# Games that Promote Equity and Mathematical Brilliance

## in the Upper Elementary Classroom

Louisa Connaughton & Jenna Laib

Regional Conference & Exposition
BALTIMORE
NOVEMBER 30–DECEMBER 2, 2022

# Intros

**Louisa Connaughton**
PK-6 Math Specialist
Chestnut Hill, MA

**Jenna Laib**
K-8 Math Specialist & Coach
Brookline, MA

# You're at the right presentation if...

- You are passionate about building equitable classroom communities
- You recognize the value of using games for strategic purposes
- You value and appreciate simplicity

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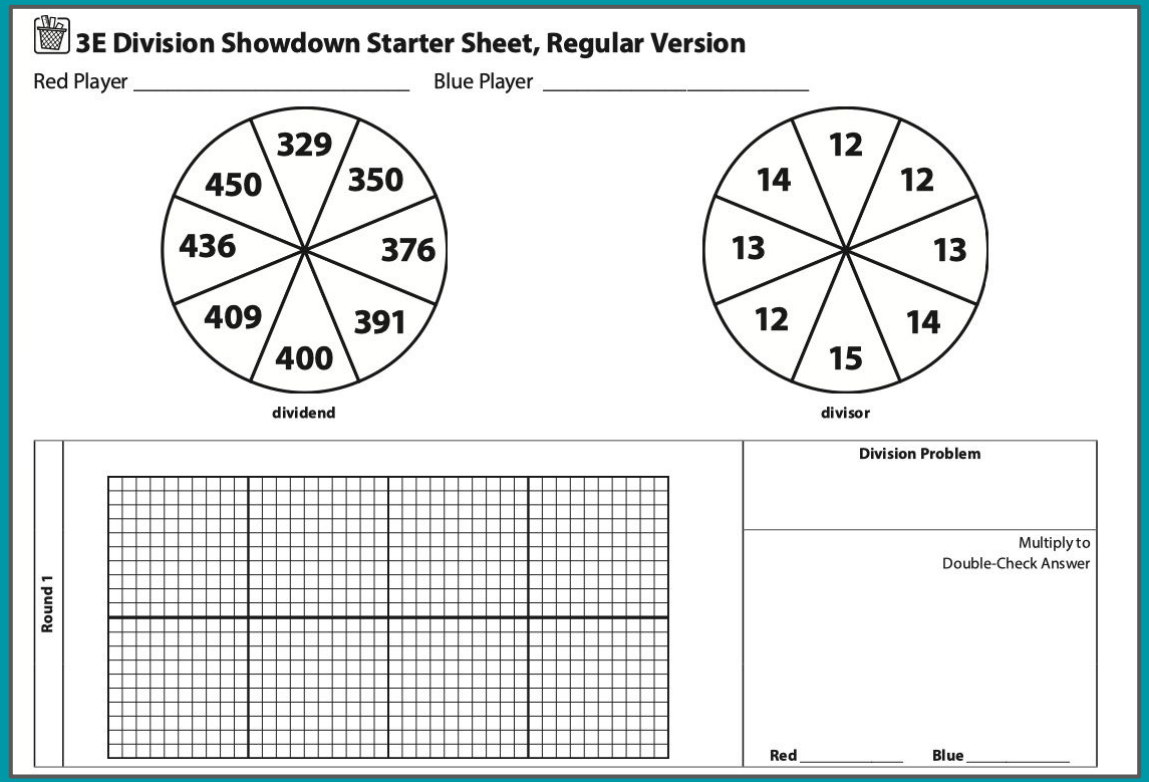
@lpconnaughton @jennalaib

# What do you notice? ...wonder?



**3E Division Showdown Starter Sheet, Regular Version**

Red Player _____ Blue Player _____

# Work Place Instructions 3E Division Showdown page 1 of 2

**Each pair of players needs**

- a 3E Division Showdown Starter Sheet (Regular or Challenge Version) to share
- a 3E Division Showdown Continuation Sheet A to share
- a 3E Division Showdown Continuation Sheet B to share
- 1 spinner overlay
- 1 red and 1 blue colored pencil or markers

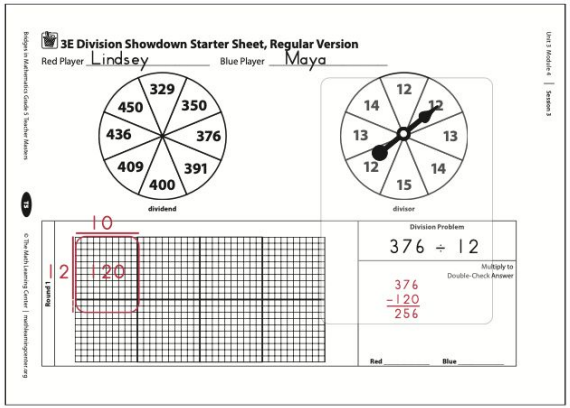
**1** Players record their names at the top of the starter sheet, then decide which player will go first and what color each player will use.

**2** Player 1 spins the spinners and records a division problem using the two numbers. Then he marks and labels the known dimension (the divisor) on the grid with his or her color.

**3** Next, Player 1 loops and labels 10 times the divisor, and records the results in the figuring box to the right of the grid, working in his or her own color.

For example, if the divisor spun was 12, loop and label 12 × 10 on the grid, then mark it by drawing the dimension across the top. Work in the figuring box to subtract 120 from the dividend to see how much is still left.

> ***Lindsey*** *OK, I'm first. I spun 376 and 12, so now I have to write 376 ÷ 12 in the division problem box. Then I have to mark 12 on the side of the grid, and loop and label 10 × 12, which is 120. The last thing I have to do is subtract 120 from 376 so we can see how much we still have. It's 256, and it's your turn now, Maya.*




**4** Player 2 takes a turn to loop and label 10 times the divisor using his or her own color, and record the results in the figuring box.



**5** Players take turns looping and labeling 10 times the divisor and recording the results in the figuring box until there isn't enough left of the dividend to subtract 10 times the divisor again.

**6** When there isn't enough left to subtract 10 times the divisor anymore, the player whose turn it is gets to subtract as many groups of the divisor as he or she wants.

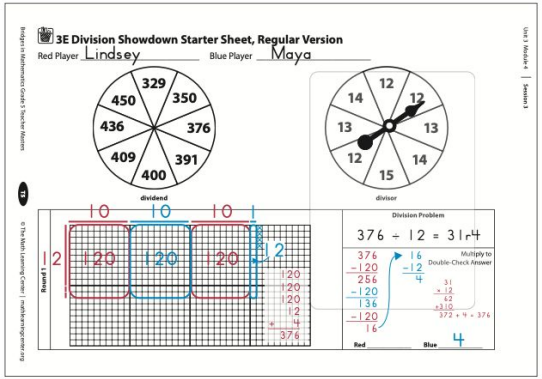
The player should try to remove as many groups as possible, since the player who makes the last removal wins the round.

**7** The player who makes the last move must do the following:

- Loop and label the final groups on the grid.
- Subtract the final amount in the figuring box.
- Show the remainder, if there is one, with Xs on the grid.
- Write the answer to the division problem.
- Multiply the quotient times the divisor, and add the remainder if there is one, to double-check the answer.

**8** The player who makes the last move scores points equal to the remainder, if there is one. If there is no remainder he scores 1 point for being the last to make a move.

Before the winner of the round can take the points, the other player gets to add up the pieces, including the remainder, on the grid to be sure they total the dividend. If they don't, both players have to find the mistake and fix it.




**9** Players play four more rounds (using 3E Division Showdown Continuation Sheets A & B to record the results), then find the sum of their points from all 5 rounds to see who wins the game. (High score wins.)

Players should take turns starting first. If the red player started Round 1, the blue player should start Round 2, and they should continue to alternate starting each new round.

## Game Variations

**A** Use the Challenge Version of the Starter Sheet, which has higher dividends and divisors.

## Work Place Instructions 3E Division Showdown page 1 of 2

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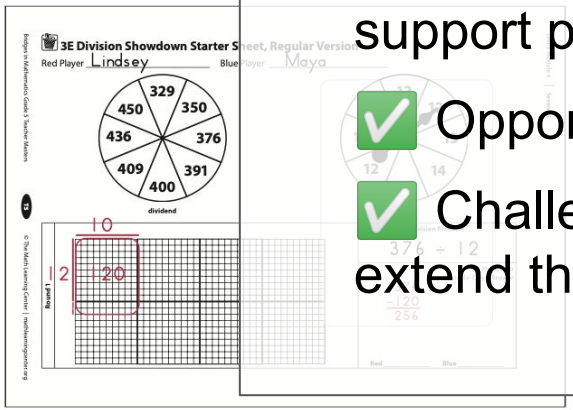
For example, if the divisor spun was 12, loop and label 12 × 10 on the grid, and record 10 across the top. Work in the figuring box to subtract 120 from the dividend to see how much is still left.

*Lindsey OK, I'm first. I spun 376 and 12, so now I have to write 376 ÷ 12 in the division problem box. Then I have to mark 12 on the side of the grid, and loop 10 [illegible]. The last thing I have to do is subtract 120 from 376 so we can see [illegible] it's your turn now, Maya.*




**4** Player 2 takes a turn to loop and label 10 times the divisor using his or her own color, and record the results in the figuring box.

## Work Place Instructions 3E Division Showdown page 2 of 2

**5** Players take turns looping and labeling 10 times the divisor and recording the results in the figuring box until there isn't enough left of the dividend to subtract 10 times the divisor again.

**6** When there isn't enough left to subtract 10 times the divisor anymore, the player whose turn it is gets to subtract as many groups of the divisor as he or she wants.

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- Show the remainder, if there is one, with Xs on the grid.
- Write the answer to the division problem.

Optional: Multiply to double-check the answer by adding the remainder if there is one, to double-check the answer.

**8** The player who makes the last move scores points equal to the remainder, if there is one. If there is no remainder he scores 1 point for being the last to make a move.

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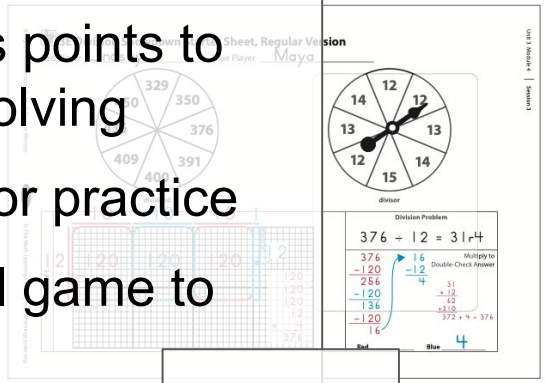


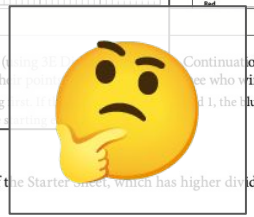

**9** Players play four more rounds (using 3E Division Showdown Continuation Sheets A & B to record the results), then find the sum of their points. The player who wins the game. (High score wins.)

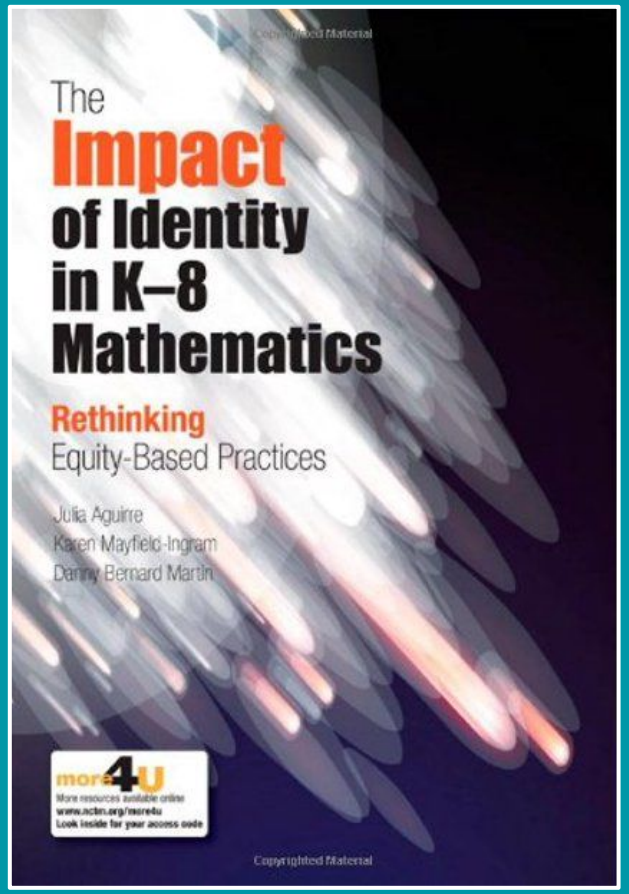
Players should take turns starting [illegible] Round 1, the blue player should start Round 2, and they should continue to alternate [illegible]

### Game Variations

**A** Use the Challenge Version of the Starter Sheet, which has higher dividends and divisors.

- ✅ Opportunities to connect representations
- ✅ Multiple access points to support problem solving
- ✅ Opportunities for practice
- ✅ Challenge level game to extend thinking






# The Impact of Identity in K-8 Mathematics: Rethinking Equity-Based Practices

Julia Aguirre, Karen Mayfield-Ingram, and Danny Bernard Martin

Published by NCTM in 2013

# Defining *equity*

"All students, in light of their humanity—their personal experiences, backgrounds, histories, languages, and physical and emotional well-being—must have the opportunity and support to learn rich mathematics that fosters meaning making, empowers decision making, and critiques, challenges, and transforms inequities and injustices."

from *The Impact of Identity in K-8 Mathematics: Rethinking Equity-Based Practices* (Aguirre, Mayfield-Ingram, Martin; NCTM 2013)

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# 5 Equity-Based Teaching Practices

- Going deep with mathematics
- Leveraging multiple mathematical competencies
- Affirming mathematics learners' identities
- Challenging spaces of marginality
- Drawing on multiple resources of knowledge (math, culture, language, family, community)

from *The Impact of Identity in K-8 Mathematics: Rethinking Equity-Based Practices* (Aguirre, Mayfield-Ingram, Martin; NCTM 2013)

# Evaluating games with equity in mind

| | |
|---|---|
| #1 Going deep with mathematics | **Will playing the game deepen mathematical understanding?** |
| #2 Leveraging multiple mathematical competencies | **Are there multiple entry points?** |
| #3 Affirming mathematics learners' identities | **Are there multiple ways to participate?** |
| #4 Challenging spaces of marginality | **Are there multiple ways to be successful?** |
| #5 Drawing on multiple resources of knowledge | **Is the game simple and accessible?** |

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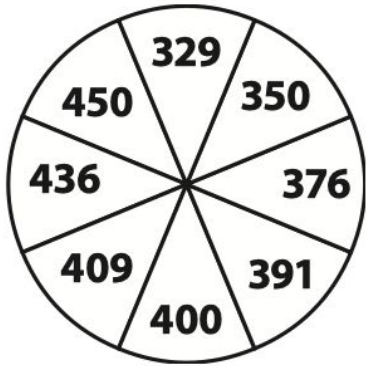
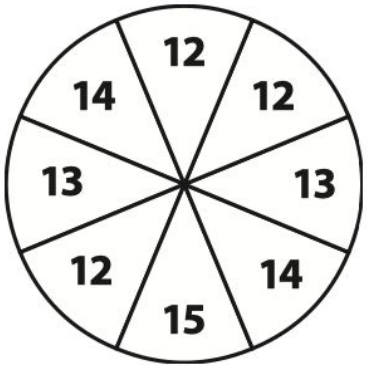
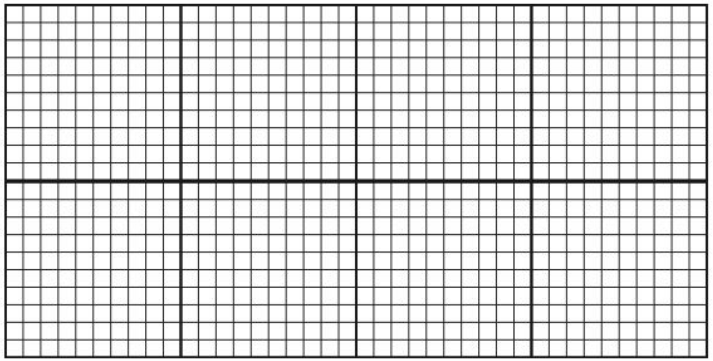



dividend




divisor

Round 1



**Division Problem**

Multiply to
Double-Check Answer

**Red** _____ **Blue** _____

# Equity and Student Brilliance

- Students feel a sense of belonging when they are:
  - Welcome to share their brilliance
  - Expected to develop their thinking further
  - Learn *with* and *from* others in the room

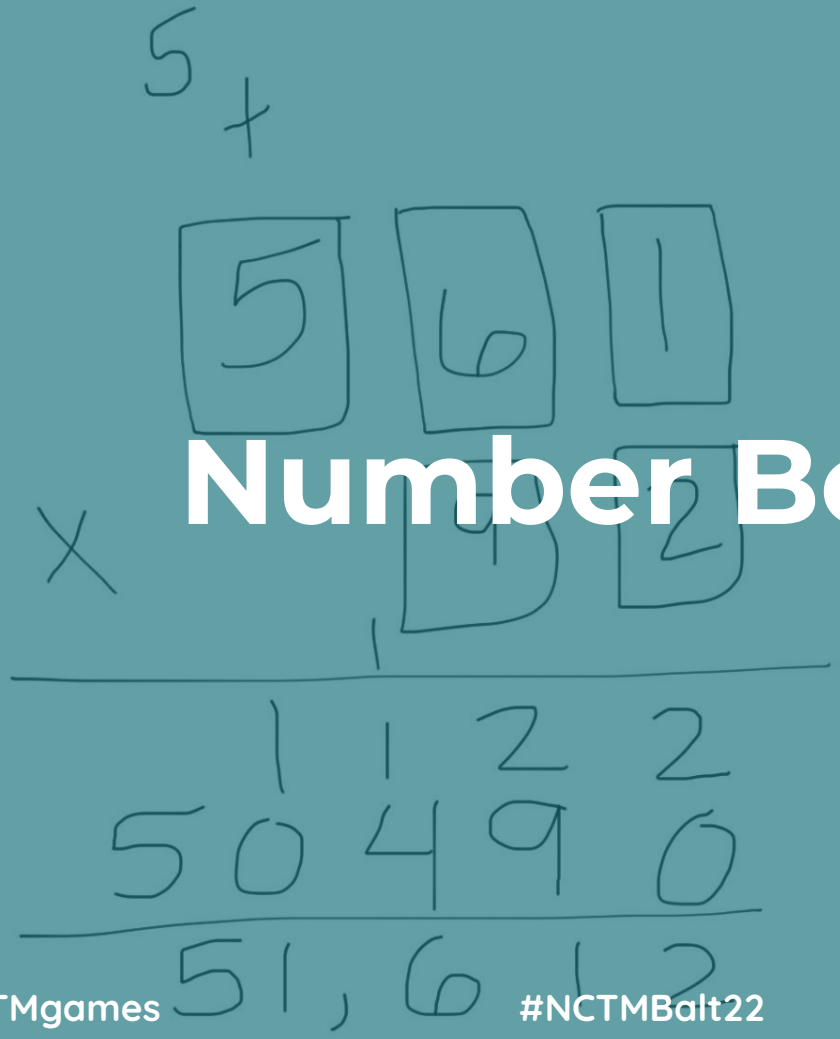
**What games promote this kind of environment?**

**What facilitation moves support this work?**

# The Games

## *Number Boxes*

## *The Skip Count Game*



# Number Boxes

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# Getting Started: Number Boxes

<u>Materials</u>

- Something to write *with*

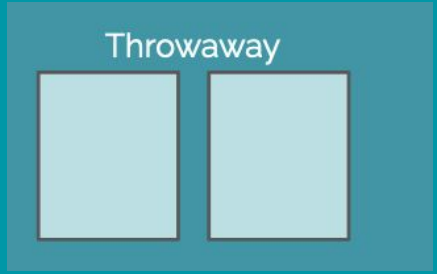

- Something to write *on*

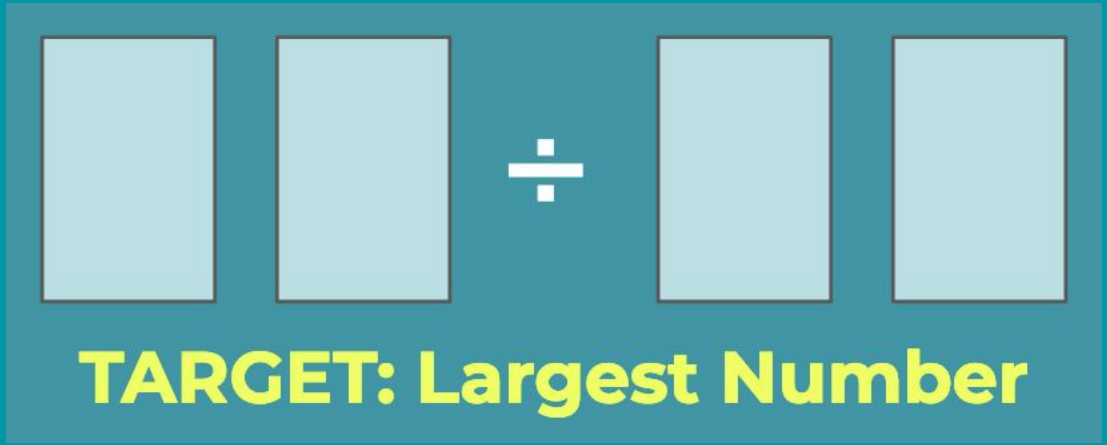
- Something to generate random numbers

- A Plan
  - Structure of game board
  - Target/goal

# How To Play

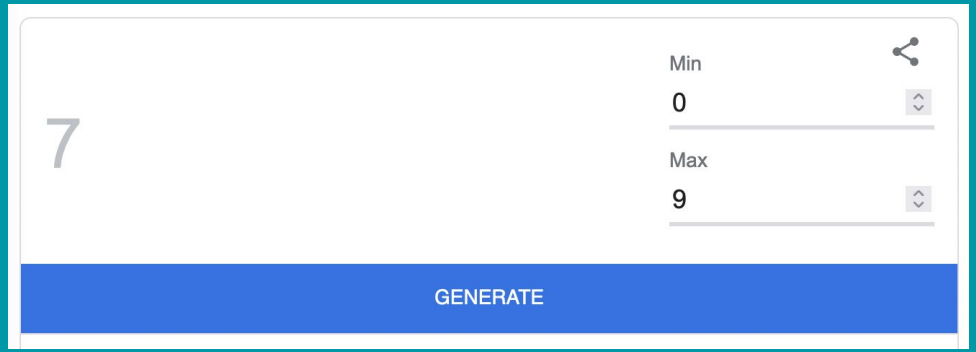
1. Set up a board and set the target



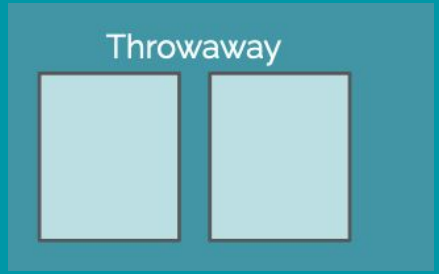
# How To Play

1. Set up a board and set the target
2. Generate a random digit



# How To Play

1. Set up a board and set the target
2. Generate a random digit
3. Place the digit *(and it can't be moved!)*




# How To Play

1. Set up a board and set the target
2. Generate a random digit
3. Place the digit *(and it can't be moved!)*
4. Repeat until all boxes have been filled

# How To Play

1. Set up a board and set the target
2. Generate a random digit
3. Place the digit *(and it can't be moved!)*
4. Repeat until all boxes have been filled
5. Calculate (or collaborate)!

# Thank you, Wipebook

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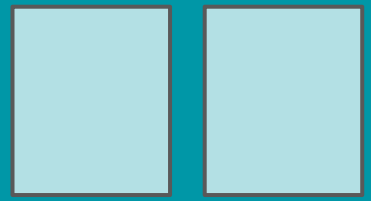
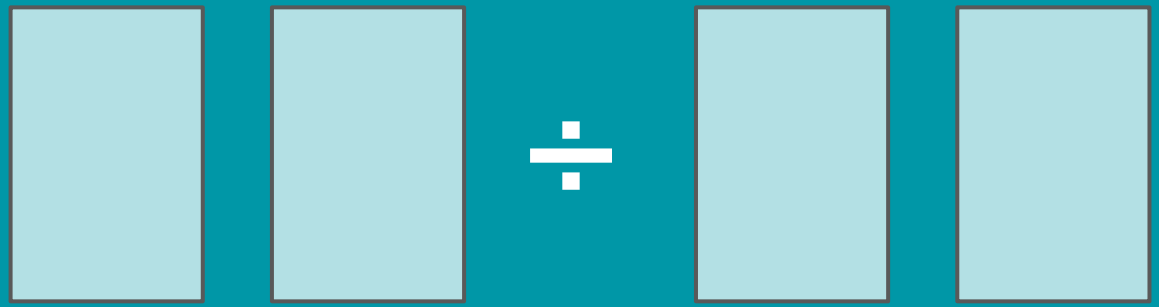
# Playing the Game

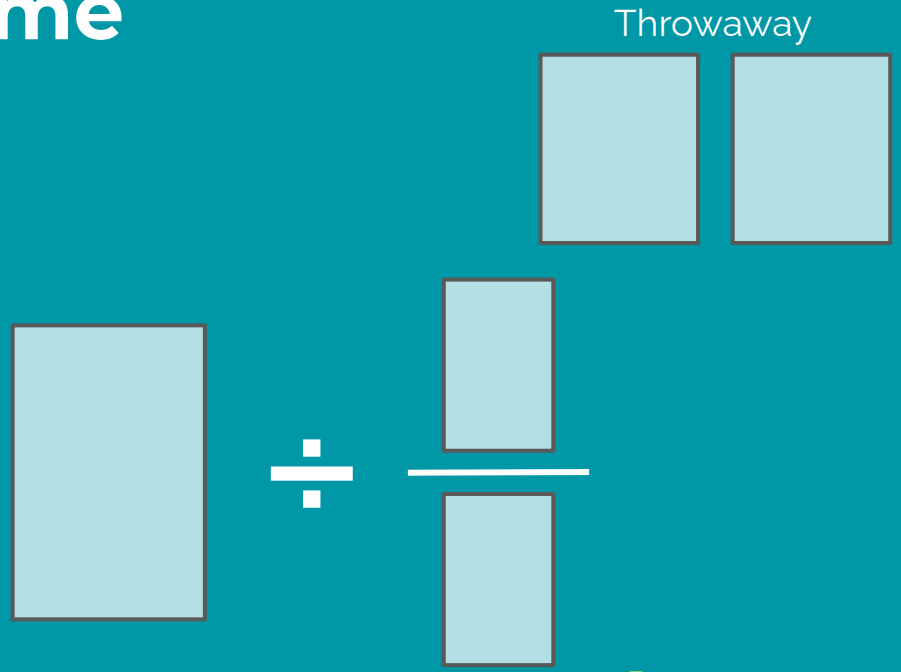
Throwaway





**TARGET: Largest Number**

# Playing the Game

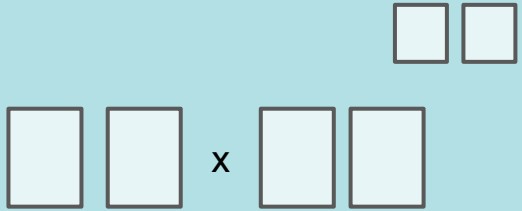



**TARGET: Largest Number**

# Playing the Game

**A**

**Target:** Closest to 1,500

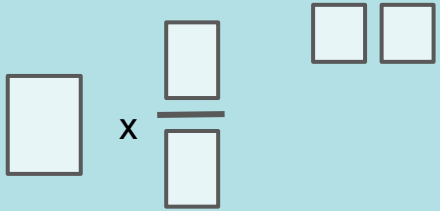


**B**

**Target:** Largest Number

**C**

**Target:** Smallest Product



**then…**

Come up with your own!

- What mathematical content?
- How will you set up the board?
- What will the target or goal be?

**Reflect:**
What facilitation moves could help uncover student brilliance?

http://bit.ly/NCTMgames

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@lpconnaughton @jennalaib

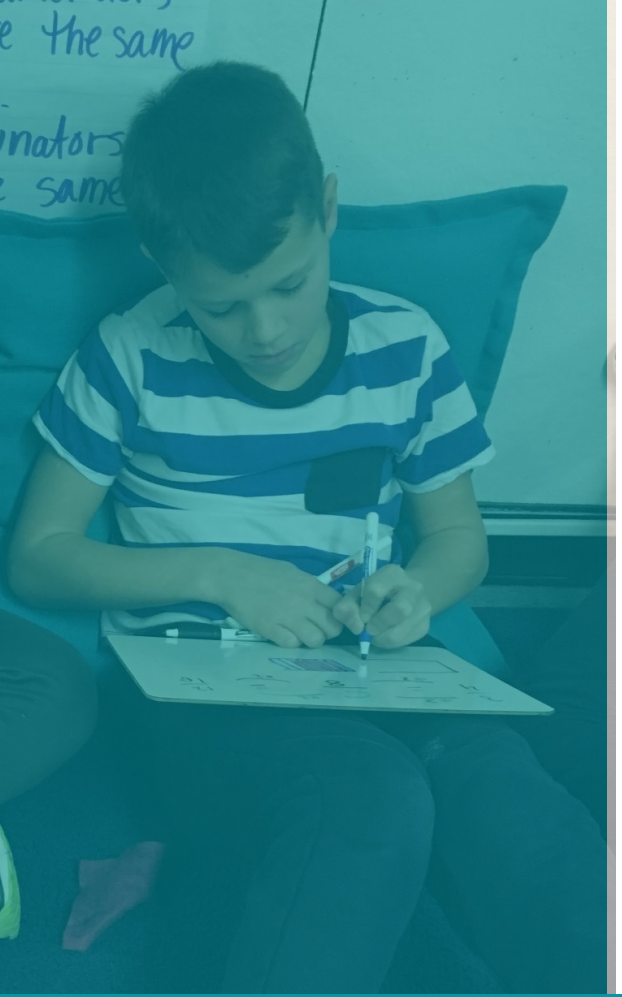
# If you tried to plan your own...

- What worked well?

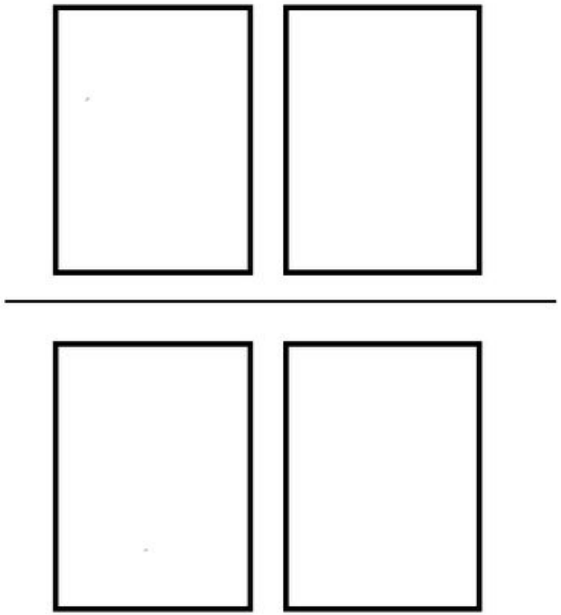
- What was challenging?

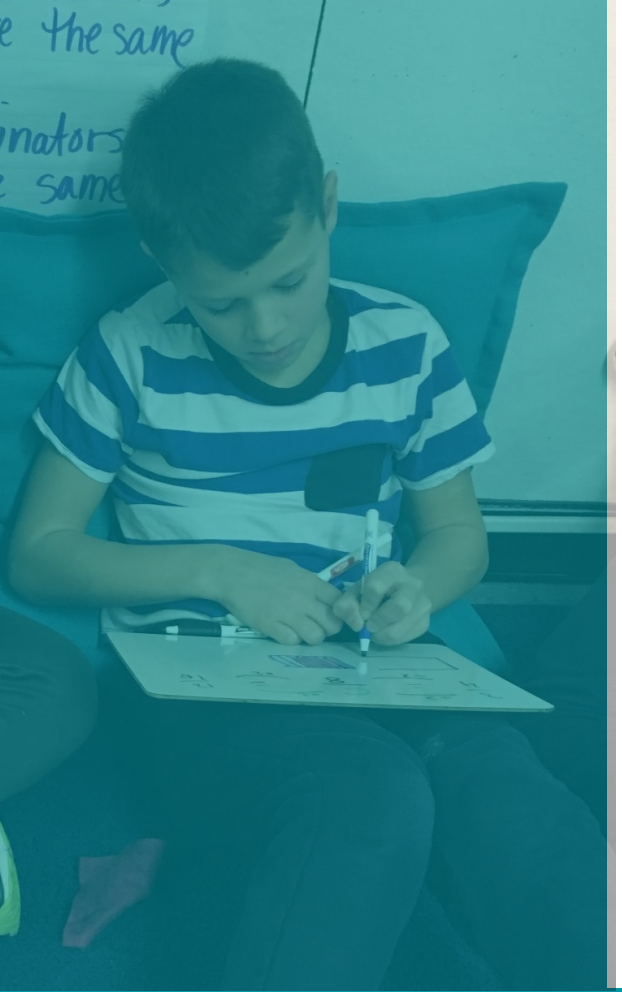
# Planning the Structure

- What mathematical content do you want to focus on?
- What mathematical ideas do you anticipate will surface that you might want to explore?
- What structures (board and target) will maximize your learning goals?

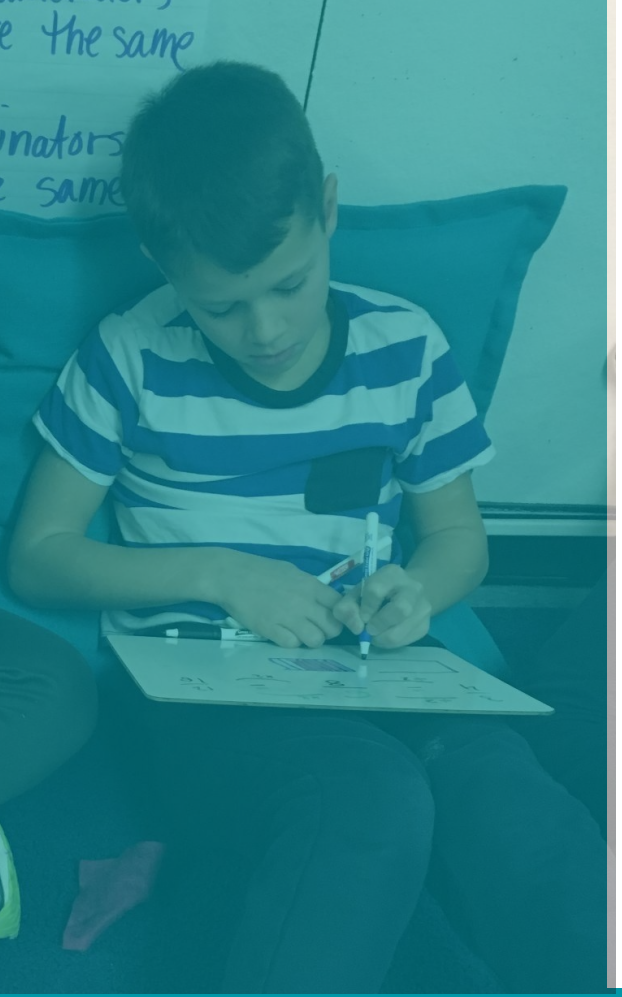



# Game 1 - Smallest Fraction



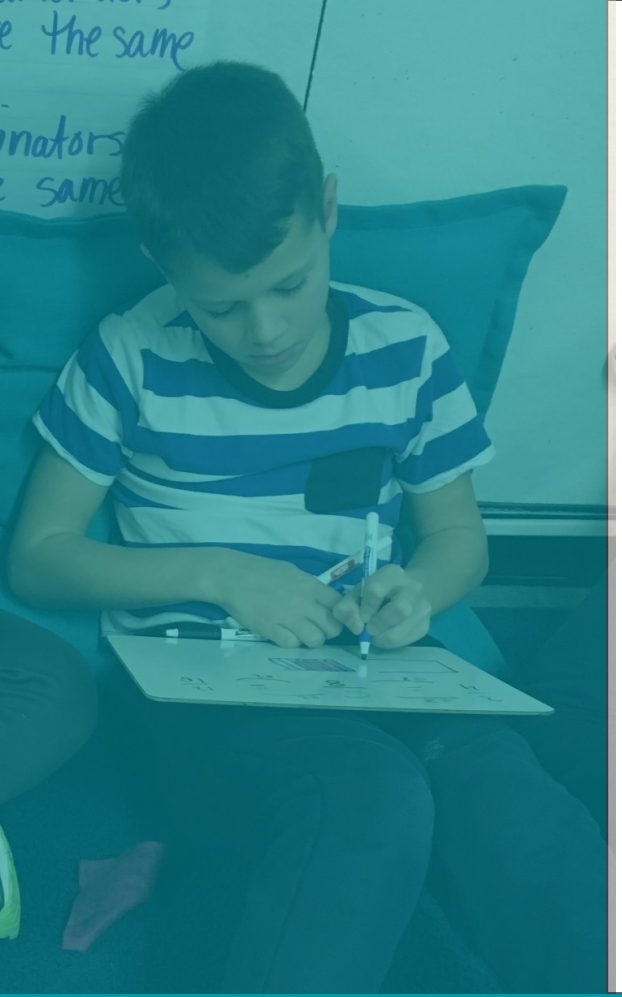



$$\frac{25}{66} \text{ vs } \frac{26}{65}$$



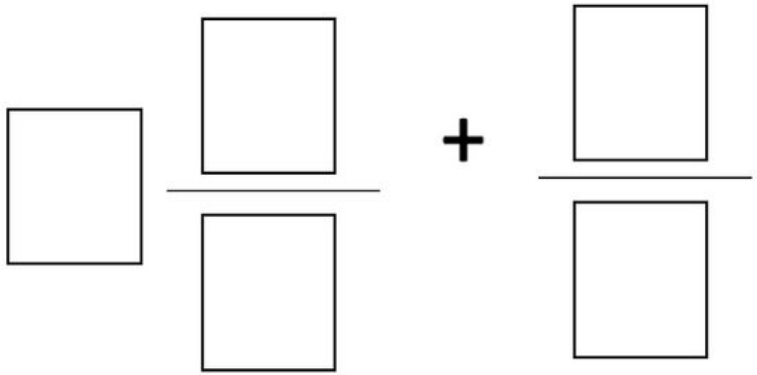
## Game 2 - Smallest Sum

$$\frac{\square}{\square} + \frac{\square}{\square}$$



Use each of the digits 2, 3, 4, 5, 6 to fill in the boxes below to create an expression with the **smallest value** possible.

You do not need to solve the problem (but you can if you want!)



# Evaluating games with equity in mind

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#2 Leveraging multiple mathematical competencies

✅ **Are there multiple entry points?**

#3 Affirming mathematics learners' identities

✅ **Are there multiple ways to participate?**

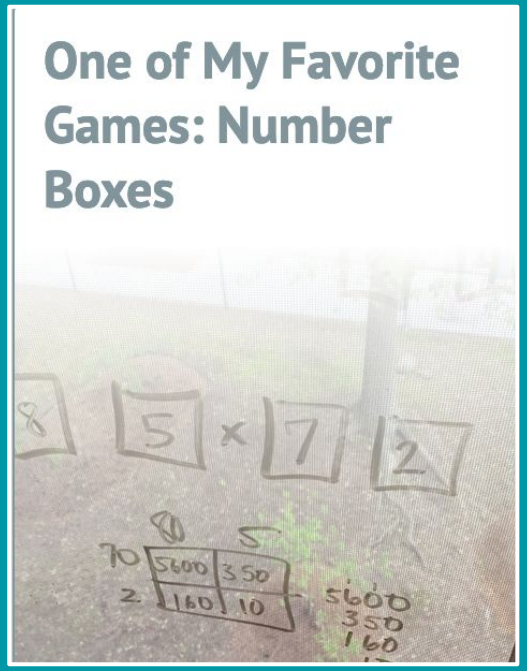
#4 Challenging spaces of marginality

✅ **Are there multiple ways to be successful?**

#5 Drawing on multiple resources of knowledge

✅ **Is the game simple and accessible?**

# Read More




THINKING MATHEMATICALLY

ABOUT

GUES

## “Number Boxes”

NOVEMBER 6, 2021

MARK CHUBB

5 COMMENTS

A few weeks ago I was introduced to Jenna Laib‘s game “Number Boxes” and was very interested in using it as a dynamic game to help students learn a variety of new content — Jenna’s blog explaining the game can be found here: “One of My Favorite Games: Number Boxes“.

http://bit.ly/NCTMgames

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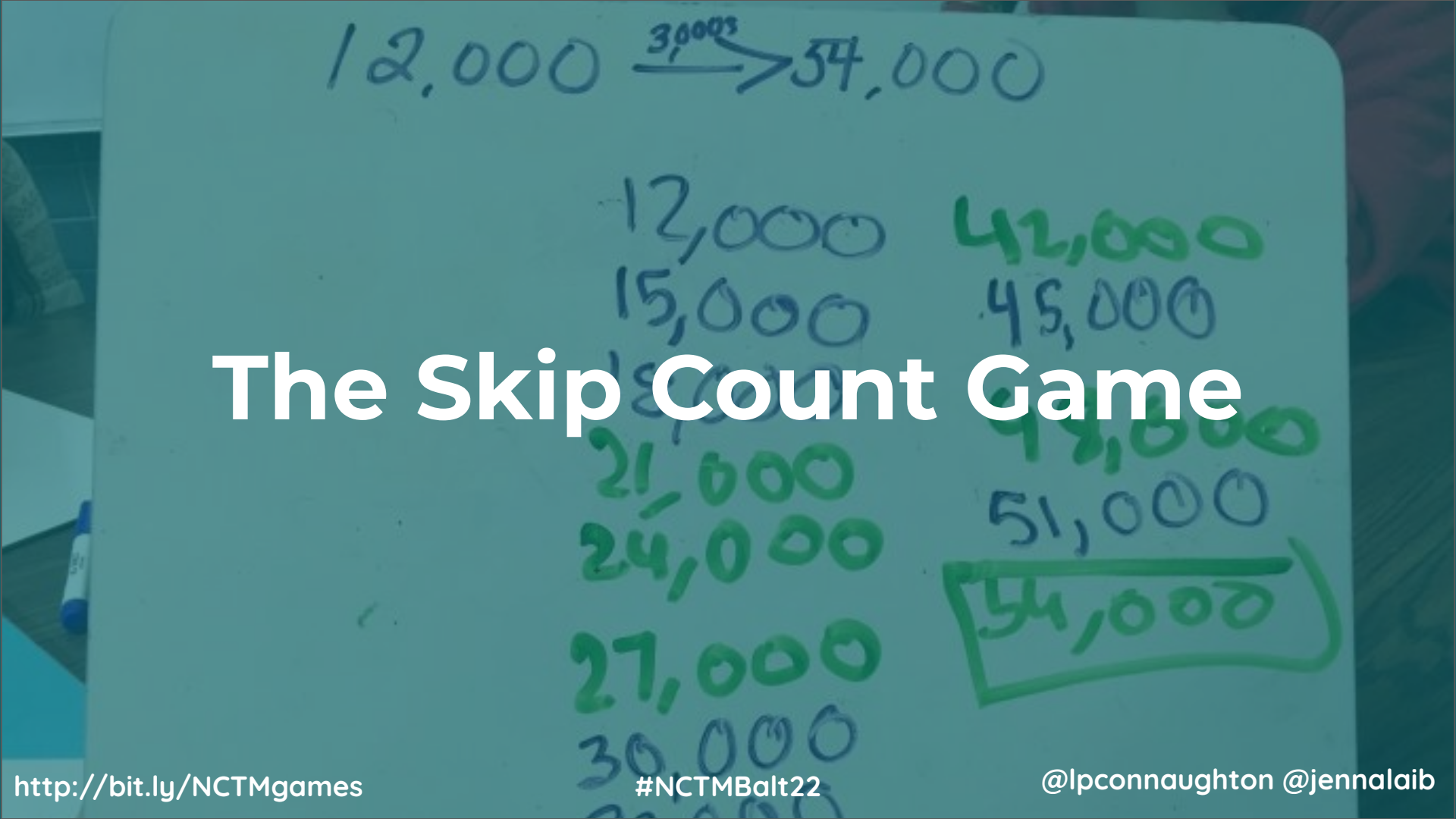
@lpconnaughton @jennalaib




# The Skip Count Game

# Nim (21 Game)

| | | |
|---|---|---|
| 1 | 8 | 15 |
| 2 | 9 | 16 |
| 3 | 10 | 17 |
| 4 | 11 | 18 |
| 5 | 12 | 19 |
| 6 | 13 | 20 |
| 7 | 14 | |

# The Skip Count Game

- Players alternate writing 1, 2, or 3 numbers that follow a skip counting pattern.
- Does not need to start at 1, or end at 21
- Can skip count forwards or backwards
  - e.g. 8s, or 125s, or ¼s, etc.
- Player who lands on the ending number wins. 🏆

# How To Play the Skip Count Game

## Materials

- Something to write *with*

- Something to write *on*


- Plan
  - What to **skip count by**
  - Where to **stop/start**

# How To Play the Skip Count Game

## Materials

- Something to write *with*

- Something to write *on*


- Plan
  - What to **skip count by**
  - Where to **stop/start**

## Directions

- Player 1 starts at starting number, and skip counts 1, 2, or 3 numbers
- Player 2 continues skip counting (1, 2, or 3 numbers)
- Play continues until a player reaches the end
- Player who hits 'end' number wins

**402** *Forward by 20s* → **762**

| | | |
|---|---|---|
| 402 | 542 | 682 |
| 422 | 562 | 702 |
| 442 | 582 | 722 |
| 462 | 602 | 742 |
| 482 | 622 | 762 |
| 502 | 642 | |
| 522 | 662 | |

# Playing the Game

**A**

Start at **355**

Skip count **forwards by 50s**

End at **1255**

**B**

Start at **¼**

Skip count **forwards by ¼ s**

End at **21/4**

**C**

Start at **12,000**

Skip count **backwards by 200s**

End at **4,200**

---

**then…**

Come up with your own!

- What will be the start/end?
- What will you skip count by?
- How many "jumps"?

**Reflect:**
What facilitation moves could help uncover student brilliance?

# If you tried to plan your own...

- What was easy for you to do?

- What was challenging?

# Planning the Numbers

- What mathematical structures will emerge?
- Are there patterns you hope students will leverage? If so, what are they?
- How many “turns” should there be?

# Evaluating games with equity in mind

#1 Going deep with mathematics

✅ **Will playing the game deepen mathematical understanding?**

#2 Leveraging multiple mathematical competencies

✅ **Are there multiple entry points?**

#3 Affirming mathematics learners' identities

✅ **Are there multiple ways to participate?**

#4 Challenging spaces of marginality

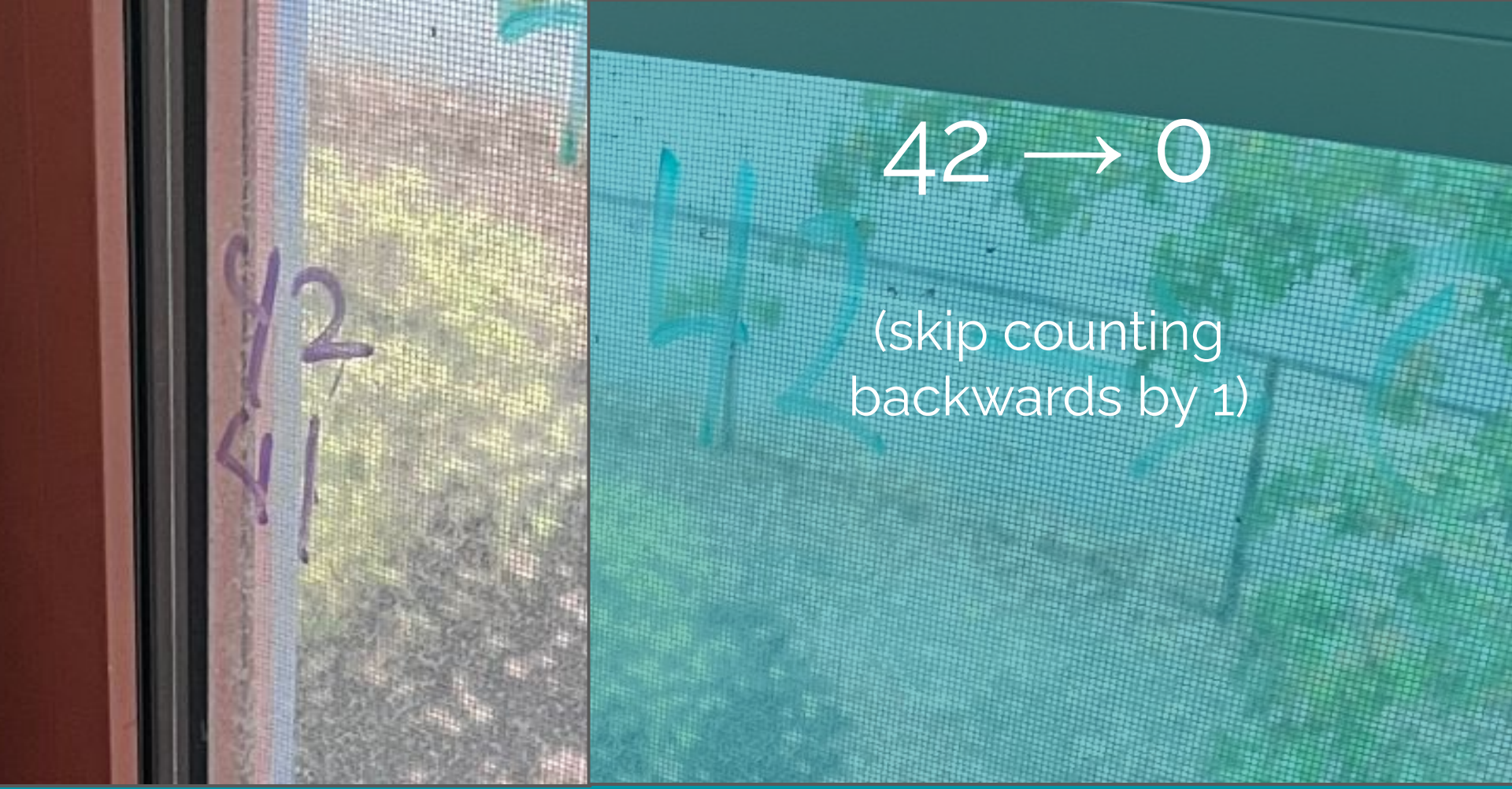
✅ **Are there multiple ways to be successful?**

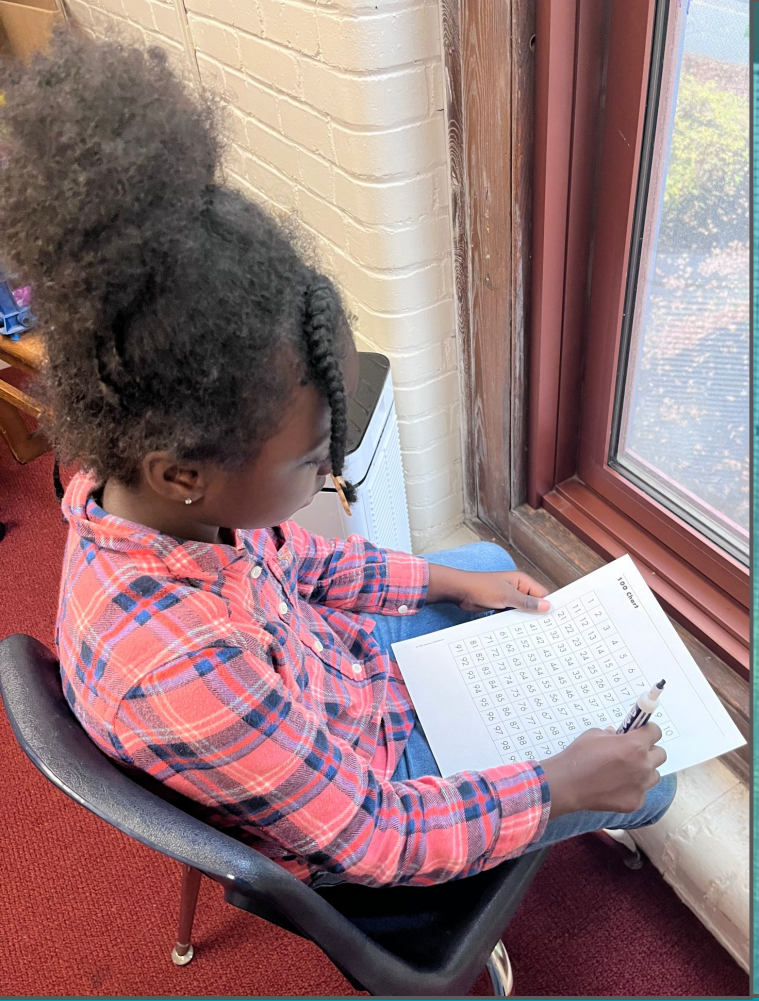
#5 Drawing on multiple resources of knowledge

✅ **Is the game simple and accessible?**

# 42 → 0

(skip counting backwards by 1)


42 → 0
(skip counting
backwards by 1)



# 42 → 0

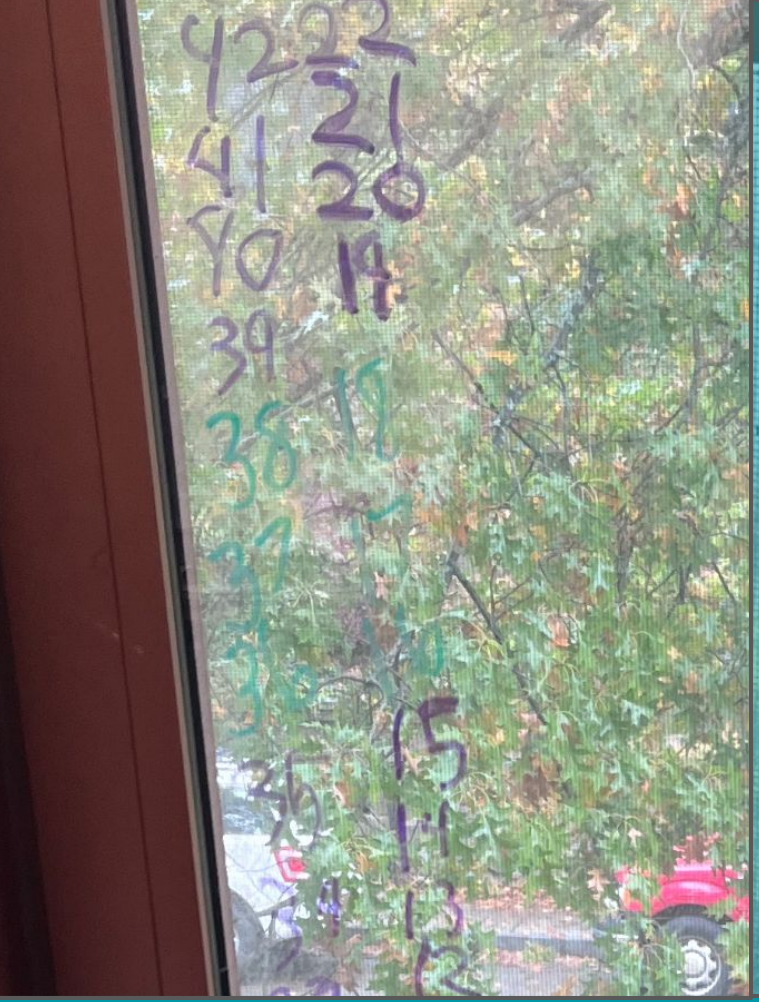
(skip counting backwards by 1)

# 42 → 0

(skip counting backwards by 1)

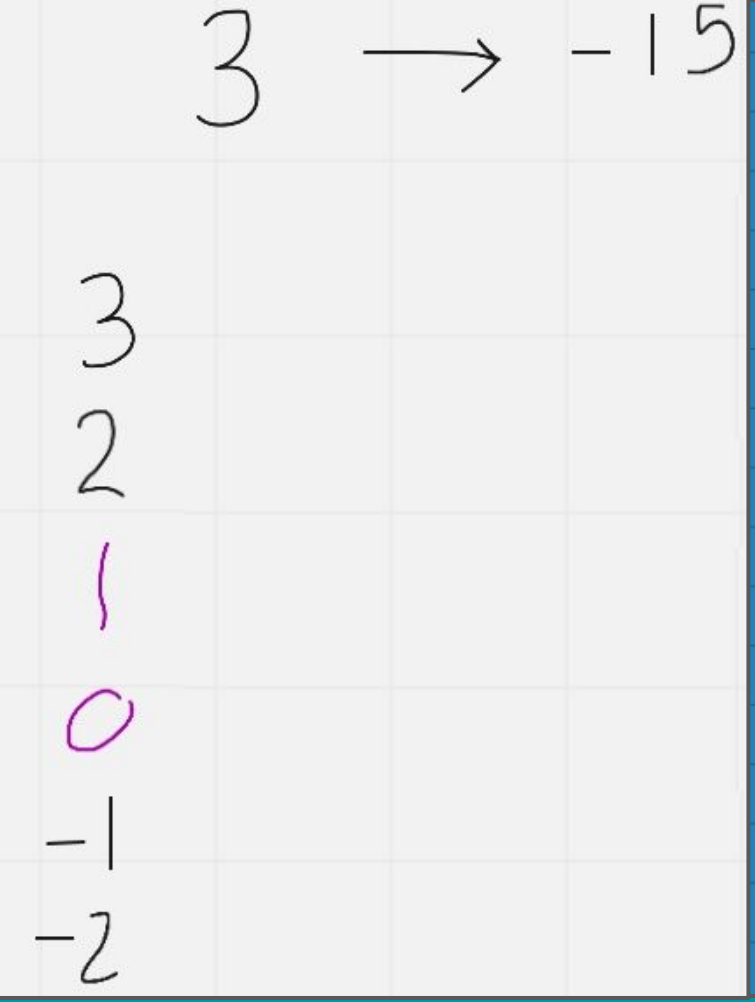
# 42 → 0

(skip counting backwards by 1)



# 42 → 0

(skip counting backwards by 1)




# 3 → -15

(skip counting backwards by 1)

3 → -15

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

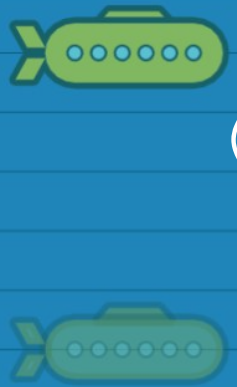
# 3 → -15

(skip counting backwards by 1)

6 $\xrightarrow{-2s}$ −24

6 −8 −20
4 −10 −22
2 −12 −24
0 −14
−2 −16
−4 −18
−6

$6 \xrightarrow{-2s} -24$

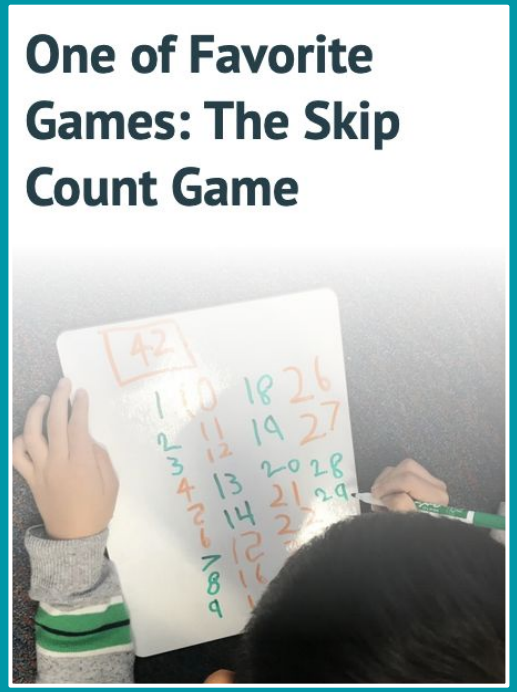



(skip counting by -2s)

# Evaluating games with equity in mind

| | |
|---|---|
| #1 Going deep with mathematics | **Will playing the game deepen mathematical understanding?** |
| #2 Leveraging multiple mathematical competencies | **Are there multiple entry points?** |
| #3 Affirming mathematics learners' identities | **Are there multiple ways to participate?** |
| #4 Challenging spaces of marginality | **Are there multiple ways to be successful?** |
| #5 Drawing on multiple resources of knowledge | **Is the game simple and accessible?** |

# Read More





http://bit.ly/NCTMgames

#NCTMBalt22

@lpconnaughton @jennalaib

*Standards for Mathematical Practice*

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate tools strategically.
- Attend to precision.
- Look for and make use of structure.
- Use repeated reasoning

**GAMES**

*Five Equity-Based Teaching Practices*

- Going deep with mathematics
- Leveraging multiple mathematical competencies
- Affirming mathematics learners' identities
- Challenging spaces of marginality
- Drawing on multiple resources of knowledge (math, culture, language, family, community)

# What games promote an equitable environment?

# What facilitation moves support this work?

# Wipebook

wipebook.com/psbma

Enter to win a free pack of Wipebooks.

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*Thank you!*