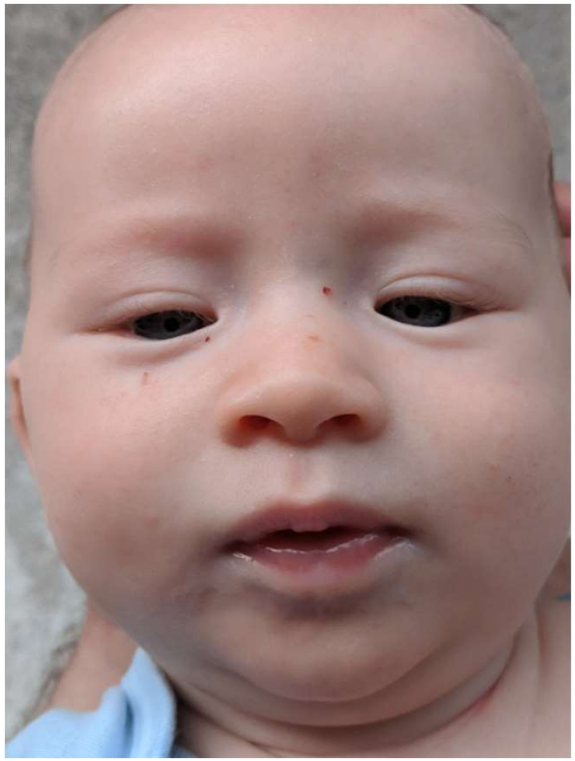
Calculus: The Next Step in Your Math Journey

Day 1: Intro

Wait, my schedule says Mr. Fassino



Mr. Fassino had a baby, Oscar

Mr. Briggs, used to teach math

Let's hear about you!

- Name, Grade
- Anything you'd like to share about your relationship with math

This course: Structure, Content, Expectations

Resources: Canvas, Teams F Periods, OneNote [Calculus (Web view)]

- Note, to get oneNote access, you have to click on the class notebook link in canvas.

Books: Paul's online notes [Primary], OpenStax Calculus [Additional Reference]

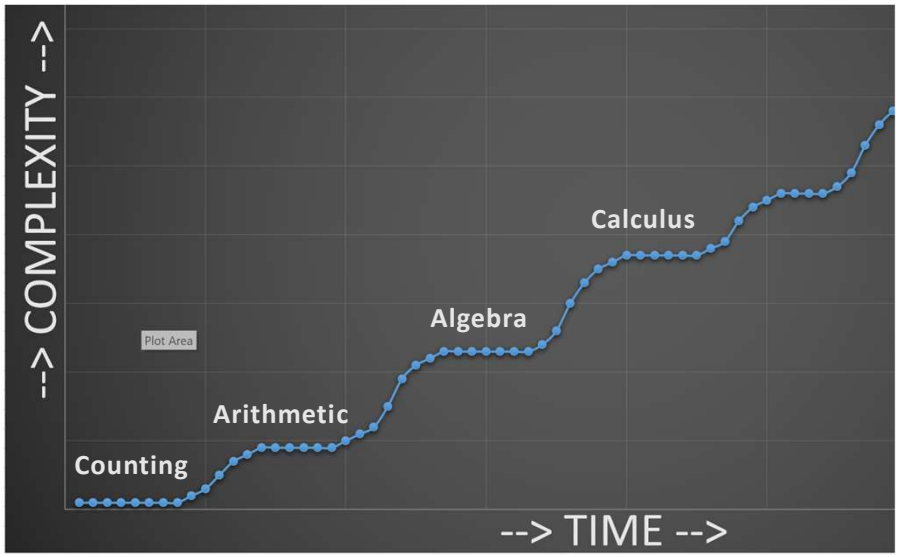
Plan of attack for the year:

- Warm up our math brains
- Think through how equations behave as variables approach values
- Apply that to graphs and the ways that they change
- Reverse that thinking to apply that to the area under graphs
- Start thinking about these concepts in 3D
- Look at equations that relate to the change in other variables rather than the variables themselves

Many more details and policies in the syllabus in canvas

Calculus is an abstraction beyond algebra

- This course will feel like it levels up, like algebra felt.
- Algebra, Geometry, Algebra 2, Precalc set the foundation for being able to think “calculus”



Calculus primarily follows this pattern

- Slice something up into enough parts that they are easy to reason about.
  - Think about how those parts combine
    - Arrive at a truth about the complex part being nothing more than a very large collection of simple parts.

Zooming in far enough will almost always get you to straight lines. Therefore most curves can be thought of as a series of infinitely small linear equations (y = mx + b)

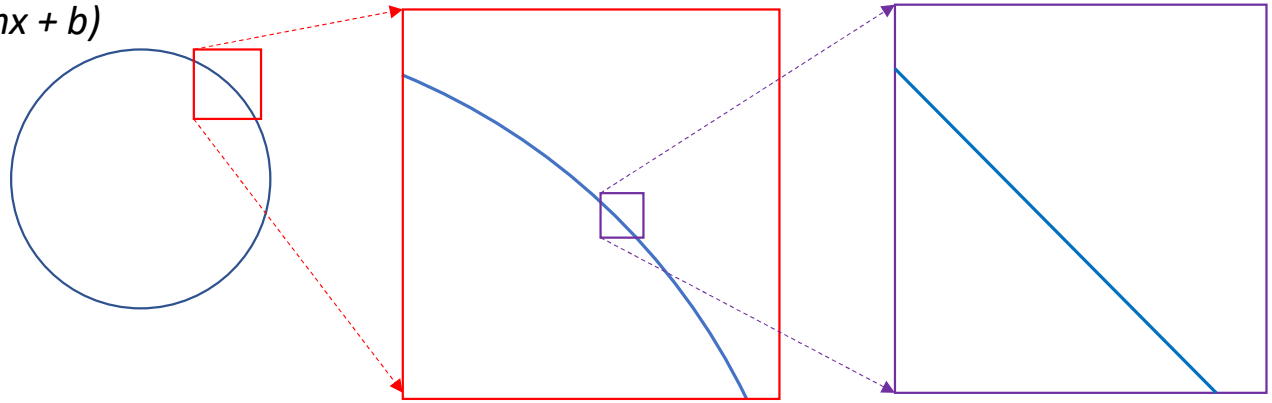


Table Groups: Calculus thinking example

Go to your table group channel

Start a meet-now meeting (or join the one in progress).

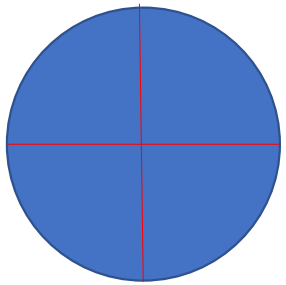
Consider the slides that will appear in the channel.

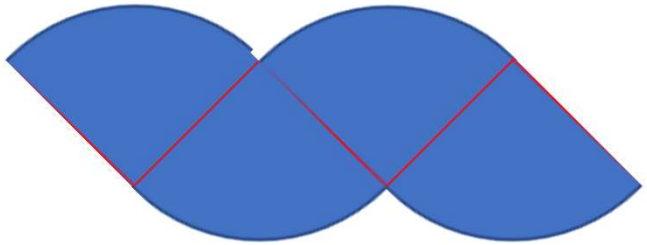
Return at 10:30

1.Table	2.Table	3.Table	4.Table	5.Table	6.Table
Alex Burris	Emme Laundry	Julian Crosetto	Max Lee	Vivi Rutherford	Eric Zhou
David Dong	Fino Li	Arya Sanjay	Max Goertzmann	Siddarth Ghali	Hazel Goetch
Meagan Dunnigan	Jack Little	Keyan Premji	Trishna Krishnan	Toby Mariuz	Piper Hawley

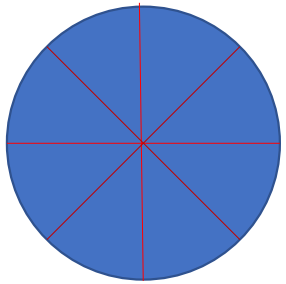
Example: Calculus concepts [3min]

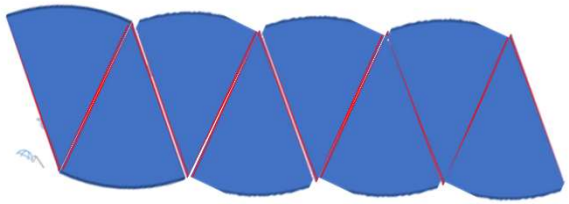
- π = circumference / diameter [by definition] = C / (2r) [because radius is easier to deal with]
- Use calculus reasoning to find the area of a circle…
  - We can rearrange the circle like so, not very helpful. All the curved edges are ¼ the circumference, each of the red lines is the radius. How can this help you determine the area of a circle?



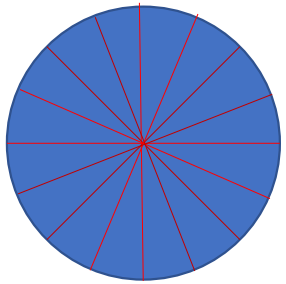


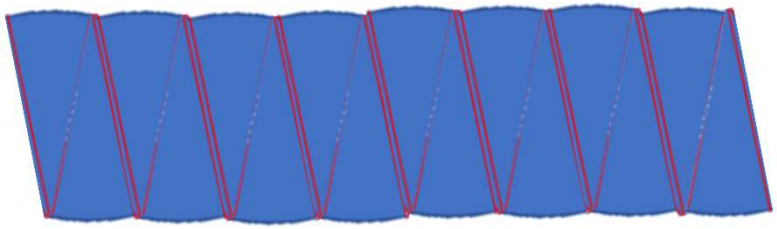
- We can continue to segment the circle. All the curved edges are $1/8^{th}$ the circumference, each of the red lines is the radius.
  - How long are the top curved lines? How long are the bottom curved lines?
  - What does the resulting shape start to look like?



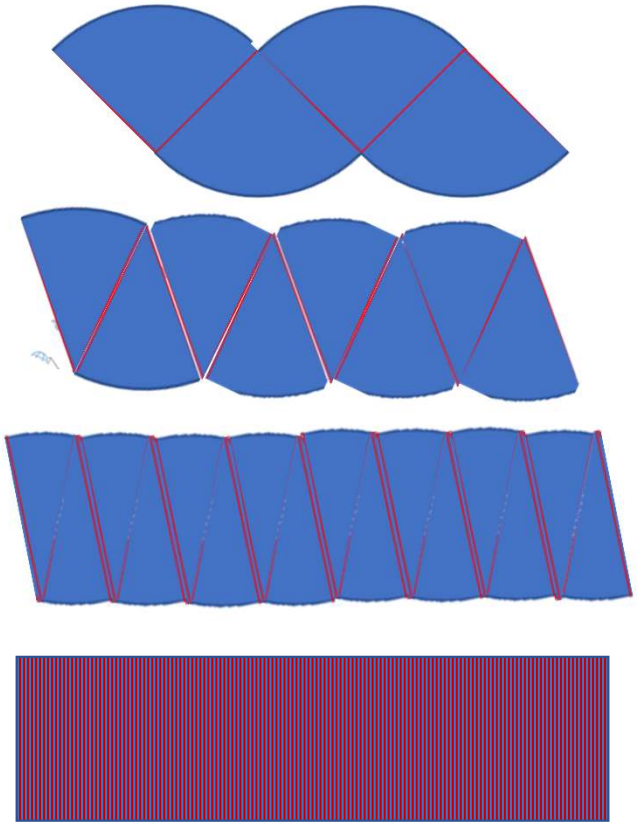


- We can continue to segment the circle. All the curved edges are $1/16^{th}$ the circumference, each of the red lines is the radius.
  - What is the length of all the curved lines at the top? Has this changed?
  - The shape looks like a parallelogram, will is start to look like a rectangle as we continue?
  - Does this lead you to a solution?





Calculus asks, what if we make infinite wedges



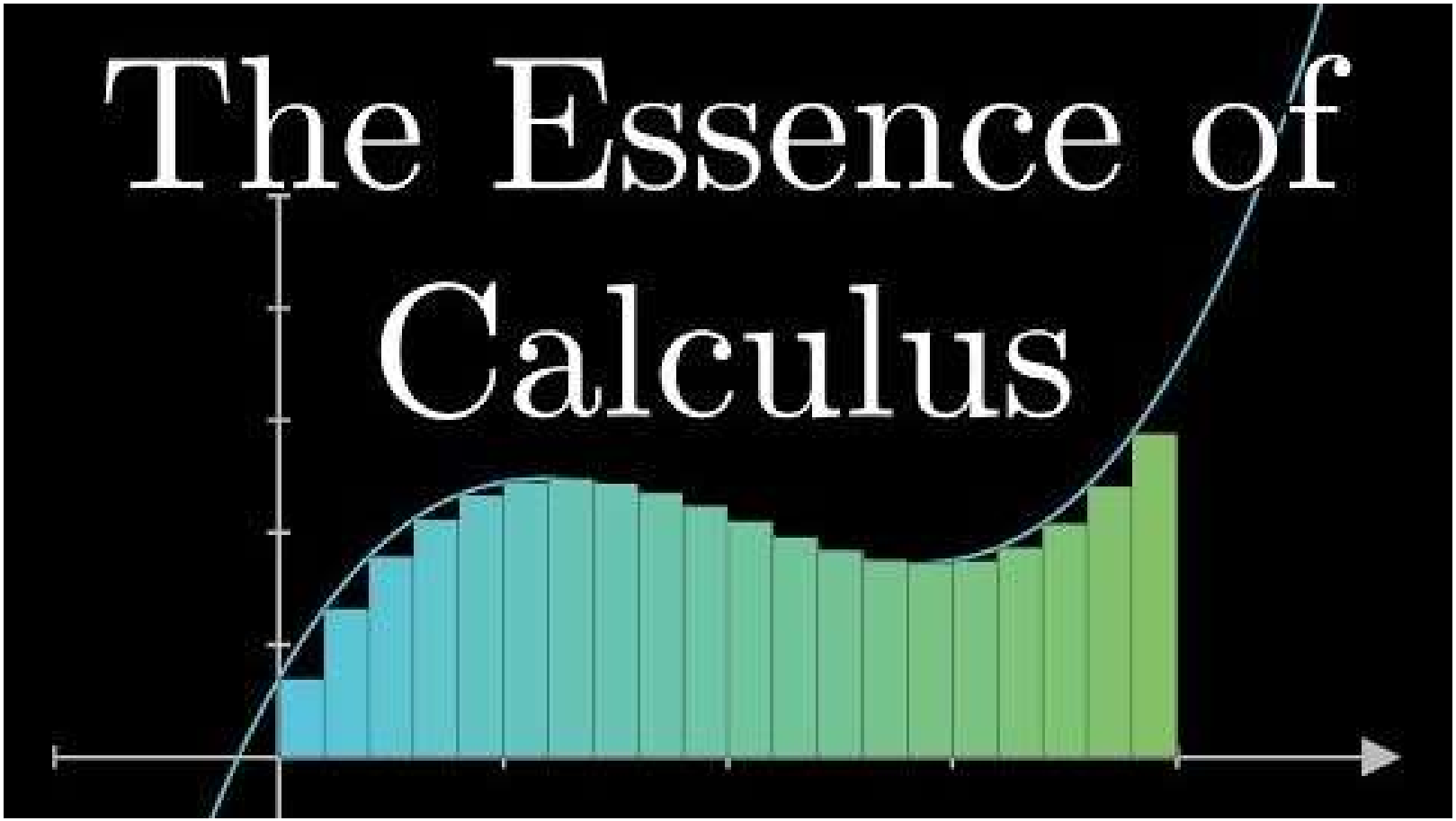
- The radius edges approach vertical
- The width remains ½ Circumference
- Area of this rectangle is H * W
- H = r
- W = C / 2 = π * r
- Area = r * π * r = πr^2

Note: That's the idea of calculus

- You actually have to mathematically show that the radius approaches vertical and that the width approaches circumference / 2. That's where we start our journey with limits.

- You will also hear that calculus is the study of:
  - Rates of change
  - How much we stretch or squish the number line when applying a function
  - Finding optimal solutions to equations
  - Finding maxima and minima
- All of that is also true and related to the concept of slicing things into smaller and smaller parts.

Another Calculus Overview Using the Circle



Aside: How to win at math!

Let no question go unanswered.

Math is a self consistent world. If anything doesn't make sense now, address it until it does. It will come back to haunt you.

Figure out why you got a question wrong.

Was it typo style error – you wrote 38 instead of 83 somewhere

Was it a calculator error – the instructions you gave your TI weren't what you meant

Was it a conceptual error – you misunderstood a concept

- Which concept was the issue?

Was it a process error – you knew what to do but forgot some of the strategies to move forward.

- Which strategy was problematic

A word about remote

Excitement

Experiments

Feedback welcome