Assignment 5

```matlab
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%Date: 3/13/2021
```

Part a

```matlab
%Estimate the derivative of the function at the point x = 1 using 3-
point midpoint formula for the
%following values of h: h = 10#n for n going from 16 by integers to 1
 (e.g., h = 10#1
%Plot the step size h versus the relative error in a loglog plot.
%On the same figure, plot the estimated truncation error for those
 same h values in red.
%(Hint: Try plotting the 3rd derivative to figure out for which #
 value the the third derivative will be maximum at! )


f = @(x) sin(x);
dddf = @(x) -cos(x); % the third derivative of sin(x) is -cos(x)
x = 1; % the pt we are estimating the derivative of the function
E = -pi; %-cos(x) is largest when x = -pi so that -cos(x) = 1
h =
 [10^-1,10^-2,10^-3,10^-4,10^-5,10^-6,10^-7,10^-8,10^-9,10^-10,10^-11,10^-12,10^-1
 the multiple values of h
CD3 = zeros(1,16);
CD3_relative_error = zeros(1,16);
%CD3_relative_error = h^2/6 * f^3 (E)

for i = 1:16
    CD3(i) = (1/(2*h(i)) * (f(x + h(i)) - f(x - h(i))));
    CD3_relative_error(i) = h(i)^2 / 6 * dddf(E);
end

loglog(h,CD3_relative_error,'b'); % this is plotting the step size h
 verus relative error in a loglog plot
hold on
loglog(CD3_relative_error,'r'); % this is just plotting the estimated
 truncation error for same h in red.
hold off

%%Problem 5 part b
```
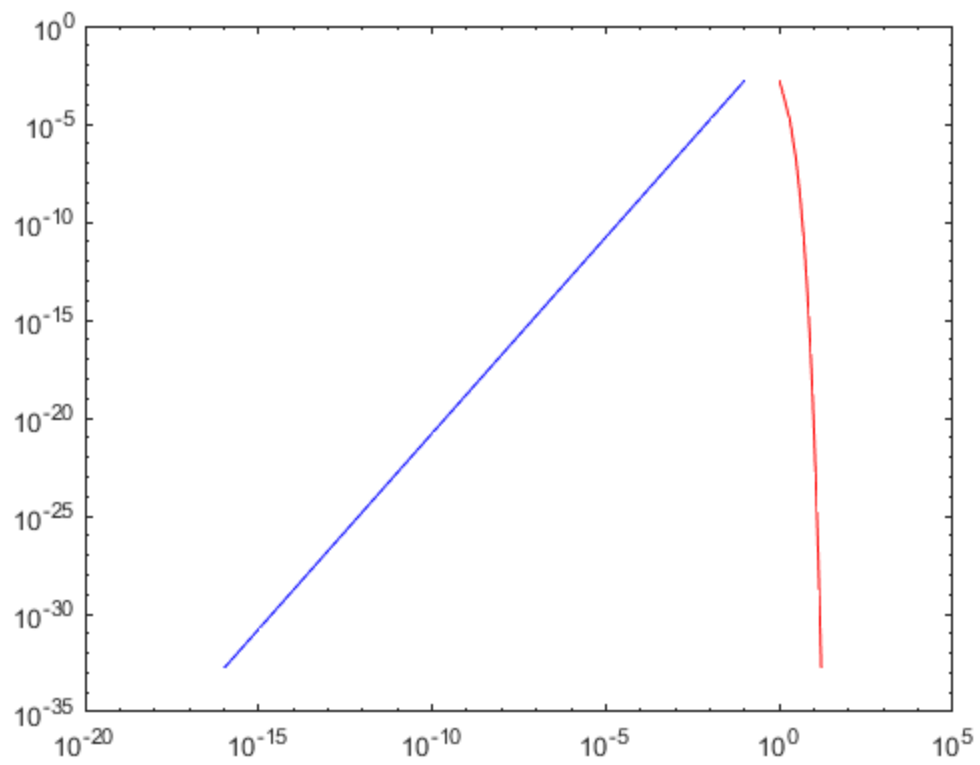
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