Warm-up Problems

1. Let \( f(x) = x^2 + x \) and let \( g(x) = 3(x - 1) + 2 \).
   (a) At \( x = 1 \), does the graph of \( f \) have positive or negative slope?
   (b) At \( x = 1 \), does the graph of \( g \) have positive or negative slope?
   (c) Find an approximation \( f(1.1) \approx 2.31 \)
   (d) Find an approximation \( g(1.1) \approx 2.3 \)
   (e) Explain the relationship between \( f(x) \) and \( g(x) \).

2. (More complicated version of previous problem)
   Let \( f(x) = \frac{\cos\left(\frac{1}{6} \pi x\right) \log(x)}{x^2 + x + 1} \) and let \( g(x) = \frac{1}{6} \sqrt{3}(x - 1) \).
   (a) At \( x = 1 \), does the graph of \( f \) have positive or negative slope?
   (b) At \( x = 1 \), does the graph of \( g \) have positive or negative slope?
   (c) Find an approximation \( f(1.1) \approx 0.241491971684 \)
   (d) Find an approximation \( g(1.1) \approx 0.288675134595 \)
   (e) Explain the relationship between \( f(x) \) and \( g(x) \).

Lecture Problems

3. Linearize the functions at the given points.
   (a) \( f(x) = x^2 + x \), at \( x = 1 \)
      \[ \text{Solution: } L(x) = 2 + 3(x - 1) \]
   (b) \( f(x) = \sqrt{x} \), at \( x = 64 \)
      \[ \text{Solution: } L(x) = 8 + 1/16(x - 64) \]
   (c) \( f(x) = \cos\left(\frac{1}{6} \pi x\right) \), at \( x = \frac{1}{6} \pi \)
      \[ \text{Solution: } L(x) = \frac{1}{2} \sqrt{3} + -\frac{1}{2}(x - \frac{1}{6} \pi) \]
   (d) \( f(x) = -x^2 + 12 \), at \( x = 2 \)
      \[ \text{Solution: } L(x) = 8 + -4(x - 2) \]
   (e) \( f(x) = \log(x + 1) \), at \( x = 0 \)
      \[ \text{Solution: } L(x) = 0 + 1(x - 0) \]
   (f) \( f(x) = \frac{1}{x + 1} \), at \( x = 1 \)
      \[ \text{Solution: } L(x) = \frac{1}{2} + \frac{1}{4}(x - 1) \]

4. Test Oct 22! Covers Sections 3.1-3.11:
   (a) Derivatives and Tangents. Limit definition.
   (b) Differentiation Rules and Formulas. All of them.
   (c) Implicit differentiation.
   (d) Derivatives of inverse functions.
   (e) Related Rates.
   (f) Linearizations.