Robotics Root-locus Question:

(A) Given transfer function is

$$KG(S)H(S) = \frac{K}{(S+1)(S+2)}$$

Poles for above transfer function is when,

$S+1=0$ and $S+2=0$

$\Rightarrow \boxed{S=-1}$ and $\boxed{S=-2}$ there are no roots (or) zeroes for the given transfer function.

$$\left.\begin{array}{l}\text{No. of poles} = 2 \\ \text{No. of zeroes} = 0\end{array}\right\} \begin{array}{l} = P \\ = Z\end{array}$$

Point of intersection of asymptotes (Centroid) 'α' =

$$\frac{Re(\Sigma \text{ location of poles} - \Sigma \text{ location of zeroes})}{\text{No. of poles} - \text{No. of zeroes}}$$

$$= \frac{(-1-2)-(0)}{2-0} = \boxed{\frac{-3}{2}}$$ → on real axis only

* There are no complex poles (or) complex zeroes and hence there will not be any angle of arrival (or) angle of departure.

Angles made by asymptotes with Real axis

$$\phi = \left(\frac{(2q+1)}{P-Z}\right)180^\circ = \left(\frac{2q+1}{2-0}\right)(180^\circ)$$

$q = 0, 1, 2, \ldots \Rightarrow \phi$, Can be 90° (or) 270° because angles more than 360° are repeated.

Now for Breakaway and Breakin points, we can use the equation

$$\frac{1}{\sigma+1} + \frac{1}{\sigma+2} = 0 \Rightarrow \boxed{\sigma+1+\sigma+2=0}$$

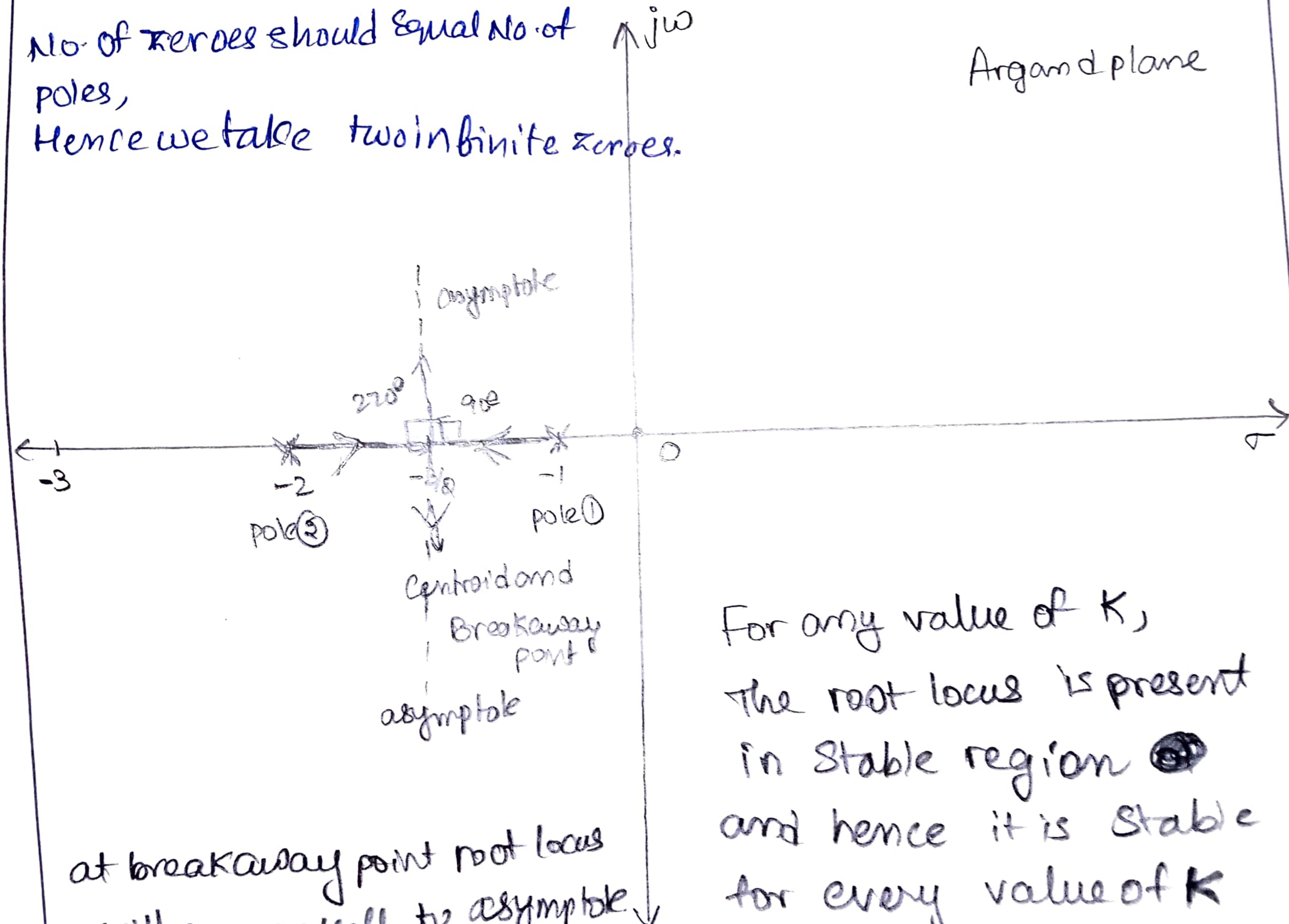
$$\Rightarrow 2\sigma = -3 \text{ and } \sigma = -3/2$$

There must be a breakaway point because we don't have any zeroes.

Now we can plot the Root locus graph as follows:

No. of zeroes should equal No. of poles,

Hence we take two infinite zeroes.



at breakaway point root locus will go parallell to asymptote.

For any value of K, The root locus is present in Stable region and hence it is Stable for every value of K

There is no jω Crossings, as the graph donot intersect with imaginary axis.