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% MATH 4540
% Assignment 3

format long

% 6.2 3c) For  $y' = 2(t + 1)y$  (log-log) plot the global truncation error of the
% explicit trapezoid method at  $t=1$  as a function of  $h = 0.1 \times 2^{-k}$  for
%  $0 \leq k \leq 5$ .

f = @(t, w) 2 * (t + 1) * w;

hs = zeros(1, 6);
gte = zeros(1, 6);
for k=0:5
    h = 0.1 * 2^(-k);
    hs(k+1) = h;
    w = euler(f, 0, 1, h, 1, 1);

    syms y(t)
    ySol(t) = dsolve(diff(y,t) == 2 * (t + 1) * y, y(0) == 1);
    gte(k+1) = abs(w - double(ySol(1)));
end
loglog(hs, gte)

function [result] = euler(f, a, b, h, y0, n)
    t = zeros(1, n+1);
    w = zeros(1, n+1);
    t(1) = a;
    w(1) = y0;
    result = 0;
    for i=1:n
        t(i+1) = t(i) + h;
        result = w(i) + (h / 2) * (f(t(i),w(i)) + f(t(i)+h,w(i)+h*f(t(i),w(i))));
        w(i+1) = result;
    end
end

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Results

