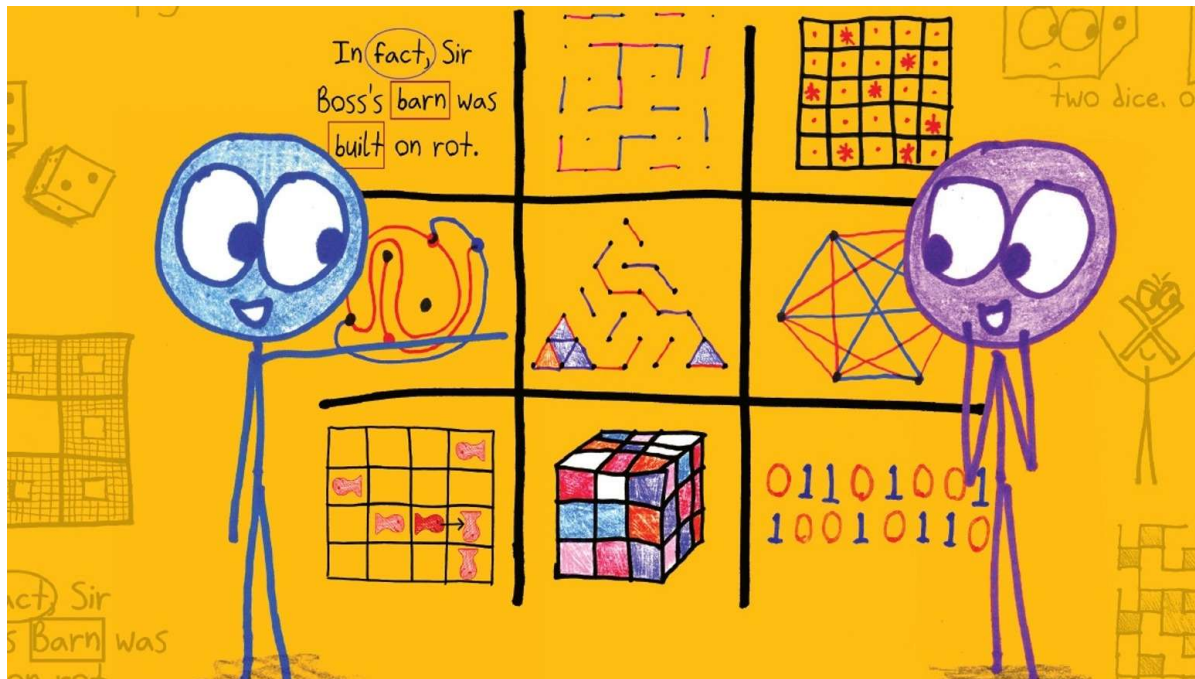


Math Games (with Bad Drawings)



BEN ORLIN

MAKING MATH
MOMENTS

NOVEMBER 16TH, 2024

MATH

with
v
Bad Drawings

IDEAS THAT

ILLUMINATING THE IDEAS THAT
SHAPE OUR REALITY

BEN ORLIN

MATH GAMES

75% SIMPLE, CHALLENGING
GO-ANYWHERE GAMES—
AND WHY THEY MATTER

BEN ORLIN

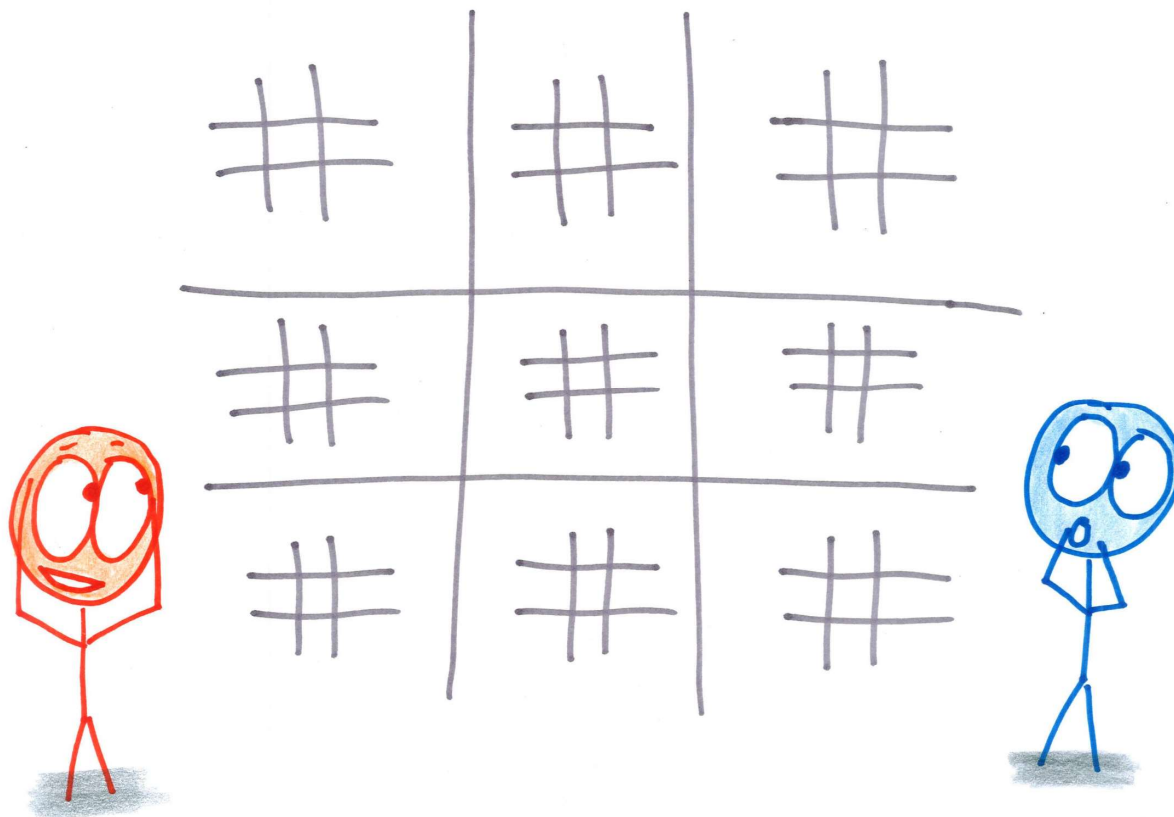
AUTHOR OF MATH WITH BAD DRAWINGS

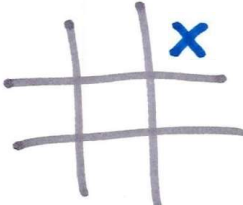
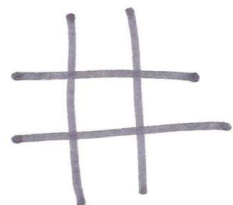
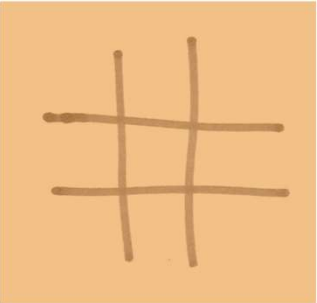
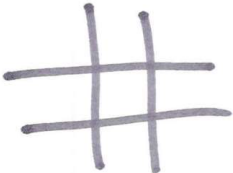
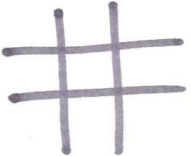
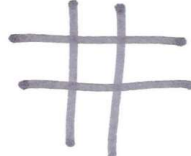
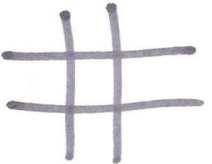
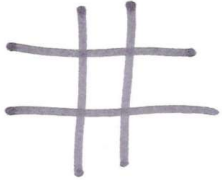
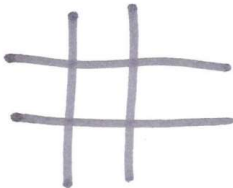
**CHANGE
IS THE ONLY
CONSTANT**

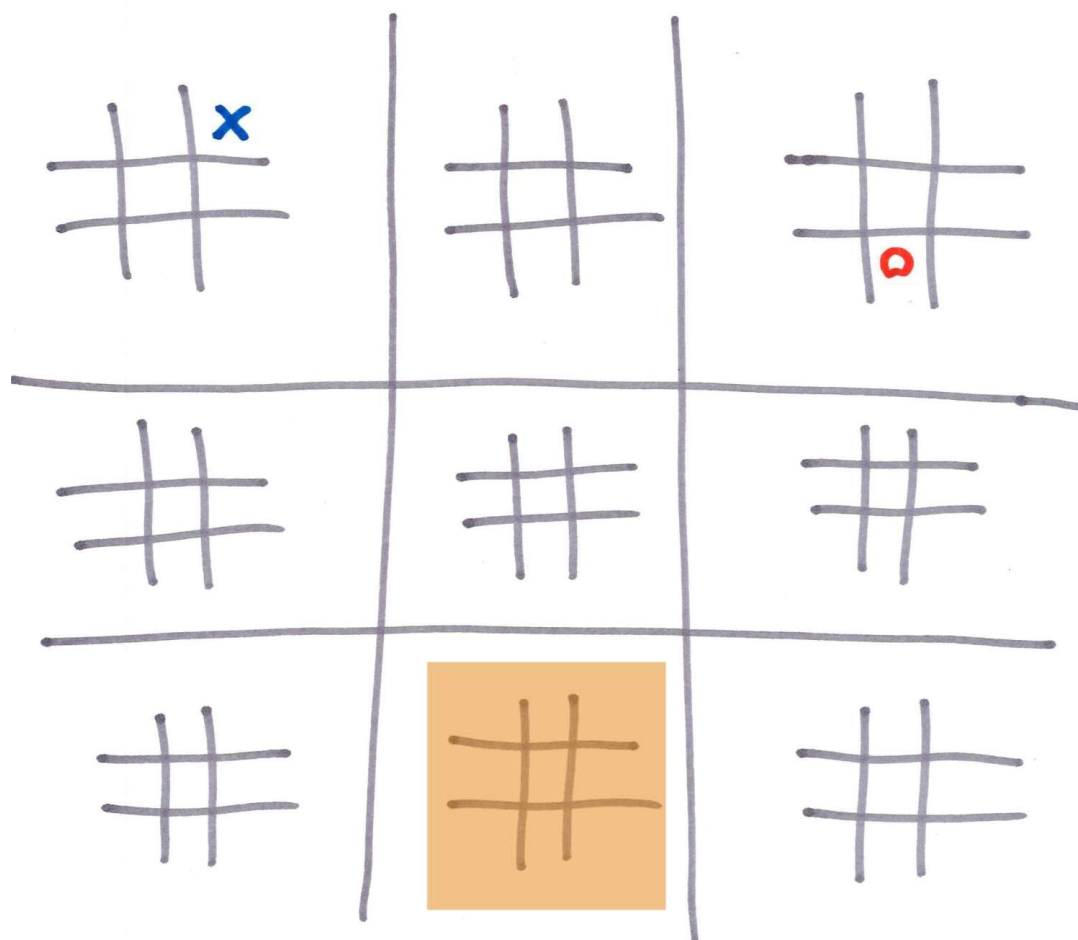
THE WISDOM OF CALCULUS
in a Madcap World

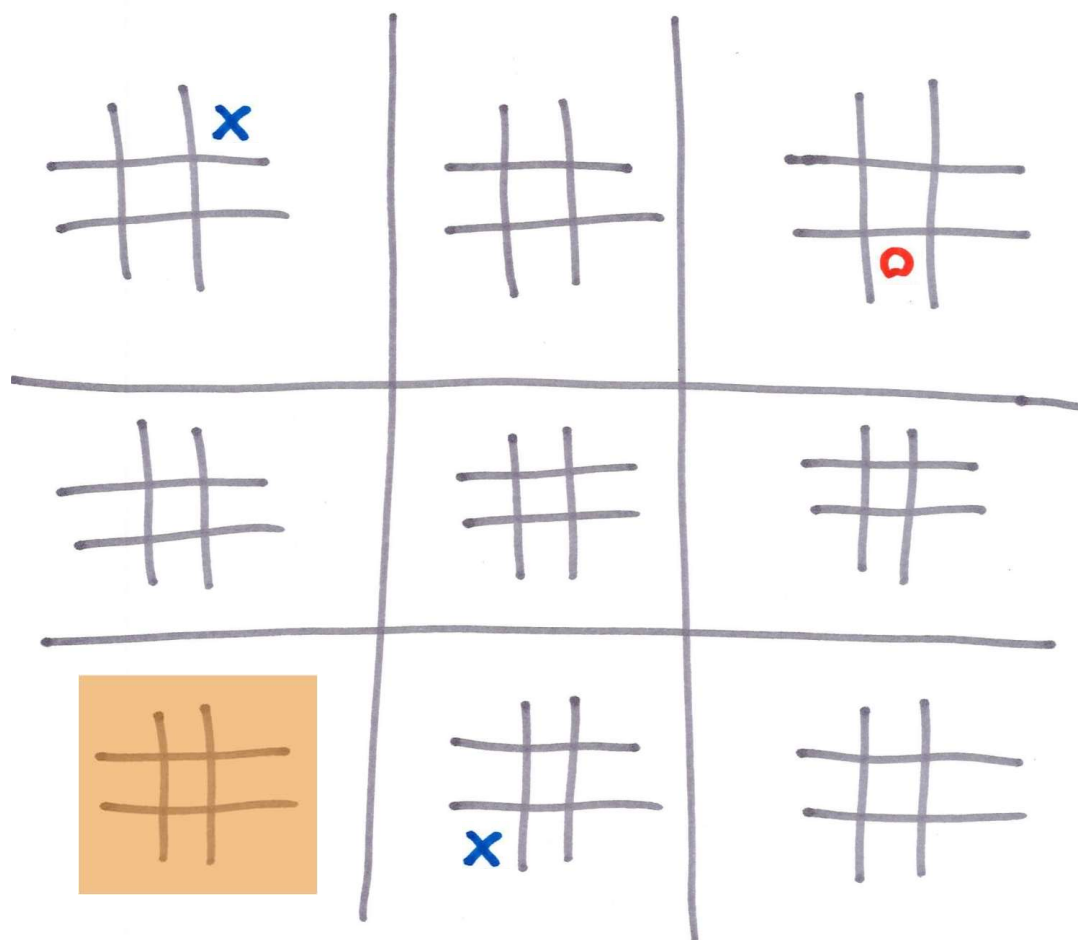
BEN ORLIN

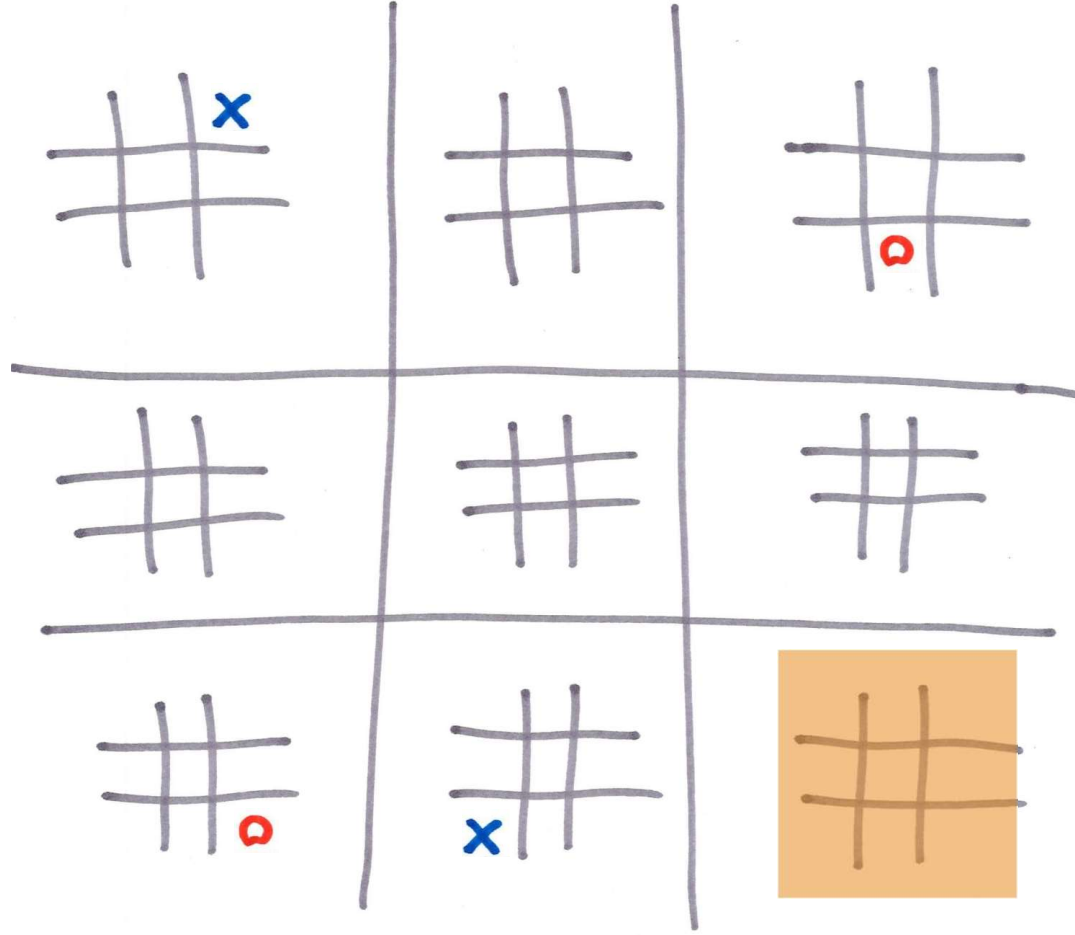
BEN URLIN
AUTHOR OF MATH WITH BAD DRAWINGS

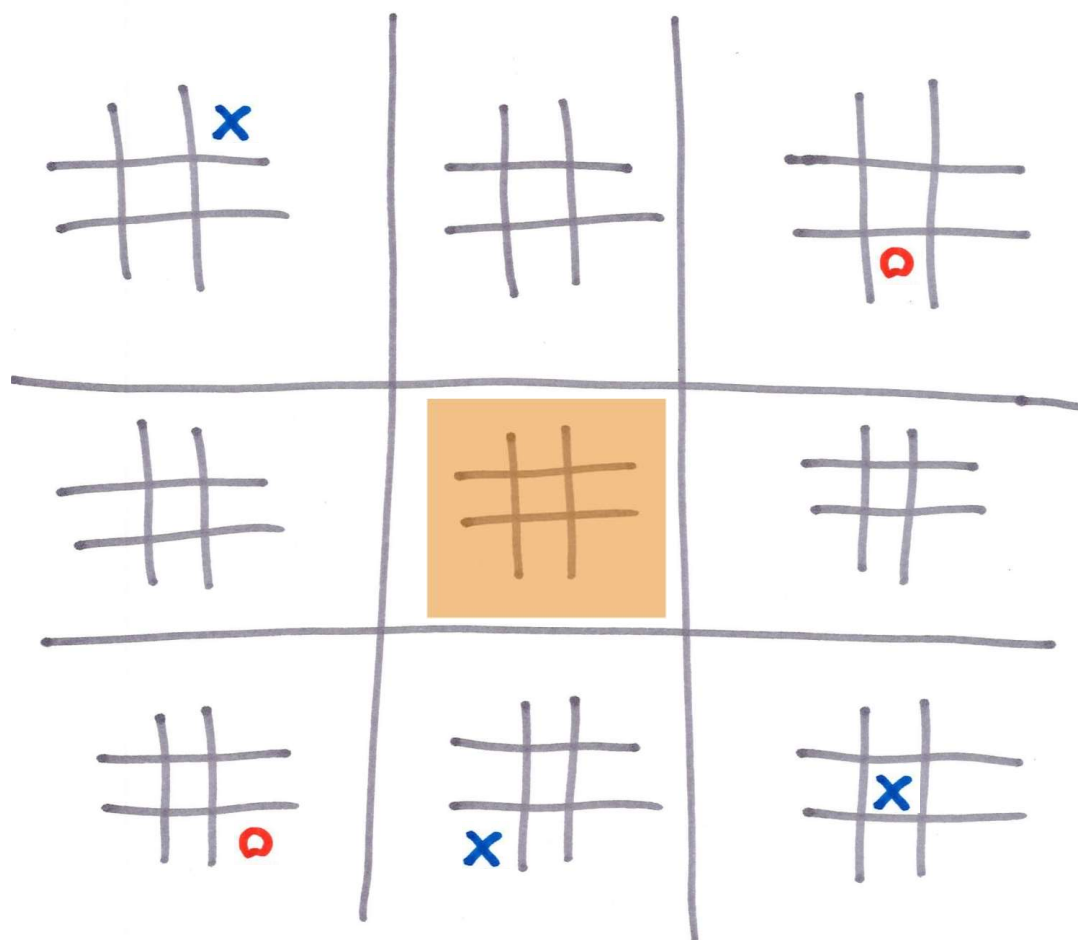










Ultimate tic-tac-toe

 6 languages 

Article [Talk](#)

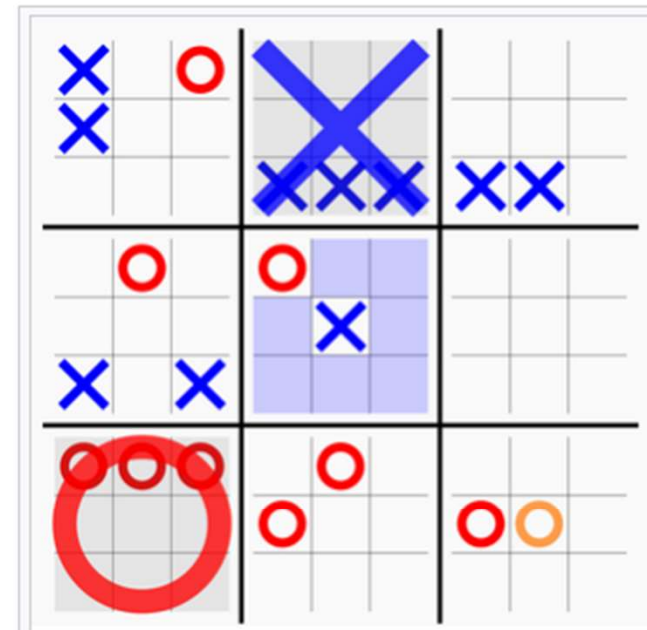
Read [Edit](#) [View history](#) [Tools](#) 

From Wikipedia, the free encyclopedia

Ultimate tic-tac-toe (also known as **super tic-tac-toe**, **meta tic-tac-toe** or **(tic-tac-toe)²**^[1]) is a board game composed of nine [tic-tac-toe](#) boards arranged in a 3 × 3 grid.^{[2][3]} Players take turns playing on the smaller tic-tac-toe boards until one of them wins on the larger board. Compared to traditional tic-tac-toe, strategy in this game is conceptually more difficult and has proven more challenging for computers.^[4]

Rules [\[edit\]](#)

Just like in regular tic-tac-toe, the two players (X and O) take turns, starting with X. The game starts with X playing wherever they want



Incomplete super tic-tac-toe game (the large 'X's and 'O's represent small boards that are

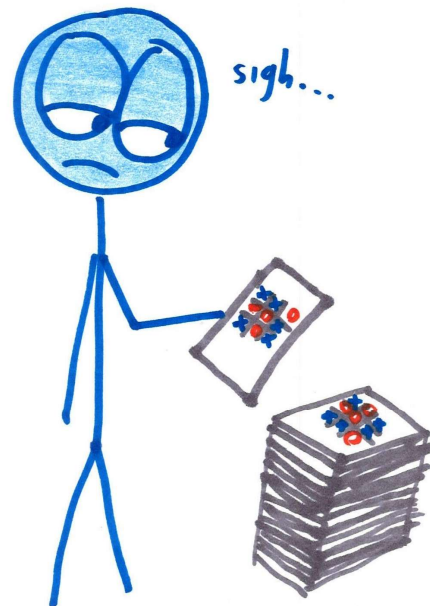
REFERENCES [\[edit \]](#)

1. [^] Konforti, Nicole; Epstein, Dave. "NP Completeness in Contemporary Board Games" [↗](#).^[*dead link*]
2. [^] ^{*a*} ^{*b*} Whitney, George; Janoski, Janine (November 26, 2016). "Group Actions on Winning Games of Super Tic-Tac-Toe". [arXiv:1606.04779](#) [↗](#) [\[math.CO\]](#) [↗](#).
3. [^] ^{*a*} ^{*b*} Orlin, Ben (June 1, 2013). "Ultimate Tic-Tac-Toe" [↗](#). *Math with Bad Drawings*. Archived from [the original](#) [↗](#) on August 30, 2021. Retrieved October 18, 2016.
4. [^] ^{*a*} ^{*b*} Lifshitz, Eytan; Tsurel, David (December 26, 2016). "AI Approaches to Ultimate Tic-Tac-Toe" [PDF](#) (PDF). *The Rachel and Selim Benin School of Computer Science and Engineering*. Archived from [the original](#) [PDF](#) (PDF) on July 29, 2021.
5. [^] Schaefer, Steve (2002). "MathRec Solutions (Tic-Tac-Toe)" [↗](#). Archived from [the original](#) [↗](#) on February 24, 2020. Retrieved October 18, 2016.
6. [^] Gila, Ofek (June 2, 2016). "What is the Monte Carlo tree search?" [↗](#). *We Blog*. Retrieved October 18, 2016.
7. [^] Bertholon, Guillaume; Géraud-Stewart, Rémi; Kugelmann, Axel; Lenoir, Théo; Naccache, David (June 3, 2020). "At Most 43 Moves, At Least 29: Optimal Strategies and Bounds for Ultimate Tic-Tac-Toe". [arXiv:2006.02353v2](#) [↗](#) [\[cs.GT\]](#) [↗](#).
8. [^] Diamond, Justin (July 13, 2022). "A Practical Method for Preventing Forced Wins in Ultimate Tic-Tac-Toe". [arXiv:2207.06239](#) [↗](#) [\[math.HO\]](#) [↗](#).

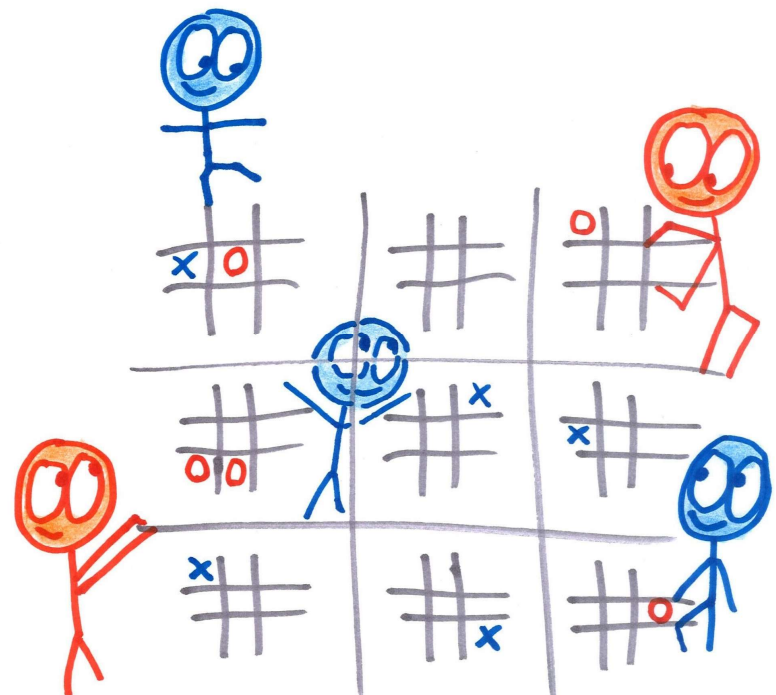
Why do math games matter?

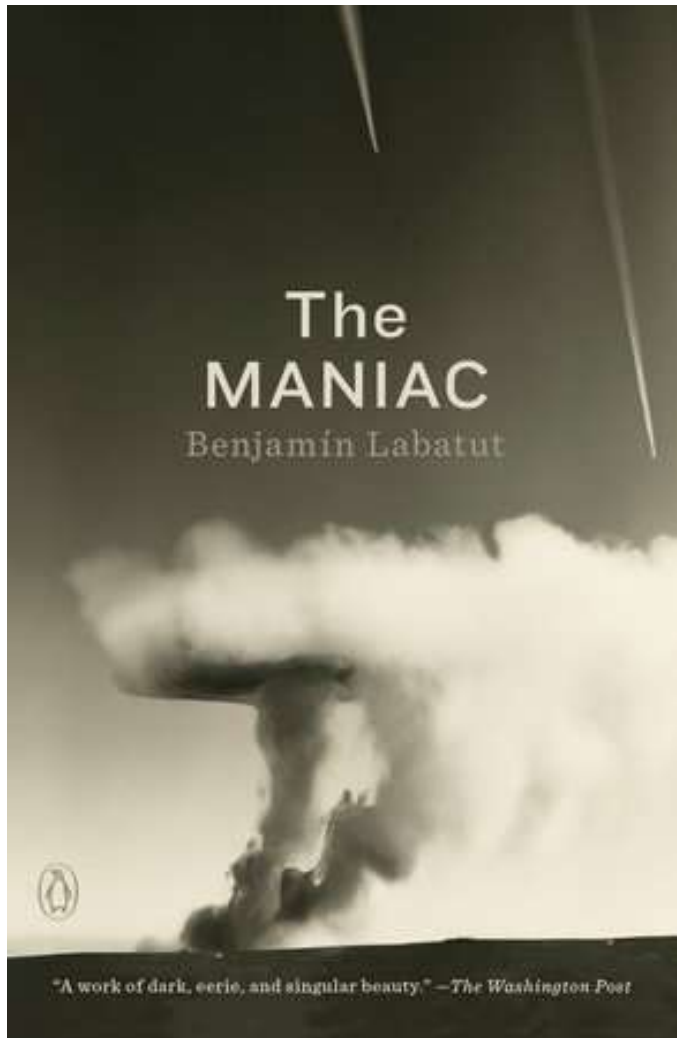
Because we like them.

Math As It Appears



Math As It Should Be





“He once told me that, just as wild animals play when they are young in preparation for lethal circumstances arising later in their lives, mathematics may be, to a large extent, nothing but a strange and wonderful collection of games, an enterprise whose real purpose, beyond any one stated outright, is to slowly work changes in the individual and collective human psyche, as a way to prepare us for a future that nobody can imagine.”

Why do math games matter?

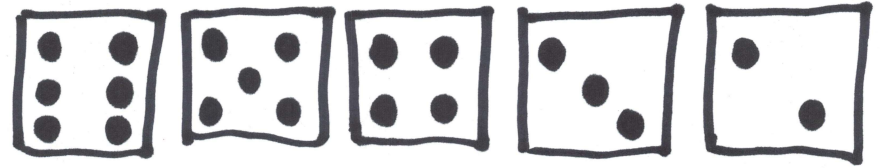
Because they change the way we think.

Pig

A GAME OF PRESSING YOUR LUCK



The Rules to Pig



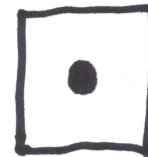
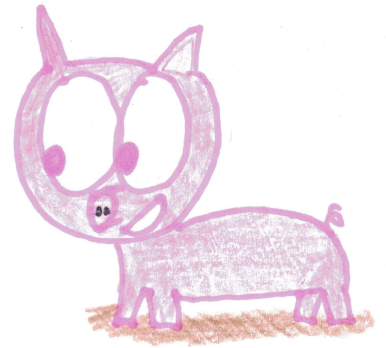
To begin a round, all players stand.

A six-sided die is rolled. Its value is added to the “Current Prize.”

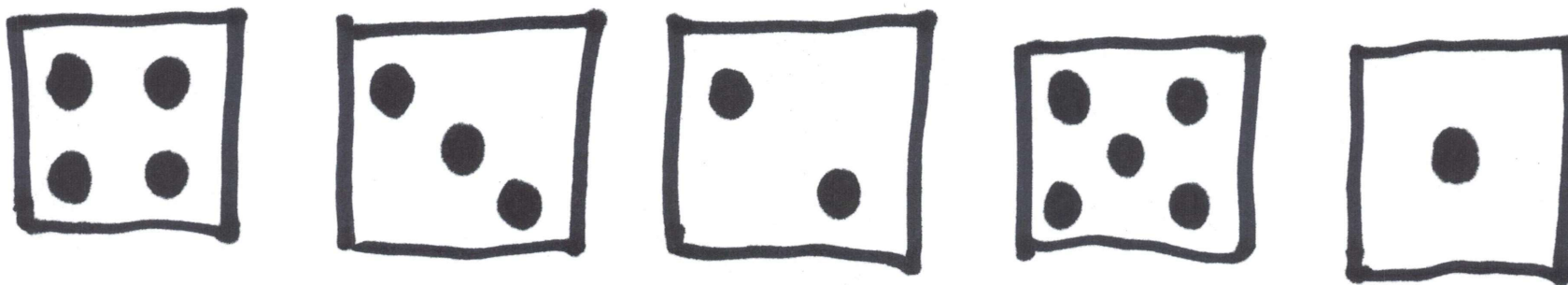
After any roll, you may sit down, taking the “Current Prize” as your score for the round.

If a “1” comes up, the round abruptly ends, and all players still standing score zero.

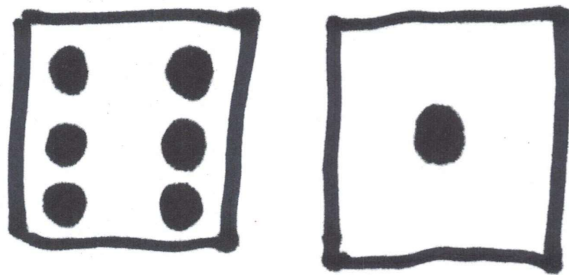
We play five rounds. Highest total wins.



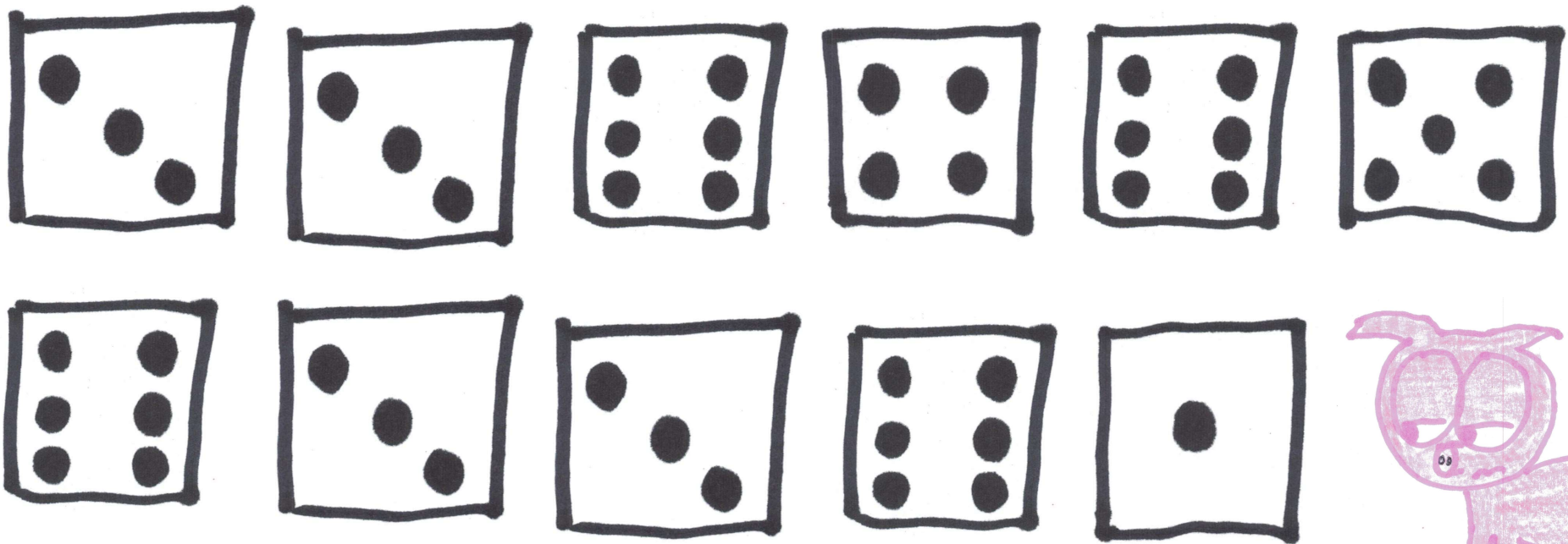
First Round!



Second Round!



Third Round!



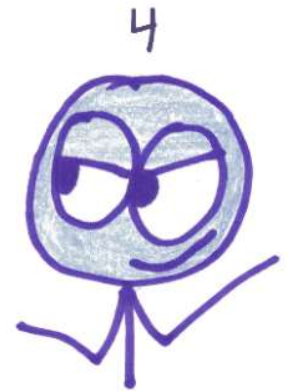


Why do math games matter?

Because they give us vivid yet contained experiences,
which lend themselves to mathematical analysis.



winner! scores 10 points



MEDIOCRITY

A GAME OF VICTORY BY "MEH"

Mediocrity: a game for three players.

Each player secretly picks a number from 0 to 20.

The numbers are revealed.

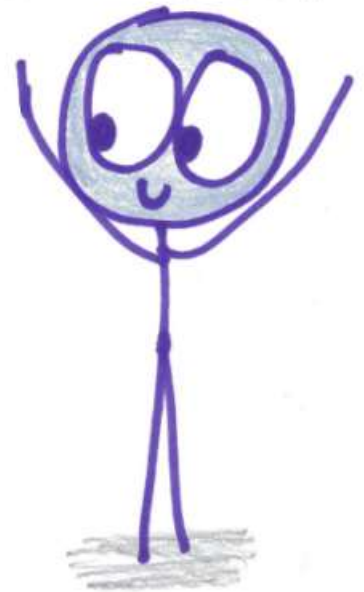
The winner is whoever picks the *middle* of the three numbers. That number is their score for the round.

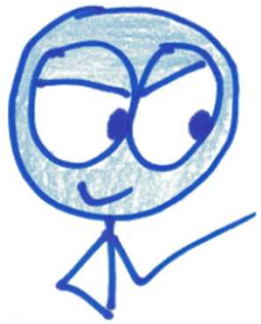
(If a tie, third person decides who gets the points.)

(If all three tie, redo the round.)

Play five rounds. The winner is whoever ends the game with the *middle* number of points.

MOST MEDIOCRE





13

7

13

10

6



10

17

2

1

20



4

19

5

14

19



13

7

13

10

6

10

17

2

1

20

4

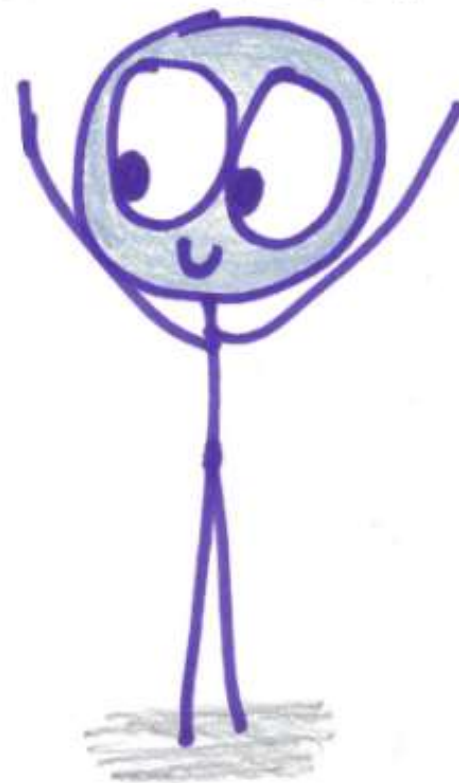
19

5

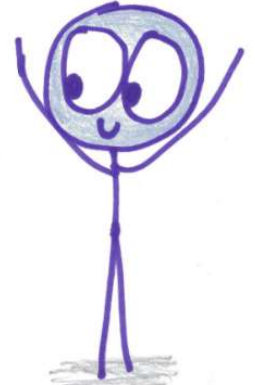
14

19

MOST MEDIOCRE



MOST MEDIOCRE

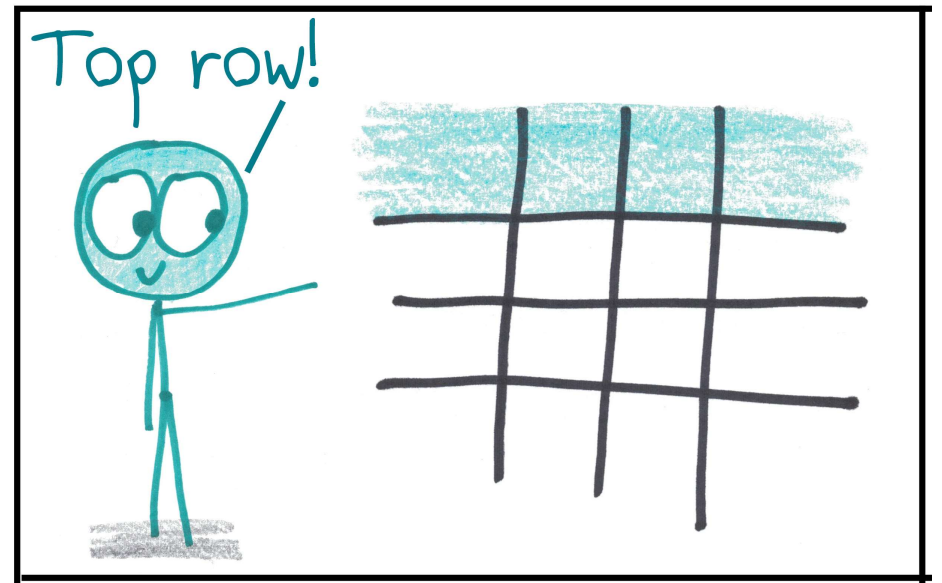


Why do math games matter?

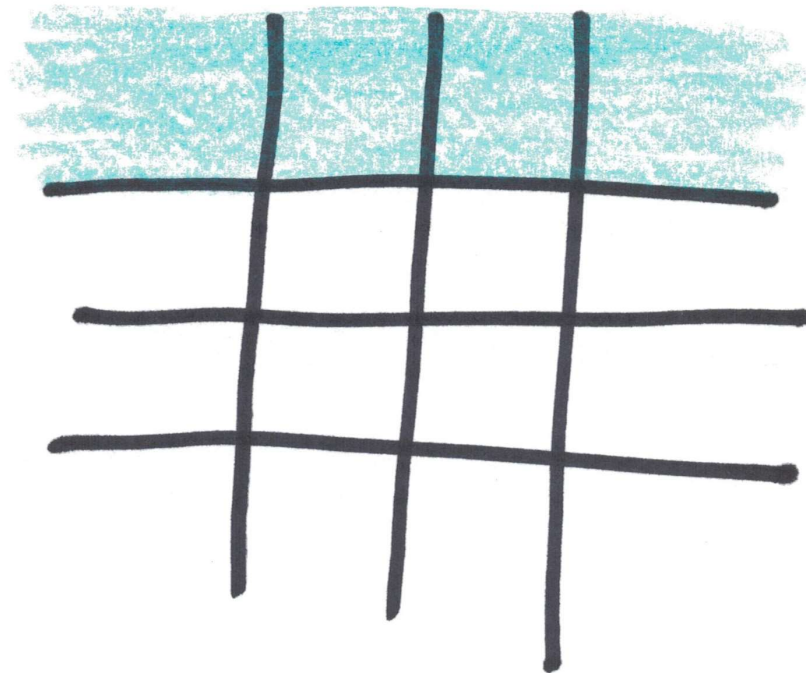
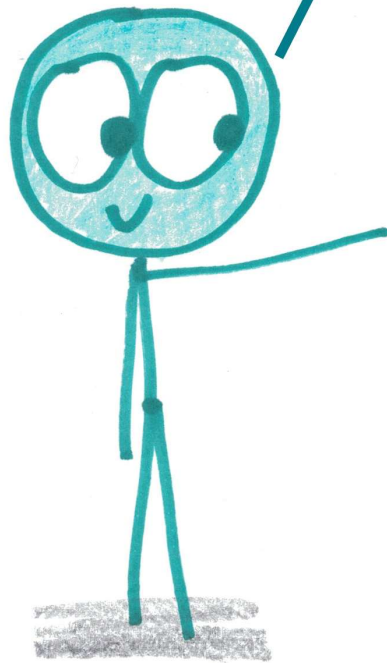
Because they let us explore spaces of logical possibilities—
and find delight where we never would have expected it.

ROW CALL

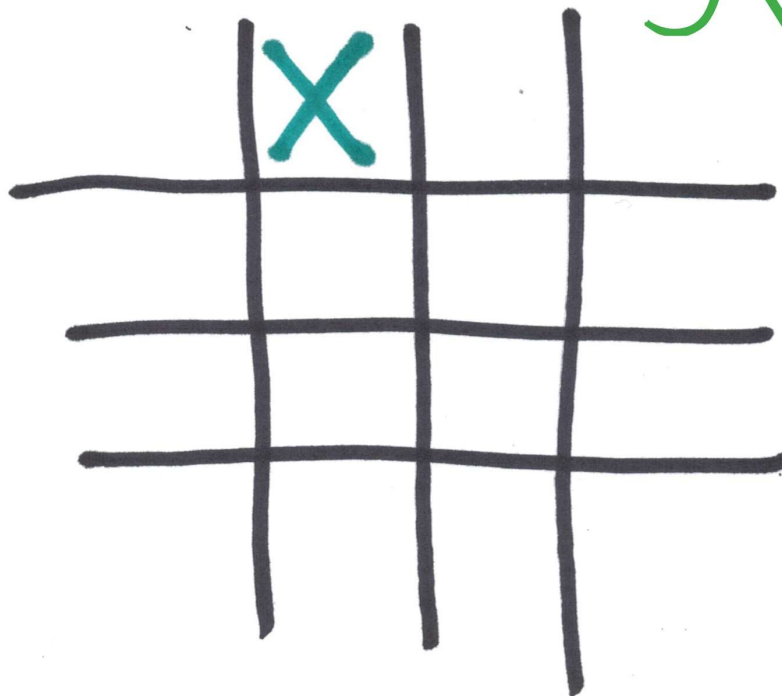
A GAME OF TUSSLING FOR CONTROL



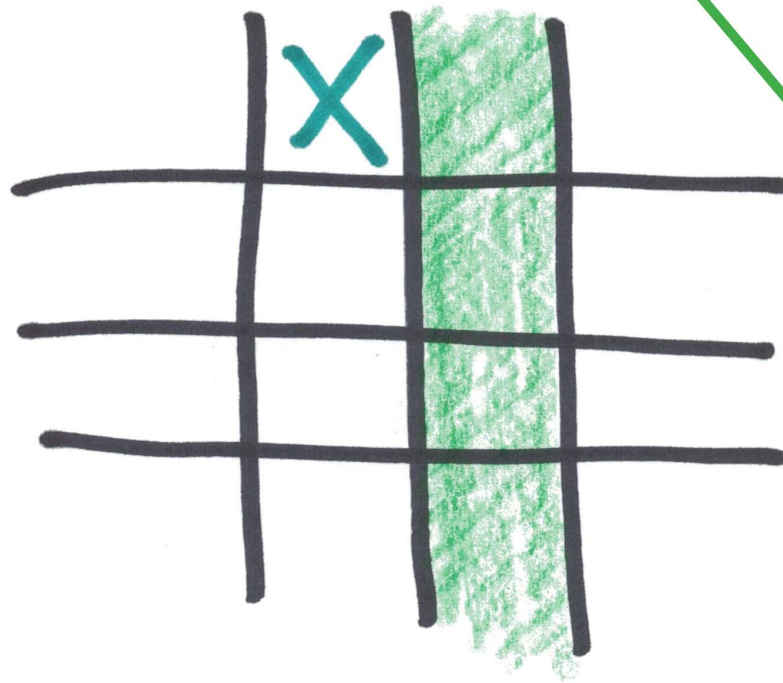
Top row!



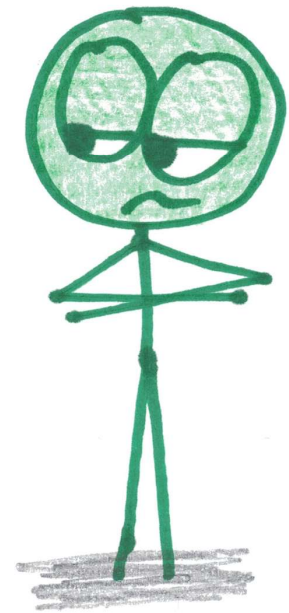
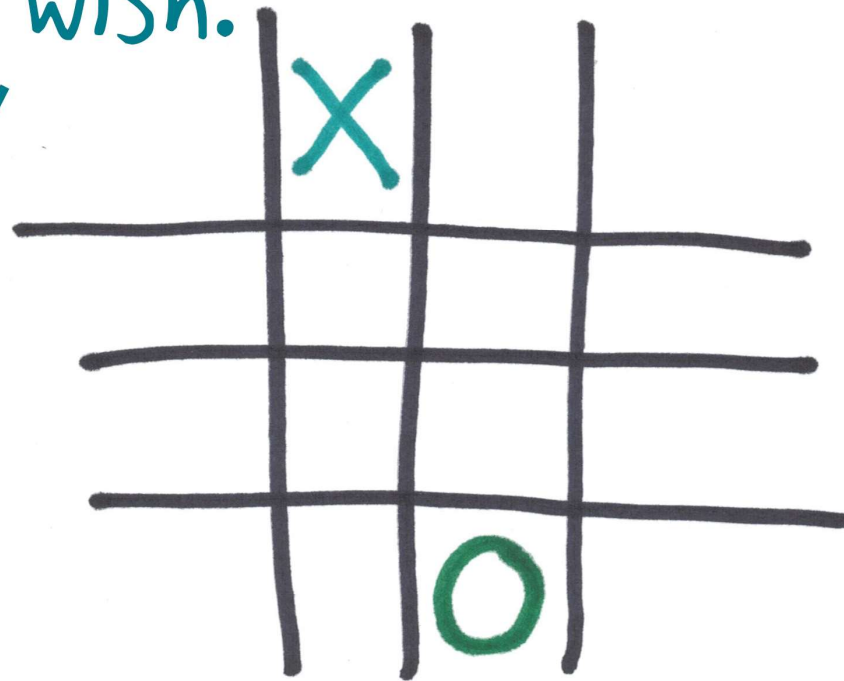
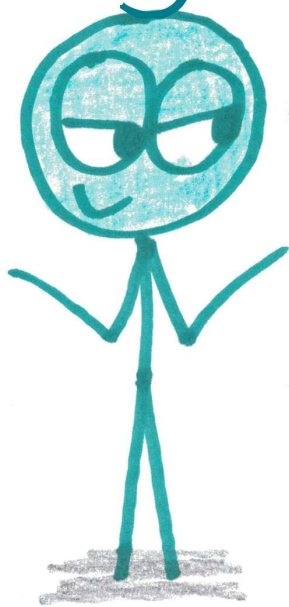
There you go.



Third column!

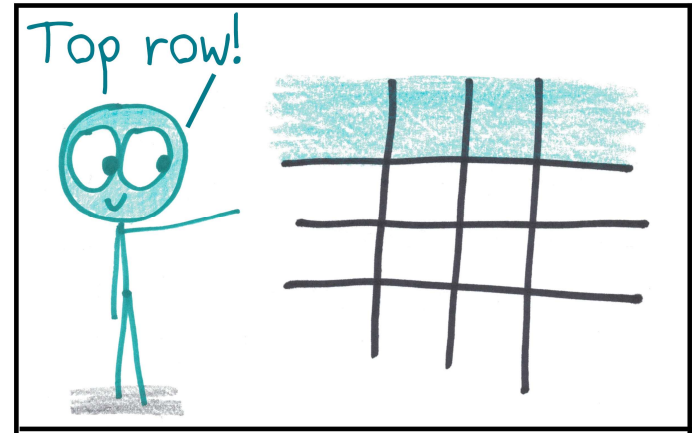


As you wish.



	Y	O	U	R
P				
I				
C				
K				





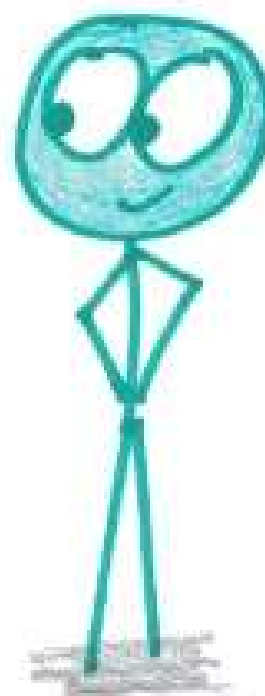
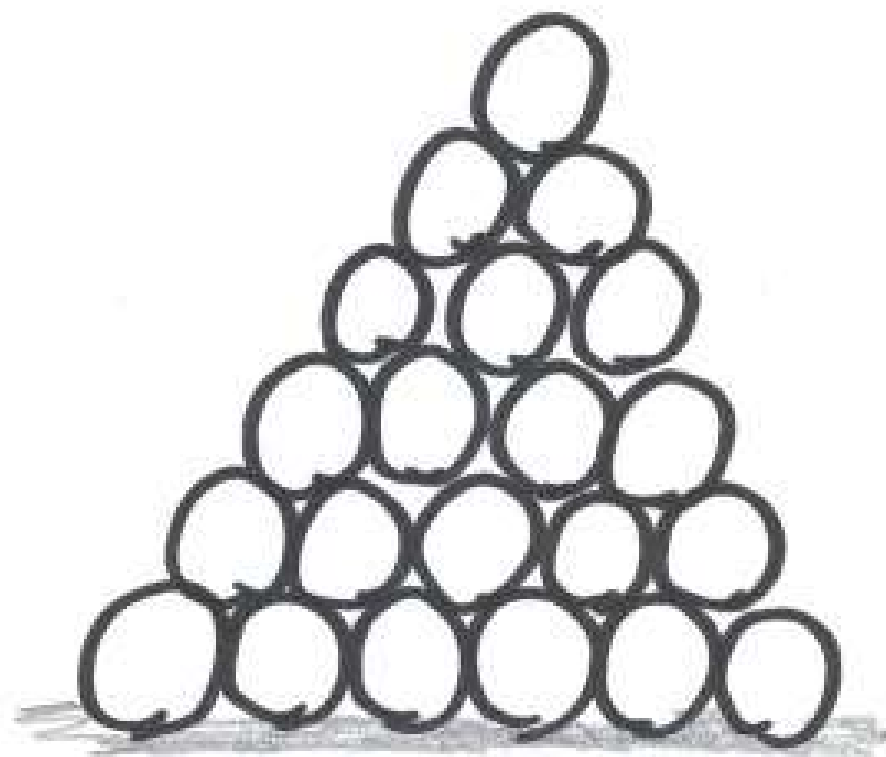
Why do math games matter?

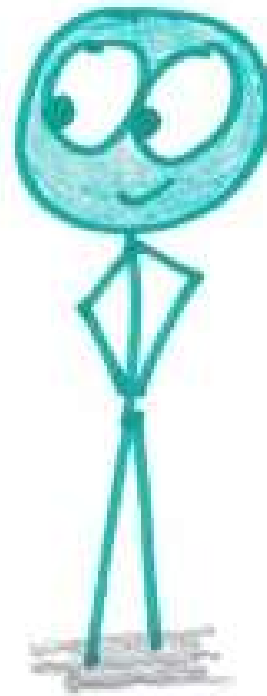
Because they teach us to seek edges, extremes, worst-case scenarios—to test our ideas by how they might fail.

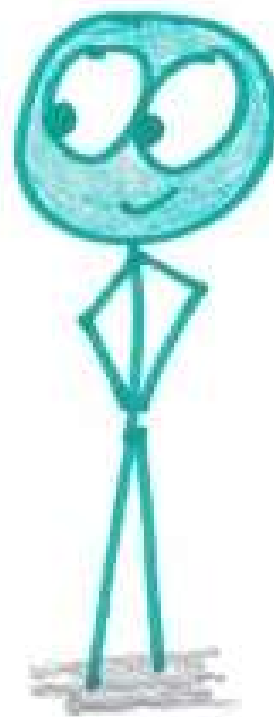
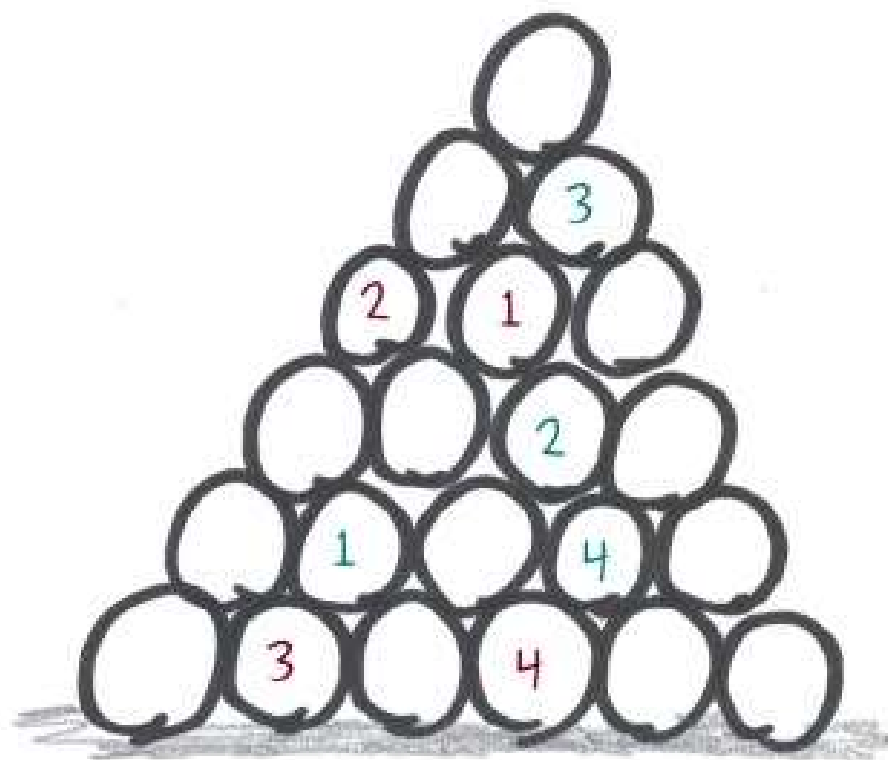
BLACK HOLE

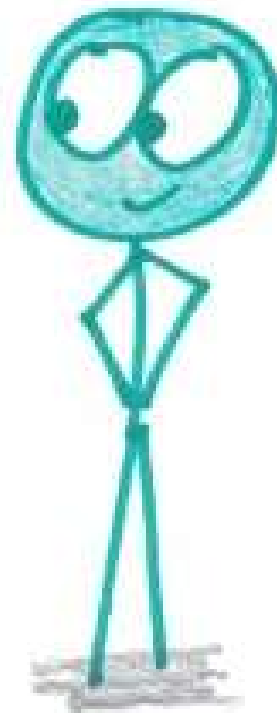
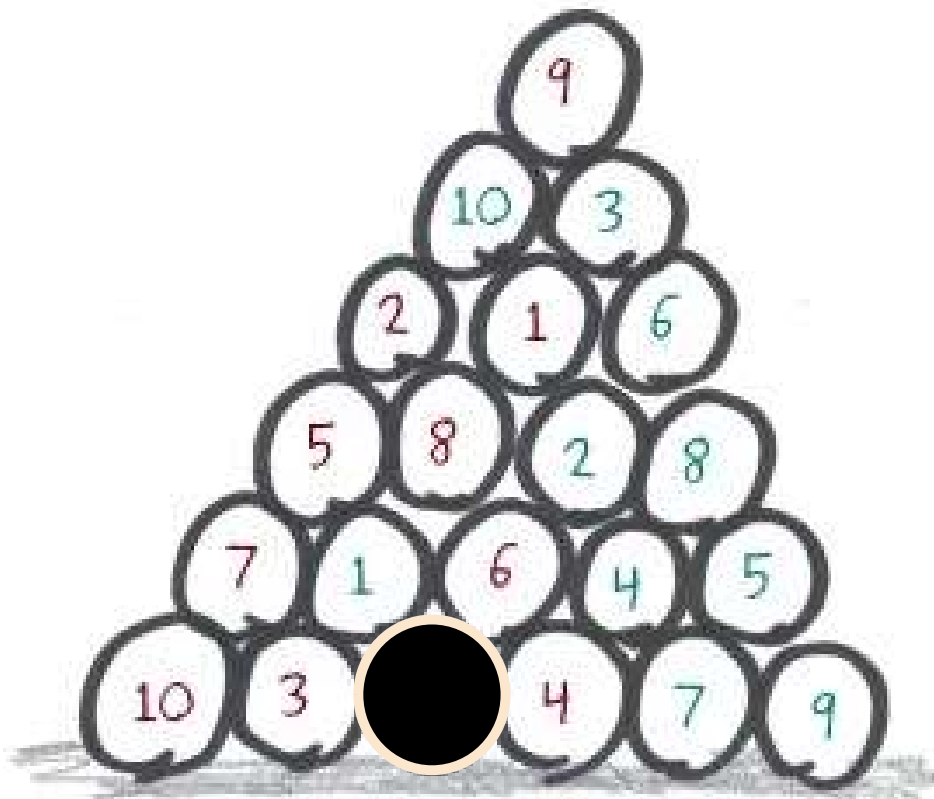
A GAME OF DISAPPEARING NUMBERS

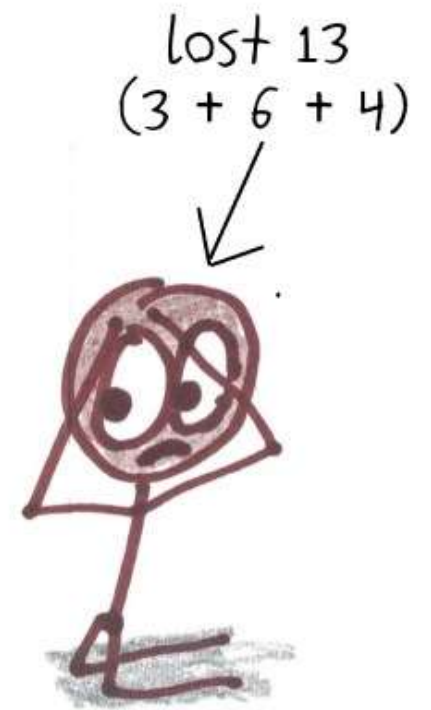
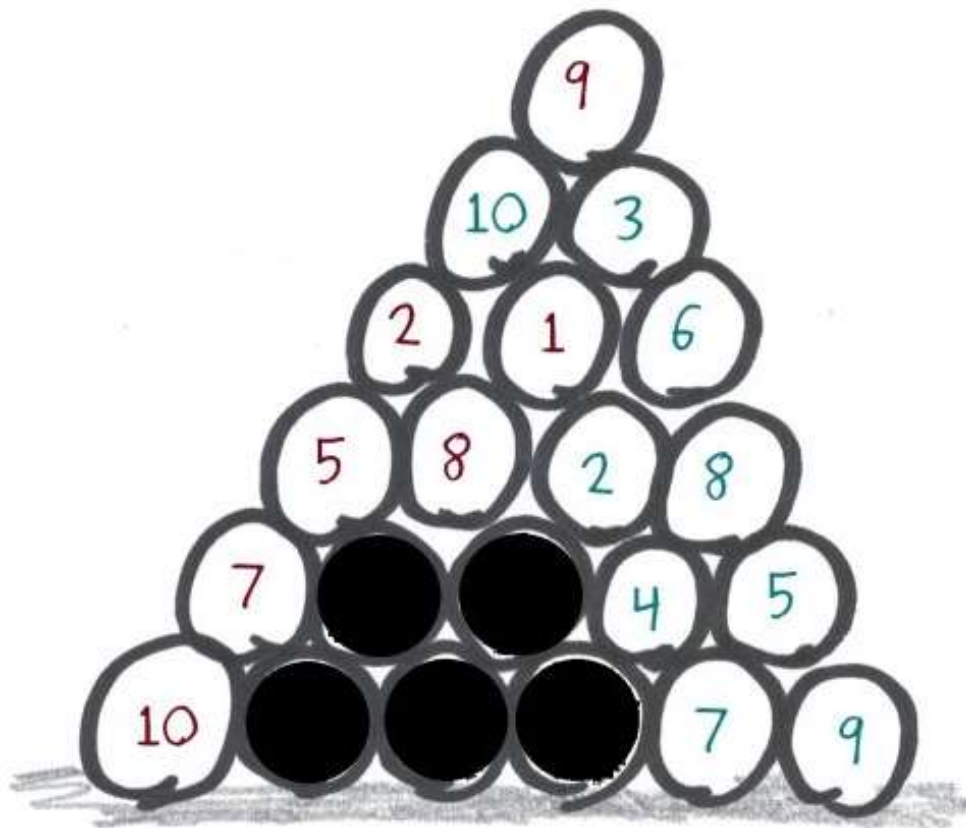


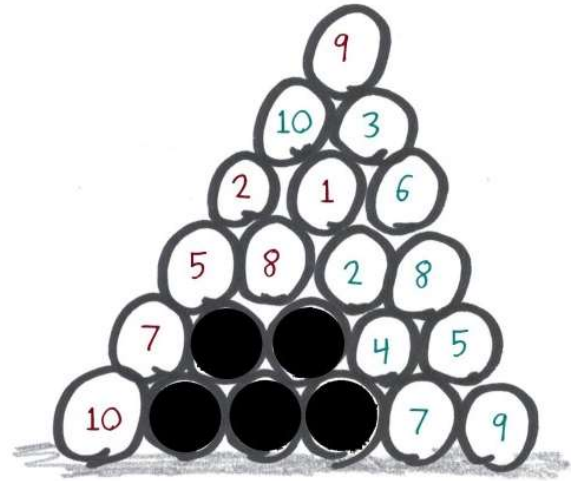












Why do math games matter?

Because they're fun little time fillers, and you know what? We're human. We need that sometimes.



OUTRANGEIOUS

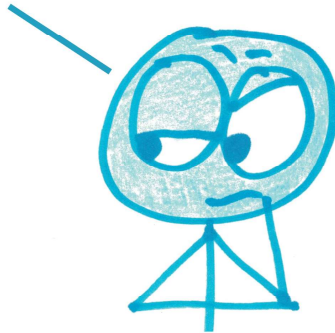
A TRIVIA GAME FOR PEOPLE WHO DON'T KNOW ANYTHING

10 to 90?

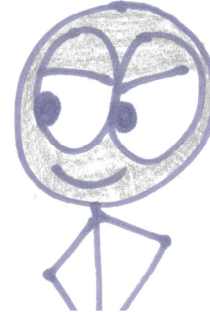


has no idea

30 to 60...

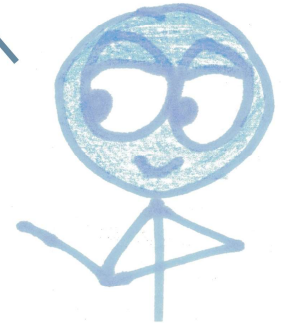


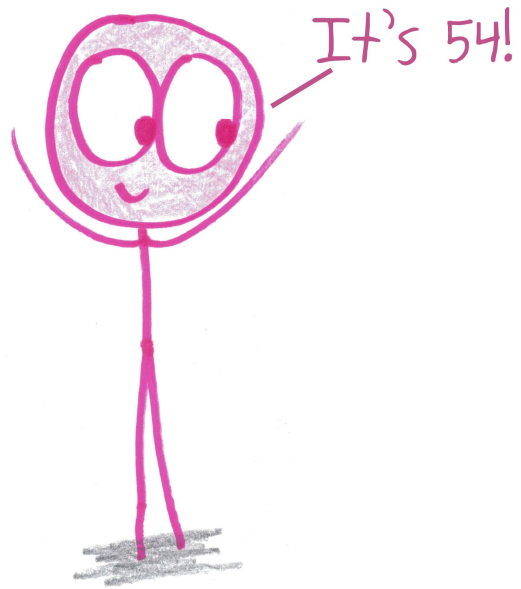
52 to 53!



very confident

40 to 55.



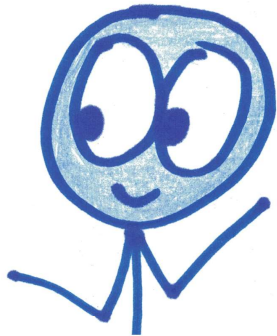


You get **one point per opponent that you defeat.**

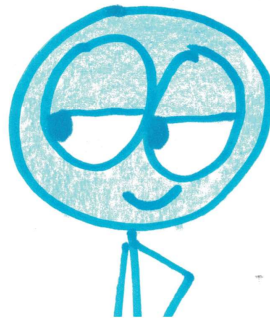
You can **defeat an opponent in one of two ways:**

- 1) Your range is valid, and theirs is not.
- 2) Both ranges are valid, and yours is narrower.

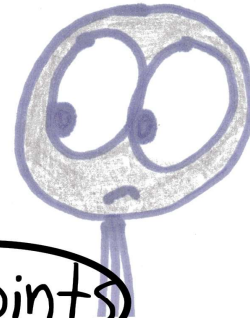
✓
10 to 90



✓
30 to 60



✗
52 to 53



0 points

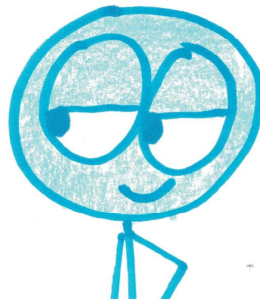
✓
40 to 55



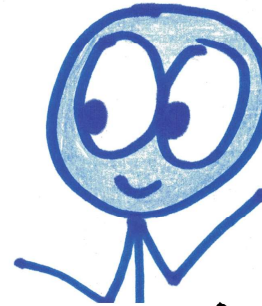
40 to 55



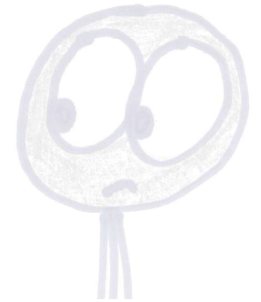
30 to 60



10 to 90



52 to 53



← narrowest widest →

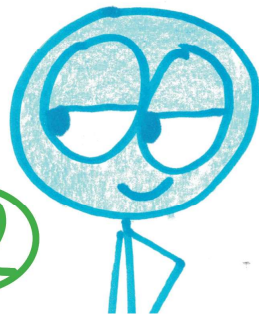
40 to 55

+3



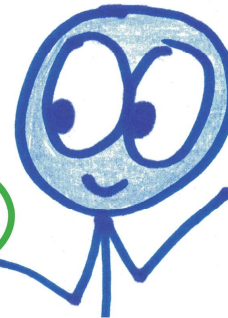
30 to 60

+2

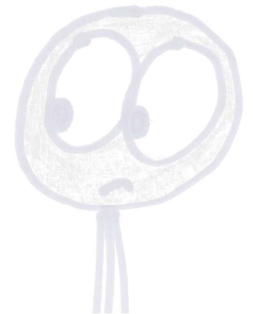


10 to 90

+1



52 to 53



(SOME
SESSIONS
HAVE
MULTIPLE
SPEAKERS)

1.
How many
speakers are at this
summit?

(GIVE
WHOLE
NUMBERS
OF YEARS)

2.
How old am I?

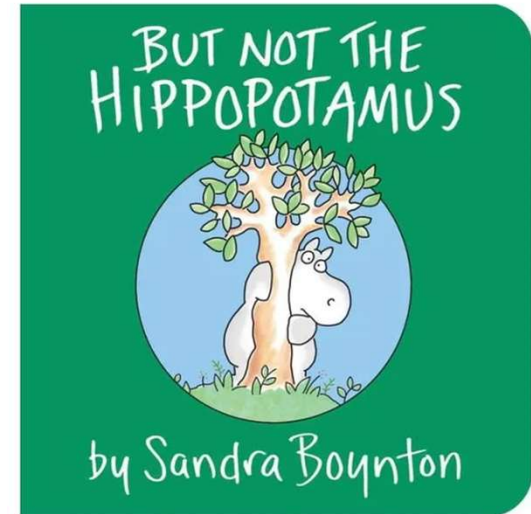
(IN
MINUTES
AND
SECONDS)

3.
What is the fastest
time ever for
running a mile?

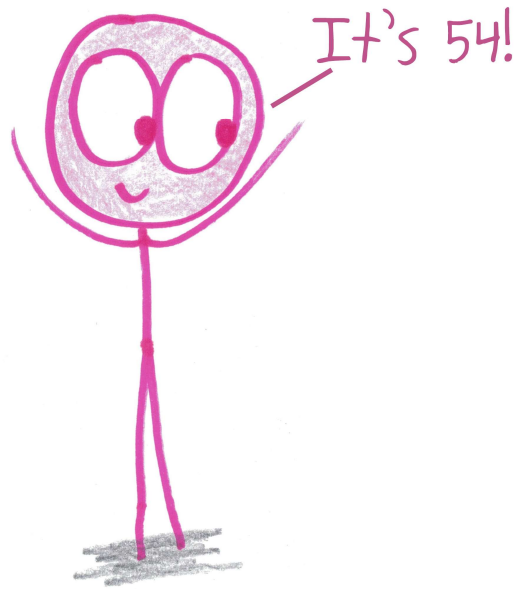
(IN FEET
AND
INCHES)

4.
How tall was
the tallest ever
NBA player?

(MY KIDS ARE
1 AND 5)



5.
How many Sandra
Boynton Books do
we have in my
house?



You get **one point per opponent that you defeat**.

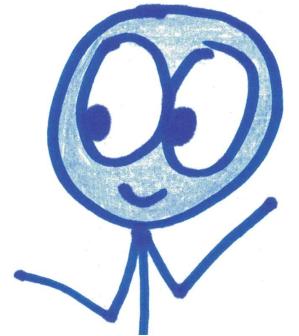
You can **defeat an opponent in one of two ways**:

- 1) Your range is valid, and theirs is not.
- 2) Both ranges are valid, and yours is narrower.

51

1.
How many
speakers are at
this summit?

10 to 200

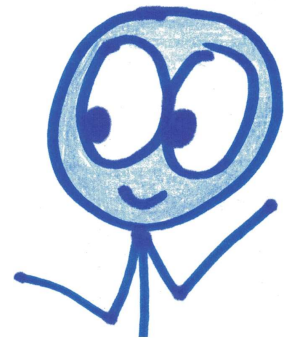


37

2.

How old am I?

20 to 50

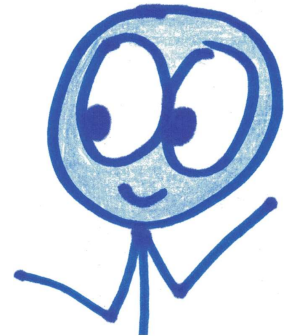


3 MINUTES,
43 SECONDS

2:00 to 7:00

3.

What is the
fastest time ever
for running a
mile?

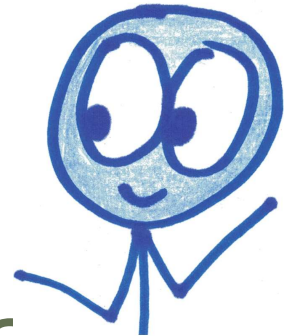


7'7"

4.

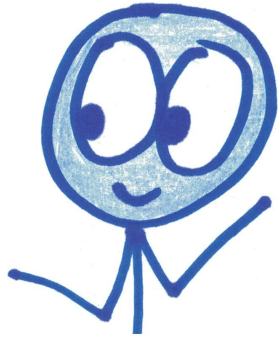
How tall was
the tallest ever
NBA player?

7'0" to 9'0"

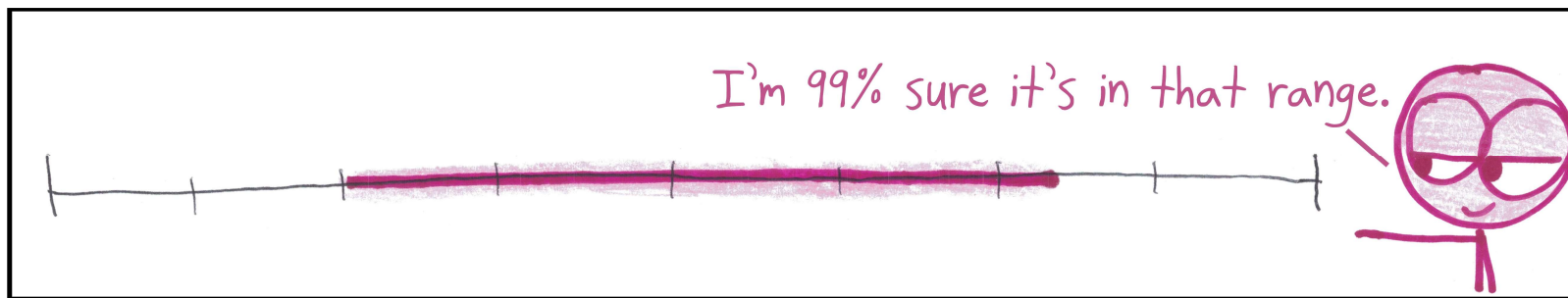
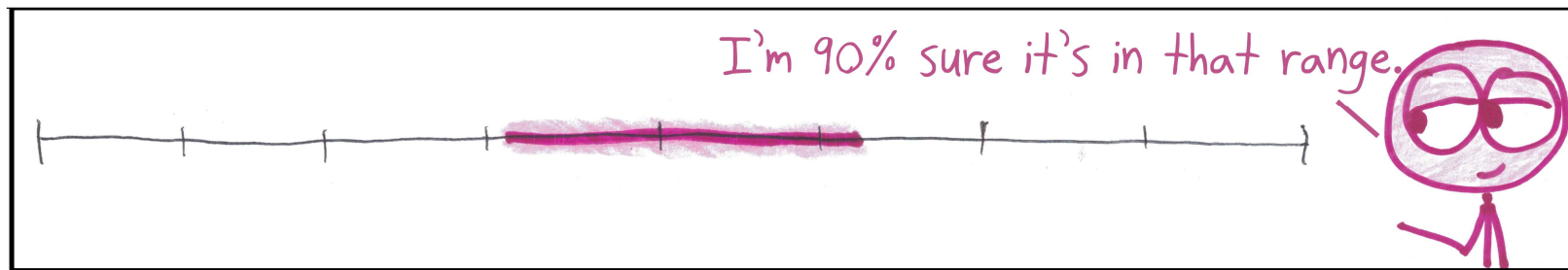
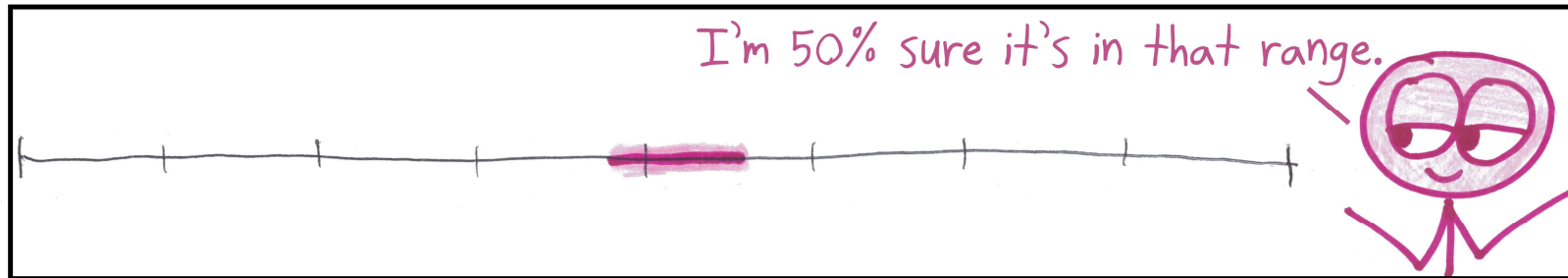


18

0 to 100

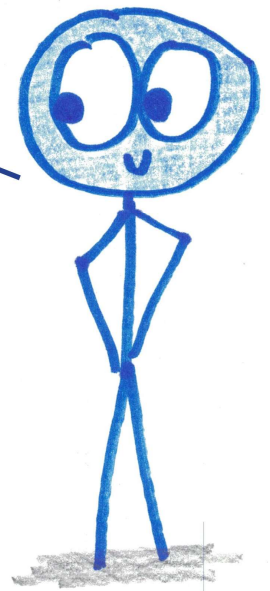
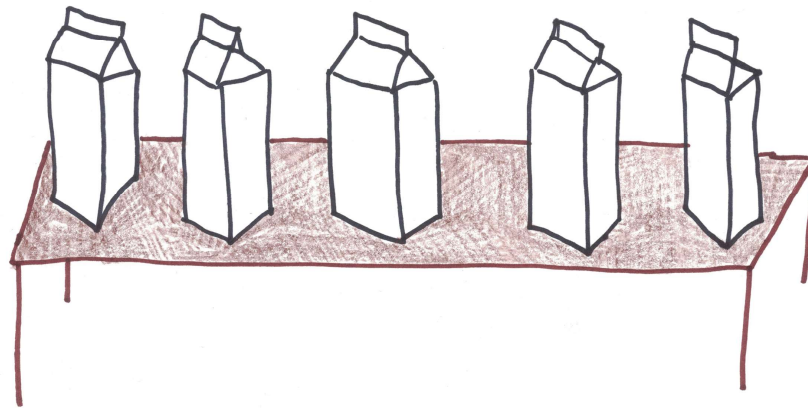
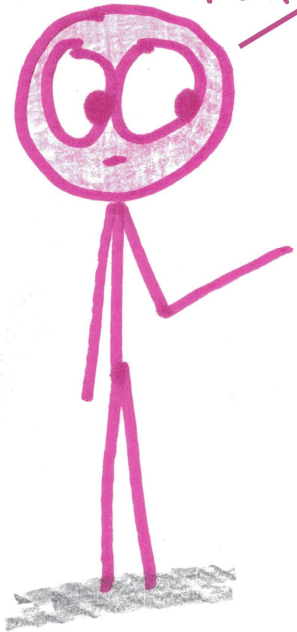


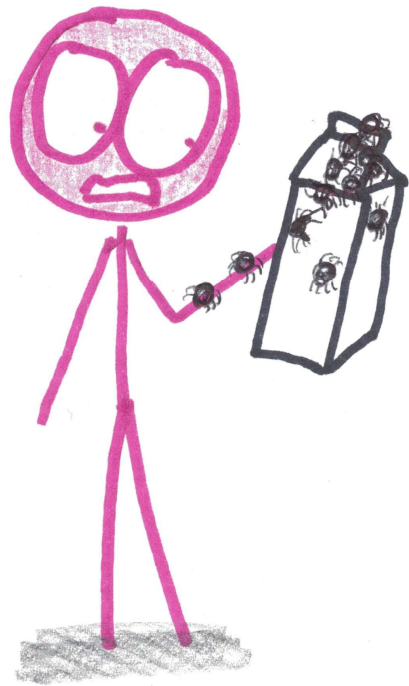
5.
How many Sandra
Boynton Books do
we have in my
house?



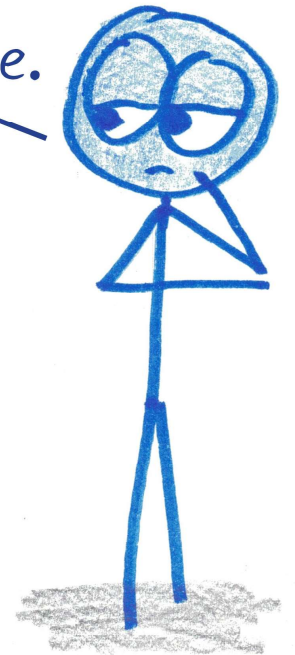
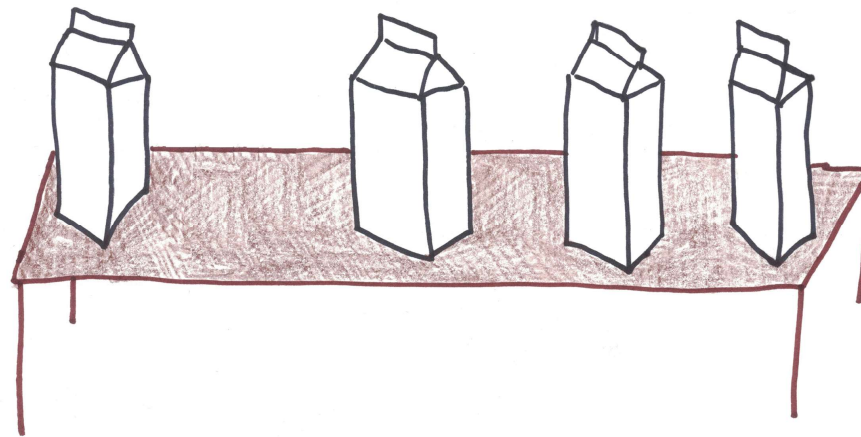
You're sure these milk cartons aren't full of spiders?

Of course! Why would you even ask? Each carton is 100% spider-free, guaranteed!





Well, like I said, 80% spider-free.



Why do math games matter?

Because they teach us the limits of certainty and give us practice navigating a world of approximation and doubt.

Thank You!

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