PS 3  
Due: Weds, Feb 11

1: By the book  Book section 2.5, p10, 11; section 4.6, p16.

2: Definitions  Let \( \hat{x} = 32 \) be regarded as an approximation to the positive solution for \( f(x^*) = x^*_2 - 1000 = 0 \). What are the absolute error, the relative error, and the residual error?

3: Pi, see!  The following routine estimates \( \pi \) by recursively computing the semiperimeter of a sequence of \( 2^{k+1} \)-gons embedded in the unit circle:

```plaintext
N = 4;
L(1) = sqrt(2);
s(1) = N*L(1)/2;
for k = 1:30
    N = N*2;
    L(k+1) = sqrt( 2*(1-sqrt(1-L(k)^2/4)) );
    s(k+1) = N*L(k+1)/2;
end
semilogy(1:length(s), abs(s-pi));
ylabel('|s_k − \pi|');
xlabel('k')
```

Plot the absolute error \( |s_k - \pi| \) against \( k \) on a semilog plot. Explain why the algorithm behaves as it does, and describe a reformulation of the algorithm that does not suffer from this problem.