1. Find A and $\phi$ for $w=1$ and 4

$$\frac{dy}{dt} + 3y = \sin \omega t \quad \Rightarrow \quad y = A \sin(\omega t + \phi)$$

2. Find the gain and phase in terms of $w$ and hence find $y(t)$ when $Y(s) = G(s)U(s)$ for $w=6$ with $G(s) = \frac{8}{s^2 + 7}$

$$G(s) = \frac{4}{s + 0.5} \quad \Rightarrow \quad y(t) = A \cos(wt + \phi)$$

$$u(t) = \cos(0.1\sqrt{5} \ t)$$

3. Given $G(s) = \frac{3}{s^2 + 2}$, find $y(t)$ for the following $u(t)$.

$$G(s) = \frac{3}{s + 2} \quad \Rightarrow \quad G(j\omega) =$$

4. $u(t) = \sin(2t)$ $\Rightarrow$

5. $u(t) = \cos(4t)$ $\Rightarrow$

6. $u(t) = 2.8 \Rightarrow$

7. Find the gain and phase for $w=4$.

8. Find the gain and phase

$$G(s) = \frac{s + 2}{s + 3}$$

$$G(s) = \frac{(s + 2)}{(s + 3)(s + 4)}$$

$$G(s) = \frac{(s + 1)(s + 2)}{(s + 3)(s + 4)}$$

$$G(s) = \frac{4}{s(s + 4)}$$

NOTE: Integrators have a fixed argument of $\pi/2$
By first plotting the argand diagram for each factor, find the phase for:

\[
\begin{align*}
(s - 2) \\
\frac{1}{s - 1} \\
(2 - s) \\
\frac{s - 1}{3 - s}
\end{align*}
\]

Given \( G(s) \) and a sinusoidal input signal \( u(t) \) whose amplitude is 1 and frequency is 2 \( \text{rad/s} \).\n
\[ G(s) = \frac{5}{1 + 0.5s} \]

- Compute the corresponding steady-state output \( y(t) \).
- What is the gain and phase of the process at this frequency?
- What is the gain and phase for frequencies of 4, 6, 8 and 10 \( \text{rad/s} \). Sketch how the gain and phase depend upon frequency.

Repeat the above with the following examples:

\[
\begin{align*}
G(s) &= \frac{(s + 1)}{(s + 4)(s + 2)}; \\
G(s) &= \frac{2}{(s + 10)(s + 1)(s + 3)}; \\
G(s) &= \frac{1}{s(s + 1)}
\end{align*}
\]