Math 151:19-21 Workshop 3 **Ian Coley** **24 September 2019**

Problem 1. Compute $\lim_{x\to\infty} f(x)$ for $f(x) = e^{-x}\sin x$ by following these steps:

(a) Why isn't "plugging in" an option?
(b) Recall that we can bound $-1 \leq \sin x \leq 1$. Set up bounds for $f(x)$ using this.
(c) What is $\lim_{x\to\infty} e^{-x}$? Now use the squeeze theorem to solve the problem.

Problem 2. Consider the function $g(x) = x^3 - 2x$.

(a) Consider the secant line through the point $x = 5$ and an arbitrary point $x = c$. Show that the slope of this line is $c^2 + 5c + 23$.
(b) Compute the instantaneous rate of change at $x = 5$ using a limit.

Problem 3. Compute the following limits, if they exist:

(a) $\lim_{x\to -2} \frac{4}{x^3}$

(b) $\lim_{x\to 1} \frac{x^3 - x}{x - 1}$

(c) $\lim_{x\to -\infty} \frac{x^3 - 2x + 1}{5x^3 + 2x^2 - x + 1}$

(d) $\lim_{\theta\to 0} \frac{\tan 2\theta}{\sin 2\theta}$

(e) $\lim_{\theta\to 0} \frac{\cos\theta - 2}{\theta}$

Problem 4. Prove that $\cos\theta = 2\sin\theta$ has a solution in the interval $[\pi, 2\pi]$. Hint: rephrase this as an intermediate value problem, don't try to find θ directly.