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OH: M 11-12pm / **ML:** Th 1-3pm

Name:

Collaborators:

Section Day/Time:

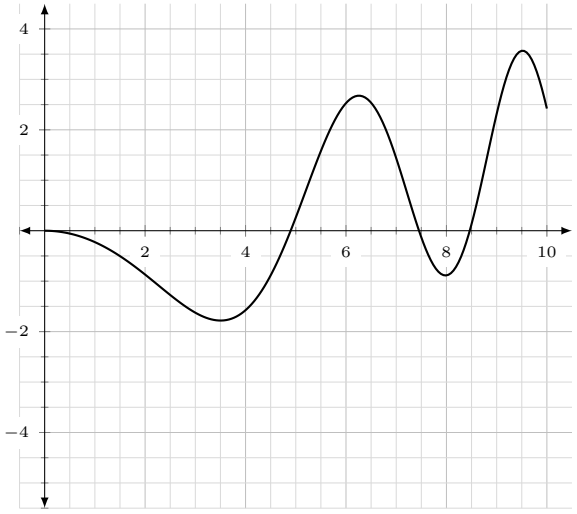
"The moving power of mathematical invention is not reasoning, but imagination."
-Augustus De Morgan

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 $f(t) = -(t-2)^3 + (t+2)^2 + 20$, 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.

t	$f(t+0.001)$	$f(t-0.001)$	estimated velocity of kite at time t
0			
2			
4			
6			

3. Compute the following limits:

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

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

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

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

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

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?