Name:______________________________________ **Email:** _________________________________

CSE 254, F08, Dr. T. J. Peters

1. Draw two polygons, denoted as A, B, such that $A \cap B$ is non-empty and is a subest of some shared edge between A and B.

a) Draw their set subtraction. This corresponds to infinite precision arithmetic.

b) Draw their regularized set subtraction.

c) Draw what pathology could occur for 1a under floating point arithmetic.

2. If one considers the unit interval $(0, 1)$ with the usual operations of addition and mulitiplication, is this algebraically closed? Either prove or give a counterexample.

3. For your answer to 1c, show what problems could happen with a graphics algorithm that tried to fill the resultant object as if it were a polygon. Specifically, show some good scan lines and one that goes awry. What happens with the one that goes awry – namely, how would this error become apparent?

4. In each of the indicated sets, specify whether the indicated point is in the interior or is a limit point. Give a brief justification of your answer.

a. $(0, 1)$ and the point 0.

b. $(0, 1)$ and the point 1/2.

c. $(0, 1)$ and the point 1/200.

5. Given a polygon and the definition of an interior point, is it possible to write an algorithm that *exhaustively* checks whether any particular point is an element of the interior of a set? Your answer should make very careful use of quantifiers.

6. Given a polygon and the definition of a limit point, is it possible to write an algorithm that *exhaustively* checks whether any particular point is a limit point? Your answer should make very careful use of quantifiers.

Definition 1: For a set A and a point $x \in A$, the point x is in the interior of A (denoted int(A)) iff there exists some open ball, B about x such that $B \subset A$.

Definition 2: For a set $A \subset X$ and a point $x \in X$, the point x is a limit point of A iff for every open ball, B about x, it is true that $B \cap A \neq \emptyset$.