in the wording, starting easy and finishing hard. Read each one slowly. They come from Amusements in Mathematics by Henry Ernest Dudeney, published in 1917, in his own words.

NO. 1 · EASY

THE MOTOR-CAR RACE

I happened to be at a motor-car race at Brooklands, when one spectator said to another, while a number of cars were whirling round and round the circular track:

"There's Gogglesmith, that man in the white car!"

"Yes, I see," was the reply; "but how many cars are running in this race?"

Then came this curious rejoinder: "One-third of the cars in front of Gogglesmith added to three-quarters of those behind him will give you the answer."

Now, can you tell how many cars were running in the race?

13 cars.

The trick is the track. It goes round in a circle, so every other car is in front of Gogglesmith and behind him at the same time.

1. So "the cars in front of him" and "the cars behind him" are the same cars: **all the others**.
2. The number of other cars has to divide by 3 and by 4. The smallest number that does is **12**.
3. One-third of 12 is 4. Three-quarters of 12 is 9. 4 + 9 = **13**.
4. 12 other cars plus Gogglesmith is **13 cars**. It matches.

The next number that divides by 3 and 4 is 24. That gives 8 + 18 = 26, but 24 other cars plus Gogglesmith is only 25. The bigger the number, the further out it gets, so 13 is the only answer.

NO. 2 · EASY, WITH A TRAP

THE INDUSTRIOUS BOOKWORM

Our friend Professor Rackbrane is propounding another of his little posers. He is explaining that since he last had occasion to take down those three volumes of a learned book from their place on his shelves a bookworm has actually bored a hole straight through from the first page to the last. He says that the leaves are together three inches thick in each volume, and that every cover is exactly one-eighth of an inch thick, and he asks how long a tunnel had the industrious worm to bore in preparing his new tube railway. Can you tell him?

In plain English: Three volumes stand in order on a shelf, left to right. The pages of each are 3 inches thick, and each cover is 1/8 of an inch. A bookworm bores in a straight line from the first page of Volume 1 to the last page of Volume 3. How far does it go?

3½ inches, not 9½.

The trap is to think the worm goes through all three books. Take a book off your own shelf to see why it does not.

1. Stand a book on a shelf the usual way, with the spine facing you. Its front cover is on the **right** and its back cover is on the left.
2. So page 1 of Volume 1 is at the right-hand end of Volume 1, **right next to Volume 2**.
3. And the last page of Volume 3 is at the left-hand end of Volume 3, **also right next to Volume 2**.
4. So the worm only goes through the middle: the front cover of Volume 1, the back cover of Volume 2, all the pages of Volume 2, the front cover of Volume 2 and the back cover of Volume 3.
5. Four covers at 1/8 of an inch each make ½ an inch. Add the 3 inches of pages in Volume 2: **3½ inches**.

The 9½ that most people give is three lots of pages and four covers, the tunnel the worm would need if it started at the far left and finished at the far right.

NO. 3 · MEDIUM

THE FOOTBALL PLAYERS

"It is a glorious game!" an enthusiast was heard to exclaim. "At the close of last season, of the footballers of my acquaintance four had broken their left arm, five had broken their right arm, two had the right arm sound, and three had sound left arms." Can you discover from that statement what is the smallest number of players that the speaker could be acquainted with? It does not at all follow that there were as many as fourteen men, because, for example, two of the men who had broken the left arm might also be the two who had sound right arms.

7 players.

Adding all four numbers gives 14, but one man can be counted twice: once for each arm. So look at one arm at a time.

1. **Left arms.** Every man's left arm is either broken or sound, never both. 4 men have a broken one and 3 have a sound one, and none of the 4 can be one of the 3. So there are at least **4 + 3 = 7** men.
2. **Right arms.** 5 broken and 2 sound is **7** again. So the right arms agree.
3. So the answer cannot be less than 7. Now check that 7 men really can fit every number.

- 2 men with both arms broken.

- 2 men with only the left arm broken.
- 3 men with only the right arm broken.

Broken left arms: 2 + 2 = 4. Broken right arms: 2 + 3 = 5. Sound right arms: the 2 with only the left arm broken. Sound left arms: the 3 with only the right arm broken. Every number matches, with **7 men**.

NO. 4 · MEDIUM

THE VILLAGE SIMPLETON

A facetious individual who was taking a long walk in the country came upon a yokel sitting on a stile. As the gentleman was not quite sure of his road, he thought he would make inquiries of the local inhabitant; but at the first glance he jumped too hastily to the conclusion that he had dropped on the village idiot. He therefore decided to test the fellow's intelligence by first putting to him the simplest question he could think of, which was, "What day of the week is this, my good man?" The following is the smart answer that he received:

"When the day after to-morrow is yesterday, to-day will be as far from Sunday as to-day was from Sunday when the day before yesterday was to-morrow."

Can the reader say what day of the week it was? It is pretty evident that the countryman was not such a fool as he looked. The gentleman went on his road a puzzled but a wiser man.

Sunday.

Untangle the two halves of his answer separately.

1. **"When the day after tomorrow is yesterday."** The day after tomorrow is 2 days away. It becomes yesterday one day after that: **3 days from now**.
2. **"When the day before yesterday was tomorrow."** The day before yesterday was 2 days ago. It was tomorrow one day before that: **3 days ago**.
3. So his answer means: **3 days from now is as far from Sunday as 3 days ago was**.
4. 3 days ago and 3 days from now sit evenly on either side of today. The only way they can both be the same distance from Sunday is if **today is Sunday**.

Check it. If today is Sunday, 3 days from now is Wednesday and 3 days ago was Thursday. Wednesday is 3 days after Sunday and Thursday is 3 days before it. The same distance.

Any other day fails. If today were Monday, 3 days from now is Thursday, which is 3 days from Sunday, but 3 days ago was Friday, which is only 2.

NO. 5 · HARD

A CALENDAR PUZZLE

If the end of the world should come on the first day of a new century, can you say what are the chances that it will happen on a Sunday?

No chance at all. The first day of a century can never be a Sunday.

Our calendar repeats itself exactly every 400 years, so there are only four centuries to check. A new century starts on 1 January of a year ending in 01, like 1901 or 2001.

1. 1 January 1801 was a **Thursday**.
2. 1 January 1901 was a **Tuesday**.
3. 1 January 2001 was a **Monday**.
4. 1 January 2101 will be a **Saturday**.
5. 1 January 2201 will be a Thursday again, and the pattern repeats for ever.

Here is why it jumps like that. An ordinary year is 52 weeks and 1 day, so each one pushes the calendar on a day. A leap year pushes it on 2. A century with 24 leap years pushes it on 100 + 24 = 124 days, which is 17 weeks and **5 days**. The century that includes a year like 2000, which is a leap year, has 25, so it moves on **6 days**.

Start at Thursday. On 5 days is Tuesday. On 6 is Monday. On 5 is Saturday. On 5 is Thursday, back where it started. It never lands on Sunday, Wednesday or Friday.

If you count a century from years like 1900 and 2000 instead, the four days are Monday, Saturday, Friday and Wednesday. Still no Sunday.

NO. 6 · HARD

THE TROUBLESOME EIGHT

Nearly everybody knows that a “magic square” is an arrangement of numbers in the form of a square so that every row, every column, and each of the two long diagonals adds up alike. For example, you would find little difficulty in merely placing a different number in each of the nine cells so that the rows, columns, and diagonals shall all add up 15. And at your first attempt you will probably find that you have an 8 in one of the corners. The puzzle is to construct the magic square, under the same conditions, with the 8 in the middle cell of the top row.

In plain English: Put a different number in each square of a 3 by 3 grid so that every row, every column and both diagonals add up to 15. The 8 must go in the middle square of the top row.

Use halves. Top row 4½, 8, 2½. Middle row 3, 5, 7. Bottom row 7½, 2, 5½.

1. **The middle square has to be 5.** The middle row, the middle column and both diagonals all pass through it, and together they add up to 4 × 15 = 60. Between them they use every square once, except the middle, which they use 4 times. All nine squares add up to 45 (three rows of 15). So 45 plus 3 more middles makes 60, and the middle is 15 ÷ 3 = 5.
2. **The bottom of the middle column is 2**, because 15 − 8 − 5 = 2.
3. **The two top corners add up to 7**, because the top row makes 15 and the 8 is already in it.
4. **Try whole numbers first.** With 3 and 4 in the top corners, a square down the side has to repeat a number that is already in the grid. With 1 and 6, the side squares have to be 10 and 0. So the numbers 1 to 9 cannot do it.
5. **The trick is the wording.** Dudeney says “a different number”, not “a different whole number”, and halves are numbers too. Try 4½ and 2½ in the top corners. They add up to 7.
6. Each bottom corner makes 10 with the top corner across the diagonal from it, since the 5 in the middle makes up the 15. So the bottom right is 10 − 4½ = **5½**, and the bottom left is 10 − 2½ = **7½**.
7. The side squares finish off the columns. Left: 15 − 4½ − 7½ = **3**. Right: 15 − 2½ − 5½ = **7**.

- **Top row:** 4½, 8, 2½

> - **Middle row:** 3, 5, 7
> - **Bottom row:** 7½, 2, 5½

> Every row, column and diagonal adds up to 15, and all nine numbers are different. Other pairs of top corners that add up to 7 work too, as long as no number repeats. And if you allow 0 and 10, there is a whole-number answer after all: 1, 8, 6 on top, 10, 5, 0 in the middle, and 4, 2, 9 on the bottom.

All six are from Amusements in Mathematics (1917), which is in the public domain. The worked answers are our own.