HANTEN X005

HANTEN EXPERIENCE · X005

Shared Birthday

How many people does it take before two of them probably share a birthday?

PLAYERS

Any group, from 2 people to a whole class

TIME

About 20 minutes

YOU NEED

This deck, an answer sheet and a pencil for each group

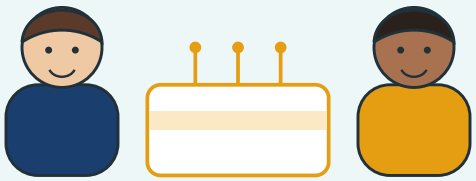
START WITH CARD 1

Keep the cards in order. Don't peek ahead.

HANTEN X005 · CARD 1

START HERE

How many people does it take before there's a 50/50 chance that two share a birthday?



12 | 23 | 56 | 183 | 253

COMMIT

Commit before Card 2.

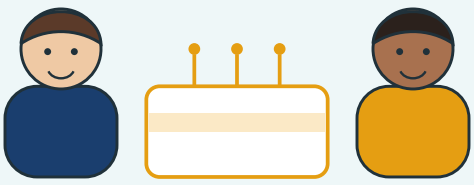
HANTEN X005 · CARD 2

FIRST REVEAL

23

people

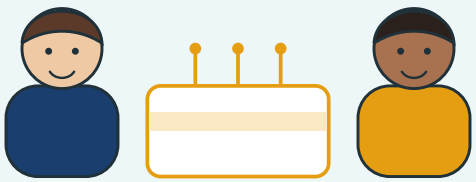
With 23 people, the chance of a shared birthday is already about 50.7%.



HANTEN X005 · CARD 3

COMMIT AGAIN

How many people before the chance of a shared birthday passes 99%?



31 | 57 | 104 | 253 | 350

COMMIT

Commit before Card 4.



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SECOND REVEAL

57

people

With only 57 people, the chance is already just over 99%.

A group of 366 would make a match guaranteed. It's almost certain long before that.

HANTEN X005 · CARD 5

WHAT'S HIDING?

How can the chance grow so fast?

What might be hiding inside a group of 23 people?

Look at more than the people themselves.

COMMIT

Commit to an explanation before Card 6.

HANTEN X005 · CARD 6

WHAT WAS HIDING

253

different pairs among 23 people



2 people	3 people	4 people	5 people
1 pair	3 pairs	6 pairs	10 pairs

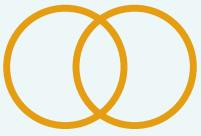
Every line is a pair who could share a birthday. Each new person pairs with everyone already there.

23 people make 253 pairs: 253 chances for a match.

HANTEN X005 · CARD 7

QUICK TRANSFER

Would the answer still be 23 for wedding anniversaries?



YES NO

COMMIT

Commit before Card 8.



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HANTEN X005 · CARD 8

ANNIVERSARY REVEAL

2

can be enough

If a married couple is in the group, those two already share an anniversary.

The birthday math assumes every birthday is random and separate. Pairs that aren't random change everything.

HANTEN X005 · CARD 9

FLIP IT

64 teams enter a single-elimination tournament.



A small bracket: 8 of the 64 teams shown.

How many games must be played to crown one champion?

COMMIT

Commit before Card 10.

HANTEN X005 · CARD 10

TOURNAMENT REVEAL

63

games

64 › 32 › 16 › 8 › 4 › 2 › 1

Every game knocks out one team. 63 teams must lose to leave one champion.

HANTEN X005 · CARD 11

SAME 64 TEAMS. DIFFERENT RULE.

Now every team plays every other team exactly once.



A few teams shown. Every pair plays.

How many games will be played?

COMMIT

Estimate. Commit before Card 12.



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HANTEN X005 · CARD 12

SECOND TOURNAMENT REVEAL

2,016

games





Elimination
7 games

Everyone plays
28 games

The same 8 teams both ways. With all 64 teams: 63 games vs. 2,016.

Elimination counts the teams that lose. Playing everyone counts every pair.

HANTEN X005 · CARD 13

LOOK BACK

23 PEOPLE

253 possible pairs

64 TEAMS

2,016 possible pairings

The surprise wasn't the number of people or teams. Where else might something be hiding in the pairs?

HANTEN X005 · CARD 14

BEHIND THE EXPERIENCE · READ LAST

WHY THE NUMBERS GROW

1. PAIRS GROW FASTER THAN GROUPS

Each person pairs with everyone else. Multiply, then divide by 2, because A-B and B-A are the same pair.

23 × 22 ÷ 2 = 253

64 × 63 ÷ 2 = 2,016

2. WHY THE CHANCE RISES SO QUICKLY

Find the chance that every birthday is different, then subtract from 100%. With 23 people that is 365/365 × 364/365 × … × 343/365, about 49.3%, so a match is about 50.7%.

3. ASSUMPTIONS

365 equally likely birthdays, no February 29, no twins. Real birthdays cluster a little, which makes matches slightly more likely.

Source: standard birthday-problem math (Wolfram MathWorld, "Birthday Problem"). See the exhibit: hanten.app/exhibits/H005



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