MATH 100:
Differential Calculus

Supplemental Learning

There will be **two SL sessions held each week**:

In-Person: Monday, 9:30 a.m. - 11 a.m., LIB 237

(Enter from the Library *West Entrance* and come up a floor to the *Student Learning Hub*)

Online: Wednesday, 12:00 p.m. - 1:00 p.m., on Zoom

Zoom Link: https://ubc.zoom.us/j/61758025867?pwd=cGV3d05HNjgweUlsNjBEZzA1d0Z6QT09

Meeting ID: 726 091 5421

Passcode: 129010

Office Hours: Monday, 11:00 a.m. - 11:30 a.m., LIB 237

You can reach out to me at any time at rajveersodhi03@gmail.com. Please note that you are free to walk in and out of my SL sessions at any time you please; you do not necessarily have to stay for the entirety of the sessions.

You can find all the slides or content I create on this website!

I look forward to meeting some of you on Monday in the Library!

Algebra Identities

- $\sin(2x) = 2\sin(x)\cos(x)$
- $\cos^2(x) = \dfrac{1 + \cos(2x)}{2}$
- $\sin^2(x) = \dfrac{1 - \cos(2x)}{2}$
- $a^{x+y} = a^x a^y$
- $a^{xy} = (a^x)^y = (a^y)^x$
- $\log_a(xy) = \log_a(x) + \log_a(y)$
- $\log_a(x/y) = \log_a(x) - \log_a(y)$
- $\log_a(x^n) = n\log_a(x)$
- $ax^2 + bx + c = 0 \implies x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Quiz 1!

Limits

Friday, September 22nd

Introduction to Limits

Graphical Limits

Vertical Asymptotes

One-sided Limits

Algebraic Techniques for Limits

Limits at Infinity

1. Calculate the following limits.

(a) $\lim_{x \to -4} \dfrac{x^2 + 4x}{x^2 + 2x - 8}$

(b) $\lim_{x \to 1} \dfrac{\frac{1}{x} - 1}{x - 1}$

(c) $\lim_{x \to 0} \dfrac{\sqrt{1-x} - (x+1)}{x^2 + x}$

(d) $\lim_{x \to 2} \dfrac{3x^2 - 2x - 8}{x^2 - 4x - 5}$

$x^2 + x - 6$

(e) $\lim_{x \to 0} (e^x - 1) \sin\left(\frac{1}{x}\right)$

2. Determine all vertical asymptotes of $f(x) = \dfrac{x-1}{x^2-5x+6}$. Then determine the infinite behaviour of $f(x)$ on both sides of each asymptote.

3. Determine the values of a and b that makes the function below continuous everywhere

$$f(x) = \begin{cases} ax + b & \text{if } x \leq 1 \\ ax^2 - bx + 1 & \text{if } x > 1 \end{cases}$$

Find $\lim_{x \to 0} \frac{x}{3 - \sqrt{x+9}}$

Additional Exercises (as per profs)

Openstax:

- Examples 2.17, 2.18, 2.19 on pages 165/166
- 2.3 Exercises: 96, 97, 101, 102

APEX:

- Exercises 1.3: 7, 9, 12, 14, 29, 30, 35, 36, 38
- Exercises 1.4: 8, 11, 13, 14, 15, 20
- Exercises 1.5: 12, 17, 20, 22, 23, 24, 26, 29
- Exercises 1.6: 19, 20, 22, 24 (only vertical asymptotes)

Additional Exercises: CLP (as per profs)

Q[3]: Given the function shown below, evaluate:

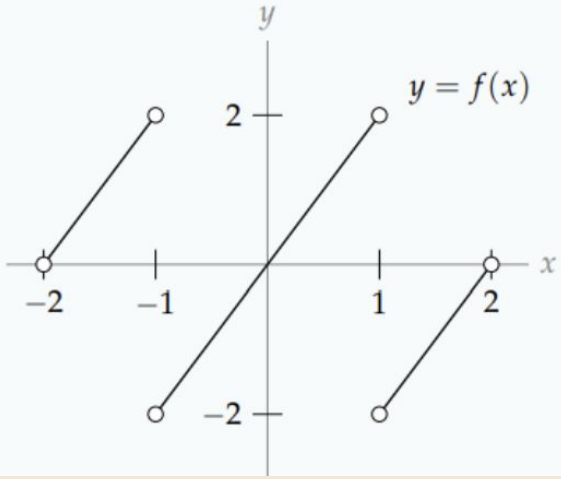
(a) $\lim_{x \to -1^-} f(x)$

(b) $\lim_{x \to -1^+} f(x)$

(c) $\lim_{x \to -1} f(x)$

(d) $\lim_{x \to -2^+} f(x)$

(e) $\lim_{x \to 2^-} f(x)$



Q[6]: Suppose $\lim_{x \to 3} f(x) = 10$. True or false: $f(3) = 10$.

Q[7]: Suppose $f(3) = 10$. True or false: $\lim_{x \to 3} f(x) = 10$.

Q[7]: $\lim_{y \to 0} \dfrac{(y+1)(y+2)(y+3)}{\cos y}$

Q[8]: $\lim_{x \to 3} \left(\dfrac{4x-2}{x+2} \right)^4$

Q[9](*): $\lim_{t \to -3} \left(\dfrac{1-t}{\cos(t)} \right)$

$2x^2yy' + y^2 = 2$

Q[10](∗): $\lim_{h\to 0} \dfrac{(2+h)^2-4}{2h}$

Q[11](∗): $\lim_{t\to -2} \left(\dfrac{t-5}{t+4}\right)$

Q[12](∗): $\lim_{x\to 1} \sqrt{5x^3+4}$

Q[13](∗): $\lim_{t\to -1} \left(\dfrac{t-2}{t+3}\right)$

Q[18](∗): $\lim_{x\to -3} \dfrac{x^2-9}{x+3}$

Q[19]: $\lim_{t\to 2} \dfrac{1}{2}t^4 - 3t^3 + t$

Q[20](∗): $\lim_{x\to -1} \dfrac{\sqrt{x^2+8}-3}{x+1}$.

Q[21](∗): $\lim_{x\to 2} \dfrac{\sqrt{x+7}-\sqrt{11-x}}{2x-4}$.

Q[22](∗): $\lim_{x\to 1} \dfrac{\sqrt{x+2}-\sqrt{4-x}}{x-1}$

Q[23](∗): $\lim_{x\to 3} \dfrac{\sqrt{x-2}-\sqrt{4-x}}{x-3}$.

Q[24](∗): $\lim_{t\to 1} \dfrac{3t-3}{2-\sqrt{5-t}}$.

Q[38]: Evaluate $\lim_{t\to\frac{1}{2}} \dfrac{\frac{1}{3t^2}+\frac{1}{t^2-1}}{2t-1}$.

Q[39]: Evaluate $\lim_{x\to 0}\left(3+\dfrac{|x|}{x}\right)$.

Q[40]: Evaluate $\lim_{d\to -4} \dfrac{|3d+12|}{d+4}$

Q[41]: Evaluate $\lim_{x\to 0} \dfrac{5x-9}{|x|+2}$.

Q[42]: Suppose $\lim_{x\to -1} f(x) = -1$. Evaluate $\lim_{x\to -1} \dfrac{xf(x)+3}{2f(x)+1}$.

Q[49]: Suppose

$$f(x) = \begin{cases} x^2 + 3 & , \quad x > 0 \\ 0 & , \quad x = 0 \\ x^2 - 3 & , \quad x < 0 \end{cases}$$

(a) Evaluate $\lim_{x \to 0^-} f(x)$.

(b) Evaluate $\lim_{x \to 0^+} f(x)$.

(c) Evaluate $\lim_{x \to 0} f(x)$.

Q[50]: Suppose

$$f(x) = \begin{cases} \dfrac{x^2 + 8x + 16}{x^2 + 30x - 4} & , \quad x > -4 \\ x^3 + 8x^2 + 16x & , \quad x \leqslant -4 \end{cases}$$

(a) Evaluate $\lim_{x \to -4^-} f(x)$.

(b) Evaluate $\lim_{x \to -4^+} f(x)$.

(c) Evaluate $\lim_{x \to -4} f(x)$.

Any Questions?????