Practice Problems and Tasks

Numerical Problems:

Q1: Given $H(s) = \frac{5}{s^2+6s+5}$:

- Determine the poles and zeros.
- Plot the step response.
- Is the system stable?

Q2: Find the Laplace Transform of the following:

- $f(t) = e^{-2t}$
- $f(t) = \sin(3t)$
- $f(t) = t^2 \cdot u(t)$

Q3: A system is modeled as:

$$\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 3y = x(t)$$

- Use Laplace Transform to solve for $Y(s)$ in terms of $X(s)$.
- Find the transfer function $H(s) = \frac{Y(s)}{X(s)}$.

Simulation Tasks:

Task 1: Simulate the system with transfer function $H(s) = \frac{2s+4}{s^2+5s+6}$ in Octave or MATLAB.

- Plot the step and impulse responses.
- Use `pzmap()` to visualize the poles and zeros.
- Determine the system stability.

Task 2: Write a custom function to determine if a system is stable based on its poles:

```
function stability_check(H)
  poles = pole(H);
  if all(real(poles) < 0)
    disp("Stable System");
  else
    disp("Unstable System");
  end
end
```