1. True or False. (20 pts) If you answer False, you must give a reason. Often, a good reason is a counterexample. In any case, express yourself clearly. Watch for subtleties.

T F If $|x| < |y|$, then $x^2 < y^2$.

T F If $x < y$, then $x^2 < y^2$.

T F All horizontal lines have slope 0.

T F All vertical lines have slope 1.

T F For any function $f$, every vertical line intersects the graph of $f$ at exactly one point.

T F If $z$ is a zero of some function $f$, then $z$ is a root of the equation $f(x) = z$.

T F The function $\sin(\frac{x}{2} - \frac{\pi}{6})$ has phase shift $\frac{\pi}{6}$.

T F Define $f$ by $f(x) = \frac{x^2 - 9}{x - 3}$. Then $f(3) = 6$.

T F Define $f$ by $f(x) = \frac{x^2 - 9}{x - 3}$. Then $\lim_{x \to 3} f(x) = 6$.

T F If $f(a)$ is defined, then $f$ has a limit as $x \to a$. 
2. (10 pts) Solve the inequality \( x > \frac{1}{x} \). Clearly show or describe how you get your answer.

3. (8 pts) Solve the inequality \(|3x - 2| < |2x + 1|\). Clearly show or describe how you get your answer.

4. A given circle has radius 8.
   (a) (3 pts) Express the length \( b \) of a chord of this circle as a function of the (perpendicular) distance \( p \) from the center of the circle to the chord. What is the range of this function?

   (b) (3 pts) Express the area \( A \) of the triangle formed by the chord and its central angle as a function of the distance \( p \) as in part (a). What is the natural domain of this function?

   (c) (4 pts) Graph the functions for chord length and area which you found in parts (a) and (b) on your calculator and sketch the graphs below. Be sure to label the axes, show the scale, and distinguish between the two graphs.
5. (6 pts) Identify which graph is which. Be sure to label both sides of the common intersection point.

\( f(x) = (x + 2) - |x - 1|, \ g(x) = |x| - (x - 1), \ h(x) = |x - 2| - (|x| + 1). \)

6. \( f(x) = \frac{\sqrt{2x + 1} - \sqrt{3}}{x - 1} \)

HP48G form: 

\[ 'F(X) = (\sqrt{2 \times X + 1} - \sqrt{3}) ÷ (X - 1)' \]

(a) (8 pts) Estimate \( \lim_{x \to 1} f(x) \) correct to 4 decimal places by making a table of values for \( x = 0.99, \ 0.999, \ 0.9999, \ 1.0001, \ 1.001, \) and \( 1.01. \)

(b) (8 pts) Find the exact value of \( \lim_{x \to 1} f(x) \) by rationalizing the numerator of \( f(x). \)

7. Given that \( \lim_{x \to a} f(x) = b, \ \lim_{x \to b} g(x) = c, \) and \( \lim_{x \to a} h(x) = d, \) find

(a) (4 pts) \( \lim_{x \to a} (2f(x) - (h(x))^3) \)

(b) (4 pts) \( \lim_{x \to a} h(x) \cos(g(f(x))) \)
8. (6 pts) Let \( f(x) = \frac{x^4 - 1}{x - 1} \) and \( g(x) = (x^2 + 1)(x + 1) \). The functions \( f \) and \( g \) are almost, but not quite, the same. Clearly describe the difference between \( f \) and \( g \). Explain how \( \lim_{x \to 1} f(x) \) can be found using \( \lim_{x \to 1} g(x) \).

9. (8 pts) Given that \( \lim_{x \to 0} \frac{\sin x}{x} = 1 \), prove that \( \lim_{x \to 0} \frac{1 - \cos x}{x} = 0 \).

10. (8 pts) When \( x = \pi/4 \) the tangent line to the graph of \( y = \tan x - x \) has slope 1. Find where this tangent line intersects the x-axis. (Recall that \( \tan \pi/4 = 1 \).)