TA: Kyle Hansen (kylehansen@math.ucsb.edu)
Office: South Hall, 6431 V
OH: M 11-12pm / **ML:** Th 1-3pm

Name:

"The moving power of mathematical invention is not reasoning, but imagination."
-Augustus De Morgan

Collaborators:

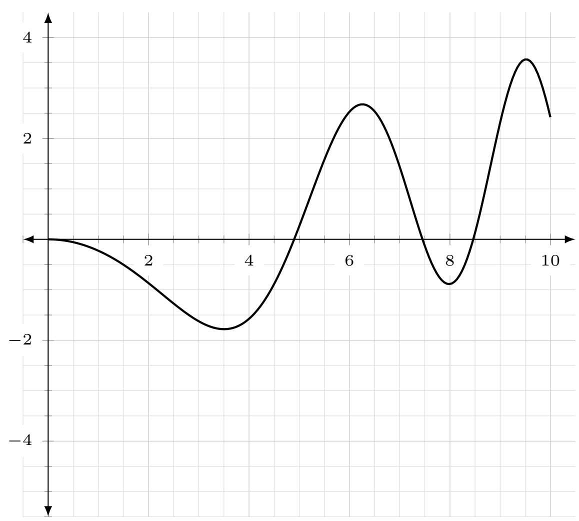
Section Day/Time:

Tangents, Velocity, and Limits

Equation of a Tangent Line

A line tangent to curve $f(x)$ intersecting the y-axis at point b and having slope m can be expressed in *slope-intercept form*: $y = mx + b$.

1. Draw the lines tangent to the corresponding values of x, and complete the chart on the right with appropriate estimates.



x	slope at $f(x)$	equation of line tangent to $f(x)$
2		
4		
6		
8		

2. A kite's height in meters above the ground at time t is modeled by the function $f(t) = (2-t)\sin(t) + 8$, where t is measured in seconds. Use the table provided to estimate the vertical velocity of the kite at the given points using points close to t. Be sure to include units in the final column!

t	$f(t+0.001)$	$f(t-0.001)$	estimated velocity of kite at time t
2			
4			
6			
8			

3. Compute the following limits:

a) $\displaystyle\lim_{z\to 3} \frac{z^2}{(z-2)^2}$

b) $\displaystyle\lim_{x\to 1} x^3 - \frac{x+2}{x^2+x-2}$

c) $\displaystyle\lim_{a\to 1^-} \frac{\ln(a-1)}{1-a}$

Discuss: Does $\displaystyle\lim_{a\to 1} \frac{\ln(a-1)}{1-a}$ exist? Why or why not?

d) Suppose $\lim_{y\to 2} g(y) = 3$ and $\lim_{y\to 4} g(y) = 2$. Find $\displaystyle\lim_{y\to 2}[g(y^2)\cdot g(y)^2]$

Asymptotes

Let $a \neq \pm\infty$. A function f has a *vertical asymptote* at $x = a$ if $\lim_{x\to a^{+/-}} f(x) =$ _______ .

Discuss: By looking at a function of the form $f(x) = \frac{g(x)}{h(x)}$ where $p(x)$ and $q(x)$ are polynomials, how do you think we can find where the vertical asymptotes are?

4. Find all vertical asymptotes, and sketch a possible graph for each of the following functions:

a) $f(x) = \dfrac{x^{2020} - 2019}{(x-5)(x+2)}$

b) $g(x) = \csc(x) = \dfrac{1}{\sin(x)}$

Discuss: Give our definition of a vertical asymptote, how do you think a *horizontal asymptote* would be defined? Can you think of any functions with a horizontal asymptote?