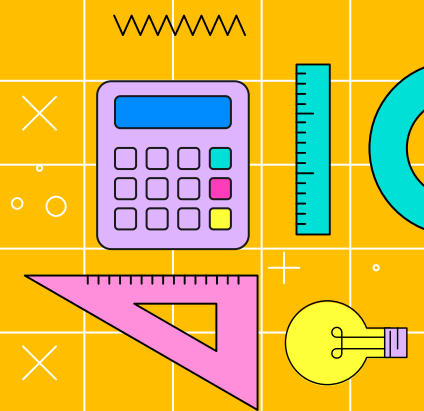
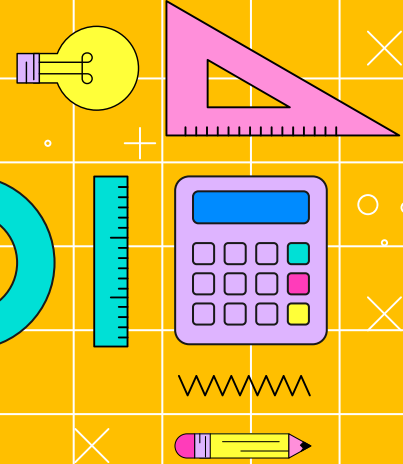
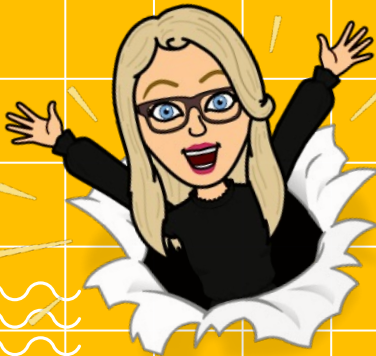


29<sup>TH</sup> NOV 2024

# BRINGING THE CRAIC BACK TO MATHS WITH: TECHNOLOGY

@Craic\_Matamaitic



# MY LIFE IN NUMBERS

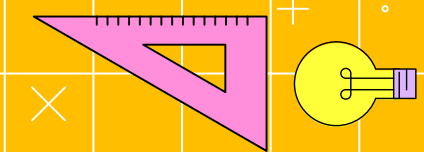
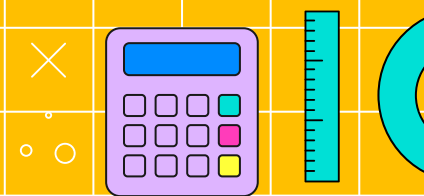
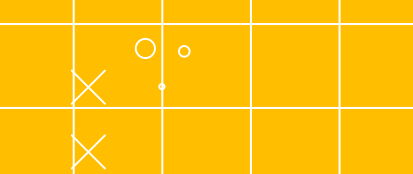
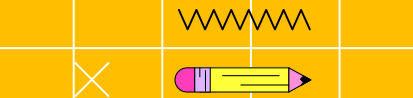
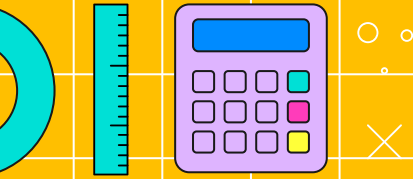
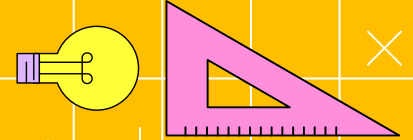
- 5 years teaching in an all-boys school in Cabra
- 9 years teaching in non-formal STEM Ed. (TWC, CTYI)
- 2 Years providing CPD for teachers
- 1 Year on the IMTA National council
- 3 Years as @Craic\_Matamaitic



# WHAT IS CRAIC?



**Maths can  
and should be  
an enjoyable  
subject for all  
(including  
the teacher!)**



# PHET!

Physics Education Technology



University of Colorado  
Boulder

[HTTPS://PHET.COLORADO.EDU/](https://phet.colorado.edu/)



[SIMULATIONS](#)

[TEACHING](#)

[RESEARCH](#)

[INITIATIVES](#)

[DONATE](#)



## Interactive Simulations for Science and Math

[EXPLORE OUR SIMS](#)

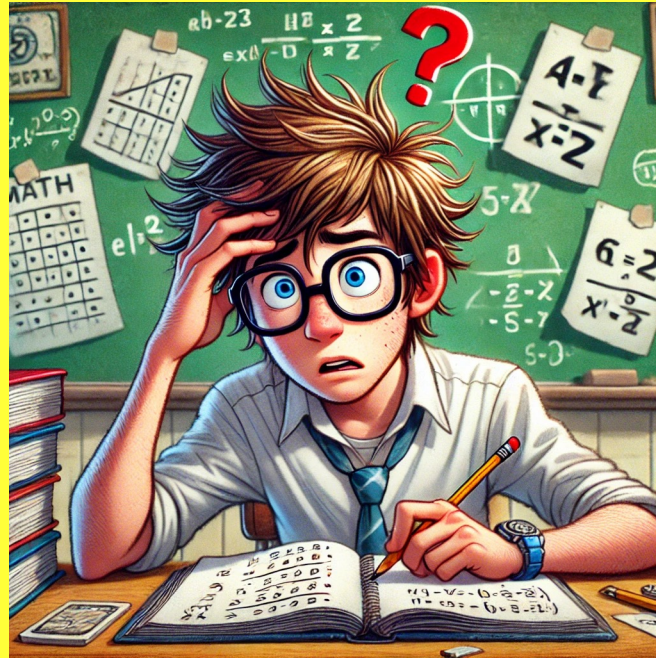
# CARL WIEMANN

“Education is about learning to  
make better decisions”



DEMO

# MATHS EDUCATION CURRENTLY





# MATHS SHOULD BE MORE LIKE COOKING



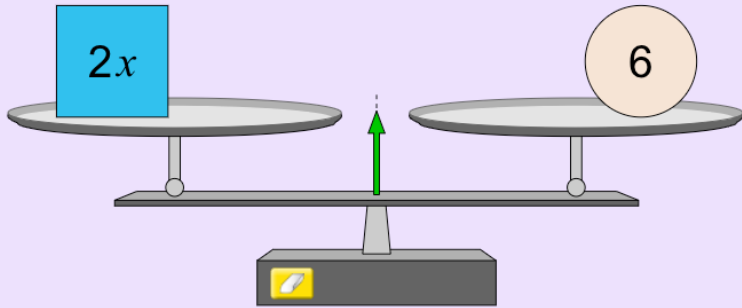
# EQUALITY EXPLORER

$2x = 6$

$+$   $-$   $\times$   $\div$   $2$   $\downarrow$

+ Variable

+ Snapshots



$x$   $-x$   $1$   $-1$



$x$   $-x$   $1$   $-1$



Equality Explorer

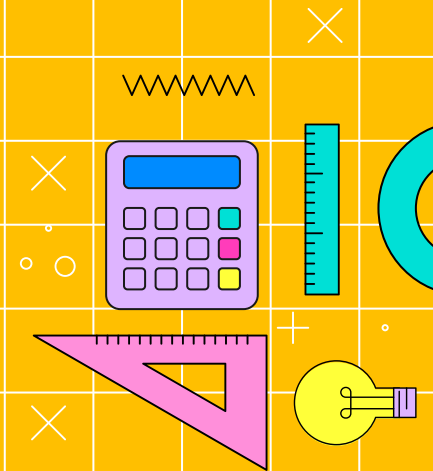
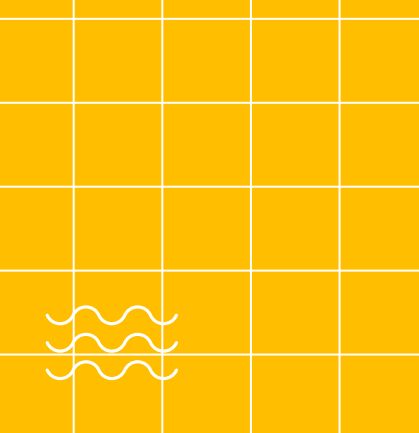
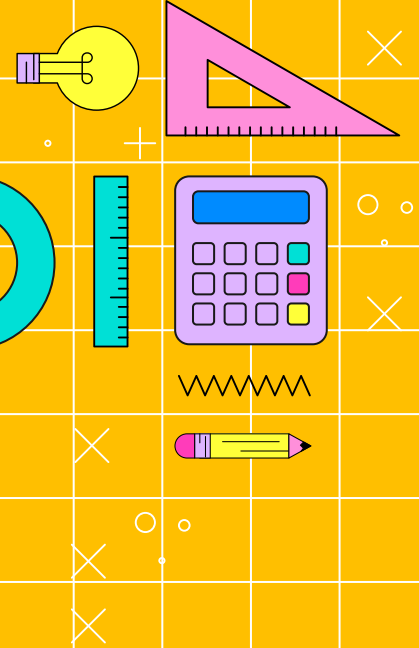


PhET

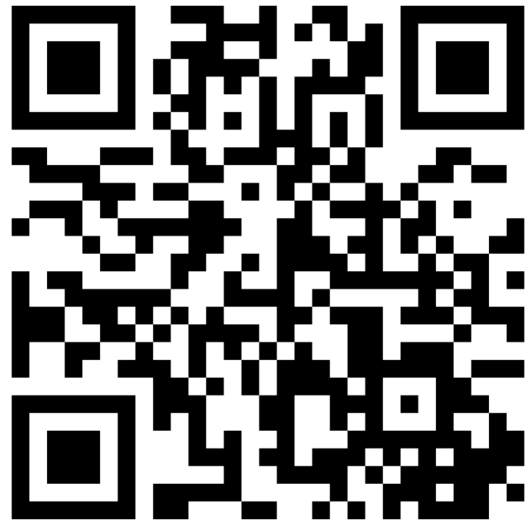
01

# TEACHER TIP

It's all in the questioning



# WHAT QUESTIONS WOULD YOU ASK?



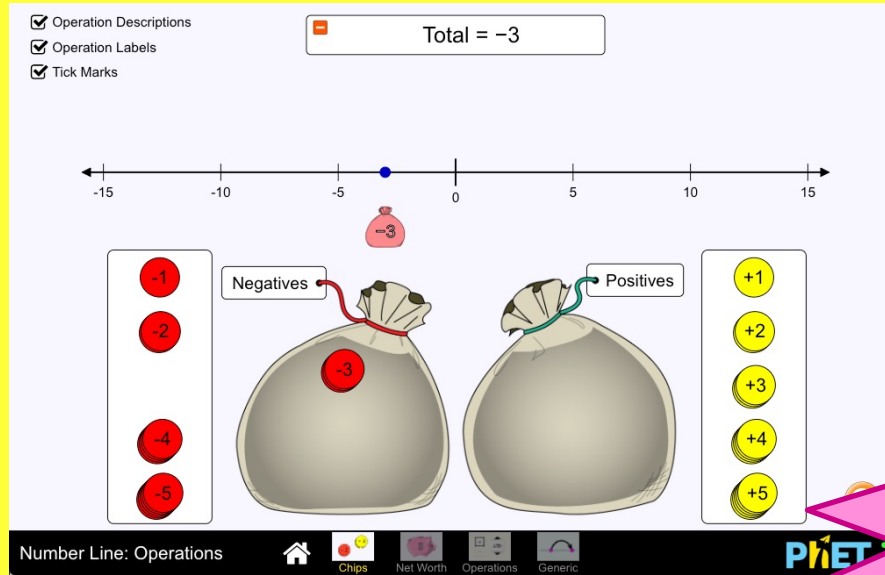
## ITS ALL IN THE QUESTIONING

- Think about common misconceptions and draw them out of students with the questions you set up  
(e.g  $2x = 6$ , my students always start by saying take away the x..")
- Use prompts and questioning throughout & be reactive to students' answers
  - "That's interesting...what makes you say that"
  - "\_\_\_\_\_ do you agree with \_\_\_\_\_?"
  - "Did we expect that?"
  - "What would happen if..."



# PREDICT. OBSERVE. EXPLAIN

$$-8 - (-5) = ?$$



Allow them to  
get things  
wrong and go  
with it.

# WHAT DO YOU NOTICE? WHAT DO YOU WONDER?

The screenshot shows the PhET Plinko Probability simulation. At the top, a funnel releases balls into a triangular grid of pegs. Below the grid is a horizontal bar divided into 12 bins, each labeled with a number from 0 to 12. A 'Count' label is positioned to the left of the bins. To the right of the simulation are several control panels:

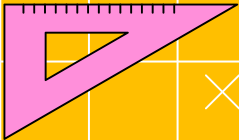
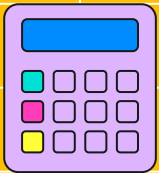
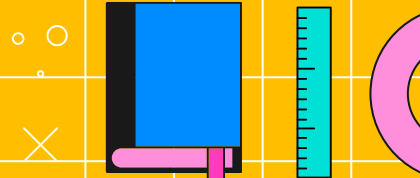
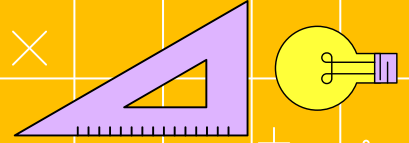
- A legend with radio buttons for 'Ball' (selected), 'Path', and 'None'.
- A play button and a 'Rows' slider set to 12, with a range from 1 to 26.
- A 'Binary Probability' slider set to 0.50, with a range from 0 to 1.
- A statistics panel showing:  $N = 0$ ,  $\bar{x} = 0.000$ ,  $\mu = 6.000$ ,  $s = 0.000$ ,  $\sigma = 1.732$ , and  $S_{\text{mean}} = 0.000$ . There is also an 'Ideal' checkbox.
- Buttons for volume and refresh.

At the bottom of the simulation window, there is a navigation bar with a home icon, 'Intro', 'Lab', and the PhET logo.

02

# TEACHER TIP

Use Mini Whiteboards / Mentimeter





# COLLECTING STUDENT RESPONSES

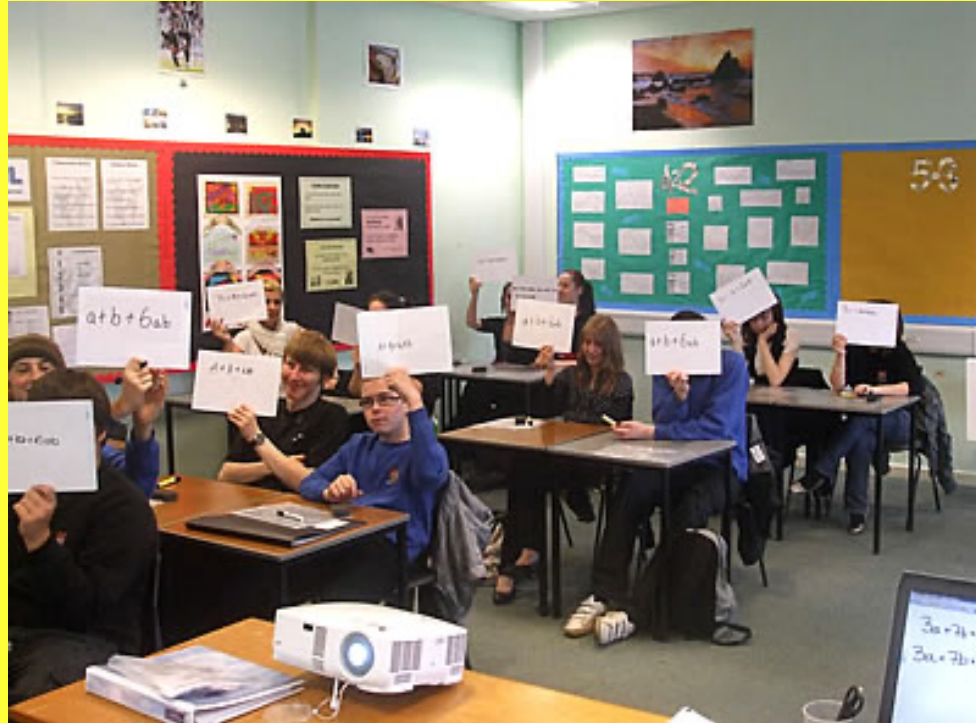
## HIGH TECH CLASSROOM

- Have a way of engaging students throughout the lesson on a whole class level
- Use mentimeter or similar to gather student responses to develop discussions

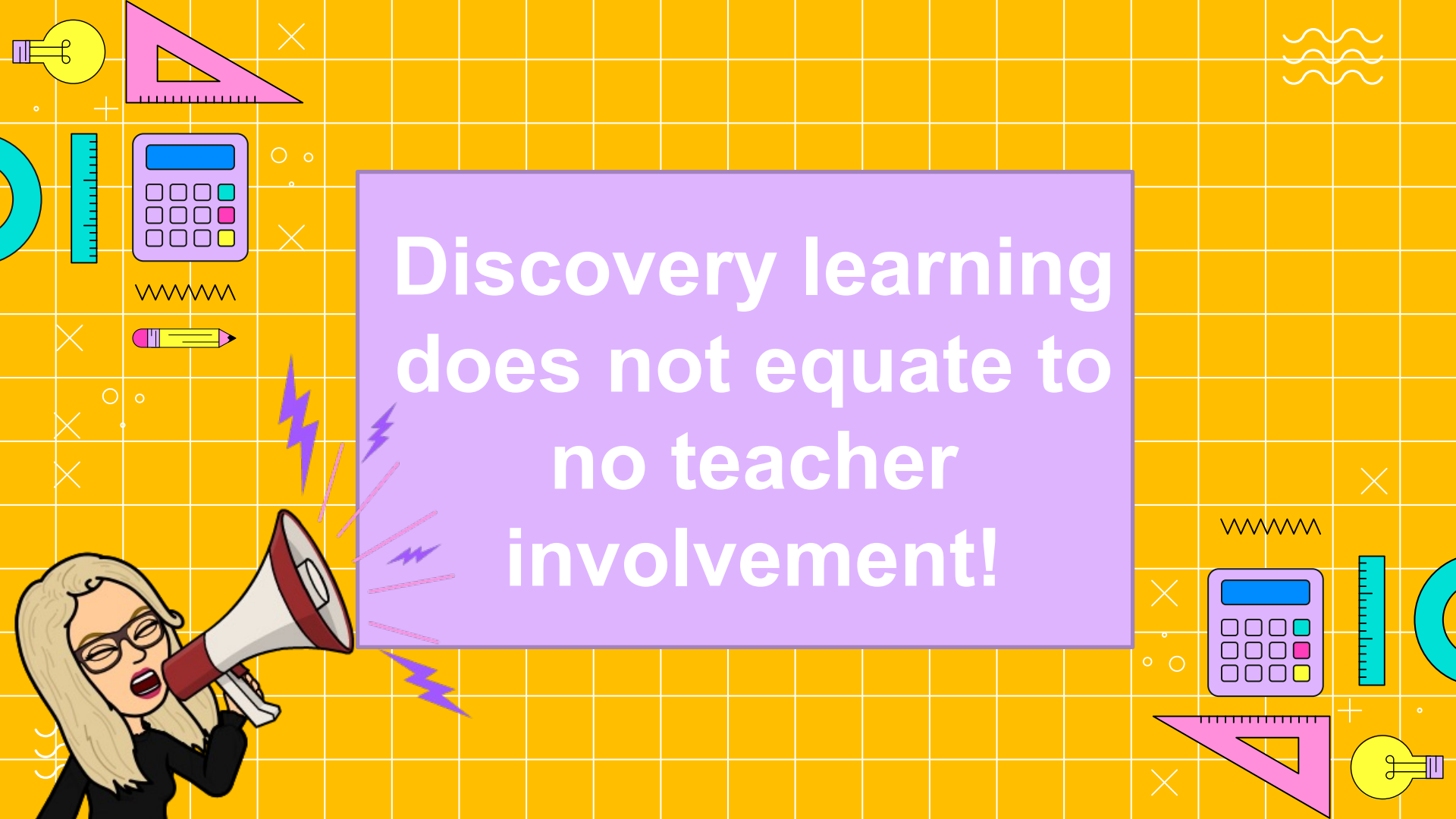
## LOW TECH CLASSROOM

- Use mini whiteboards during the 'Predict' and 'Explain' intervals to involve all students and gauge understanding
- Use student responses as whole class discussion starters

# MINI WHITEBOARDS



Discovery learning  
does not equate to  
no teacher  
involvement!



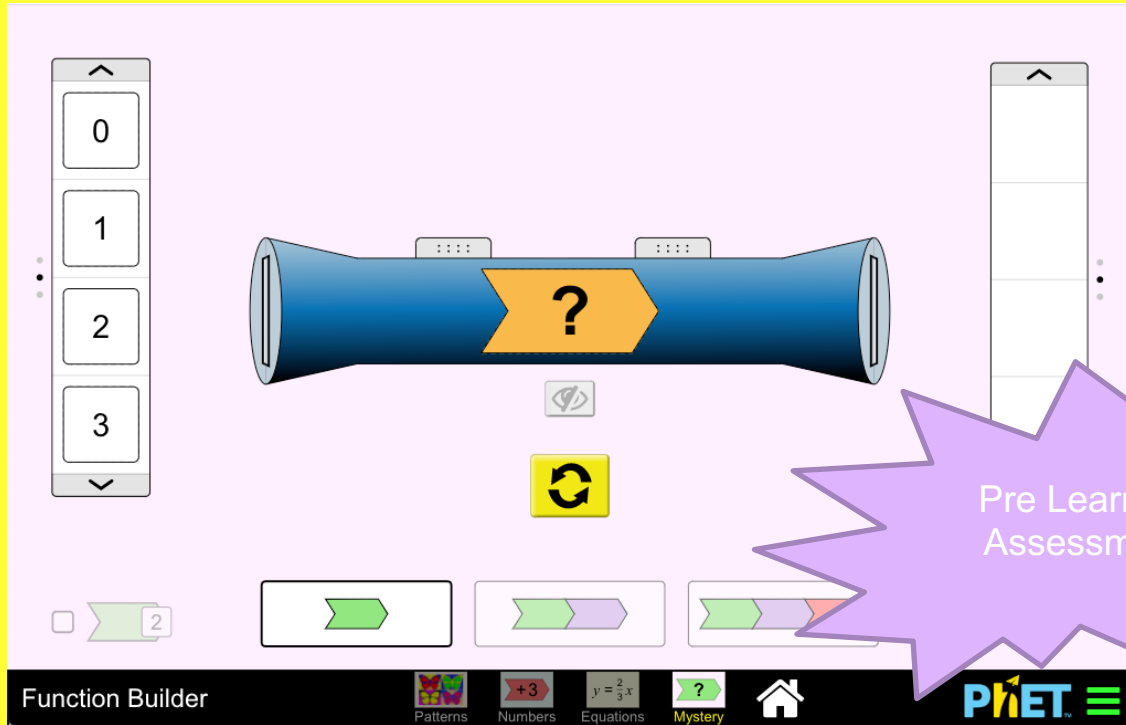
# TEACHER TIP

03

Gamify the assessment



# GAMIFY THE ASSESSMENT



# GAMIFY THE ASSESSMENT

My Matches

Level: 5  
Score: 0

←

↺

			$\frac{4}{9}$	
			$\frac{42}{24}$	$\frac{24}{24}$

Fraction Matcher

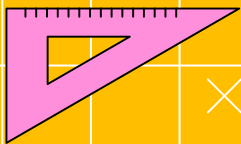
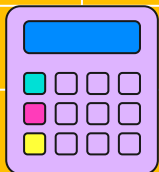
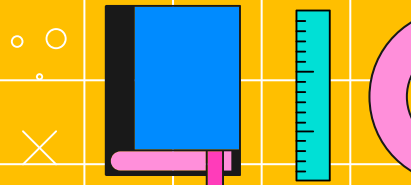
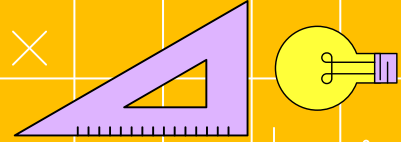
Home Fractions Mixed Numbers

Post Learning  
Assessment

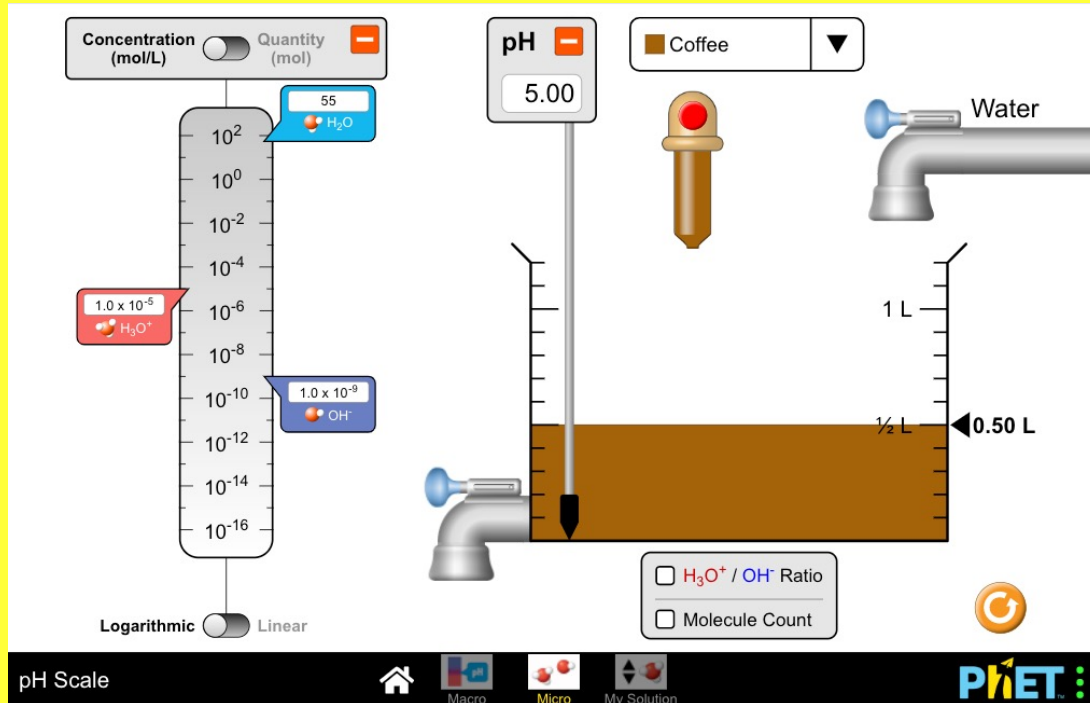
04

# TEACHER TIP

Make difficult concepts real & meaningful



# LOGARITHMS



## Uses :

- Introduction to logs
- Teach students about the necessity of logarithms



# PROJECTILES

The screenshot shows the PhET Projectile Motion simulation interface. The main window displays a cannon on the left and a target on the right. The cannon is set to launch a projectile at an initial speed of 18 m/s at an angle of 80 degrees. The target is located 15.0 m away. The simulation includes a control panel with various settings and options.

**Simulation Settings:**

- Cannonball:** Diameter: 0.8 m, Mass: 5 kg
- Air Resistance:**  Air Resistance (Drag Coefficient: 0.47)
- Display Options:**
  - Total
  - Components
  - Velocity Vectors (green arrow)
  - Acceleration Vectors (yellow arrow)
  - Force Vectors (black arrow)

**Simulation Controls:**

- Initial Speed:** 18 m/s
- Playback:** Play, Pause, Stop, Reset
- Speed:** Normal, Slow

**Navigation:** Home, Intro, Vectors, Drag, Lab, PhET logo

## Uses :

- Vectors
- Quadratic equations
- Simultaneous equations
- Completing the square
- Introduction to calculus

# CALCULATING THE RANGE

$$R = \frac{u^2 \sin 2\theta}{g}$$

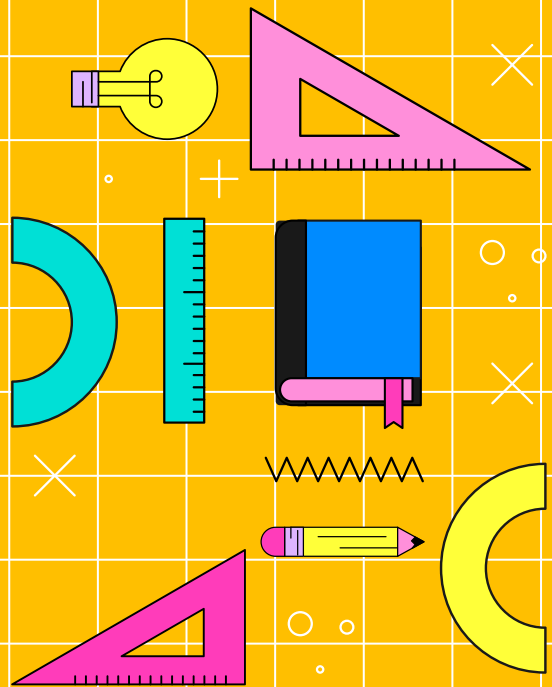
$u$  = initial velocity

$\theta$  = final angle

$g = 9.8 \text{ m/s}^2$

# WHY I USE PHET?

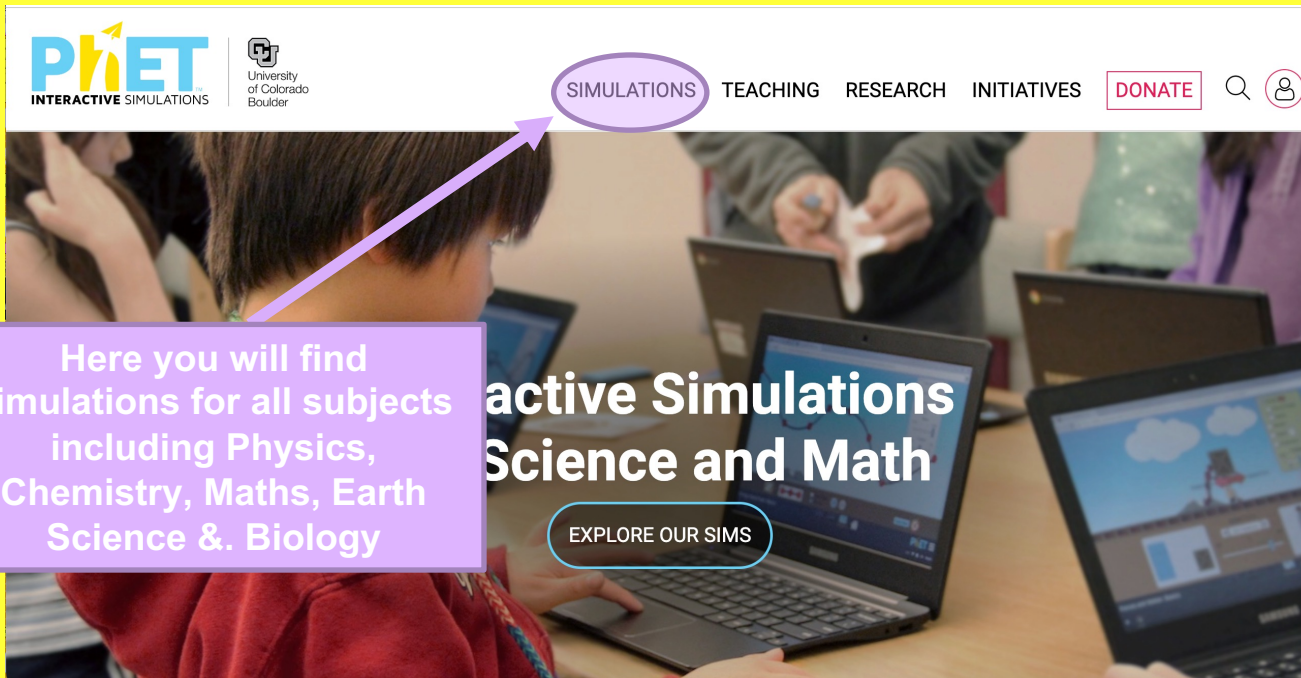
1. Student centered
2. Discovery/Inquiry based
3. Prioritises student reasoning over rule learning → Deep learning
4. Supports the needs of all learners



Free worksheets to  
accompany all  
simulations are  
available on phet!



[HTTPS://PHET.COLORADO.EDU/](https://phet.colorado.edu/)

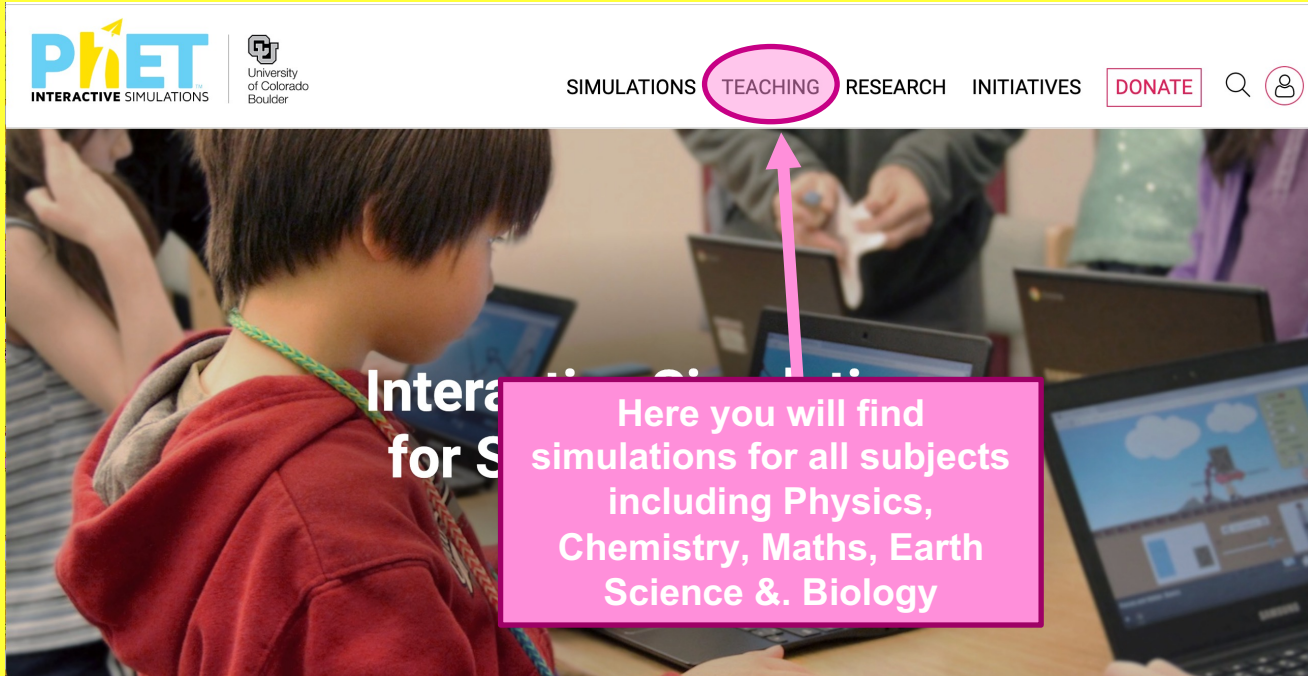


Here you will find simulations for all subjects including Physics, Chemistry, Maths, Earth Science & Biology

Interactive Simulations  
Science and Math

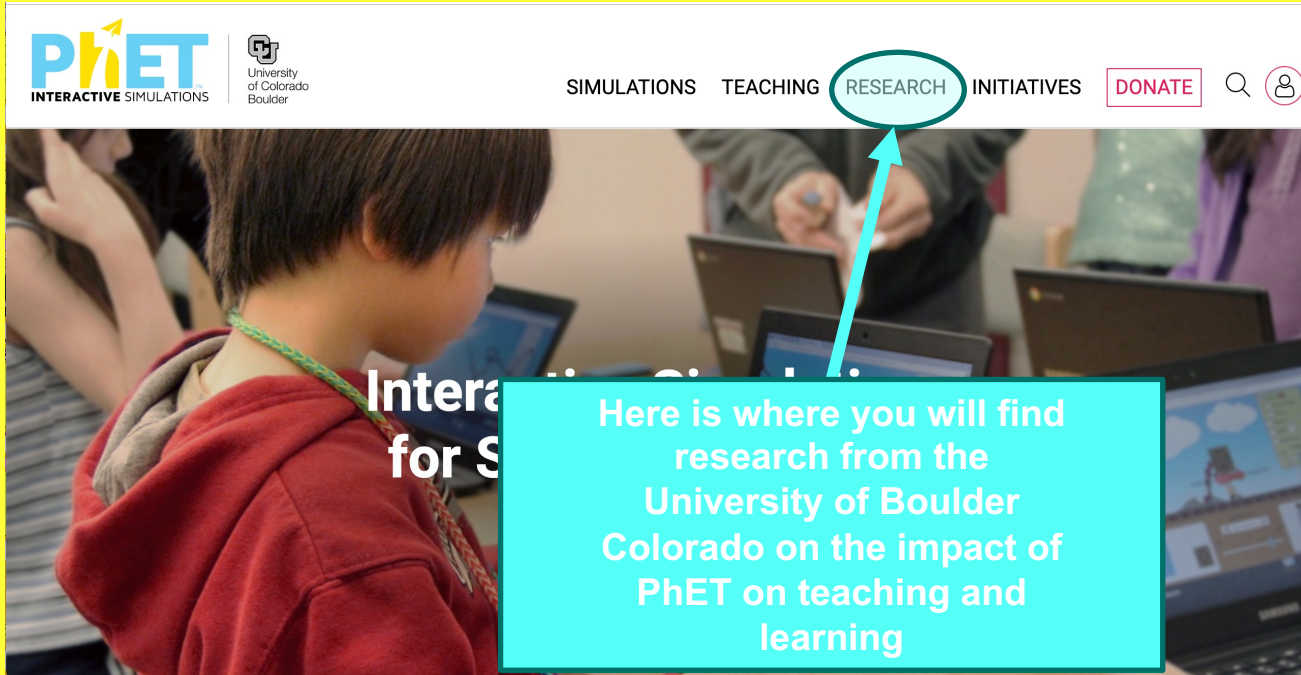
EXPLORE OUR SIMS

[HTTPS://PHET.COLORADO.EDU/](https://phet.colorado.edu/)



Here you will find simulations for all subjects including Physics, Chemistry, Maths, Earth Science & Biology

[HTTPS://PHET.COLORADO.EDU/](https://phet.colorado.edu/)



The screenshot shows the top navigation bar of the PhET website. On the left, there is the PhET logo (Interactive Simulations) and the University of Colorado Boulder logo. The navigation menu includes links for SIMULATIONS, TEACHING, RESEARCH, and INITIATIVES. A red circle highlights the RESEARCH link, and a red arrow points from it to a red text box. To the right of the navigation menu are buttons for DONATE, a search icon, and a user profile icon. Below the navigation bar is a banner image of a child in a red hoodie looking at a laptop screen. The text 'Interactive Simulations for Science Education' is partially visible on the banner.

**PHET**  
INTERACTIVE SIMULATIONS

University of Colorado Boulder

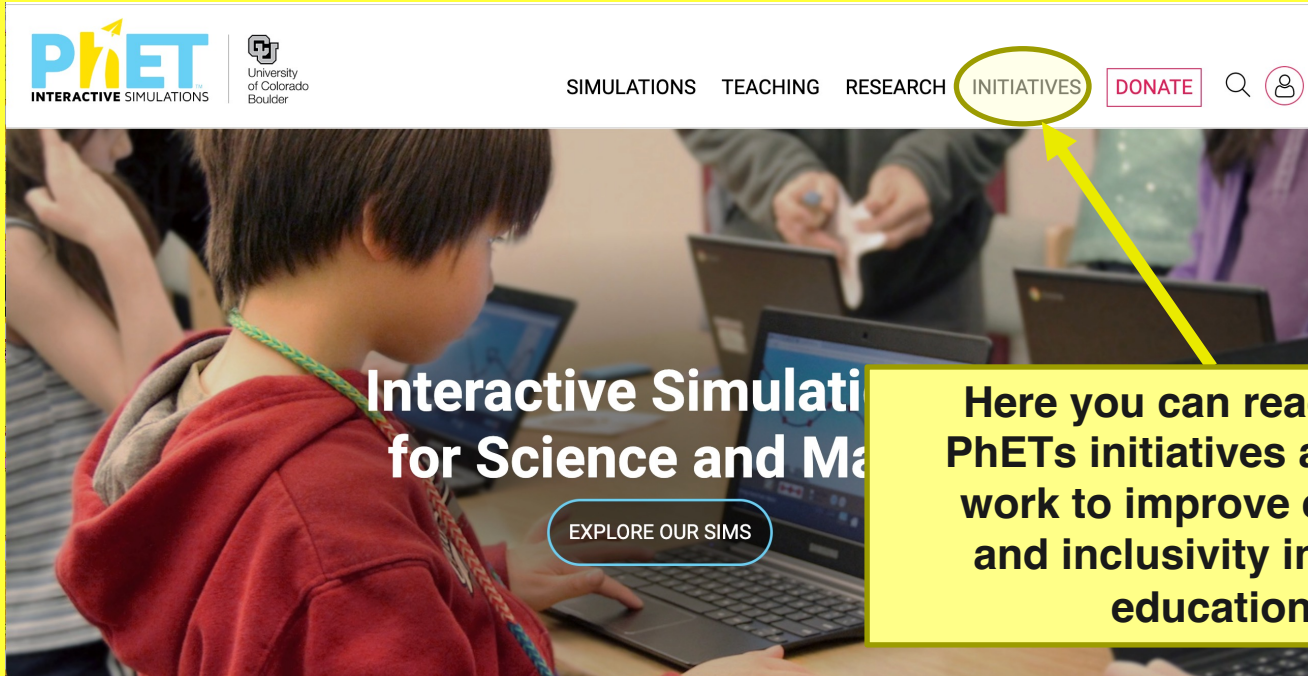
SIMULATIONS TEACHING **RESEARCH** INITIATIVES

DONATE

Interactive Simulations for Science Education

Here is where you will find research from the University of Boulder Colorado on the impact of PhET on teaching and learning

[HTTPS://PHET.COLORADO.EDU/](https://phet.colorado.edu/)



The image shows a screenshot of the PhET website homepage. At the top left is the PhET logo (University of Colorado Boulder) and the text 'INTERACTIVE SIMULATIONS'. To the right are navigation links: 'SIMULATIONS', 'TEACHING', 'RESEARCH', 'INITIATIVES', and 'DONATE'. A yellow circle highlights the 'INITIATIVES' link, with a yellow arrow pointing to a callout box on the right. The main content area features a background image of a child using a laptop, with the text 'Interactive Simulations for Science and Mathematics' and a button that says 'EXPLORE OUR SIMS'. The callout box contains the text: 'Here you can read about PhET's initiatives and their work to improve equality and inclusivity in STEM education'.

Here you can read about PhET's initiatives and their work to improve equality and inclusivity in STEM education



# [HTTPS://PHET.COLORADO.EDU/](https://phet.colorado.edu/)

Browse Activities  
- Optional text  
search

SIMULATIONS TEACHING RESEARCH INITIATIVES

DONATE



	Types	Subjects	Levels	Languages
Base Solutions (HTML5)	All Types	All Subjects	All Levels	All Languages
Radioactive Decay	Remote	Astronomy	K-5	Abkhazian
Area Builder (HTML5)	Lab	Biology	MS	Afar
Area Model Algebra (HTML5)	HW	Chemistry	HS	Afrikaans
Area Model Decimals (HTML5)	MC	Earth Science	UG-Intro	Akan
Area Model Introduction (HTML5)	Discuss	Mathematics	UG-Adv	Albanian
Area Model Multiplication (HTML5)	Demo	Physics	Grad	Amharic
Arithmetic (HTML5)	Guided	Other	Other	Arabic

Optional text search

TITLE	★	PHET	AUTHORS	LEVEL	TYPE	SUBJECT	SIMULATIONS
<a href="#">Investigating Climate Change at the Macroscopic and Microscopic Level</a>	★	PHET	Amy Rouinfar	HS MS	Lab	Earth Science	<a href="#">Glaciers</a> <a href="#">The Greenhouse Effect</a>
<a href="#">Balancing Act Remote Lab</a>	★	PHET	Trish Loeblein	K-5 UG-Intro MS HS	HW Lab Remote	Physics Mathematics	<a href="#">Balancing Act (HTML5)</a>

# FACILITATION TIPS

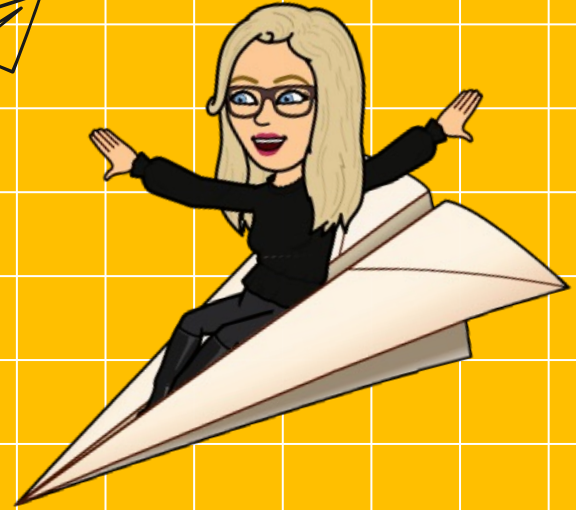
## HIGH TECH CLASSROOM

- Make the goals of the lesson clear
- Have a guided worksheet for students to work through
- Plan your questioning
- Have extension tasks ready
- \* Turn the sound off the sims or use headphones

## LOW TECH CLASSROOM

- Have students seated in pairs/pods
- Give each student a mini whiteboard to contribute
- Use thumbs/down sideways for AFL

# DESMOS IN LOW TECH CLASSROOMS



# 01 WHAT?

What is Desmos?





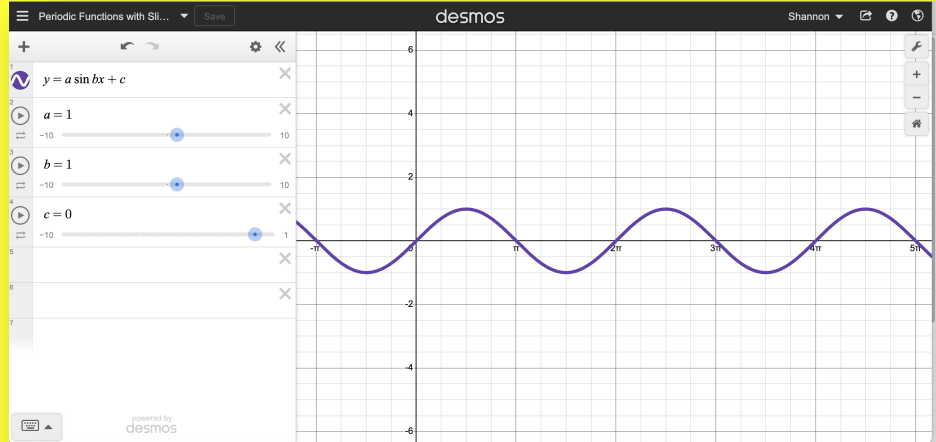
# DESMOS

*“Desmos Studio is a Public Benefit Corporation with a goal of helping everyone learn math, love math, and grow with math. We believe that everyone has an inner mathematician and that some people haven’t been given the opportunity, encouragement, or tools to discover theirs.”*

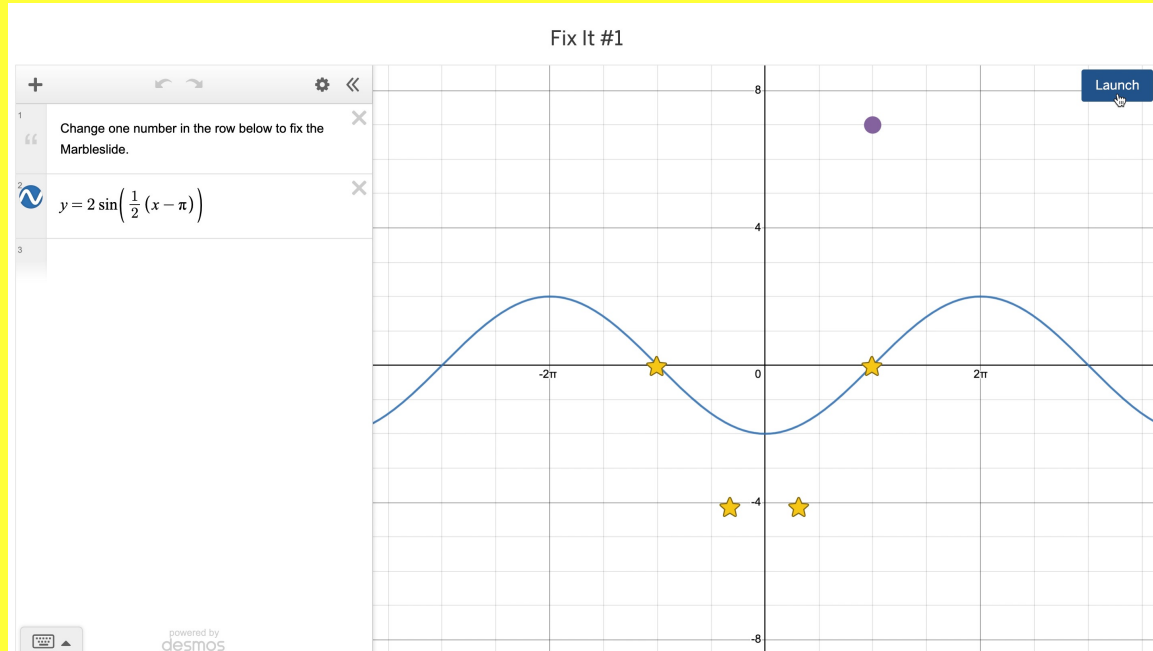
# DESMOS

Desmos is an advanced and interactive online graphing calculator.

It is designed to help students and educators explore mathematical concepts, visualise mathematical relationships, and solve a wide range of mathematical problems.



# MARBLESLIDES



### Looking for Desmos Classroom?

Desmos Classroom is a free teaching and learning platform, [now part of Amplify.](#)

#### Teachers

Find interactive and creative lessons for your class, or build your own.

Teacher Home



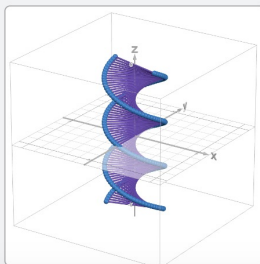
#### Students

Enter a classcode to join your classmates!

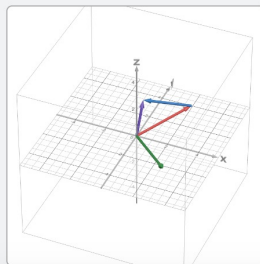
Student Home



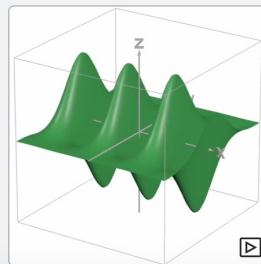
### Example 3D Graphs >



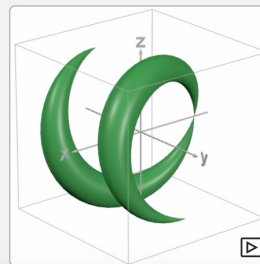
Double Helix



Vectors



Function of  $x, y$

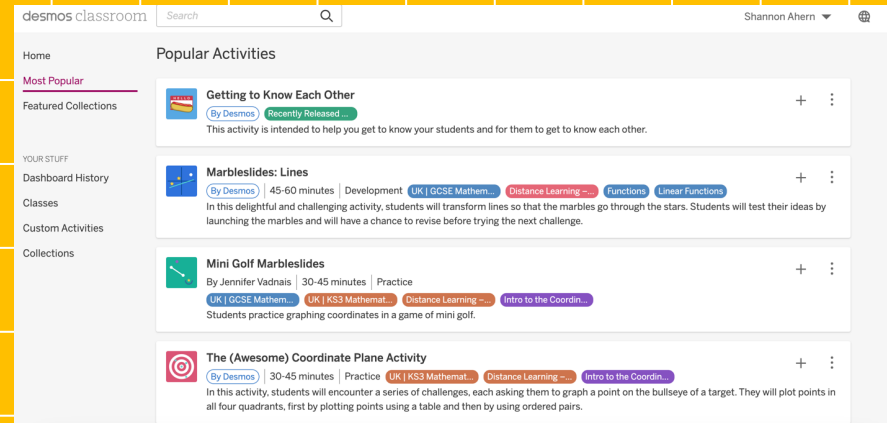


Parametric Surface



# DESMOS

Desmos.com hosts dozen's of free activities and manipulatives to effortlessly engage students in the maths classroom.



The screenshot shows the Desmos Classroom interface. At the top, there is a search bar and the user name "Shannon Ahern". The main content area is titled "Popular Activities" and lists three activities:

- Getting to Know Each Other**: By Desmos, Recently Released. This activity is intended to help you get to know your students and for them to get to know each other.
- Marbleslides: Lines**: By Desmos, 45-60 minutes | Development. Tags: UK | GCSE Mathem..., Distance Learning..., Functions, Linear Functions. In this delightful and challenging activity, students will transform lines so that the marbles go through the stars. Students will test their ideas by launching the marbles and will have a chance to revise before trying the next challenge.
- Mini Golf Marbleslides**: By Jennifer Vadnais, 30-45 minutes | Practice. Tags: UK | GCSE Mathem..., UK | KS3 Mathemat..., Distance Learning..., Intro to the Coordin... Students practice graphing coordinates in a game of mini golf.
- The (Awesome) Coordinate Plane Activity**: By Desmos, 30-45 minutes | Practice. Tags: UK | KS3 Mathemat..., Distance Learning..., Intro to the Coordin... In this activity, students will encounter a series of challenges, each asking them to graph a point on the bullseye of a target. They will plot points in all four quadrants, first by plotting points using a table and then by using ordered pairs.

# DESMOS WITH DEVICES

Laser Challenge 0 students UKJF5S

Snapshots Summary Teacher Student

Anonymize Pace Sync to Me Pause

SORT BY Time Entered

1 Warmu... 2 Warmu... 3 Challen... 4 Challen... 5 Challen... 6 Error A... 7 Challen... 8 Challen... 9 Challen... 10 And...

Student Screen Preview 1 of 11 Next

Here's your goal: Send the laser through the blue targets.

Change one value in the table so the laser passes through the targets.

Item	Angle (degrees)
Laser	45
Mirror	45

Teacher Moves

What the student sees

# DESMOS WITH DEVICES

← Laser Challenge 15 students Inactive Code

Snapshots Summary **Teacher** Student

Anonymized Pace Sync to Me Pause

1 Warmu... 2 Warmu... 3 Challen... 4 Challen... 5 Challen... 6 Error A... 7 Challen... 8 Challen... 9 Challen... 10 Ang...

Here's your... Enter the angles in... Aaliyah used...

SORT BY Time Entered

Anonymize mode is on. Your students' names have been changed to the names of notable mathematicians. [Learn more](#)

Screen 1 of 11

### Warmup #1

Show Correctness

Responses Overlay

Hypatia  Evelyn Boy...  Wen-Tsun ...

Diarra Bou...  Erica Walker  Tasha Inniss

Florence G...  Julio Cesar...  Mary Som...

Here's your goal: Send the laser through the blue targets.

Change one value in the table so the laser passes through the targets.

Responses Original

Item	Angle (...)
Laser	90
Mirror	45

Item	Angle (...)
Laser	90
Mirror	45

Item	Angle (...)
Laser	
Mirror	

Erica Walker  Tasha Inniss  Florence G...

Teacher Moves

Teacher Overview

# DESMOS WITH DEVICES

← Laser Challenge ▾ 15 students *Inactive Code* Snapshots Summary Teacher Student

Anonymized Pace Sync to Me Pause

SORT BY Time Entered ▾

1 Warmu... 2 Warmu... 3 Challen... 4 Challen... 5 Challen... 6 Error A... 7 Challen... 8 Challen... 9 Challen... 10 An...

Anonymize mode is on. Your students' names have been changed to the names of notable mathematicians. [Learn more](#)

Hypatia	⋮																		
Evelyn Boyd Granville	⋮	✓	✓	✓	✗														
Wen-Tsun Wu	⋮	✓	✓	✗	✓	✗													
Diarra Bousso Gueye	⋮	✗	✗															✗	
Erica Walker	⋮	✓	✓	✓	✓	✓	●	✗											
Tasha Inniss	⋮	✗	✗	✗	✗	✓	✗	✓	✓										
Florence Glanfield	⋮	✓	✓	✓	✗	✗		✗	✗										
Julio Cesar de Mello e Souza	⋮	✓	✗																
Mary Somerville	⋮	✓	✗		✗	✗													✗
Jesse Wilkins Jr.	⋮	✓	✓	✓	✓	✓	●	✓											
Al-Khwarizmi	⋮	✓	✓	✓	✓	✓	●	✗											

Student Progress Summary

# DESMOS WITHOUT DEVICES

desmos classroom  Shannon Ahern 12 May 4, 2024 at 1:36 pm [Dashboard](#)

Point Collector [Reactivate](#)

Point Collector:  
Lines

Polygraph:  
Polygons

- **Laser Challenge**

Puzzling It Out

Sector Area

### Screens

<b>1 Warmup #1</b> Here's your goal: Send the laser through the blue targets. 	<b>2 Warmup #2</b> Enter the angles in the table so the laser hits the targets. 	<b>3 Challenge #1: Hit the targets.</b> 	<b>4 Challenge #2: Hit the targets.</b> 	<b>5 Challenge #3: Hit the targets.</b> 
<b>6 Error Analysis</b> Aaliyah used $210^\circ$ for the laser, and $60^\circ$ for the mirror. 	<b>7 Challenge #4: Hit the targets.</b> 	<b>8 Challenge #5: Hit the targets.</b> 	<b>9 Challenge #6: Hit the targets.</b> 	<b>10 Another Angle</b> Brandon solved this challenge with the angles shown here.  $f(x)$
<b>11 Class Gallery</b> 				

**Accessibility Notes** | This activity is not screen reader friendly, so we recommend pairing visually impaired students with a sighted classmate.



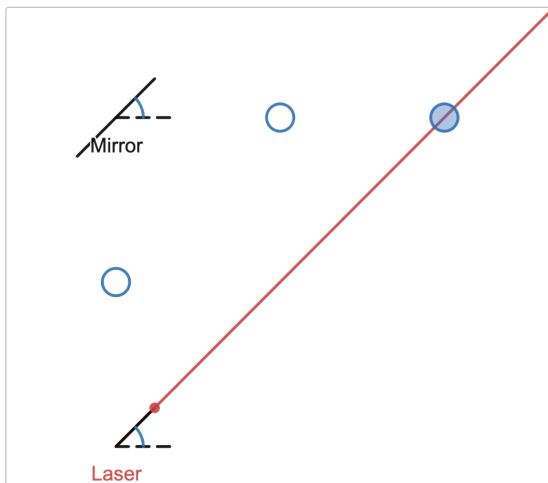
Student Screen Preview



1 of 11

Next &gt;

## Warmup #1



Here's your goal: Send the laser through the blue targets.

Change one value in the table so the laser passes through the targets.

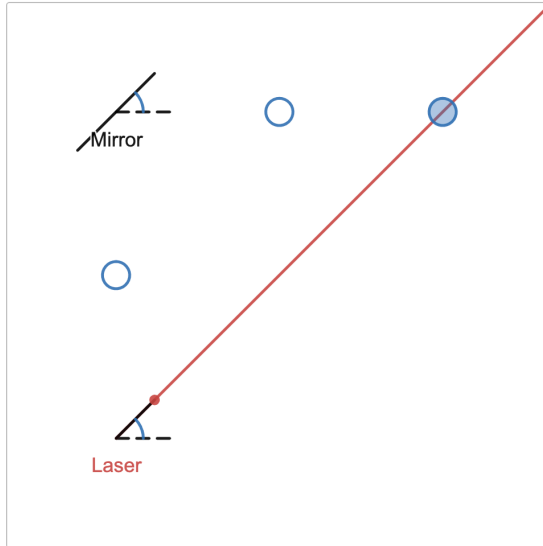
Item	Angle (degrees)
Laser	45
Mirror	45

Teacher Moves

## Accessibility Notes

This activity is not screen reader friendly, so we recommend pairing visually impaired students with a sighted classmate.

## Warmup #1



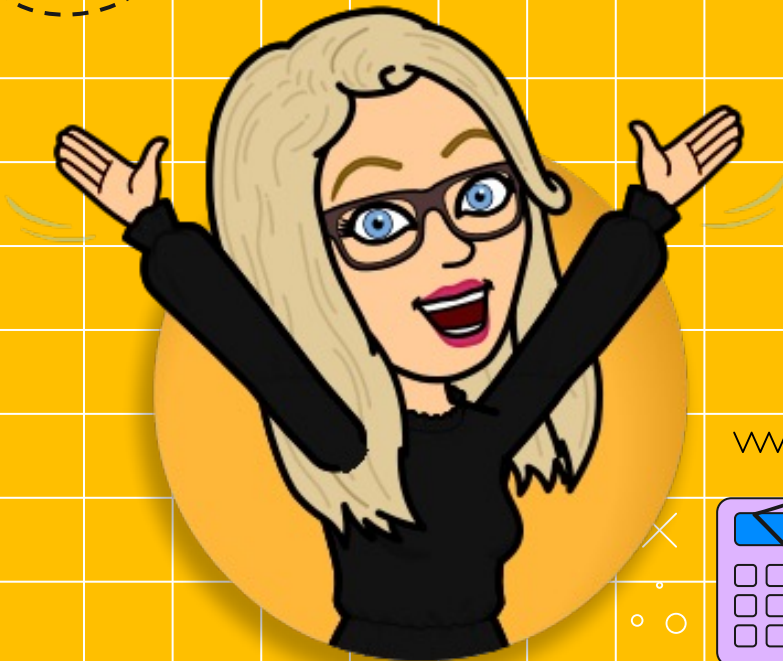
Here's your goal: Send the laser through the blue targets.

Change one value in the table so the laser passes through the targets.

Item	Angle (degrees)
Laser	45
Mirror	45

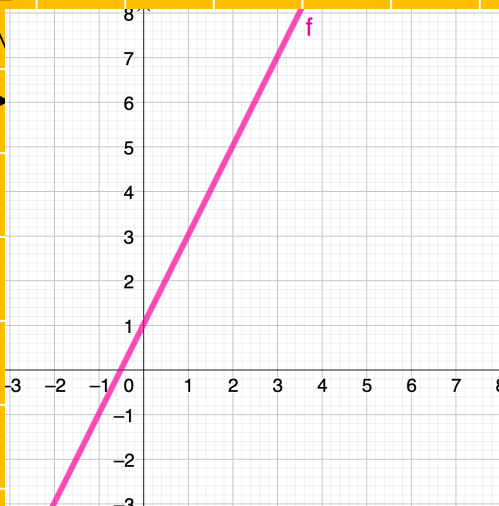
# 02 WHY?

Why I use Desmos

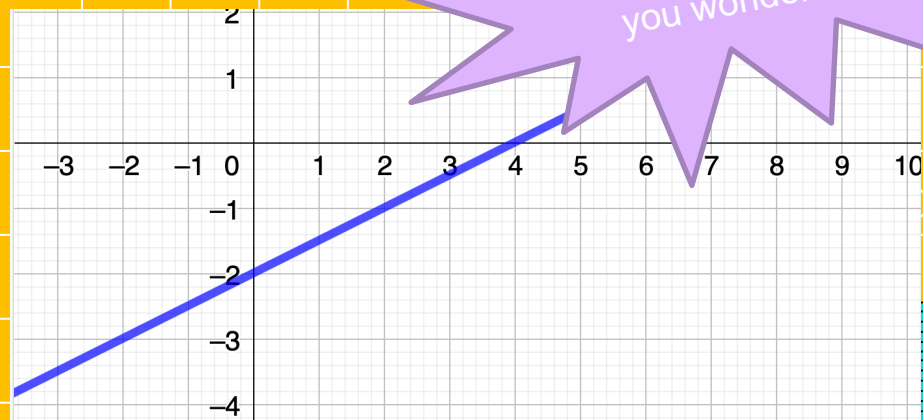




# SAMPLE LESSON



$$y = 2x + 1$$



$$y = 0.5x - 2$$

What do you notice? What do you wonder?

# SAMPLE LESSON

**THE EQUATION OF THE LINE IS**

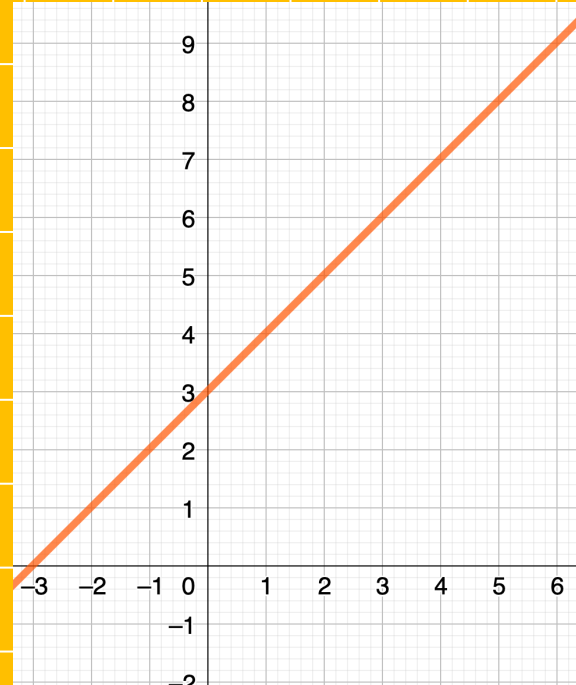
$$Y = MX + C$$

**M = SLOPE**

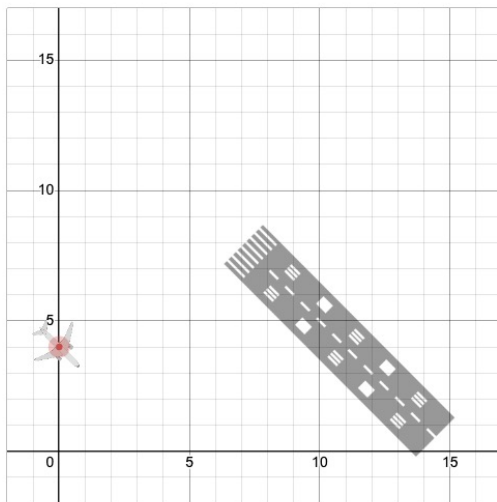
**C = Y - INTERCEPT**

# SAMPLE LESSON

WHAT IS THE  
EQUATION OF  
THIS LINE



A line can help.



Lines can help us be more precise.

The path for a safe landing of the airplane follows the line  $y = 15 - x$ .

Let's try this one more time. Move the plane so it lands safely. Then press "Submit" to check your answer.

Submit

# Why I use Desmos



Gamified learning

# GAMIFIED LEARNING



[https://www.youtube.com/watch?v=9vJRopau0g0&ab\\_channel=TEDxTalks](https://www.youtube.com/watch?v=9vJRopau0g0&ab_channel=TEDxTalks)

# Why I use Desmos



Gamified learning



Instantaneous, Visual Feedback



Discovery-based learning



Authentic Real-world Problems



I enjoy the lessons!

# MY FAVOURITE DESMOS ACTIVITIES

- Land the Plane – Equation of the line
- Marbleslides – Transformations (Linear, Quadratic, Periodic)
- The (Awesome) Coordinate Plane Activity - Coordinates
- Laser Challenge – Angles
- The Solar System, Test Tubes and Scientific Notation



# 03 HOW?

How to use Desmos in a Low Tech Classroom



# PLAN YOUR QUESTIONS

1. Before using the Desmos interactive in class play around with it yourself – what are the points of interest? What are the “sticky points”
2. Is there an example that you can provide students to make them think?
  - a. E.g using  $(\sin(x-90))$  instead of  $\cos x$ ? Or using  $-60$  instead of  $300$  degrees?
3. Is there cross-curricular links that can be built on using questions?
  - a. Eg. “Remember when we did patterns...what was the formula then?”

# MINI WHITEBOARDS

- Particularly useful for coordinate-geometry based interactives (Coordinates, Land the Plane, Marble Slides)
  - Great to get the class discussion going!
  - Where different strategies are used make a point of this

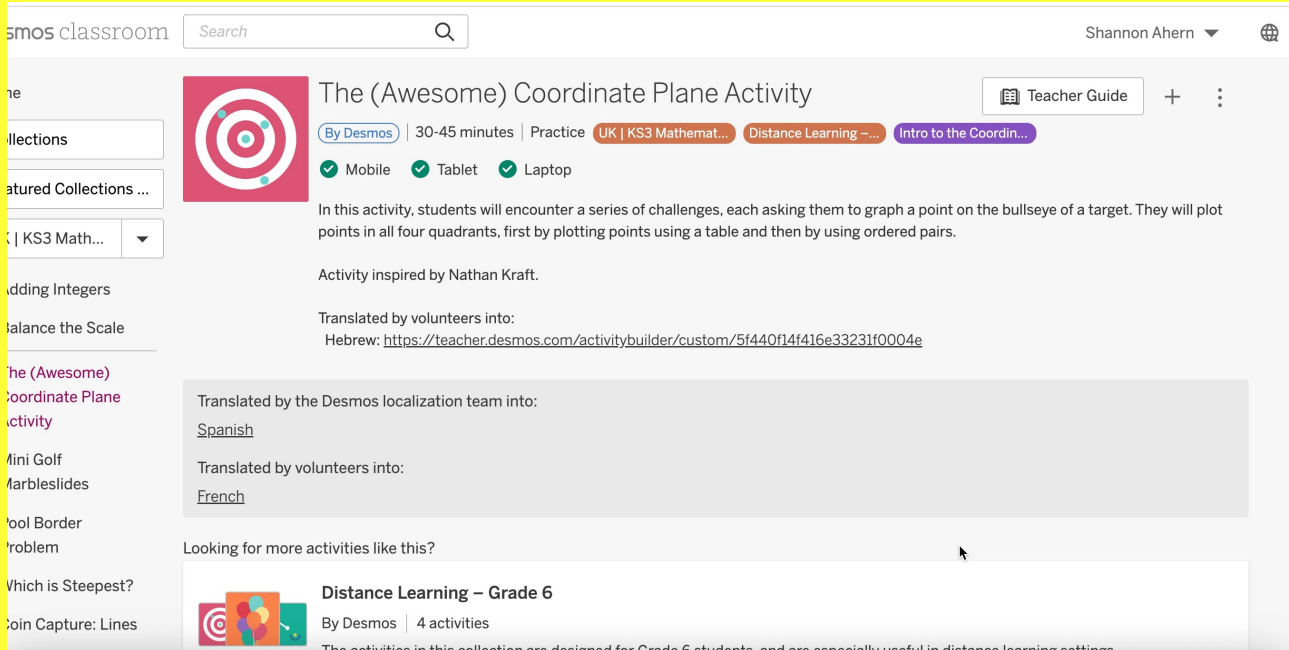
# STUDENT VOICE

- "\_\_\_\_\_ says it increases, do you agree?"
- "John says its  $2x+3$  but you say  $1x+4$  where did your strategies thinking differ?"
- "What would happen if..."
- "Could you improve on this idea?"
- "Could we represent this another way?"
- Sometimes students will be too afraid to engage with all class discussions.  
Teacher Hack: tell them to "Tell the person beside you what you think" and then ask the group what they said!

# THUMBS UP/DOWN/SIDEWAYS

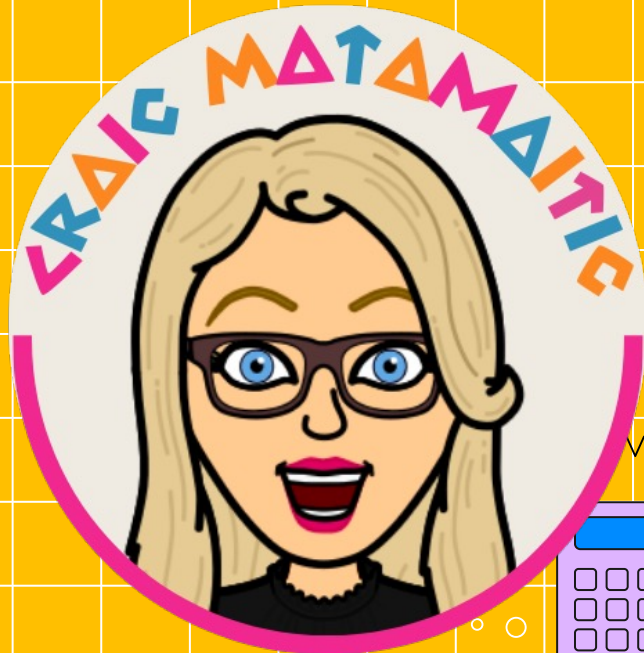
- To engage all students in the class, do a thumbs up/down/sideways vote
- Thumbs up – agree
- Thumbs down – disagree
- Thumbs sideways – not sure yet
- Where there are students that are not sure yet – ask a student from each side to convince them that they are right!

# ASSIGN IT FOR HOMEWORK



The screenshot shows a Desmos classroom interface. At the top, there's a search bar and the user name 'Shannon Ahern'. The main content area displays the activity 'The (Awesome) Coordinate Plane Activity' with a target icon. Below the title, it indicates 'By Desmos', '30-45 minutes', 'Practice', and 'UK | KS3 Mathemat...'. There are also tags for 'Distance Learning' and 'Intro to the Coordin...'. Below this, it shows compatibility with 'Mobile', 'Tablet', and 'Laptop'. The description states: 'In this activity, students will encounter a series of challenges, each asking them to graph a point on the bullseye of a target. They will plot points in all four quadrants, first by plotting points using a table and then by using ordered pairs.' It also mentions 'Activity inspired by Nathan Kraft.' and 'Translated by volunteers into: Hebrew: <https://teacher.desmos.com/activitybuilder/custom/5f440f14f416e33231f0004e>'. A section for translations by the Desmos localization team lists 'Spanish' and 'French'. At the bottom, there's a recommendation for 'Distance Learning – Grade 6' with a target icon and the text 'By Desmos | 4 activities' and 'The activities in this collection are designed for Grade 6 students, and are especially useful in distance learning settings.'

Best Solution: Give Students a link



# THANK YOU!

Any questions?



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