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% Load the data
load('DataHW06_Prob2.mat');

% Assume t and y are loaded, along with dy (the true derivative)
% Look at the variables in the workspace after loading
% whos

% Compute the time step  $\Delta T$ 
deltaT = t(2) - t(1);

% Compute the naive derivative using the difference formula
% Shift y by one index to represent  $y(t - \Delta T)$ 
y_shifted = [y(1); y(1:end-1)]; % Ensure causal computation
naive_derivative = (y - y_shifted) / deltaT;

% Plot the naive derivative estimate
figure;
plot(t, naive_derivative, 'b', 'DisplayName', 'Naive Derivative');
hold on;

% Plot the true derivative from the data file
plot(t, dy, 'r--', 'DisplayName', 'True Derivative');

% Add labels and legends
xlabel('Time t');
ylabel('Derivative');
title('Naive Derivative Estimate vs True Derivative');
legend show;
grid on;
hold off;
```

