Welcome to MAT135 LEC0501 (Assaf)

Last week, $u = \tan(x)$, then $s = \sqrt{u}$ gave us:

$$\int \sqrt{\tan(x)}dx = 2\int \frac{s^2}{s^4+1}ds$$

Here's the trick:

$$2\int \frac{s^2}{s^4+1}ds = \int \frac{1}{\sqrt{2}}\left(\frac{s}{s^2-\sqrt{2}s+1} - \frac{s}{s^2+\sqrt{2}s+1}\right)ds$$

Next week: we'll compute one of these terms.

S11.3 – Euler's Method – Stop, Point, Shoot, Repeat

Assaf Bar-Natan

" Eat, sleep, rave, repeat
Eat, sleep, rave, repeat
Eat, sleep, rave, repeat
Eat, sleep, rave, repeat"

–"Eat, Sleep, Rave, Repeat", Fatboy Slim

Feb. 12, 2020

What Is Euler's Method?

Euler's method is a bit like a biathelon.

Myriam Bédard, Canadian gold medalist in Biathelon, 1994 Winter Olympics

In a nutshell:

- Pick a starting point
- Use derivative to estimate change
- Move to next point
- Repeat

Example: What is Euler's Method?

What does this mean? Let's assume that:

$$y'(t) = f(y, t)$$

This differential equation has a family of solutions. If we specify that our solution passes through $(0, 0)$, then we know:

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This lets us estimate $y(0.01) \approx 0.01y'(0)$, giving us a new point to start with.

Takeaway

To estimate the solution of a differential equation at a point, we can apply Euler's method

Round Robin: WeBWork

In your groups, share a question in the WeBWork that you either found challenging or a question that you found interesting.

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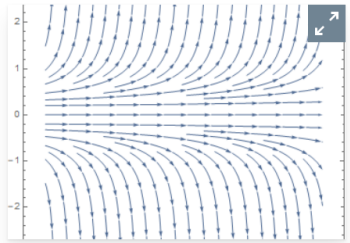
Why did we include this question in the WeBWork? What key point from the chapter does it relate to?

Submissions Closed

Below is pictured the slope field for some differential equation. For the initial condition $y(1) = c$, will Euler's method give an over- or an under-estimate when trying to estimate $y(2)$?



✓ **27%** Answered Correctly

Correct Order

1	$c = 0$	→	A The estimate matches the solution	66
2	$c = 1$	→	B Underestimate	58
3	$c = -1$	→	E Overestimate	47

February 11 at 11:59 PM results — Condense Text

118/118 answered — Ask Again

Open | Closed | Responses | ✓ Correct — 100%

Writing Exercise

Write a short paragraph explaining to the students who aren't here why Euler's method works, and how we can make it more precise.

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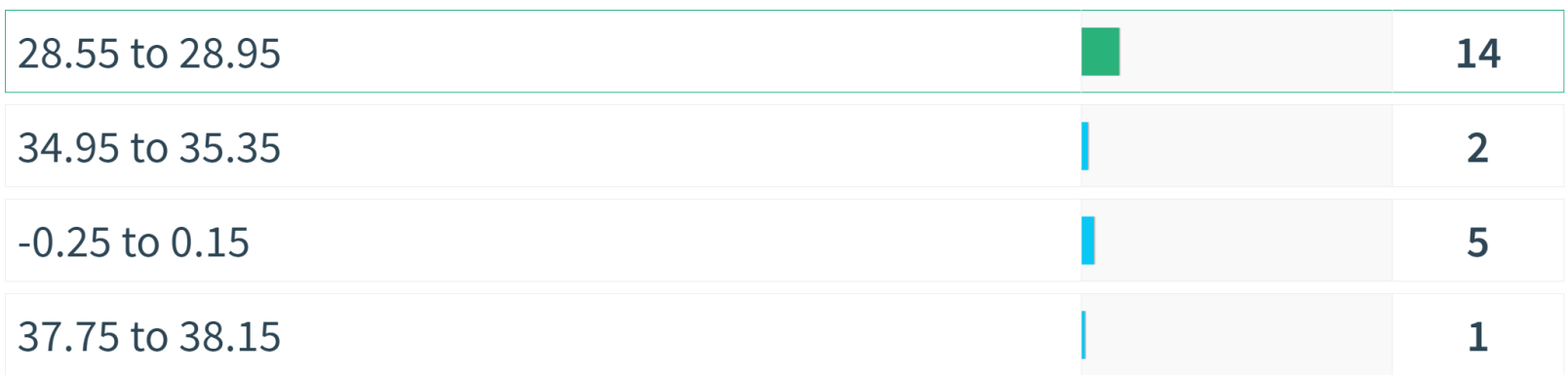
We can make Euler's method more precise by making the jumps smaller. That way, the estimate of the derivative is better.

Submissions Closed

The cats are reproducing! Their numbers are increasing! It's a happy time to be a cat. Let $y(t)$ denote the number of cats t months after the start of the year, and assume that $y'(t) = y(t)(1 - y(t)/30)($. Assume that $y(0) = 20$ Use Euler's method to estimate the number of cats after two months. Use 4 steps. (Hint: use a table)

✓ **12%** Answered Correctly



February 12 at 12:14 AM results

Show percentages Hide Graph Condense Text

116/117 answered

Ask Again

Open Closed Responses Correct

100%

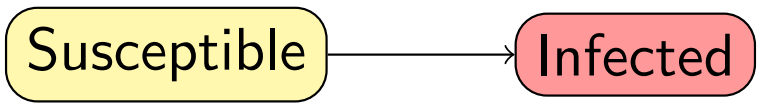
Bonus: Chaos, Fractals, Dynamics

An interesting video related to this:

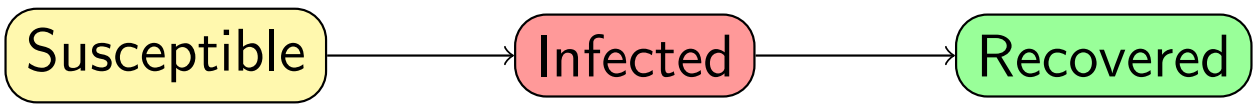
`https://www.youtube.com/watch?v=ovJcsL7vyrk`

SIS? SI? SIR?

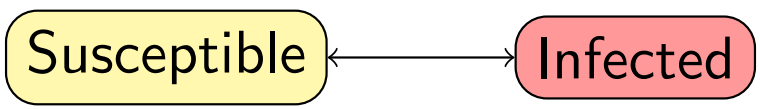
The SI model:



The SIR model:



The SIS model:



Coronavirus – SIS? SI? SIR?

Go online, and search for information about the current Coronavirus outbreak. Which model is best? What searches did you make?

Coronavirus – SIS? SI? SIR?

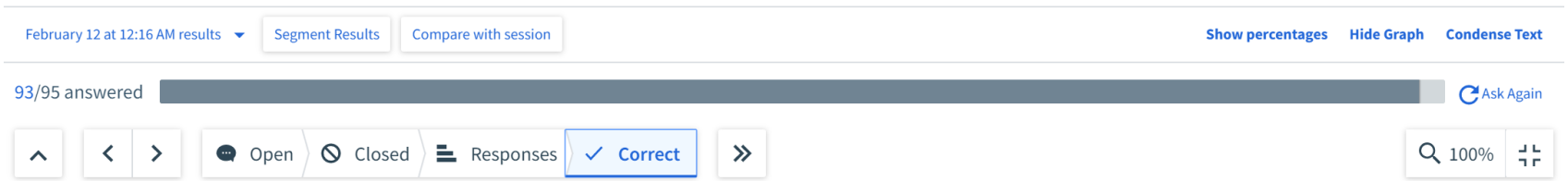
Go online, and search for information about the current Coronavirus outbreak. Which model is best? What searches did you make? After infection, what happens to surviving patients?

Submissions Closed

When modeling the Coronavirus, what model is best, considering what we know about it?

✓ **33%** Answered Correctly

A	SIS model	31
B	SIR model	53
C	SI model	9



Plans for the Future

For next time:

WeBWork 11.4 and actively read section 11.4