A picture is worth 1000 words… What is Geogebra worth?

Scott Farrar, OUSD
CMC North Asilomar 2013

Perimeter and Area
Malcolm Swan,
University of Nottingham

- Draw a shape on grid paper. Find its perimeter and area.
- Plot a Cartesian point to represent your shape: (perimeter, area)

Introductory "Pen and Paper" Problem

Perimeter and Area
Malcolm Swan,
University of Nottingham

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- Plot a Cartesian point to represent your shape: (perimeter, area)
- Which points represent squares? rectangles? equilateral triangles? etc.
- Draw a shape that may be represented by (12,4).
- Draw a shape that may be represented by (4,12).
- Find all of the "impossible" points.

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GeoGebra

Geogebra can change how students see a concept.

Geogebra can change how students interact with a concept.

How many words is Geogebra worth?

- Teacher can save words when "showing, not telling"
- Students can describe in their own words when interacting with an applet
- i.e. more student talk, less teacher talk

Working this problem in Geogebra:

Perimeter and Area
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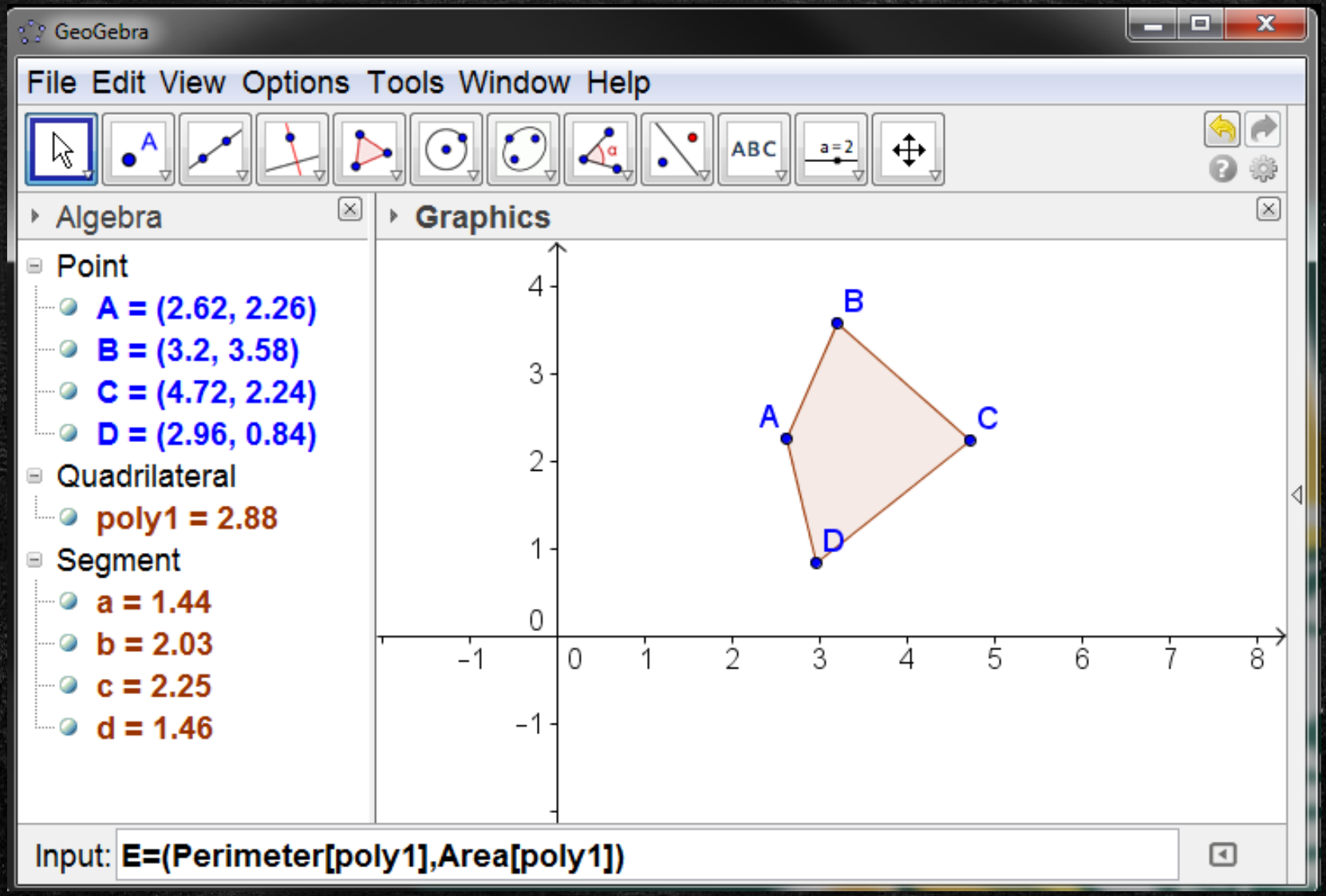
- Draw a shape on grid paper. Find its perimeter and area.
- Plot a Cartesian point to represent your shape: (perimeter, area)

1. Construct the shape

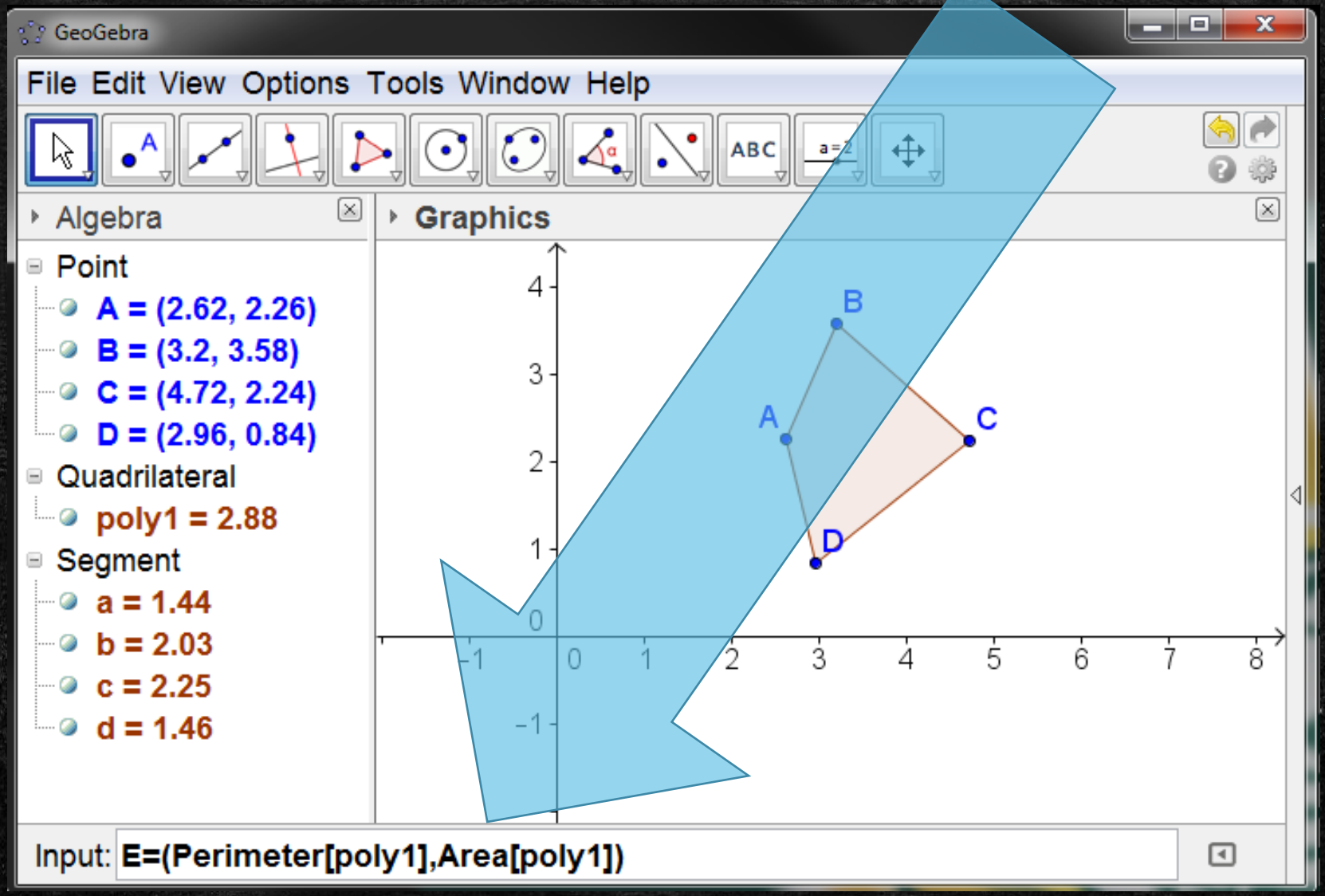
2. Calculate perimeter and area

3. Use those values to move other objects, such as a dependent coordinate point.

1. Construct the shape.

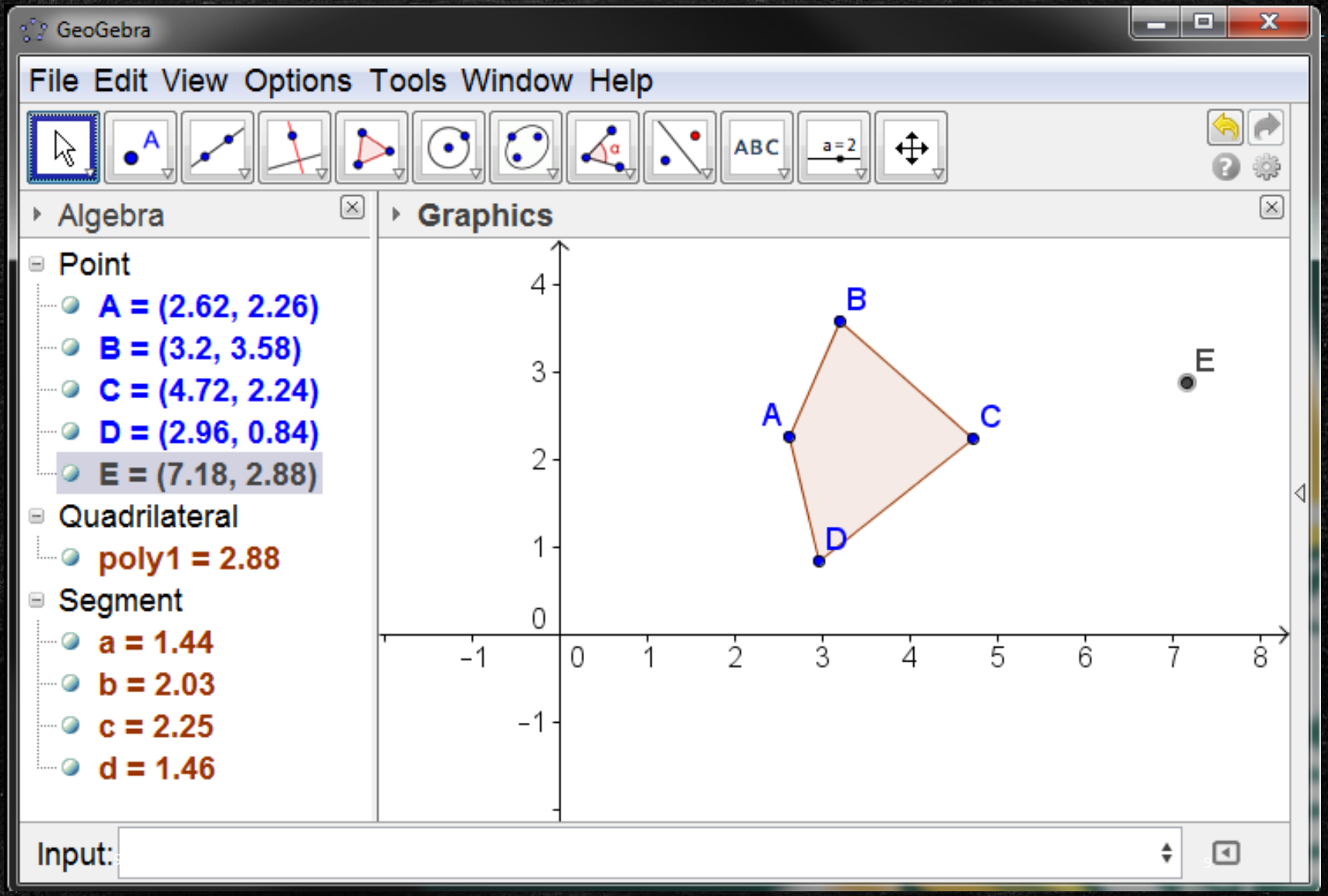


2. Calculate Perimeter and Area using the input bar.



3. Use those functions to move another object: point E

Input: E=(Perimeter[poly1],Area[poly1])



(Live Construction
for Perim v. Area)

highlights:
input bar,
defining objects from other objects.

(Polished Perim v. Area applet)

Scott Farrar, Geogebraer

- Teacher at Oakland High School and Skyline High School for a combined seven years.
- I have used Geogebra throughout those seven years in Algebra 1, Geometry, Algebra 2, Trigonometry, and Pre-Calculus.
- I think of using Geogebra in three modes:

Construction, Demonstration, Manipulative

Mode 1: Construction

- My best advice on how to learn Geogebra: pick a concept from one of your courses try to construct it.

- Lets try an Algebra 1 concept:

$$y = mx + b$$

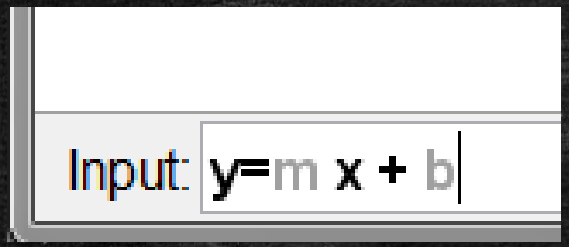
Live Construct #1

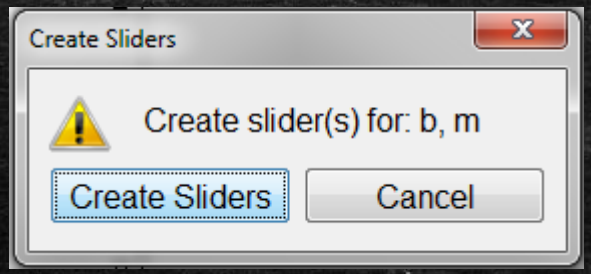
$$y = mx + b$$

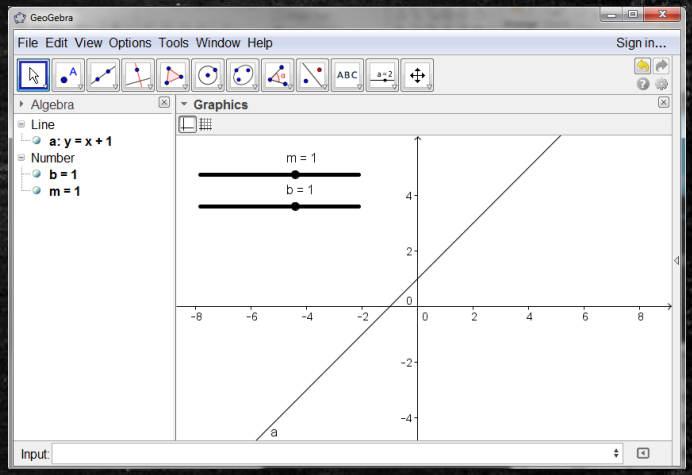
FractionText[ ]
perpendicular lines

Geogebra 4.4 was released December 1st

- Sliders can be created on the fly. (Desmos Style)







Mode 1: Construction

- Everything in Geogebra is constructed.

Con: you can't just pull a right triangle out of thin air

Pro: you can't just pull a right triangle out of thin air

The power is in the dependencies.

Creating a right triangle from scratch, and where that leads us.

(live construct)

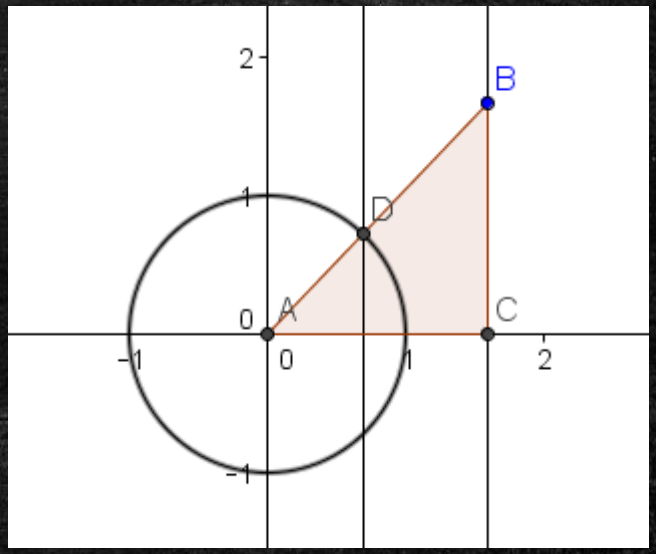
Highlights:

Dependent objects,

Object Properties

Show Trace

Construction Protocol



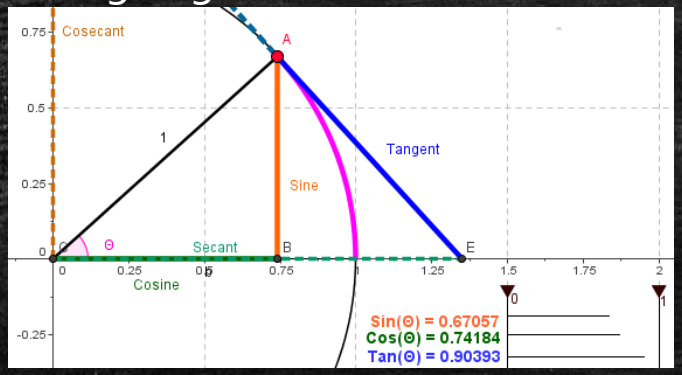
Three Modes of Geogebra

	Construction	Demonstration	Manipulative
User	Teacher or advanced Student		
Setting	Prep or play		
Who is learning?	The User*		
Good for	Learning Geogebra. Building demonstrations or manipulatives.		

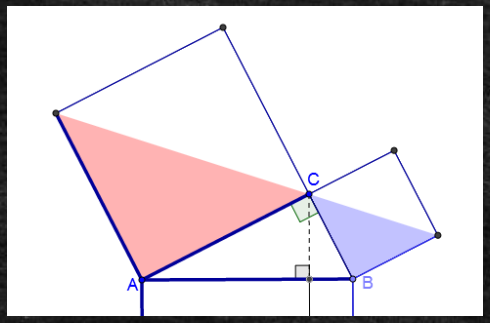
Some Pre-Built Demonstrations

Demonstrations

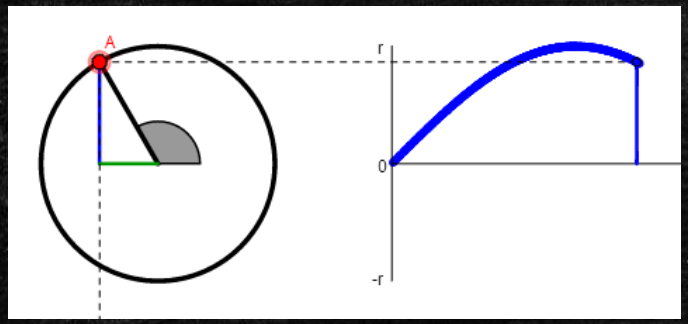
- Trig Segments



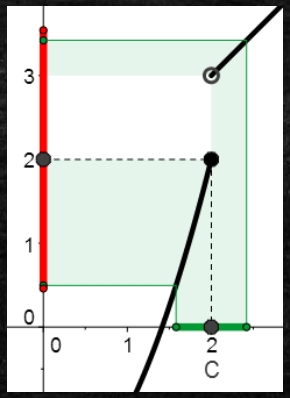
- Euclid's Pythag Proof



- Sine Wave



- Epsilon Delta Limits



What I have noticed when I use Geogebra in the classroom:

- I can introduce an idea by creating a Geogebra demonstration, saving a wordy exposition **after** intuition is built.
- Better yet: I can create a customized demonstration that allows students generate the wordy exposition. (special shout out to Michael Serra and his Discovering Geometry)
- I can create visualizations that solidify conceptual connection.

Three Modes of Geogebra

	Construction	Demonstration	Manipulative
User	Teacher or advanced Student	Teacher, or a reader	
Setting	Prep or play	Whole class, or digital "reading"	
Who is learning?	The User	The Class, or the reader.	
Good for	Learning Geogebra. Building demonstrations or manipulatives.	Illustrating / Animating a key idea.	

What I have noticed when students use Geogebra in the classroom:

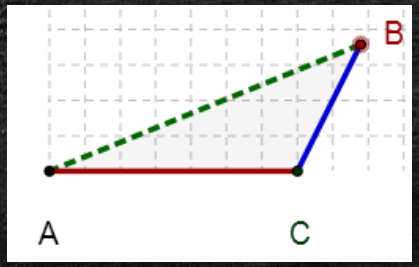
- The student can immediately see the effects of changing a variable, parameter, shape, etc.
- The student can satisfy the hundreds of unvoiced questions by simply "seeing what happens"
- Students have more content-based conversations with each other

Three Modes of Geogebra

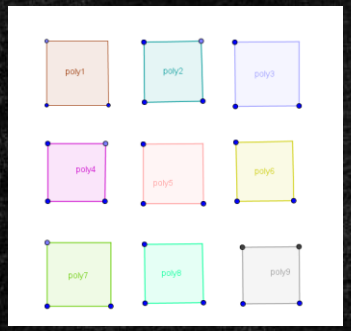
	Construction	Demonstration	Manipulative
User	Teacher or advanced Student	Teacher, or a reader	Individuals or Pairs of students
Setting	Prep or play	Whole class, or digital "reading"	Computer Lab
Who is learning?	The User	The Class, or the reader.	The User(s)
Good for	Learning Geogebra. Building demonstrations or manipulatives.	Illustrating / Animating a key idea.	Open Ended investigations. Prompting student conjectures.

Manipulatives

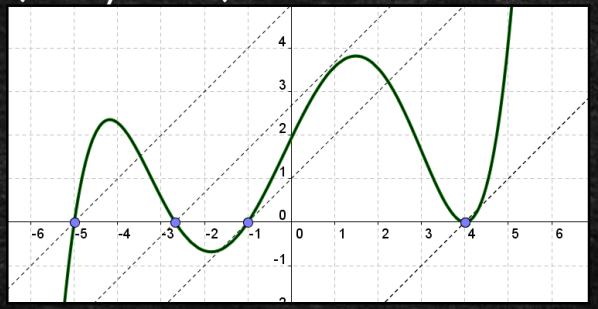
- Triangle Inequality



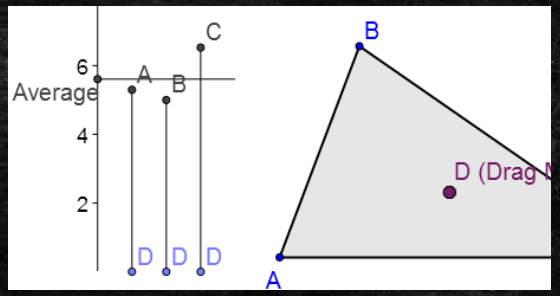
- Square Not Square (John Golden)



- Painting with Linear Factors (Riley Lark)



- Distances to Vertices



The power of dynamic Geometry software:

- It unlinks conceptual intuition from computational or linguistic skill.

Thank you to Markus Hohenwarter and the Geogebra developers,
along with
John Golden, Phil Grebe, Riley Lark, Dan Meyer, Tom Rike, Michael Serra, Malcolm Swan, the staff at Oakland High and Skyline High and my students!

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