※ 考生請注意：本試題 ☑可 ☐不可 使用計算機

P1. (25%) Explain the meaning of asymptotically stable system. Find the range of the controller gains (K, K_I) such that the feedback system in **Fig. P1**. is asymptotically stable. Plot the allowable region in parameter plane (K, K_I). What is the transfer function of the closed-loop system?

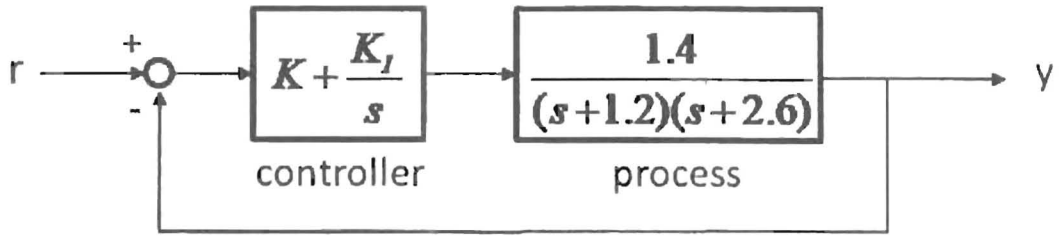

Fig. P1

P2. (25%) Roughly sketch the root loci for the pole-zero maps in Fig. P2. Show asymptotes, centroids, a rough evaluation of arrival and departure angles, and the loci for k varied from 0 to ∞. Each pole-zero map is from a characteristic equation of the form

$$1+k\frac{z(s)}{p(s)}=0$$

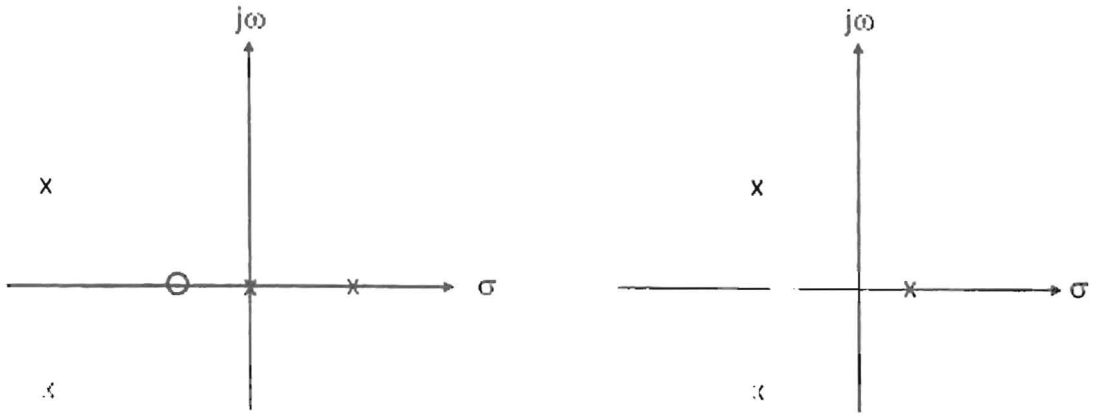

Fig. P2

(背面仍有題目,請繼續作答)

※ 考生請注意：本試題 ☑可 ☐不可 使用計算機

P3. (25%)

Assume the open-loop transfer function of a unit-feedback is,

$$G(s)=\frac{K(s+2)}{s(s-1)}.$$

(a) (10%) Sketch the corresponding complete Nyquist plot.

(b) (5%) Determine the angular frequency and the point that the Nyquist plot intersects the real axis.

(c) (10%) Based on the Nyquist plot obtained above, determine the range of K such that the closed-loop system is stable.

P4. (25%)

The magnitude plot for a system is shown as,

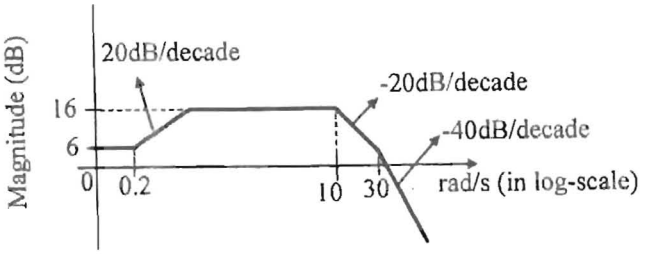

Figure 3: magnitude plot of p4.

(a) (10%) Assuming the corresponding system is a minimum-phase system, please estimate the transfer function.

(b) (10%) Based on the result of (a), sketch the phase plot.

(c) (5%) Based on the result of (a), determine the gain-margin and phase-margin.