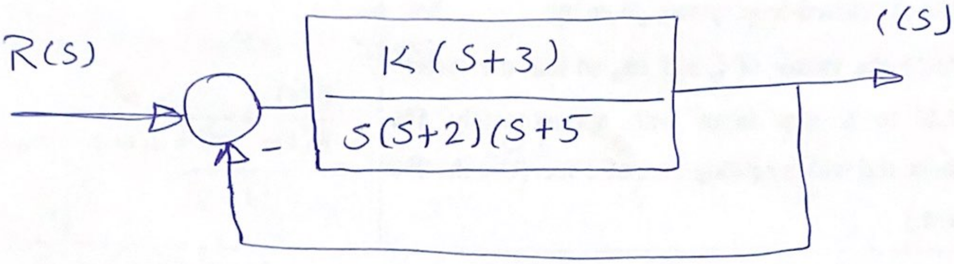
Q/ Plot the root loci For the closed loop Control System with



$\boxed{1}$ poles and Zeros

from open loop $G(S)H(S) = 0$

$$\frac{K(S+3)}{S(S+2)(S+5)} = 0$$

* poles/

$$\left.\begin{aligned} S &= 0 \\ S &= -2 \\ S &= -5 \end{aligned}\right\} \quad \text{No. of poles} = 3$$

* Zeros

$$S = -3 \quad \} \quad \text{No. of Zeros} = 1$$

$\boxed{2}$ No. of Asymptotes

= No. of poles - No. of Zeros

$= 3 - 1 = 2$

$\boxed{3}$ Angle of Asymptotes

$$\Theta = \frac{(2x+1) * 180}{\text{No. of poles} - \text{No. of zeros}} \quad ; \quad x = 0, 1$$

$$\theta_1 = \frac{2(0)+1}{3-1} * 180^\circ = 90^\circ$$

$$\theta_2 = \frac{2(1)+1}{3-1} * 180^\circ = 270^\circ$$

$\boxed{4}$ Centroid of Asymptotics

$$= \frac{\sum \text{real part of poles} - \sum \text{real part of zeros}}{\text{No. of poles} - \text{No. of zeros}}$$

$$= \frac{(-2-5)-(-3)}{3-1}$$

$$= \frac{-4}{2} = -2$$

$\boxed{5}$ Break away point

From charastestic eq.

$$1 + G(s)\,H(s) = 0$$

$$1 + \frac{K(s+3)}{s(s+2)(s+5)} = 0$$

$$\frac{s(s+2)(s+5) + K(s+3)}{s(s+2)(s+5)} = 0$$

$$(s^2+2s)(s+5) + K(s+3) = 0$$

$$s^3 + 5s^2 + 2s^2 + 10s + K(s+3) = 0$$

$$K = -\frac{s^3+7s^2+10s}{s+3}$$

$$\frac{dK}{ds} = -\frac{(s+3)(3s^2+14s+10) - (s^3+7s^2+10s)(1)}{(s+3)^2} = 0$$

$$0 = 3s^3 + 14s^2 + \cancel{10s} + 9s^2 + 42s + 30$$
$$- s^3 - 7s^2 - \cancel{10s}$$

$$0 = 2s^3 + 16s^2 + 42s + 30$$

$s = -1.136 \longrightarrow$ break away point.

$$\left.\begin{aligned} s &= -3.4 + 1.19i \\ s &= -3.4 - 1.19i \end{aligned}\right] \longrightarrow$$ No break away point because complex conjugate

6 Intersection with imaginary

There is no intersection with imaginary because of angles of asymptotes don't cross the imaginary axis. i.e $\theta_1 = 90°$; $\theta_2 = 270°$

7 Angle of departure

There is no. angle of departure, because there is no complex conjugate poles.