

*As usual, take no more than 5 minutes on question 0*

**0.)**

Tell everyone in your group one thing that you liked or that was significant about your hometown/neighborhood growing up.

**1.)**

Explain whether L'hôpital's Rule can be used to evaluate the following limits. If so, evaluate the limit

**a.)**

$$\lim_{x \rightarrow 0} \frac{\sin x}{x^2}$$

,

**b.)**

$$\lim_{x \rightarrow 1} \frac{\cos(\pi x)}{x^2 - 1}$$

**c.)**

$$\lim_{z \rightarrow \infty} x^{e^{-x}}$$

**2.)**

For each of these, *every* group member should be able to explain your answer if asked. Write your argument below

**a.)**

Suppose that  $f(x)$  is differentiable everywhere and has two roots. Show  $f'(x)$  has at least one root

**b.)**

Show that  $\sin x < x$  if  $0 < x < 2\pi$  (those who have already done this: help your groupmates can *explain* the solution!!)

**c.)**

SSuppose that  $3 \leq f'(x) \leq 5$  for all values of  $x$ . Show that  $18 \leq f(8) - f(2) \leq 30$

**3.)**

Suppose  $f(3) = 2$ ,  $f'(3) = \frac{1}{2}$ , and  $f'(x) > 0$  but  $f''(x) < 0$  for every  $x$ .

**a.)**

Sketch a possible graph of  $f(x)$

**b.)**

How many solutions does  $f(x) = 0$  have? Are there multiple possible answers here? Why?

**c.)**

Is it possible  $f'(2) = \frac{1}{3}$ ? What about  $f'(2) = 1$ ?