MATH 127 - Lecture 1.

Today's topics: - Course overview
- Intro to calculus - what and why?

Instructor

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↖ use "MATH 127" in subject.

Polls.

- Any international students?
- Major - biochem? biology? biomed? psychology?
- math hardest subject?
- who enjoys math?

General points on course:

- Calc I for sciences → life ↗ SEC 003. - life examples.
  ⇢ physical
- understanding, application, NOT memorization
- ask questions!

Grade breakdown

- End of lesson (EoL) assessment (5%) } online
- Bi-weekly assignment (10%) } ∞ attempts
- Projects (10%)
- Midterm (25%) ← Oct 15, 5.30-6.50
- Final (50%)

Resources - details on "Waterloo Learn" *

- TA - email, office hrs
- Tutorials - review material, ask qs.
- Piazza - discussion forum
- Tutorial centre - MC4066
- Textbook - Guichard 2017 - supplementary
  - dense, good practise problems.
- Mobius content - core material, digital lectures
- Wolfram alpha.
- Worked examples : www.math.uwaterloo.ca/~tbury/teaching

To do before next class

First Assignment (optional)

- previous math experience
- ~~math history~~
- expectations / apprehensions

- short biography - help us get to know you!
- practise using crowdmark

First EoL

- tips and tricks for using Mobius platform.

Introduction to Calculus

Two branches.

Integral calculus

$\int dx$

Differential calculus.

$\frac{d}{dx}$

Involves summation ~~computing areas~~ - compute areas.

e.g. total dist. travelled given speed.

total population size given population density.

Involves rates of change - compute gradients

e.g. how fast does epidemic spread given # infected.

how fast does population grow given population size.

Integral calculus in context

- Object moving in straight line at 6 km/h.
  How far does it travel in 2 hours?

$v = 6.$

$v = \frac{\lambda}{t} = \frac{\text{"dist"}}{\text{"time"}}$

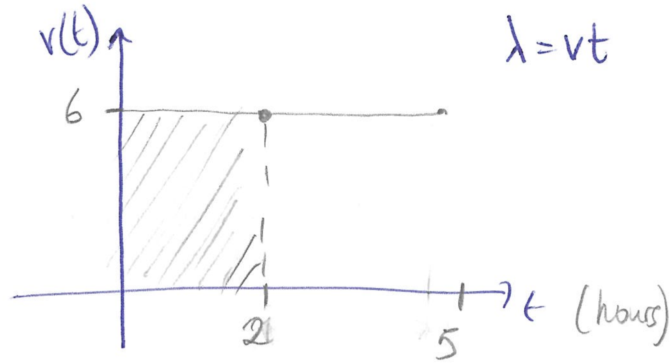
$\lambda = vt$

$\lambda = 6\,km/h \times 2h = 6\,km$

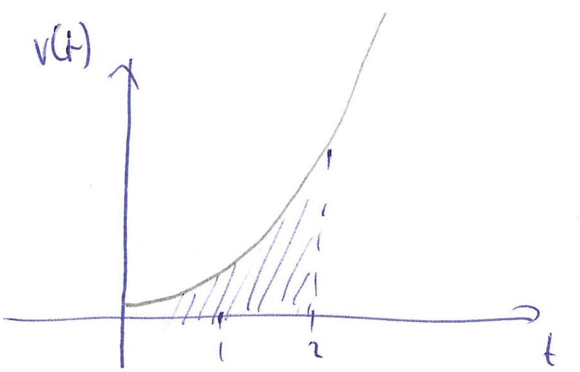
don't use d - confuse with deriv.

In 5 hours?

$\lambda = 6\,km/h \times 5h = 30\,km.$



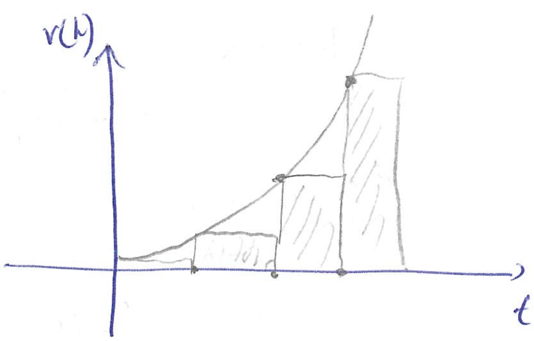
What if velocity not constant?

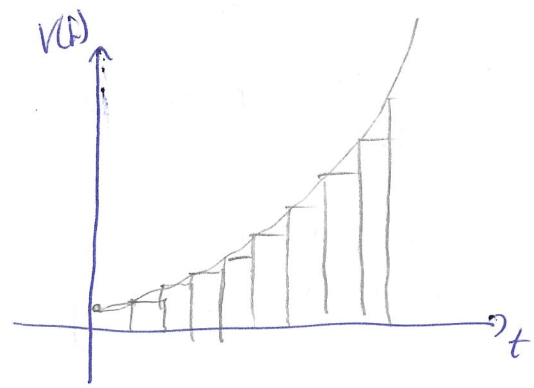


Now dist. hard to compute.
Calc. allows us to compute this area.

How?

Rectangles and Limits





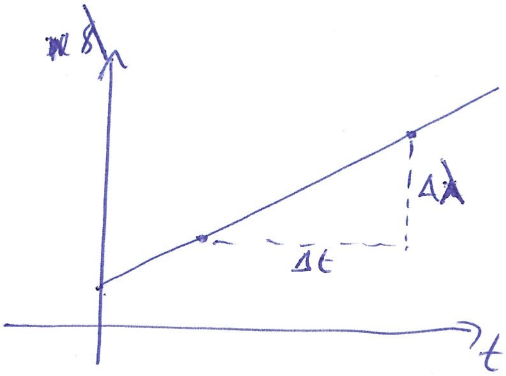
Lots of rectangles can approximate area. → more rectangles, more accurate!

Calculus takes limit as # rectangles goes to infinity to give exact ans!

Differential Calculus in context

- Revisit object moving in straight line.

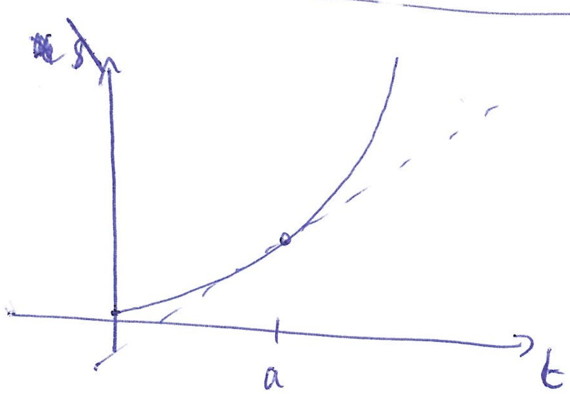
Examine ~~Plot~~ distance over time and inquire about velocity.



If ~~velocity is constant~~, change in position is steady, then velocity,

$$v = \frac{\Delta s}{\Delta t}.$$

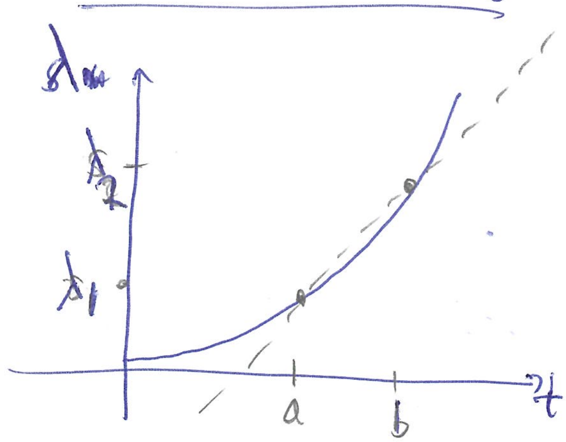
What if motion is not steady?



how can we find velocity at $t = a$?

slope of line is what we want.

Lines and Limits.



construct 'approximate' tangent lines. - pick b close to a.

Approx. gradient

$$m = \frac{s_2 - s_1}{b - a} = \frac{\Delta s}{\Delta t}$$

Calculus takes limit as b approaches a to get <u>exact</u> gradient.

Take-home points

- Calculus is an essential framework for modelling phenomena that change over time
- Integral calculus - summation / area under curve
- Differential calculus - rates of change
- EoL mini-assignment
  Intro assignment.