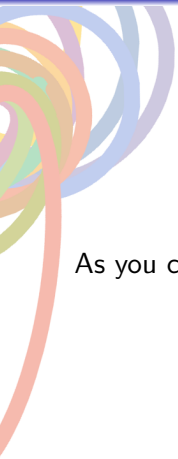


# Welcome to MAT135 LEC0501 (Assaf)



As you come in, ask your neighbours how their break was.



## S10.1 – Using Polynomials in Clever Ways

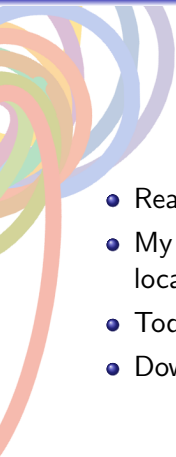
Assaf Bar-Natan

“ So this is me swallowing my pride  
Standing in front of you saying I'm sorry for that night  
And I go back to December all the time”

–“Back to December”, Taylor Swift

Jan. 6, 2020

# Announcements



- Read the syllabus (it's on Quercus).
- My office hours: Mondays at 13:00, Wednesdays at 15:00, location: probably PG104
- Today: extra office hour after this class in PG104
- Download TopHat and purchase a subscription to it.



Submissions Closed

PROF. LOUISE RITSON

## How should we grade TopHat?

A	Participation only	<div style="width: 88%;"></div>	124
B	Correctness only	<div style="width: 1%;"></div>	1
C	Both correctness and participation	<div style="width: 11%;"></div>	15

January 5 at 11:37 PM results

Segment Results

Compare with session

Show percentages

Hide Graph

Condense Text

140/144 answered

Ask Again



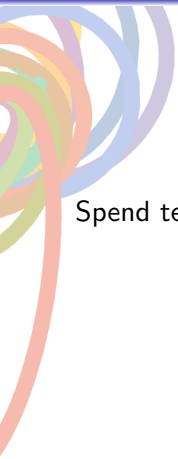
Responses



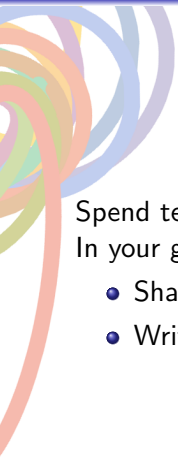
Q 100%



# Math and Active Learning



Spend ten seconds to get into groups of three.



Spend ten seconds to get into groups of three.

In your groups:

- Share names and contact information.
- Write down the main overarching **theme** of MAT135.

# The Theme of MAT135



**The main theme of MAT135 is that of the linear approximation. A “nice” looking function can be approximated by a line using the derivative**



Submissions Closed

If  $P_1(x)$  is the linear approximation of  $f(x)$  at  $a$ , then (select all that apply)

✓ 55% Answered Correctly

<b>A</b>	$P_1'(a) = f'(a)$	<input checked="" type="checkbox"/>	51
<b>B</b>	$P_1'(x) = f'(x)$ for all $x$ near $a$	<input type="checkbox"/>	32
<b>C</b>	$P_1(x) = f(x)$ for all $x$ near $a$	<input type="checkbox"/>	38
<b>D</b>	$P_1(a) = f(a)$	<input checked="" type="checkbox"/>	35

January 5 at 11:35 PM results

Segment Results

Compare with session

Show percentages

Hide Graph

Condense Text

156/160 answered

Ask Again

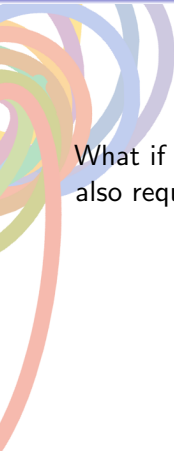


100%





# Extending the Linear Approximation



What if instead of just requiring  $f(a) = P(a)$  and  $f'(a) = P'(a)$ , we also required...

# Extending the Linear Approximation

What if instead of just requiring  $f(a) = P(a)$  and  $f'(a) = P'(a)$ , we also required...

$$f''(a) = P''(a)$$

$$f'''(a) = P'''(a)$$

⋮

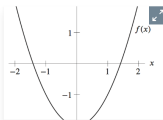
# Takeaway



**The main idea of approximating a function  $f$  around a point  $a$  using polynomials is to make the derivatives of  $f$  equal to the derivatives of the polynomial at  $a$ .**

Submissions Closed

Suppose that  $P_2(x) = a + b(x - 1) + c \frac{(x - 1)^2}{2}$  is a Taylor polynomial of degree two about  $x = 1$  for a function  $f(x)$ .  
What are the signs of  $a$ ,  $b$ ,  $c$  if the graph of  $f$  is as shown?



61% Answered Correctly

A	+, +, +	<input type="checkbox"/>	11
B	-, +, +	<input checked="" type="checkbox"/>	91
C	+, -, +	<input type="checkbox"/>	10
D	+, +, -	<input type="checkbox"/>	6
E	-, -, +	<input type="checkbox"/>	21
F	-, +, -	<input type="checkbox"/>	8

Invalid date Segment Results Compare with session

Show percentages Hide Graph Condense Text

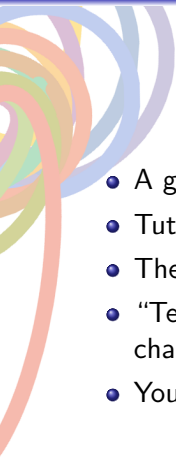
150/150 answered

Ask Again

Open Closed Responses Correct


88%

## Additional Resources for This Chapter



- A good video by 3Blue1Brown
- Tutorials!
- The Math Learning Center (PG101)
- “Test Your Understanding” questions at the end of each chapter.
- Your peers! (This one is the best one)

# Rainbow the Cat



Rainbow the kitten wants to compute the second degree polynomial approximation of  $\cos(2x)$  around  $x = 0$ . He write:

$$\cos(2x) \approx 1 + (\text{---}) \cdot x + (\text{---}) \cdot x^2$$

but is unsure how to fill in these blanks.

# Rainbow the Cat



Rainbow the kitten wants to compute the second degree polynomial approximation of  $\cos(2x)$  around  $x = 0$ . He write:

$$\cos(2x) \approx 1 + (\text{---}) \cdot x + (\text{---}) \cdot x^2$$


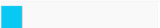


but is unsure how to fill in these blanks.

In your groups, fill in these blanks to give the second degree polynomial approximation of  $\cos(2x)$  around  $x = 0$ .

 Submissions Closed

Another cat, Blackie, says: If  $f$  and  $g$  are both different differentiable functions, then the first degree polynomial approximations of  $f$  and  $g$  will always be different.

✓ 78% Answered Correctly

A	Blackie is correct, and I am confident in my answer.		12
B	Blackie is correct, and I am not confident in my answer.		19
C	Blackie is incorrect, and I am not confident in my answer.		49
D	Blackie is incorrect, and I am confident in my answer.		63

January 5 at 11:45 PM results ▾

Segment Results

Compare with session









Show percentages

Hide Graph

Condense Text

143/148 answered

 Ask Again

    Open  Closed  Responses  Correct 

 88% 



# Plans for the Future

For next time:

**WeBWork 5.1-5.2 (worth marks!) and read sections 5.1&5.2**

Things for you to check out:

- Course website: [q.utoronto.ca](http://q.utoronto.ca)
- Guide to Technology (on main website)
- Office hours calendar!
- Get a group together, order pizza, and read the syllabus!