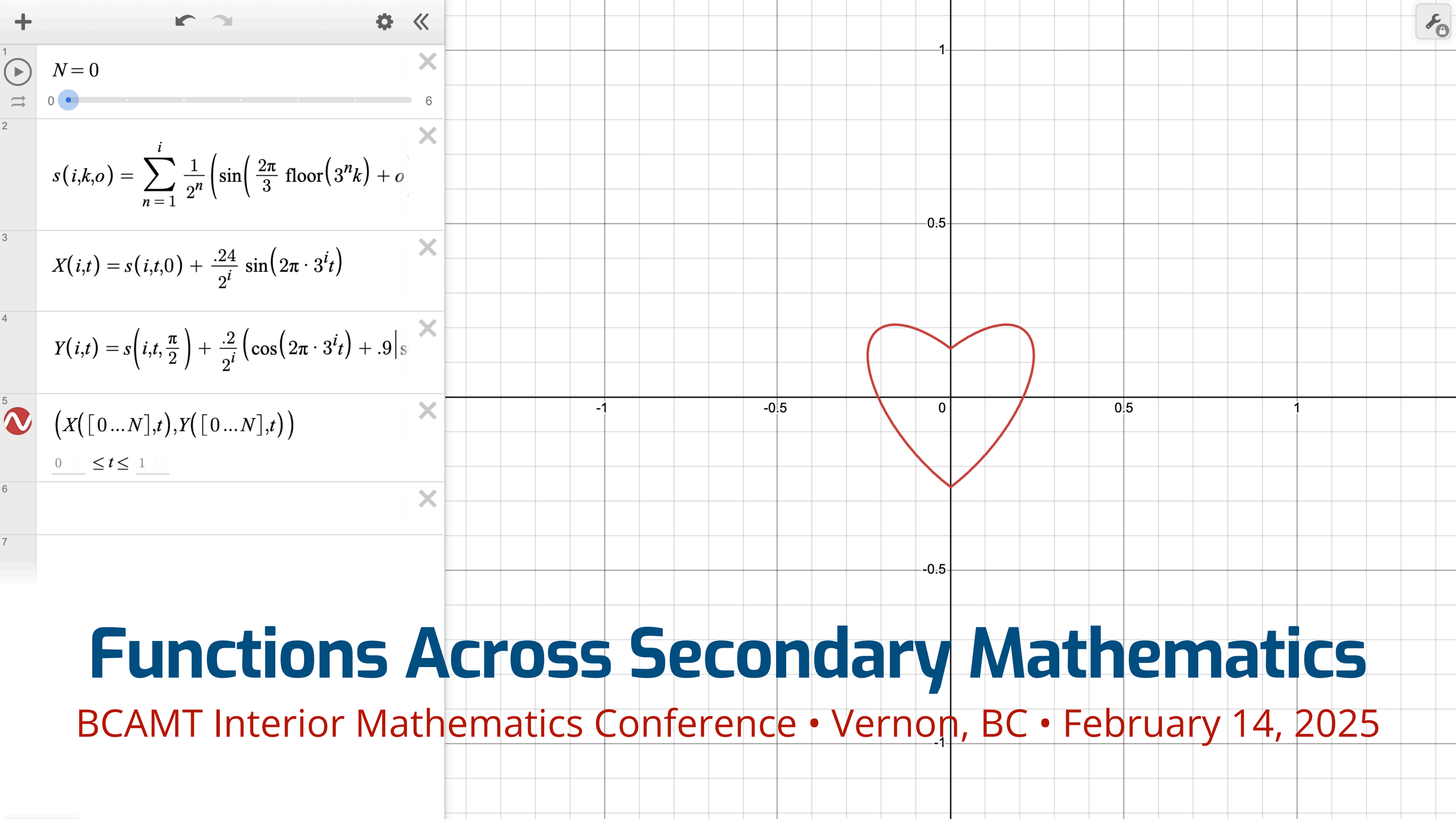

Functions Across Secondary Mathematics

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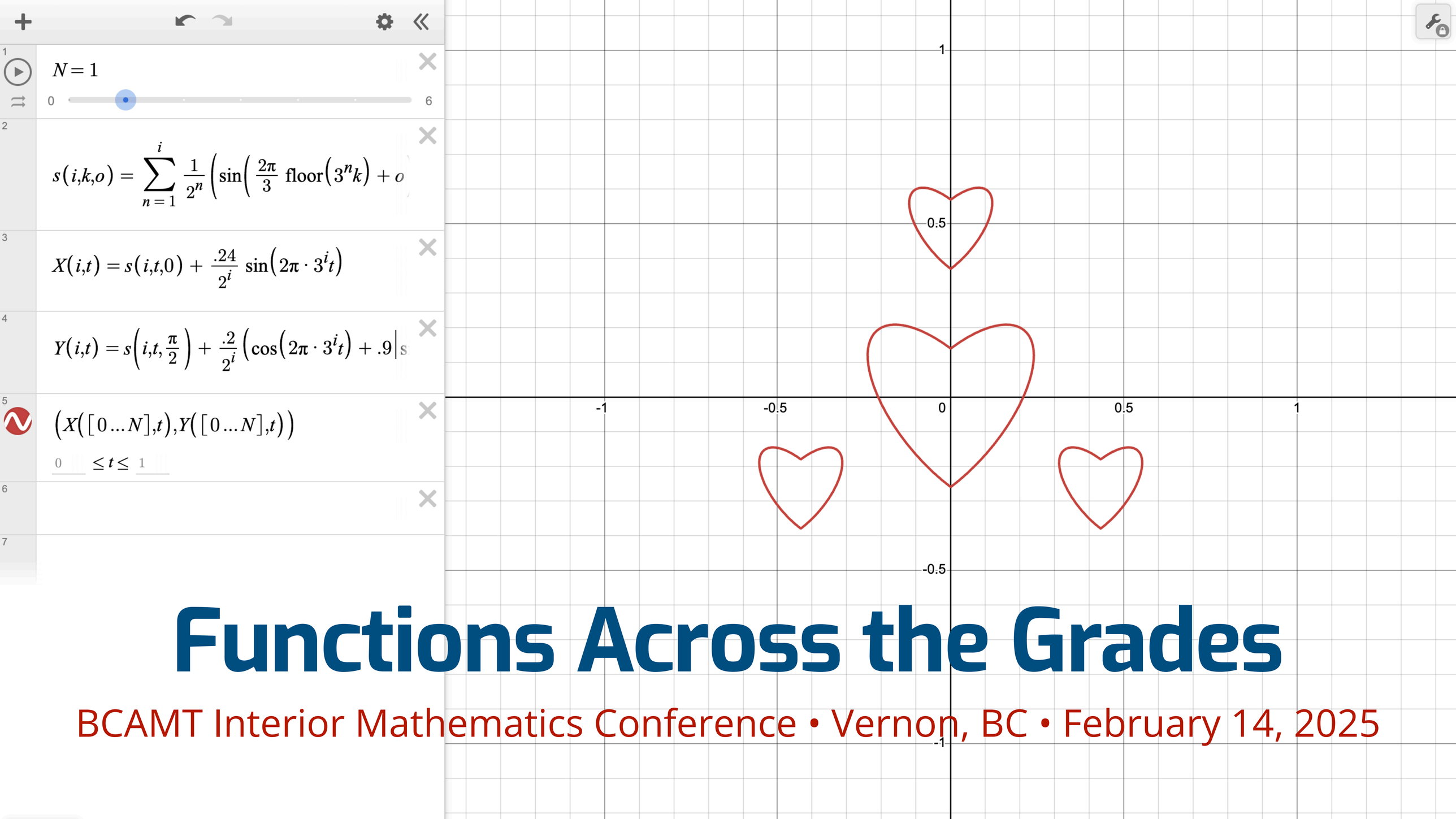

Functions Across the Grades

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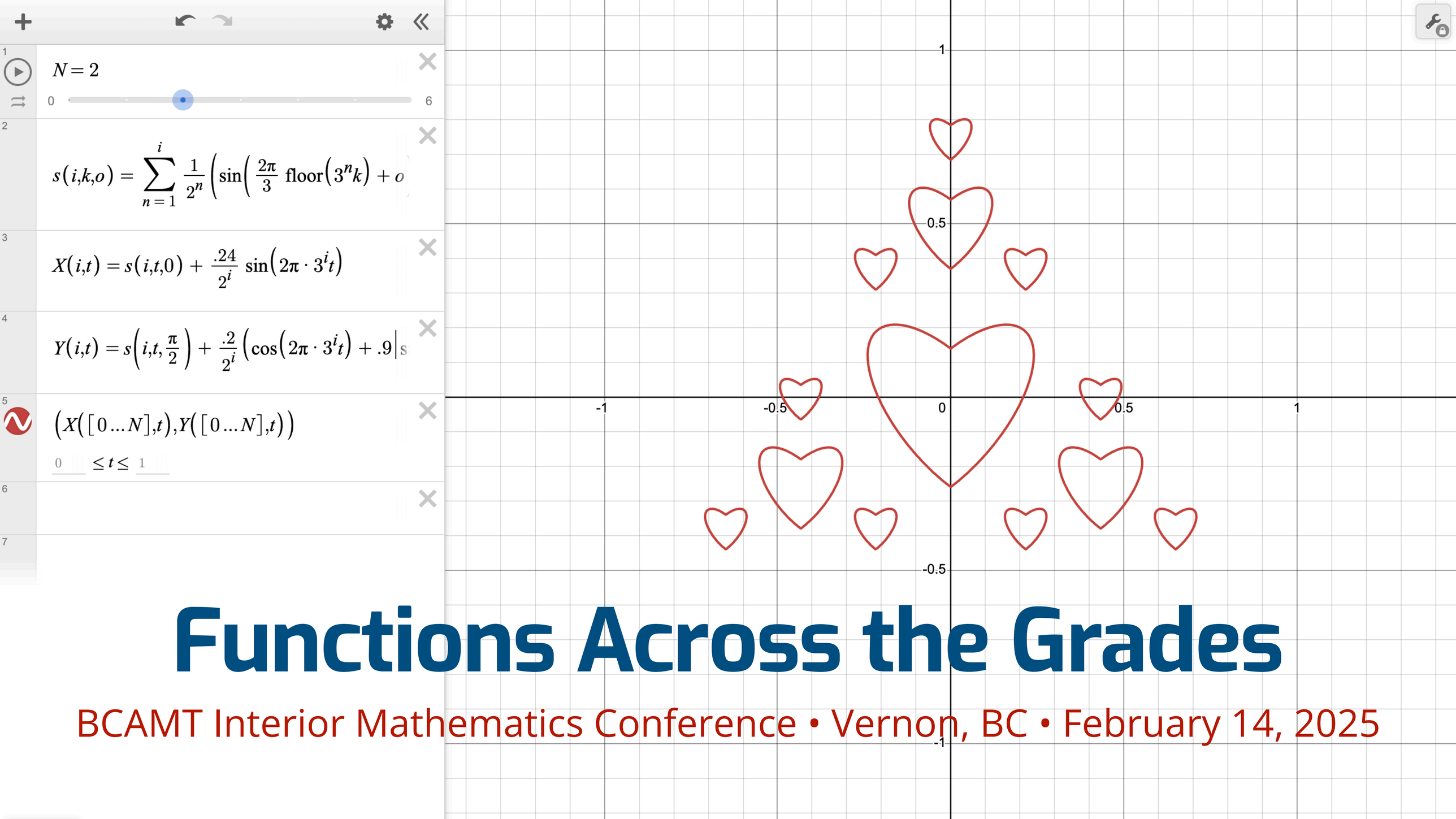

Functions Across the Grades

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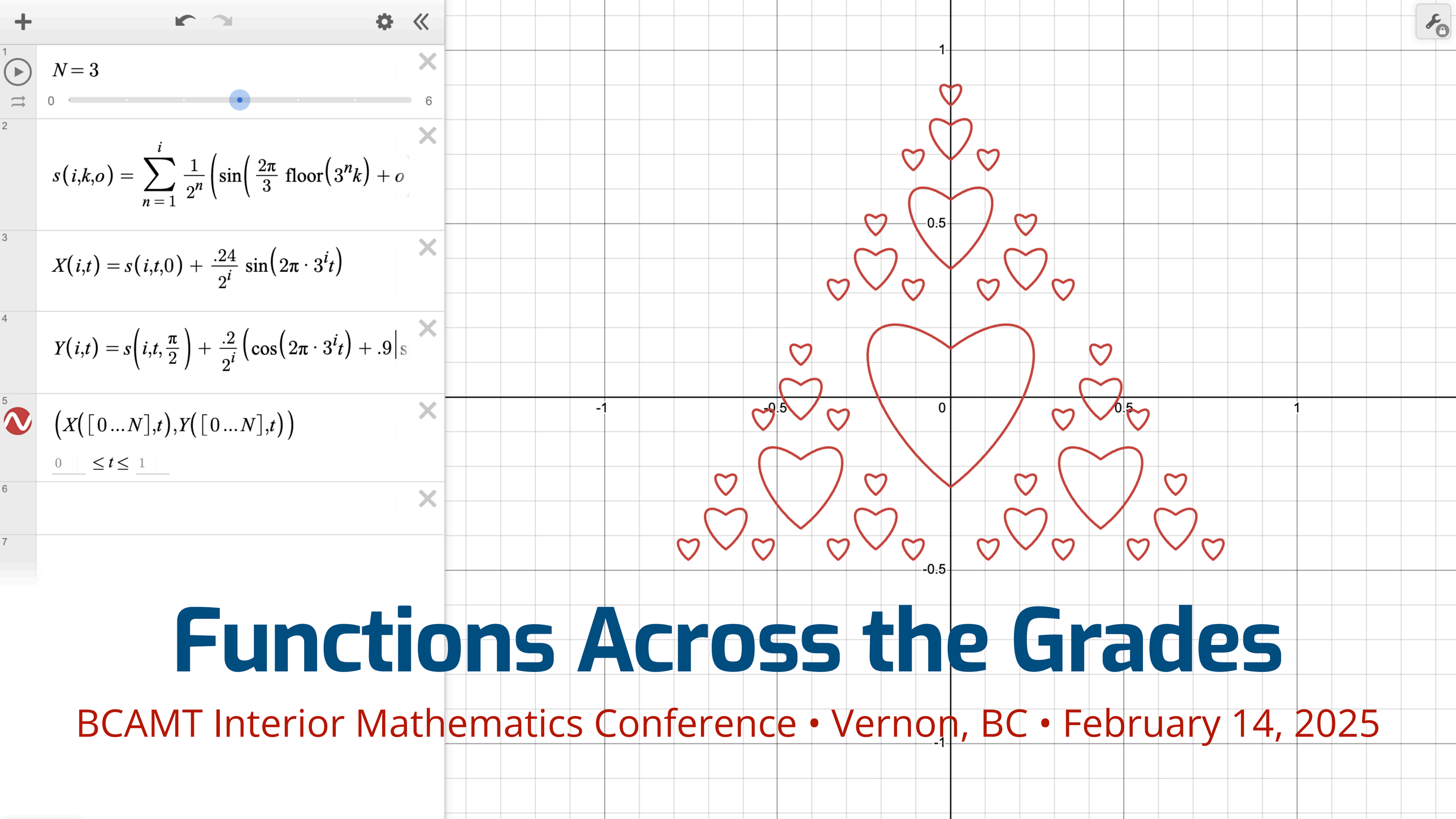

Functions Across the Grades

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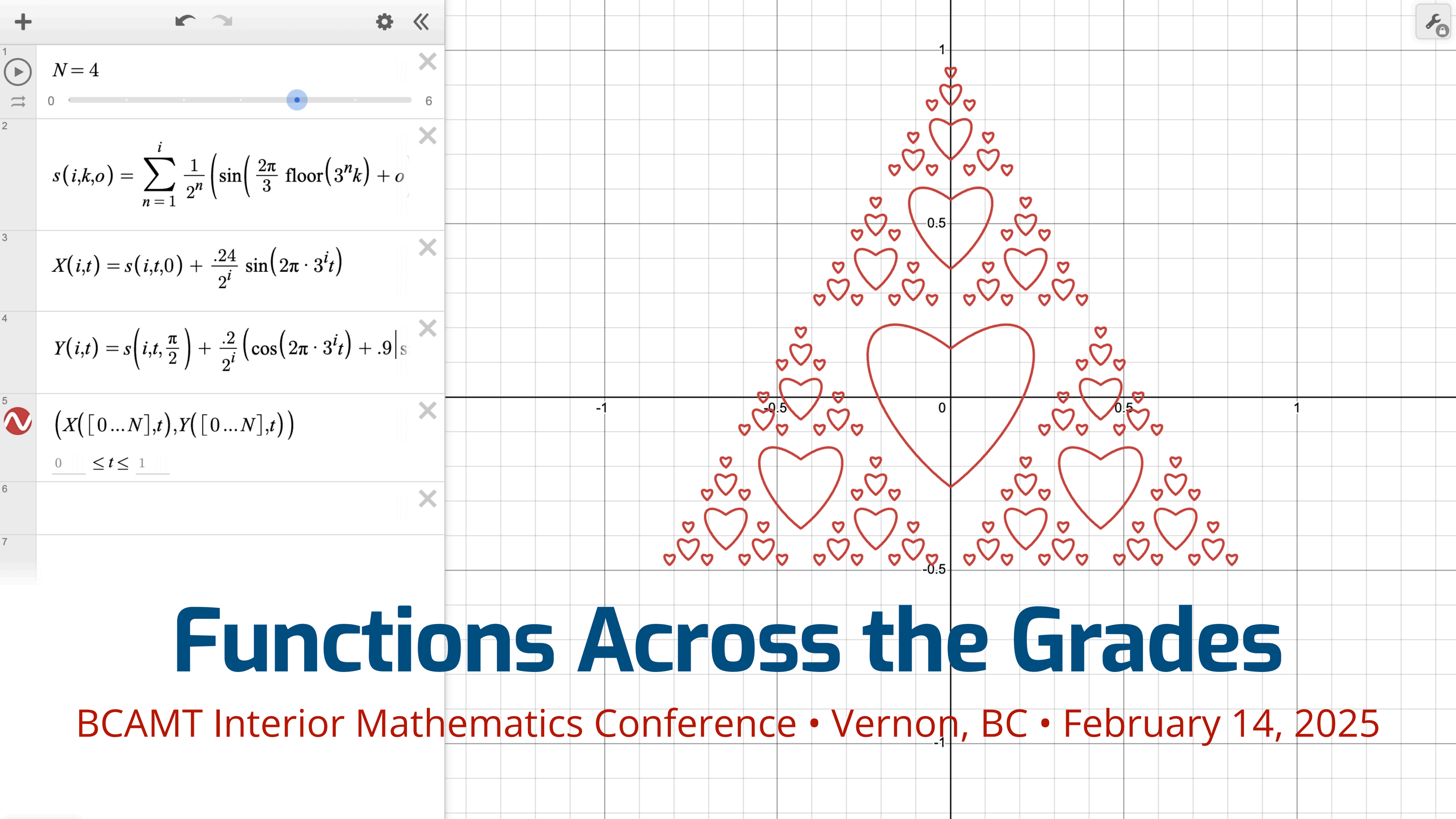

Functions Across the Grades

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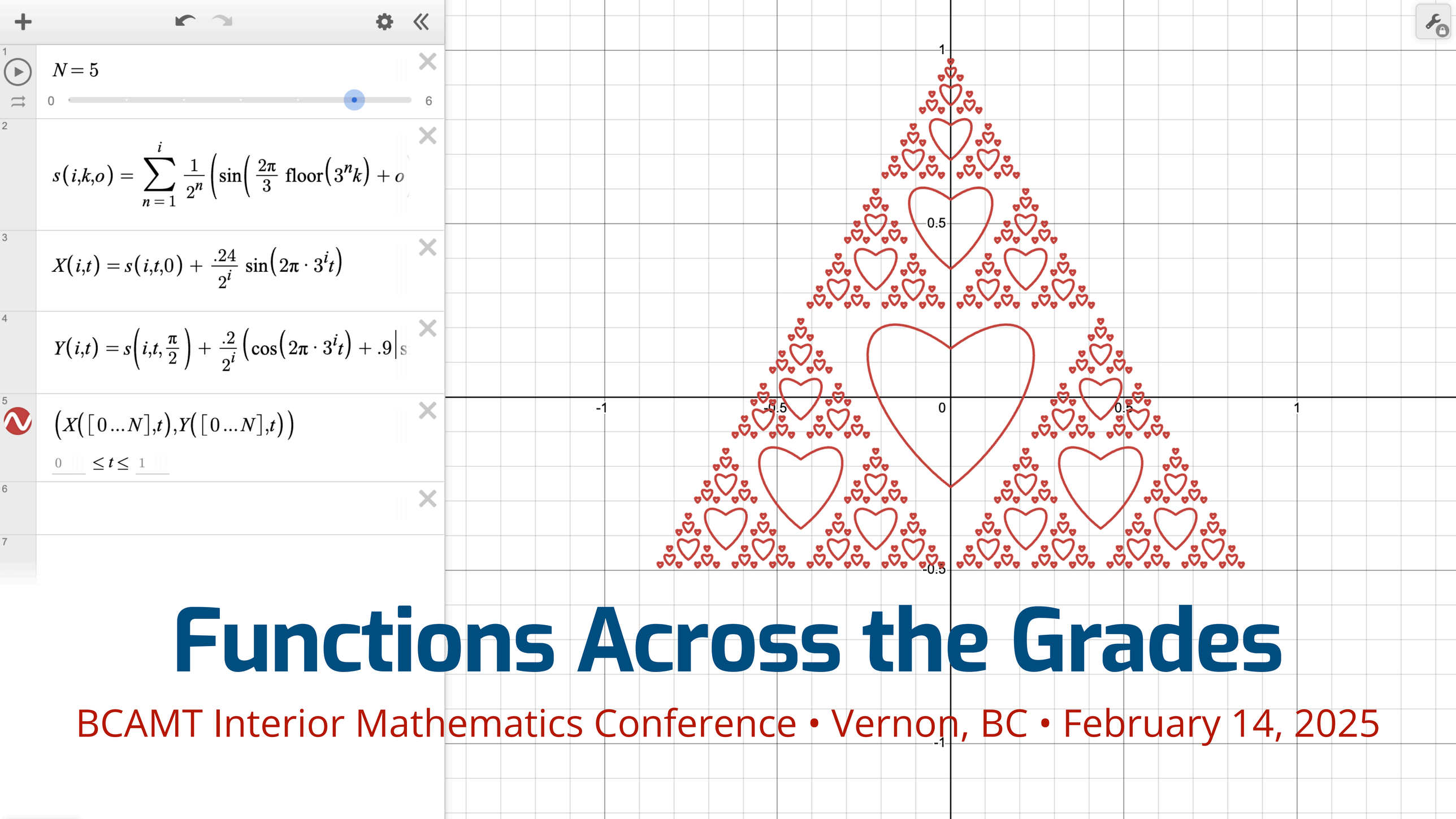

Functions Across the Grades

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$N = 6$

0 — 6

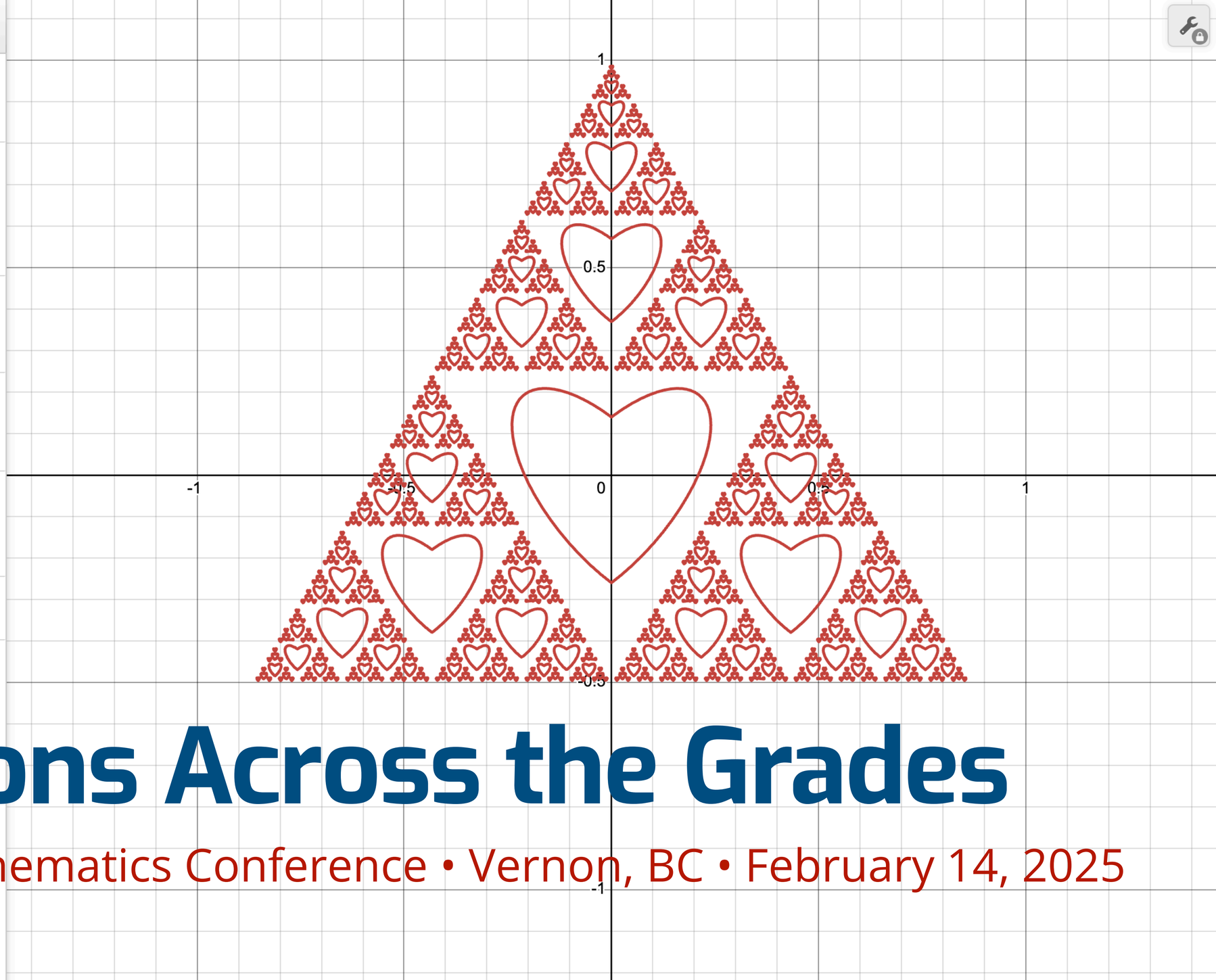
$$s(i,k,o) = \sum_{n=1}^{i} \frac{1}{2^n} \left(\sin\left(\frac{2\pi}{3} \operatorname{floor}\left(3^n k\right) + o \right.$$

$$X(i,t) = s(i,t,0) + \frac{.24}{2^i} \sin\left(2\pi \cdot 3^i t\right)$$

$$Y(i,t) = s\left(i,t,\frac{\pi}{2}\right) + \frac{.2}{2^i} \left(\cos\left(2\pi \cdot 3^i t\right) + .9\right|s$$

$$\left(X\left([0 \ldots N],t\right), Y\left([0 \ldots N],t\right)\right)$$

$0 \leq t \leq 1$



Functions Across the Grades

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BCAMT

British Columbia Association of Mathematics Teachers

10

functions and relations

linear functions

10

functions and relations

linear functions

11

quadratic functions

10

functions and relations

linear functions

11

quadratic functions

12

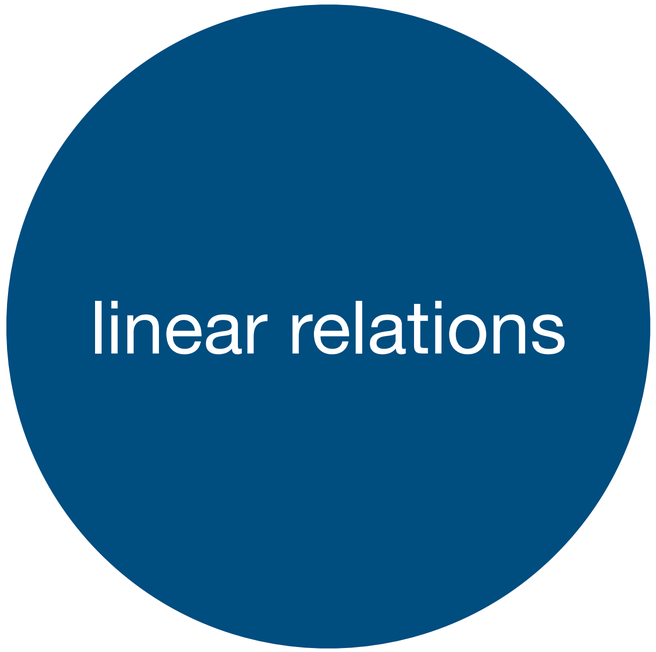
transformations

exponential, logarithmic, polynomial, rational, and trigonometric functions

6

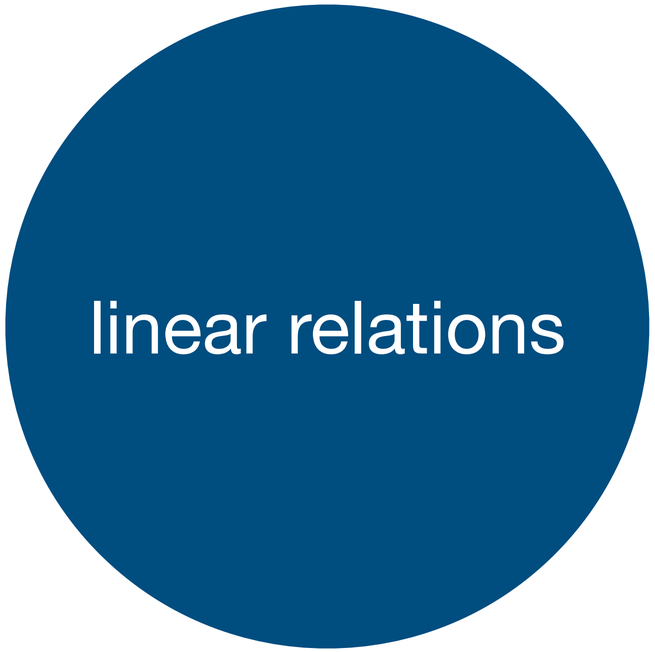
functional relationships
expressions, graphs, tables

7



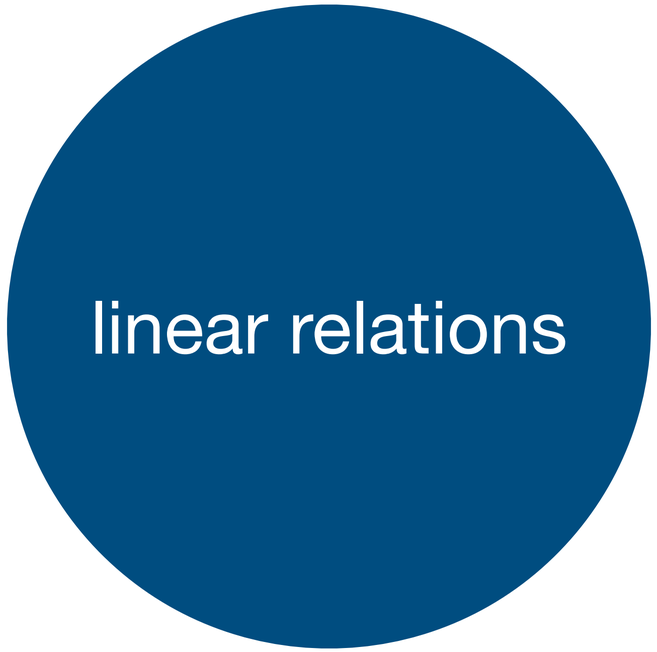
integral coordinates

8



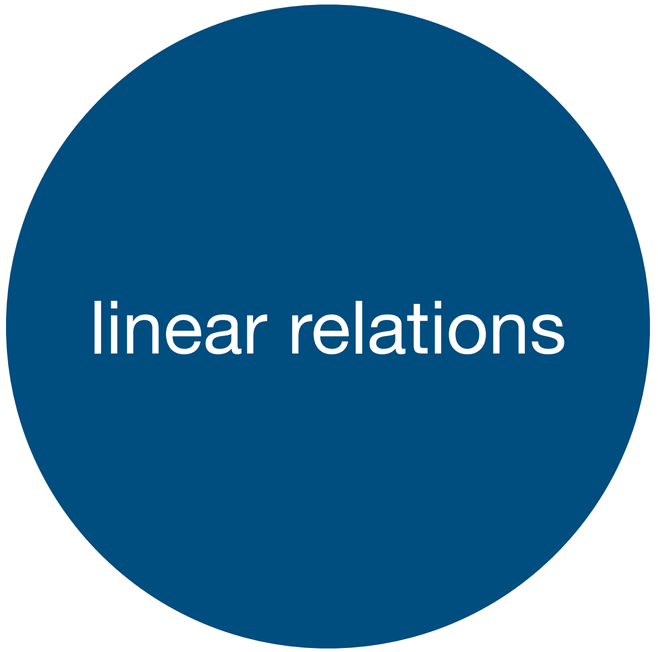
(larger) integral coordinates
equations, graphs, tables

8



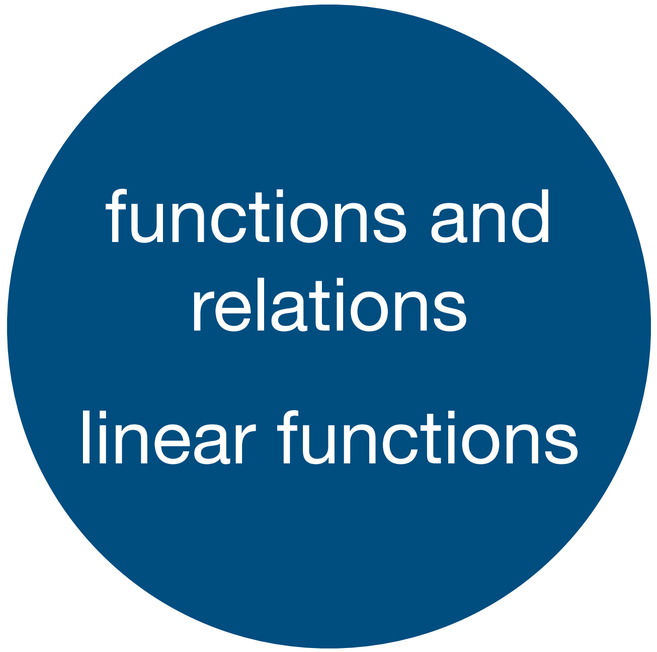
(larger) integral coordinates
equations, graphs, tables

9

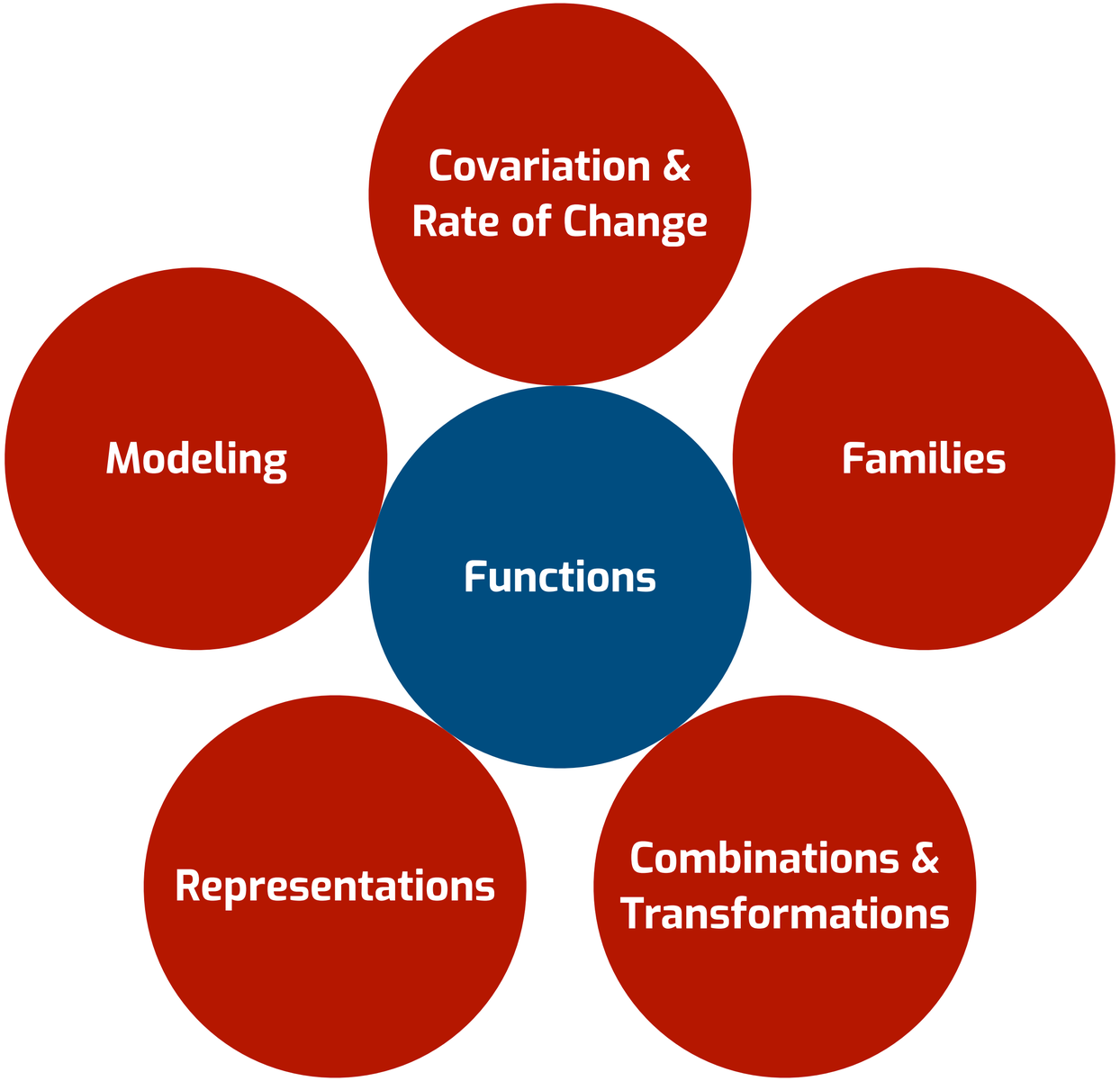


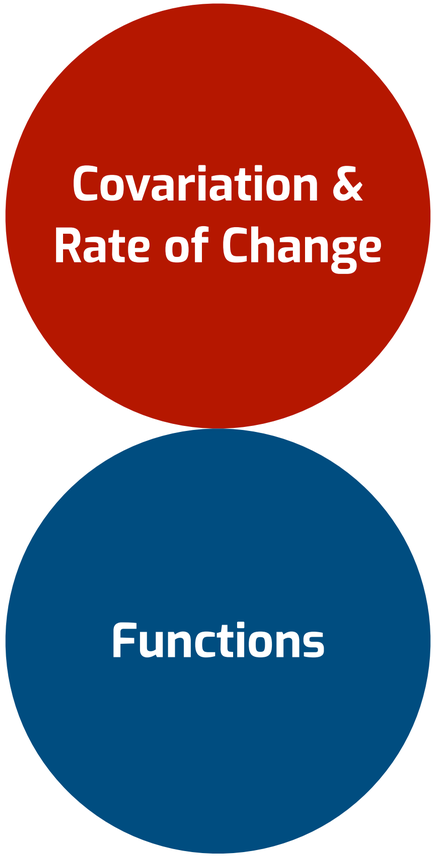
continuous
rational coordinates

10



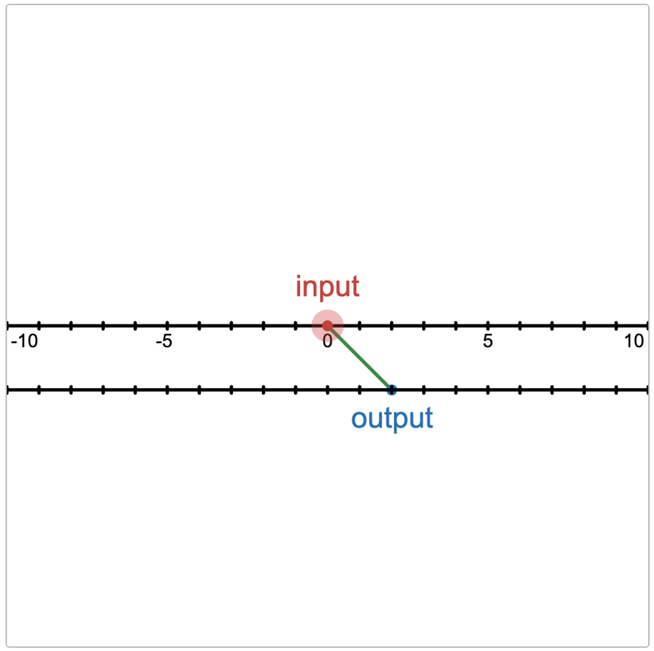
slope
equations of lines


Covariation &
Rate of Change
Modeling
Families
Functions
Representations
Combinations &
Transformations


Covariation &
Rate of Change
Functions

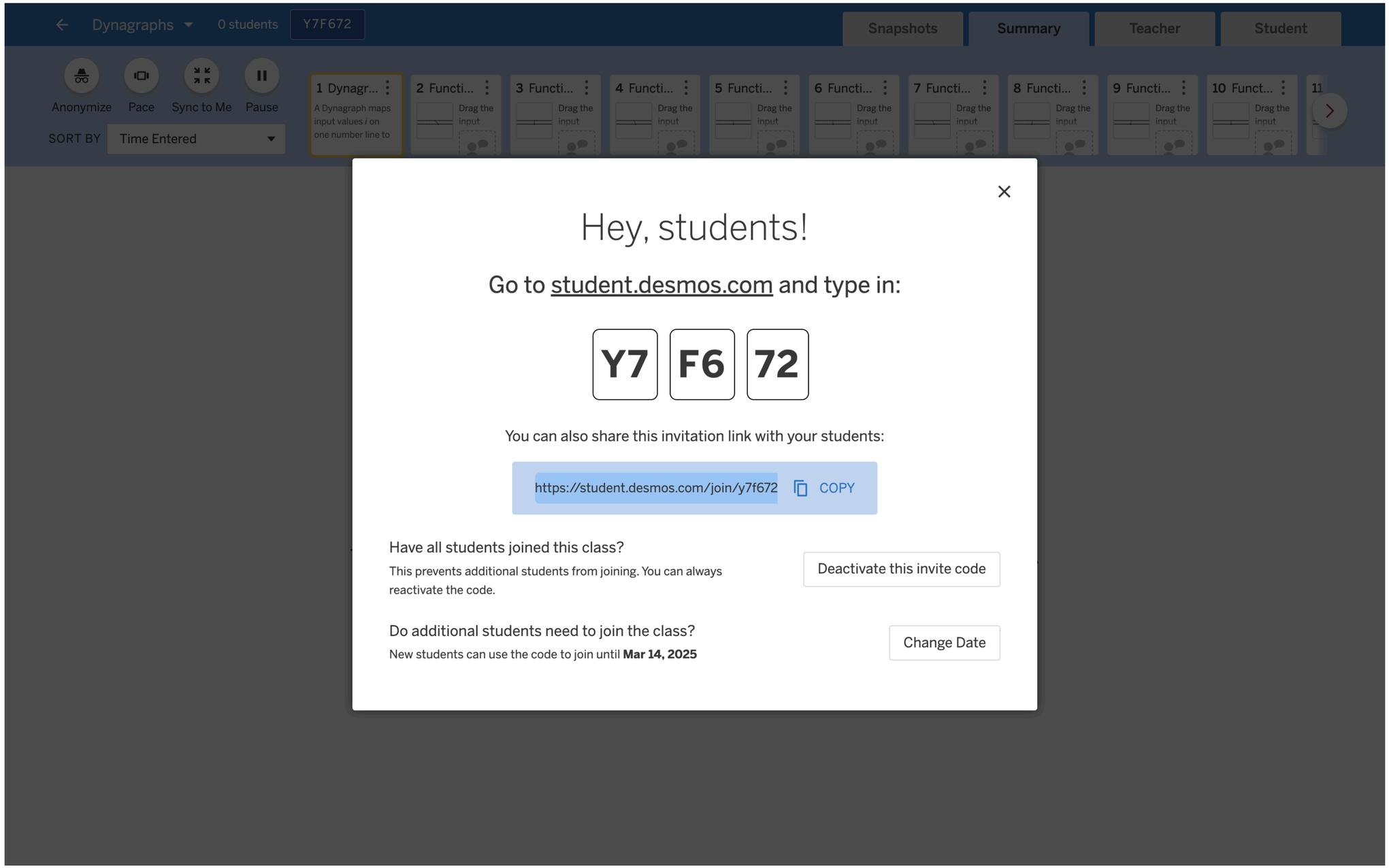
How do quantities relate to each other?

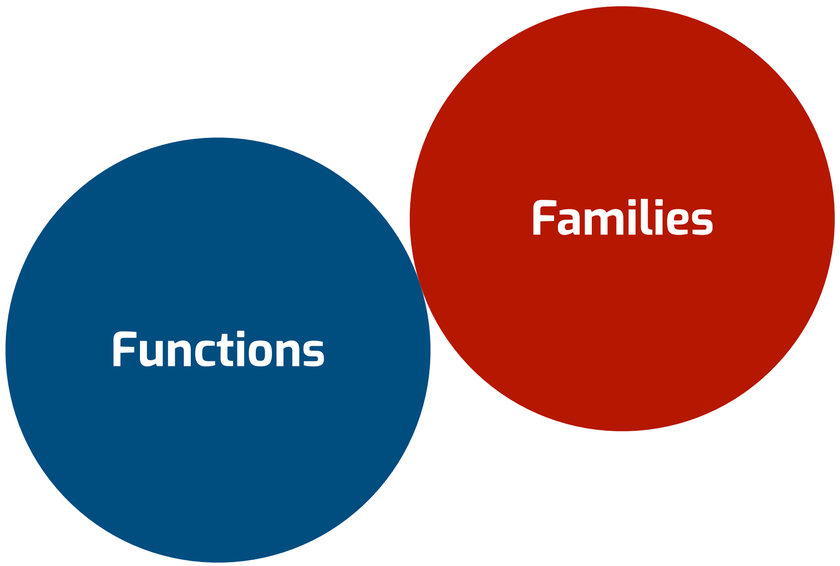
Function #1



Drag the input point to explore the input and output values visually and numerically. What is the function *f*? How do you know?

Share With Class


Dynagraphs
0 students
Y7F672
Snapshots
Summary
Teacher
Student
Anonymize
Pace
Sync to Me
Pause
SORT BY
Time Entered
1 Dynagr...
A Dynagraph maps input values i on one number line to
2 Functi...
3 Functi...
4 Functi...
5 Functi...
6 Functi...
7 Functi...
8 Functi...
9 Functi...
10 Funct...
Drag the input
Hey, students!
Go to student.desmos.com and type in:
Y7 F6 72
You can also share this invitation link with your students:
https://student.desmos.com/join/y7f672
COPY
Have all students joined this class?
This prevents additional students from joining. You can always reactivate the code.
Deactivate this invite code
Do additional students need to join the class?
New students can use the code to join until Mar 14, 2025
Change Date


Families
Functions

What are the important characteristics of … ?

WANTED

LINEAR RELATION (A.K.A. "LINE")...

... POSITIVE Y-INTERCEPT

... NEVER PASSES THROUGH QIII

... POSITIVE X-INTERCEPT

... PERPENDICULAR TO $Y = \frac{1}{2}X + 3$

... DECREASES FROM LEFT TO RIGHT

... SLOPE = -2

... X-INTERCEPT = 4

... HAS THE SAME Y-INTERCEPT AS $8X - 3Y + 24 = 0$

... PASSES THROUGH (1, 6)

WANTED

QUADRATIC FUNCTION (A.K.A. "PARABOLA")...

... OPENS UP

... POSITIVE Y-INTERCEPT

... NO X-INTERCEPTS

... NEVER ENTERS QIII

... VERTEX IN QII

... MINIMUM VALUE OF 3

... AXIS OF SYMMETRY X = -5

... VERTICALLY STRETCHED

... PASSES THROUGH (-7, 15)

... VERTEX (-5, 3)

WANTED

QUADRATIC FUNCTION (A.K.A. "PARABOLA")...

... TWO X-INTERCEPTS

... POSITIVE Y-INTERCEPT

... AXIS OF SYMMETRY $x = 2$

... VERTEX IN QI

... OPENS DOWN

... RANGE $y \leq 4$

... CONTAINS POINTS IN ALL FOUR QUADRANTS

... VERTEX $(2, 4)$

... PASSES THROUGH $(5, 1)$

... VERTICALLY SHRUNK

WANTED

QUADRATIC FUNCTION (A.K.A. "PARABOLA")...

... PASSES THROUGH (-2, 14)

... POSITIVE Y-INTERCEPT

... DOES NOT CONTAIN POINTS IN QIII, QIV

... OPENS UP

... VERTEX IN QII

... AXIS OF SYMMETRY X = -4

... PASSES THROUGH (-6, 14)

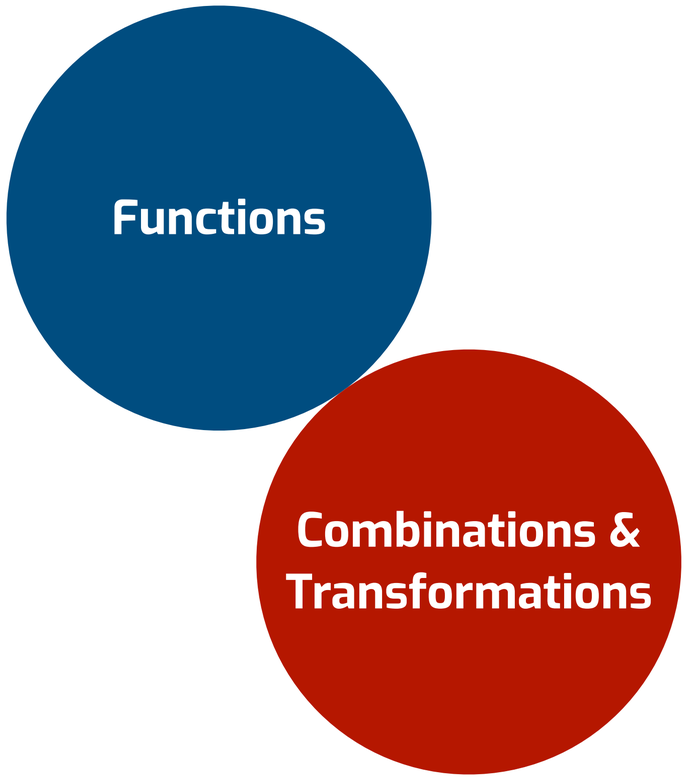
... VERTICALLY STRETCHED

... VERTEX (-4, 6)

... PASSES THROUGH (-3, 8)

A.	Has a positive slope	B.	Has a positive y-intercept
C.	Has a negative x-intercept	D.	Never enters Quadrant I
E.	Passes through (2, -3)	F.	Has a negative y-intercept
G.	Has a negative slope	H.	Passes through (4, 0)
I.	Never enters Quadrant III	J.	Has a slope less than 1

A.	Two negative x-intercepts	B.	Vertex in Quadrant II
C.	Never enters Quadrant III	D.	Vertex on the y-axis
E.	Positive y-intercept	F.	No x-intercepts
G.	Never enters Quadrant I	H.	Has a minimum value
I.	Horizontally stretched	J.	Line of symmetry enters Quadrant IV


Functions
Combinations &
Transformations

In which ways can new functions be derived from existing ones?

desmos classroom | Search | Chris Hunter

Home

Collections

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- Marbleslides: Parabolas
- Marbleslides: Rationals

- #MarbleslidesMo... - Challenge 1
- #MarbleslidesMo... - Challenge 2
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- #MarbleslidesMo... - Challenge 5
- #MarbleslidesMo...

Marbleslides

By Desmos Classroom | 15 activities

Explore this collection of Marbleslides activities and #MarbleslidesMonday challenges posted on Twitter and Facebook.

Marbleslides

Challenge your students to graph equations and functions to collect all the marbles!

Marbleslides: Lines

By Desmos Classroom | 45-60 minutes | Development

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.

Marbleslides: Exponentials

By Desmos Classroom | 45-60 minutes | Development

In this delightful and challenging activity, students will transform exponential functions 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.

Marbleslides: Periodics

By Desmos Classroom | 45-60 minutes | Development

In this delightful and challenging activity, students will transform periodic functions so that the marbles go through the stars. Students will test their ideas by launching the marbles, and have a chance to revise before trying the next challenge.

Marbleslides: Parabolas

By Desmos Classroom | 45-60 minutes | Development

In this delightful and challenging activity, students will transform parabolas so that the marbles go through the stars. Students will test their ideas by launchi

$y = 4x + 7$

Translate three units down

Reflect in the *y*-axis

Translate two units to the left

Reflect in the *x*-axis

$y = 4x - 2$

$y = 4x + 7$

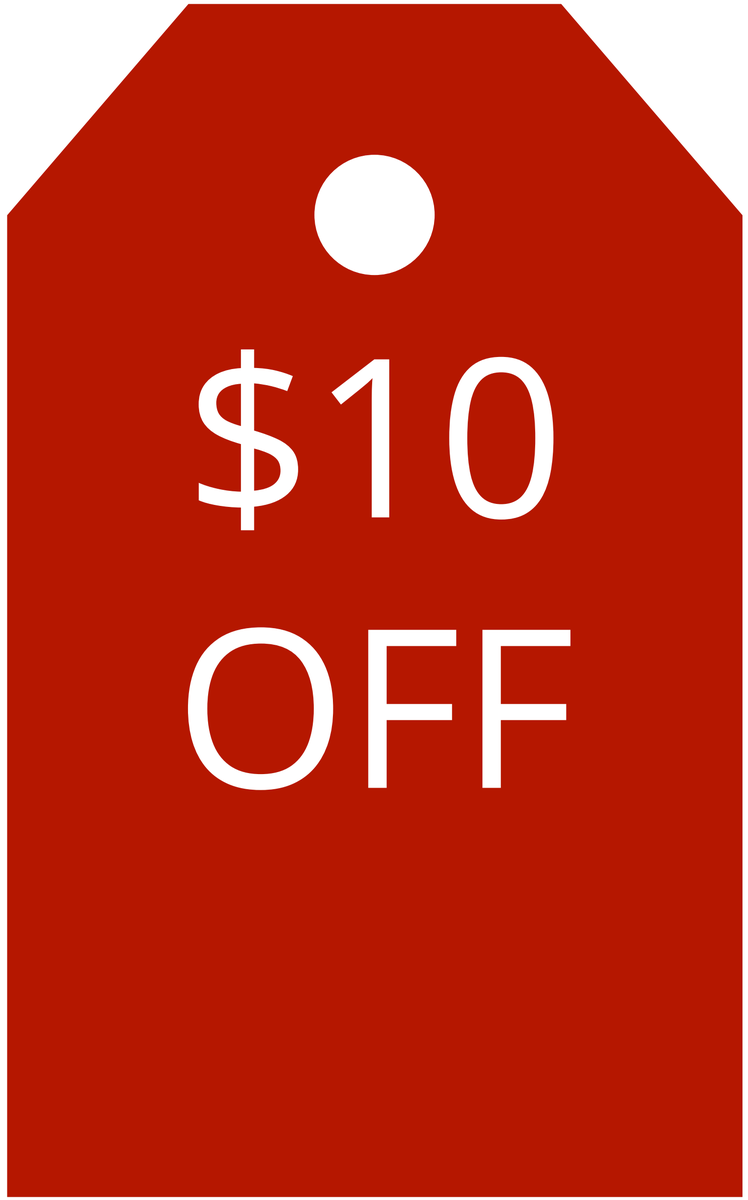
Reflect in the y-axis

Reflect in the x-axis

Translate three units down

Translate two units to the left

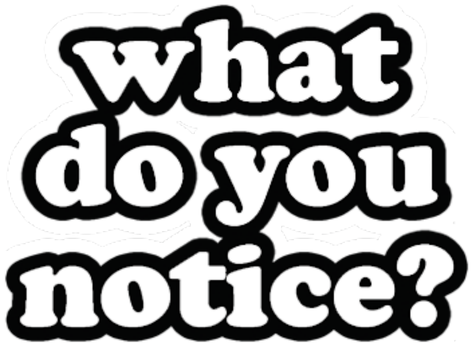
$y = 4x - 2$


$10
OFF

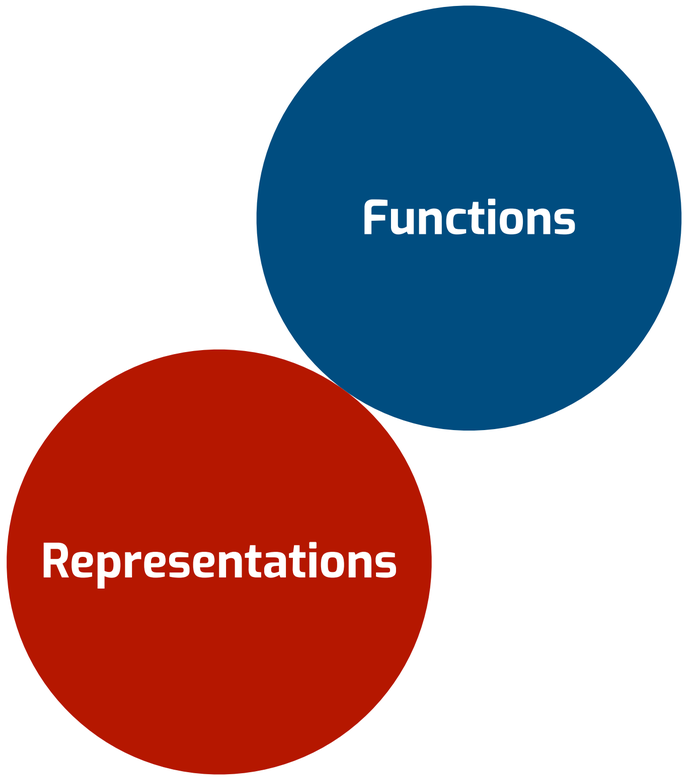

20%
OFF


$10
OFF
f


20%
OFF
g



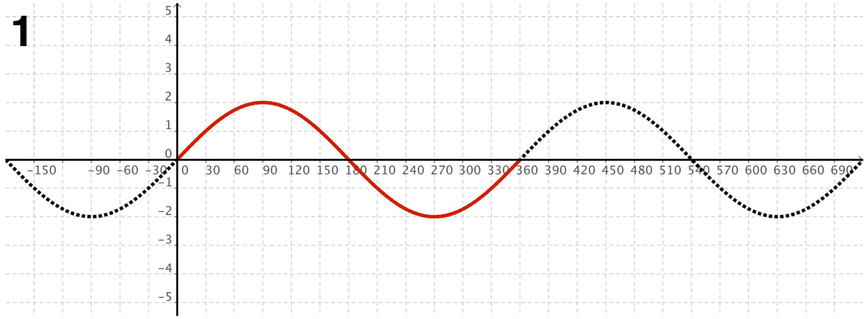
$$f(g(x)) \text{ vs. } g(f(x))$$


Functions
Representations

How do these characteristics appear in tables, graphs, and equations?

A $y = 2\sin x$	**B** $y = 3\cos\frac{1}{2}(x + 90°) - 1$
C $y = \cos x + 2$	**D** $y = -2\cos 3(x - 60°)$
E $y = \frac{1}{2}\sin(x + 60°)$	**F** $y = \cos 2x - 3$
G $y = -3\sin 2x$	**H** $y = \sin 3(x - 90°) + 1$

1



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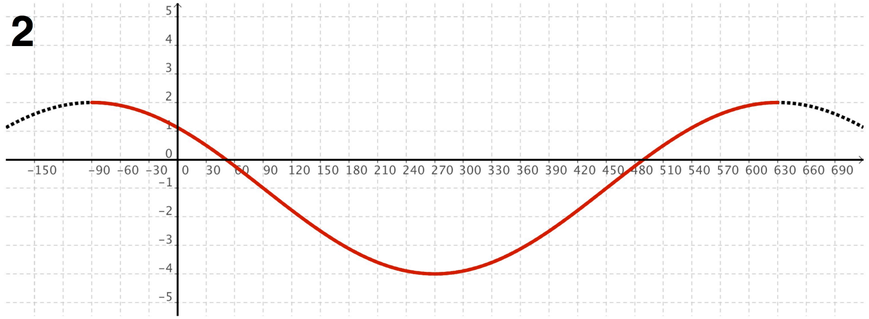

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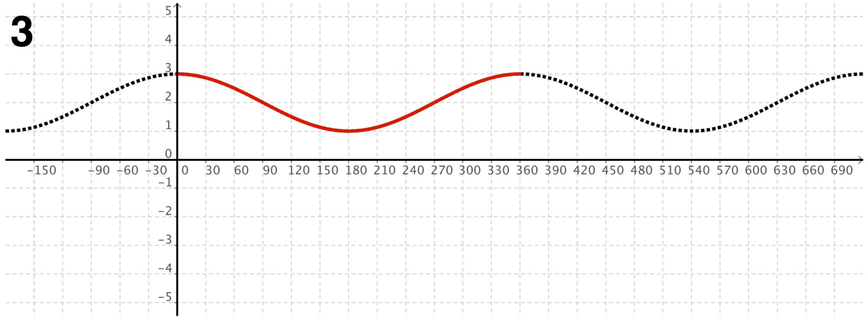

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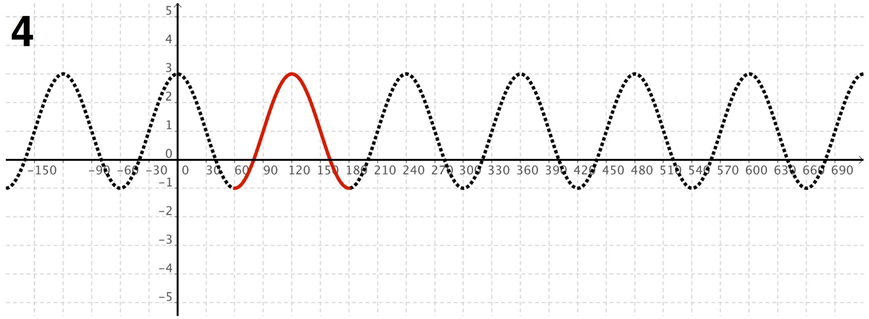

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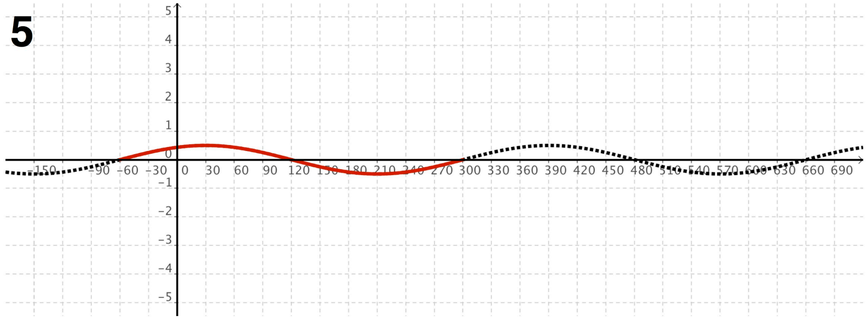

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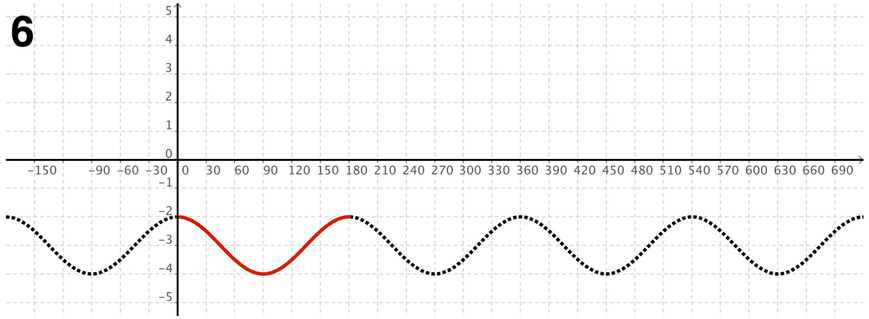

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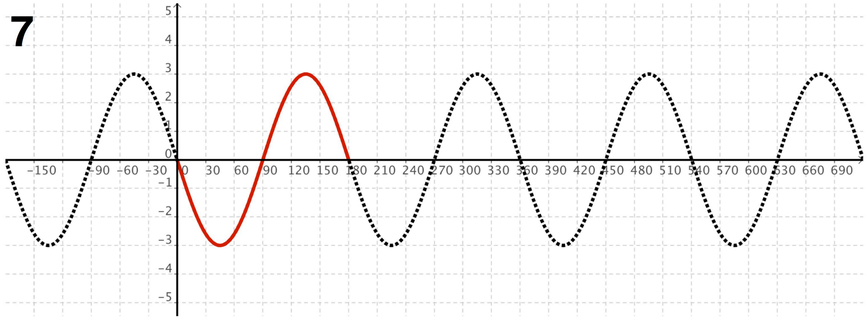

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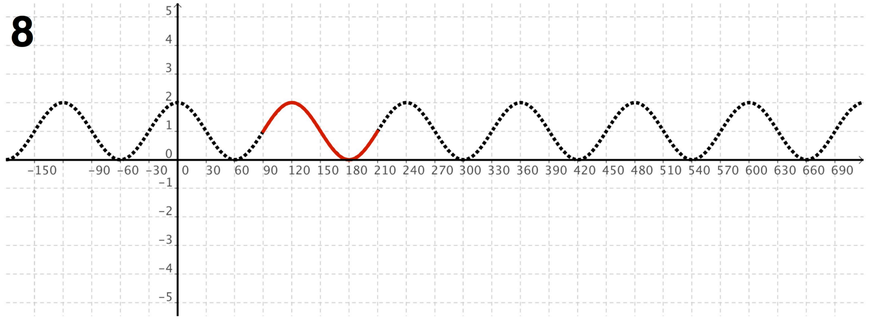
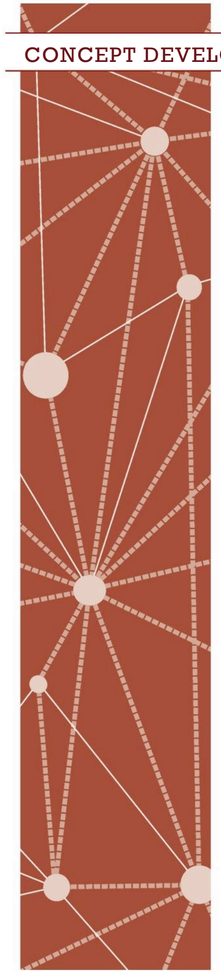


chrishunter.ca

i amplitude: 1 period: 360° maximum: 3 minimum: 1 range: $1 \le y \le 3$ vertical translation: up 2	**ii** amplitude: 1 period: 180° maximum: -2 minimum: -4 range: $-4 \le y \le -2$ vertical translation: down 3
iii amplitude: $\frac{1}{2}$ period: 360° maximum: $\frac{1}{2}$ minimum: $-\frac{1}{2}$ range: $-\frac{1}{2} \le y \le \frac{1}{2}$ horizontal translation: left 60°	**iv** amplitude: 3 period: 180° maximum: 3 minimum: -3 range: $-3 \le y \le -3$ reflection: x-axis
v amplitude: 3 period: 720° maximum: 2 minimum: -4 range: $-4 \le y \le 2$ horizontal translation: left 90° vertical translation: down 1	**vi** amplitude: 2 period: 120° maximum: 2 minimum: -2 range: $-2 \le y \le 2$ horizontal translation: right 60° reflection: x-axis
vii amplitude: 1 period: 120° maximum: 2 minimum: 0 range: $0 \le y \le 2$ horizontal translation: right 90° vertical translation: up 1	**viii** amplitude: 2 period: 360° maximum: 2 minimum: -2 range: $-2 \le y \le 2$

“Admittedly, there’s little cognitive difference between a tactile matching activity and a matching exercise on a worksheet. However, **in a card sort, the emphasis rests on the conversation among students** rather than the conversation between the student and the worksheet. **Because students can arrange and rearrange shapes or cards on the table, they naturally refine and test ideas, and talk about them.** In this way, card sorts can reinforce our message that mistakes are learning opportunities.”

Krall, G. (2018). *Necessary conditions: Teaching secondary math with academic safety, quality tasks, and effective facilitation*. Stenhouse.



CONCEPT DEVELOPMENT

Mathematics Assessment Project

CLASSROOM CHALLENGES

A Formative Assessment Lesson

Interpreting Algebraic Expressions

Mathematics Assessment Resource Service
University of Nottingham & UC Berkeley

CONCEPT DEVELOPMENT

Mathematics Assessment Project
CLASSROOM CHALLENGES
A Formative Assessment Lesson

Interpreting Algebraic Expressions

Mathematics Assessment Resource Service
University of Nottingham & UC Berkeley

Card Set A: Expressions

E1 $\frac{n+6}{2}$	**E2** $3n^2$
E3 $2n+12$	**E4** $2n+6$
E5 $2(n+3)$	**E6** $\frac{n}{2}+6$
E7 $(3n)^2$	**E8** $(n+6)^2$
E9 $n^2+12n+36$	**E10** $3+\frac{n}{2}$
E11 n^2+6	**E12** n^2+6^2
E13	**E14**

CONCEPT DEVELOPMENT

Mathematics Assessment Project
CLASSROOM CHALLENGES
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Interpreting Algebraic Expressions

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Card Set A: Expressions

E1 $\frac{n+6}{2}$	**E2** $3n^2$
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E5 $2(n+3)$	**E6** $\frac{n}{2}+6$
E7 $(3n)^2$	**E8** $(n+6)^2$
E9 $n^2+12n+36$	**E10** $3+\frac{n}{2}$
E11 n^2+6	**E12** n^2+6^2
E13	**E14**

Card Set B: Words

W1 Multiply ***n*** by two, then add six.	**W2** Multiply ***n*** by three, then square the answer.
W3 Add six to ***n*** then multiply by two.	**W4** Add six to ***n*** then divide by two.
W5 Add three to ***n*** then multiply by two.	**W6** Add six to ***n*** then square the answer.
W7 Multiply ***n*** by two then add twelve.	**W8** Divide ***n*** by two then add six.
W9 Square ***n***, then add six	**W10** Square ***n***, then multiply by nine
W11	**W12**
W13	**W14**

Card Set B: Words

W1 Multiply n by two, then add six.	**W2** Multiply n by three, then square the answer.
W3 Add six to n then multiply by two.	**W4** Add six to n then divide by two.
W5 Add three to n then multiply by two.	**W6** Add six to n then square the answer.
W7 Multiply n by two then add twelve.	**W8** Divide n by two then add six.
W9 Square n, then add six	**W10** Square n, then multiply by nine
W11	**W12**
W13	**W14**

Card Set C: Tables

T1

n	1	2	3	4
Ans	14	16	18	20

T2

n	1	2	3	4
Ans			81	144

T3

n	1	2	3	4
Ans		10	15	22

T4

n	1	2	3	4
Ans	3		27	48

T5

n	1	2	3	4
Ans			81	100

T6

n	1	2	3	4
Ans		10	12	14

T7

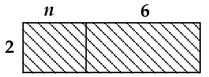
n	1	2	3	4
Ans		4		5

T8

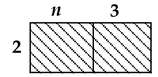
n	1	2	3	4
Ans	6.5	7	7.5	8

Card Set D: Areas

A1



A2



A3

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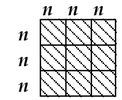

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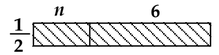

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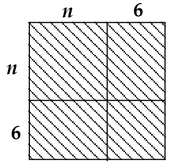

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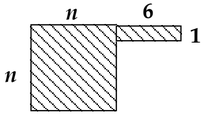
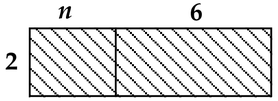


Card Set A: Expressions

E1 $\frac{n+6}{2}$	**E2** $3n^2$
E3 $2n+12$	**E4** $2n+6$
E5 $2(n+3)$	**E6** $\frac{n}{2}+6$
E7 $(3n)^2$	**E8** $(n+6)^2$
E9 $n^2+12n+36$	**E10** $3+\frac{n}{2}$
E11 n^2+6	**E12** n^2+6^2
E13	**E14**

Card Set D: Areas

A1



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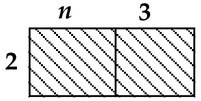

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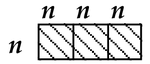

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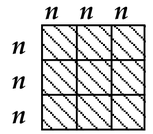

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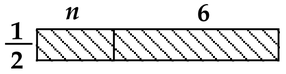

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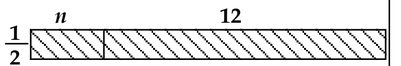

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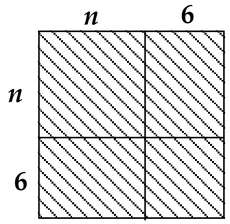

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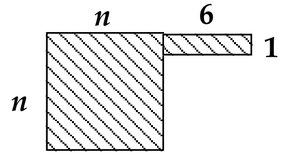

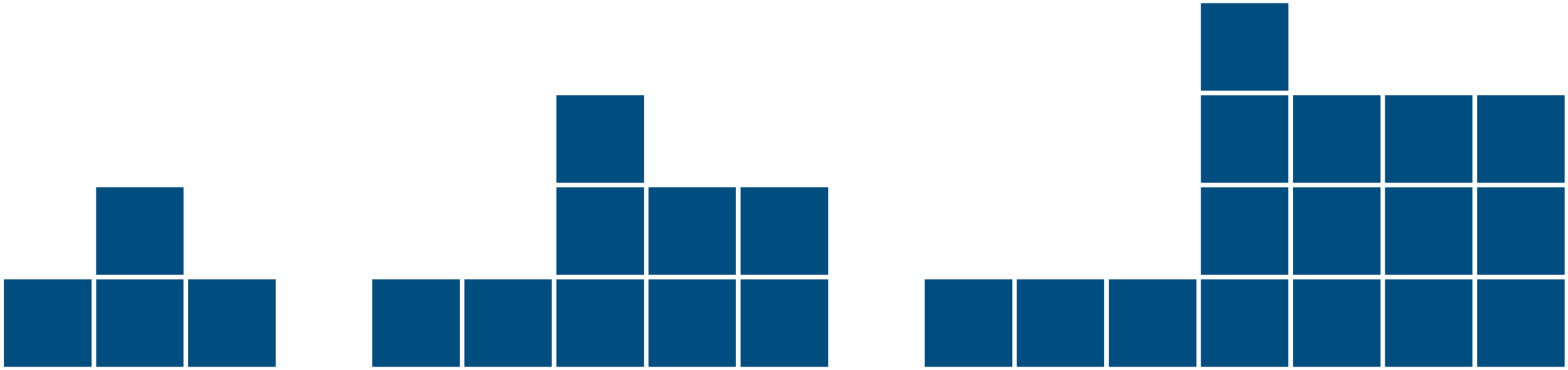

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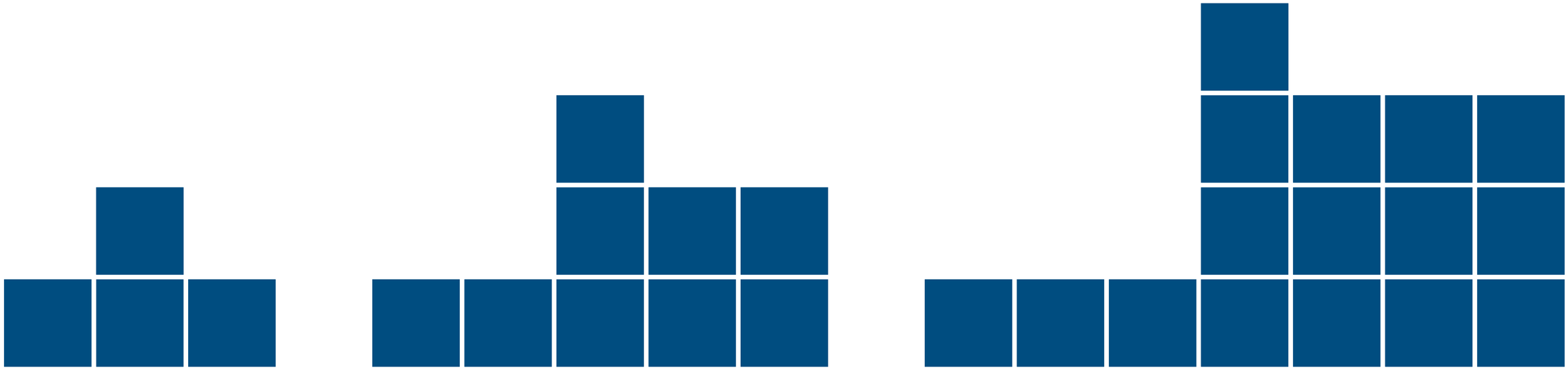

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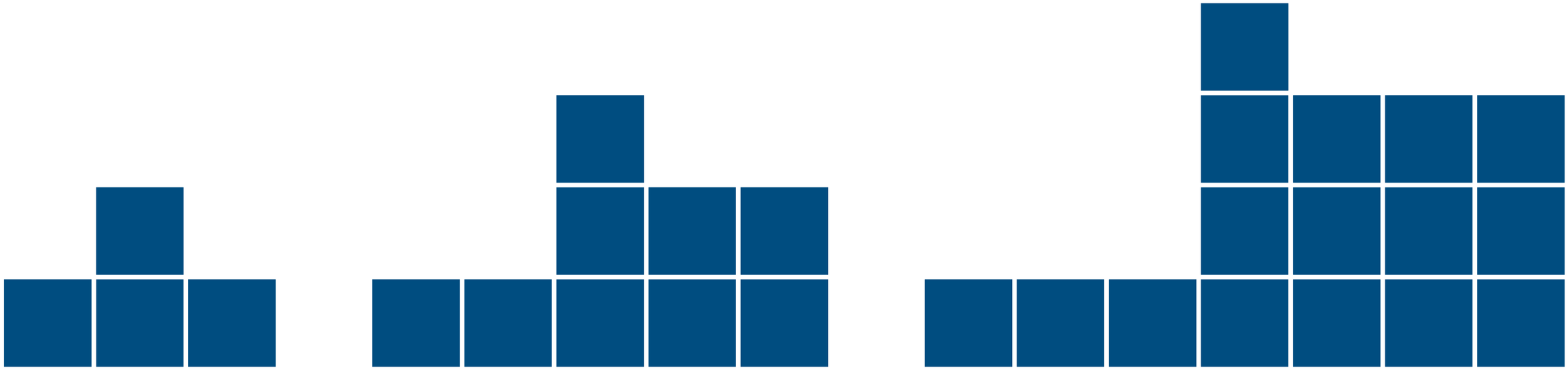

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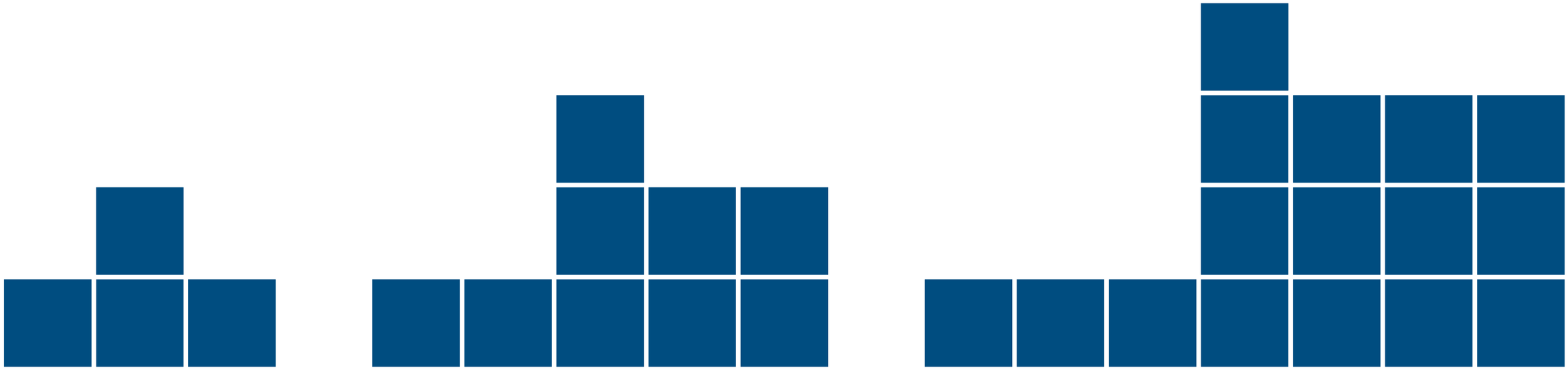

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Once upon a time, there was a thirsty crow.

She came upon a pitcher that had some water in it, but when she put her beak into the pitcher she found she could not reach the water.

Then, she had an idea.

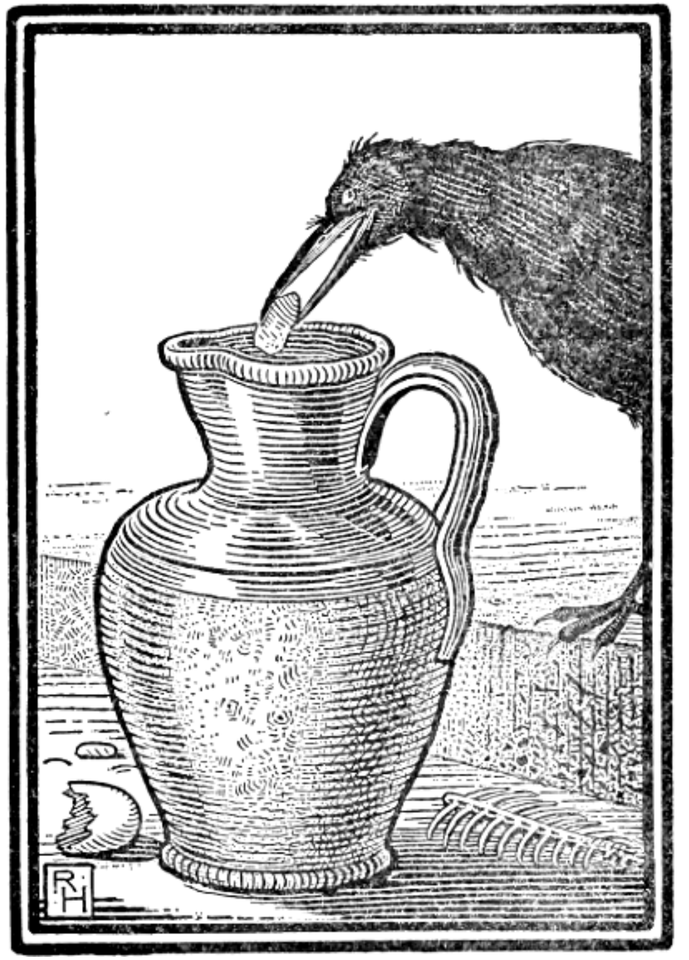
She looked around, found a pebble, and dropped it into the pitcher.

The water rose a little bit.

The crow was encouraged and continued to drop pebbles into the pitcher, one at a time, until the water rose up high enough for the crow to reach it with her beak.

The crow drank and was satisfied!

Moral: **“Little by little does the trick.”**



*Which representation is the **best**?*

*“The **table** is the best. It helps me keep track of the data and find the pattern.”*

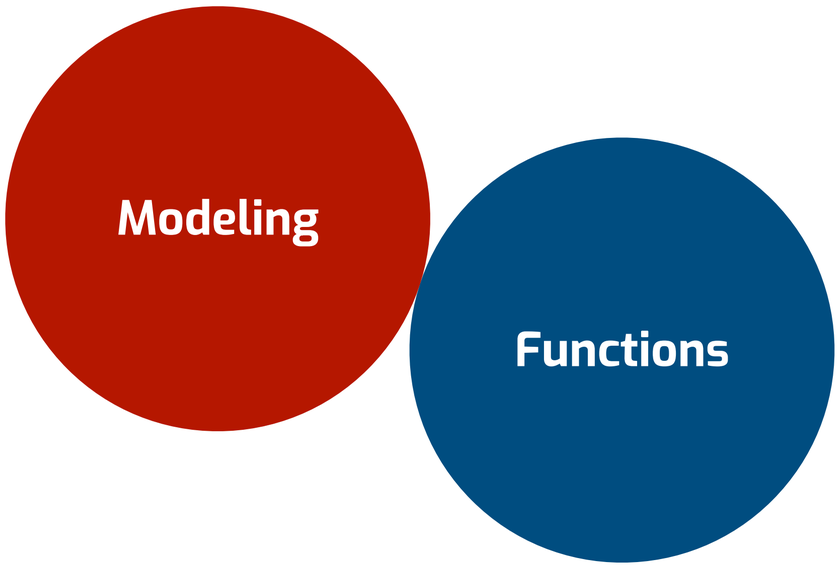
*“The **equation** is the best. It tells me the rate of change without me needing to calculate it. I can quickly solve it to figure out the number of pebbles that I’ll need.”*

*“The **graph** is the best. It shows the relationship between the variables right away.”*

*“You need to fill in a lot of rows in the **table** before you get to 100 mL.”*

*“The **equation** is unnecessary. I can use arithmetic, not algebra, to figure out how many pebbles it will take.”*

*“It’s difficult to sketch the **graph** accurately and read when y hits 100.”*


Modeling
Functions

How can I make predictions about real-world phenomena?

Act 1


TapintoTeenMinds.com

Act 2


TapintoTeenMinds.com

Act 3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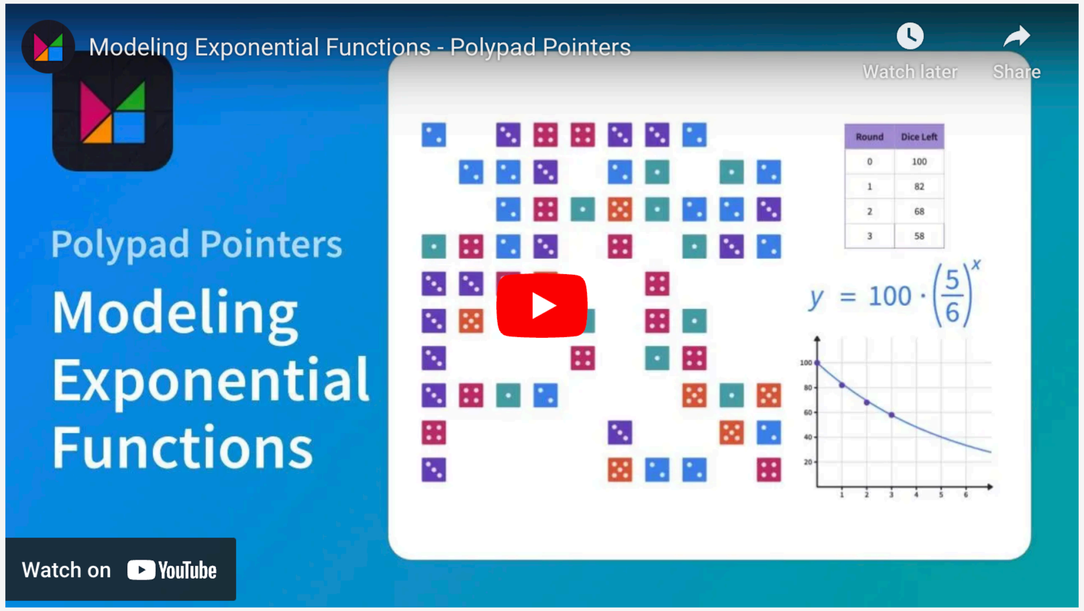
← All Lesson Plans

Exponential Decay with Dice

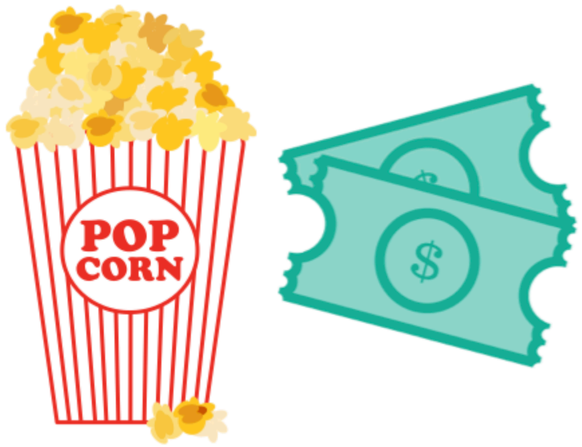
Lesson Overview

Learn how to use dice, tables, equations and graphs to explore exponential functions.



Exponential Decay – Polypad – Polypad
polypad.org/1c2lmaXaNYUFg

"When I was your age..."



Ever heard that? Me too.

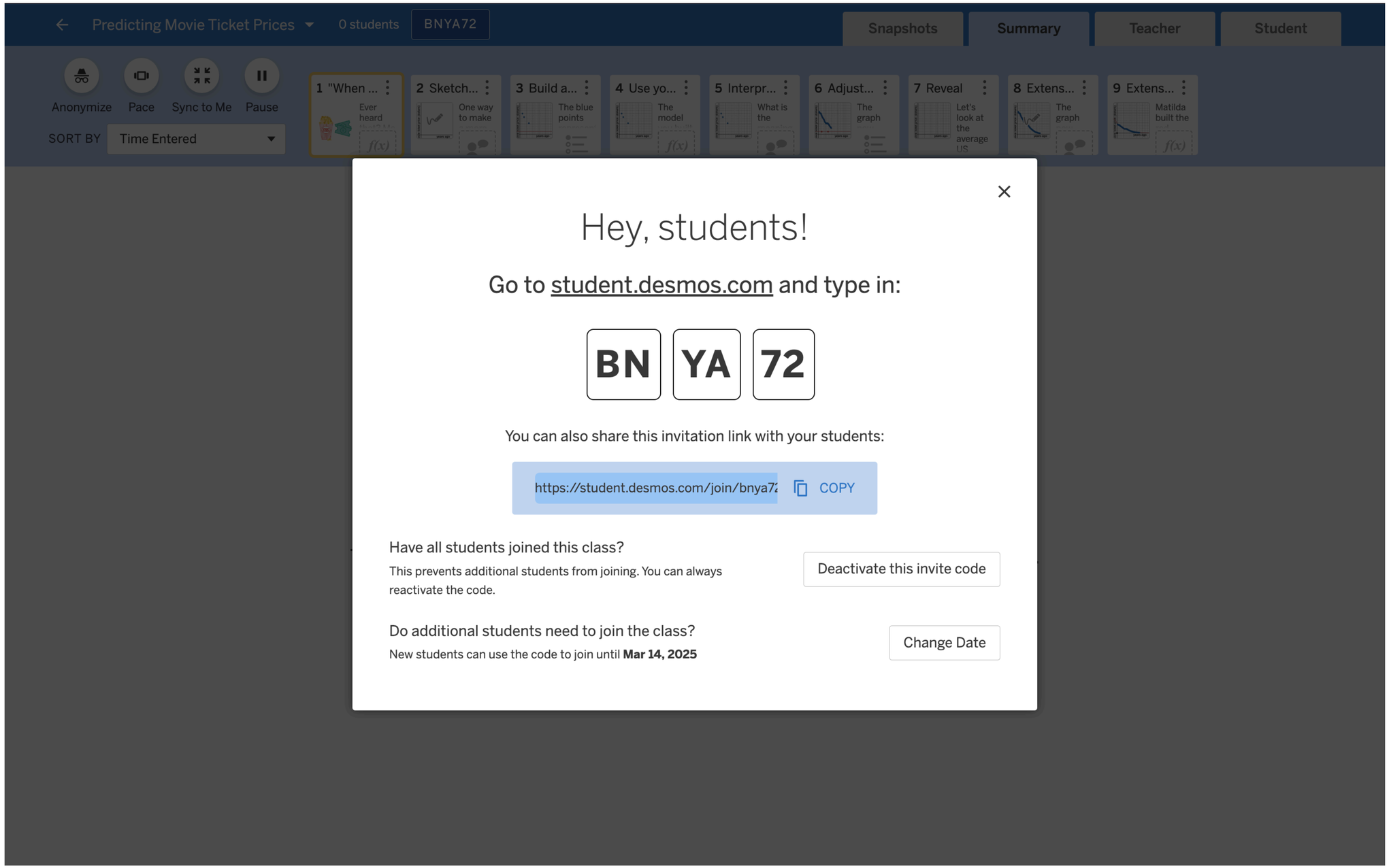
In fact, when I was YOUR age, I used to hear it all the time, including this one from my parents:

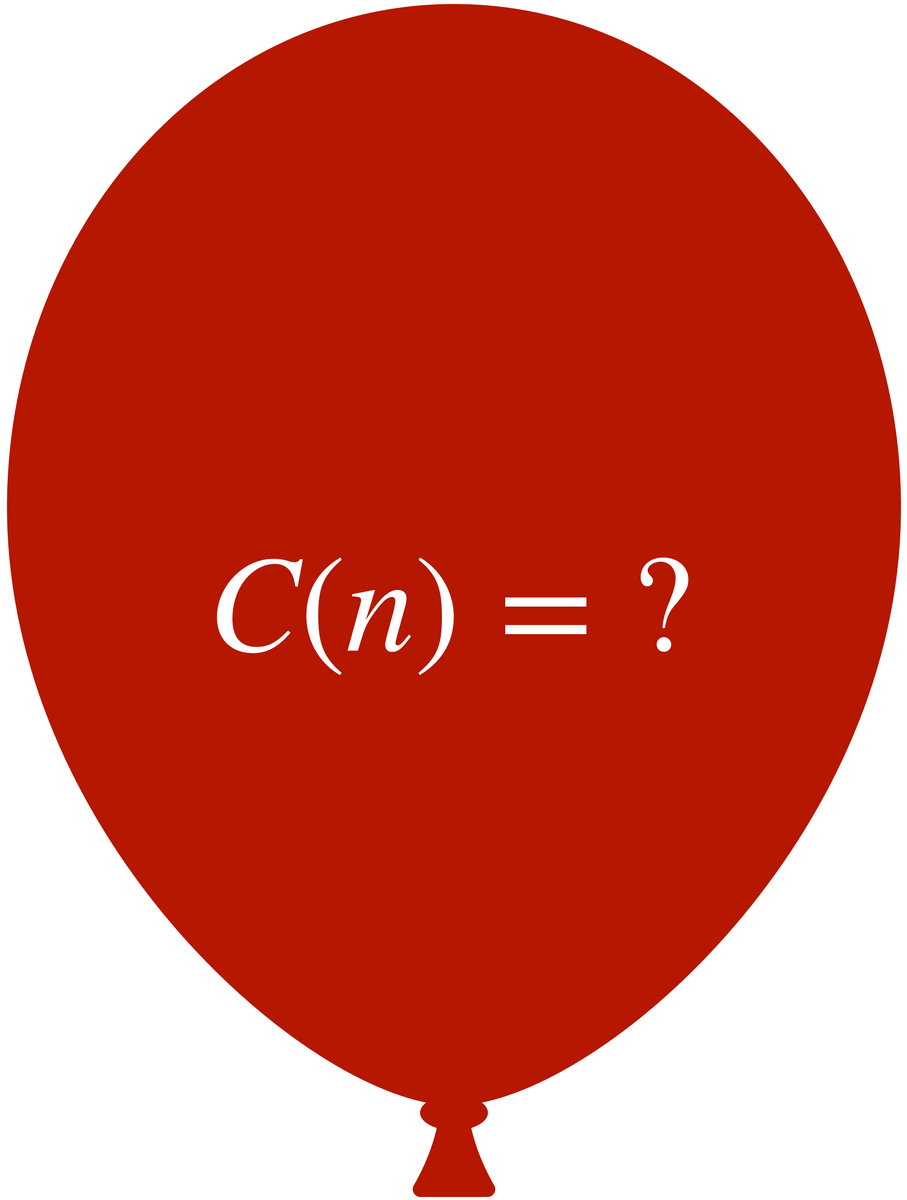
"When I was your age, everything was less expensive. In fact, movie tickets were only..."

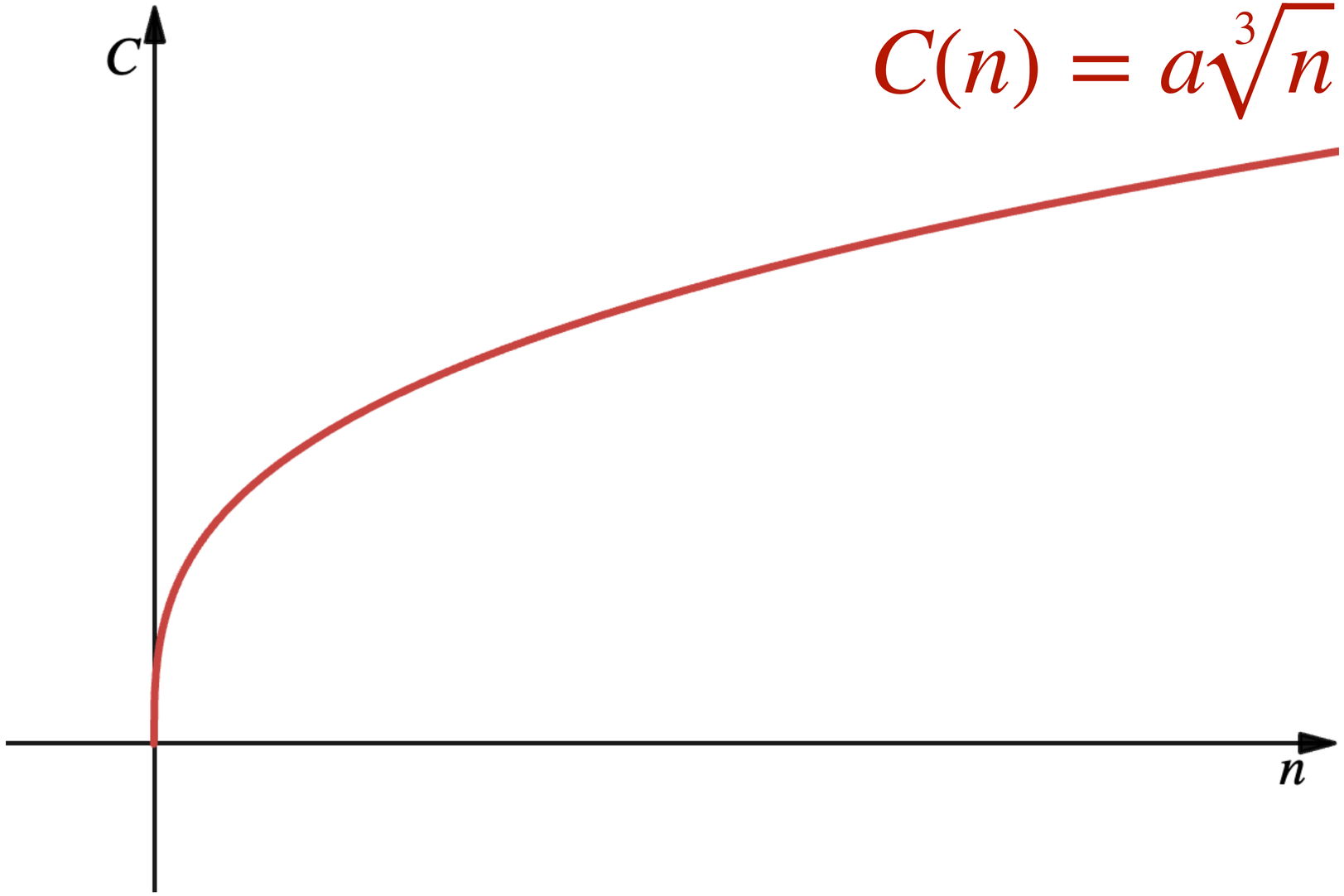
My dad was born in 1948. How much (in dollars) do you think a movie ticket cost back then?

Share With Class

Teacher Moves


Predicting Movie Ticket Prices
0 students
BNYA72
Snapshots
Summary
Teacher
Student
Anonymize
Pace
Sync to Me
Pause
SORT BY
Time Entered
1 "When ...
2 Sketch...
3 Build a...
4 Use yo...
5 Interpr...
6 Adjust...
7 Reveal
8 Extens...
9 Extens...
Hey, students!
Go to student.desmos.com and type in:
BN YA 72
You can also share this invitation link with your students:
https://student.desmos.com/join/bnya72
COPY
Have all students joined this class?
This prevents additional students from joining. You can always reactivate the code.
Deactivate this invite code
Do additional students need to join the class?
New students can use the code to join until Mar 14, 2025
Change Date


$C(n) = ?$


C
n
$C(n) = a\sqrt[3]{n}$

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Home

Collections

Pre-calculus 12

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What's My Transformation?

Function Transformations: Practice With Symbols

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Polygraph: Exponentials

Avi and Benita's Repair Shop

What Comes Next?

Marbleslides: Exponentials

Card Sort:

Pre-calculus 12

Created by You | 27 activities

Desmos activities aligned with British Columbia's Pre-calculus 12 learning standards

Transformations

Card Sort: Transformations

By Desmos Classroom | 15-30 minutes | Practice

This activity asks students to match transformations of graphs to expressions using function notation that generates these transformations.

What's My Transformation?

By Desmos Classroom | 45-60 minutes | Practice

In this activity, students explore the idea that all lines are related to each other, as are all parabolas. They extend this idea to a new function type, and they manipulate it to gain skill with symbolic representations of function transformations.

Function Transformations: Practice With Symbols

By Desmos Classroom | 45-60 minutes | Practice

Students will practice describing function transformations using words as well as algebraic notation.

Blue Point Rule

By Desmos Classroom | 45-60 minutes | Practice

Students will observe a red point transform into a blue point by way of a mystery transformation. Students will first write about that transformation verbally, developing their intuition about the transformation before writing it algebraically.