# $2^{nd}$ Order System Bode Plot - Analytical

Obtain the **asymptotic bode plot** and compare it with the plot from **MATLAB.**

$$G(s) = \frac{9}{\left(s^2 + 4.24s + 9\right)}$$

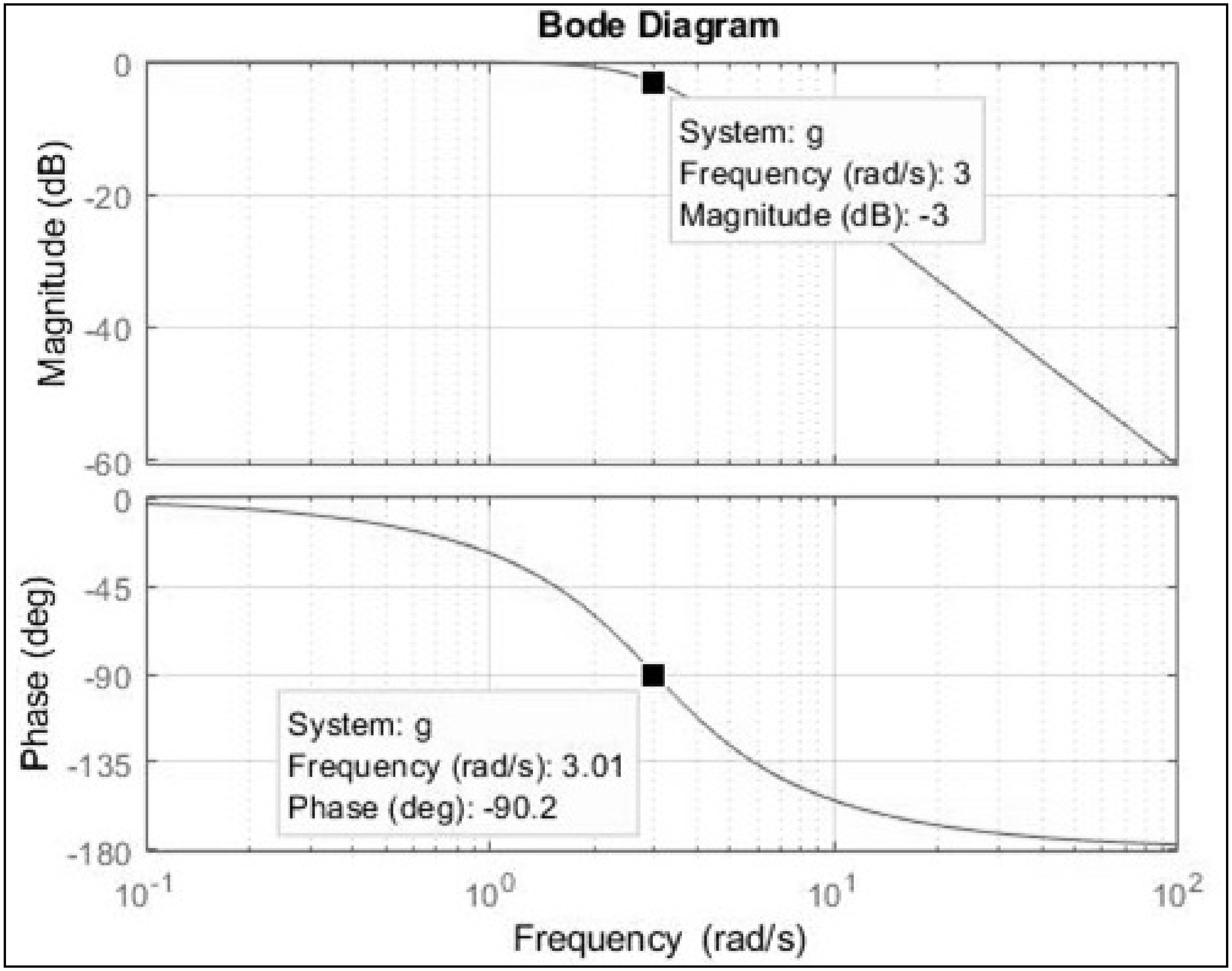
$$\left|G(j0)\right| = 0dB; \quad \angle G(j0) = 0^o; \quad \frac{d\left|G(j0)\right|}{d\omega} = 0dB/dec$$

$$\frac{dG(j\infty)}{d\omega} = -40dB/dec; \quad \left|G(j3)\right| = -3dB; \quad \angle G(j3) = -90^o$$

$$\left|G(j\infty)\right| = -\infty dB; \quad \angle G(j\infty) = -180^o$$

We see that **ω = 3** acts like a **corner** frequency so that we can **draw** the ω = ∞ **asymptote** through this **point.**

# $2^{nd}$ Order System Bode Plot - MATLAB



# $2^{nd}$ Order System Nyquist Plot

Obtain the one-sided **Nyquist plot** and compare it with the plot from **MATLAB.**

$$G(s) = \frac{9}{\left(s^2 + 4.24s + 9\right)}$$

$$\left|G(j0)\right| = 1; \quad \angle G(j0) = 0^o; \quad \left|G(j1)\right| = 0.99; \quad \angle G(j3) = -28^o$$

$$\left|G(j2)\right| = 0.91; \quad \angle G(j2) = -59^o; \quad \left|G(j3)\right| = 0.707; \quad \angle G(j3) = -90^o$$

$$\left|G(j4)\right| = 0.49; \quad \angle G(j3) = -112^o; \quad \left|G(j\infty)\right| = 0 \quad \angle G(j\infty) = -180^o$$

We see that for **ω = ∞**, the **plot** is tangent to **–ve real** axis**.**

# $2^{nd}$ Order System Nyquist Plot - MATLAB