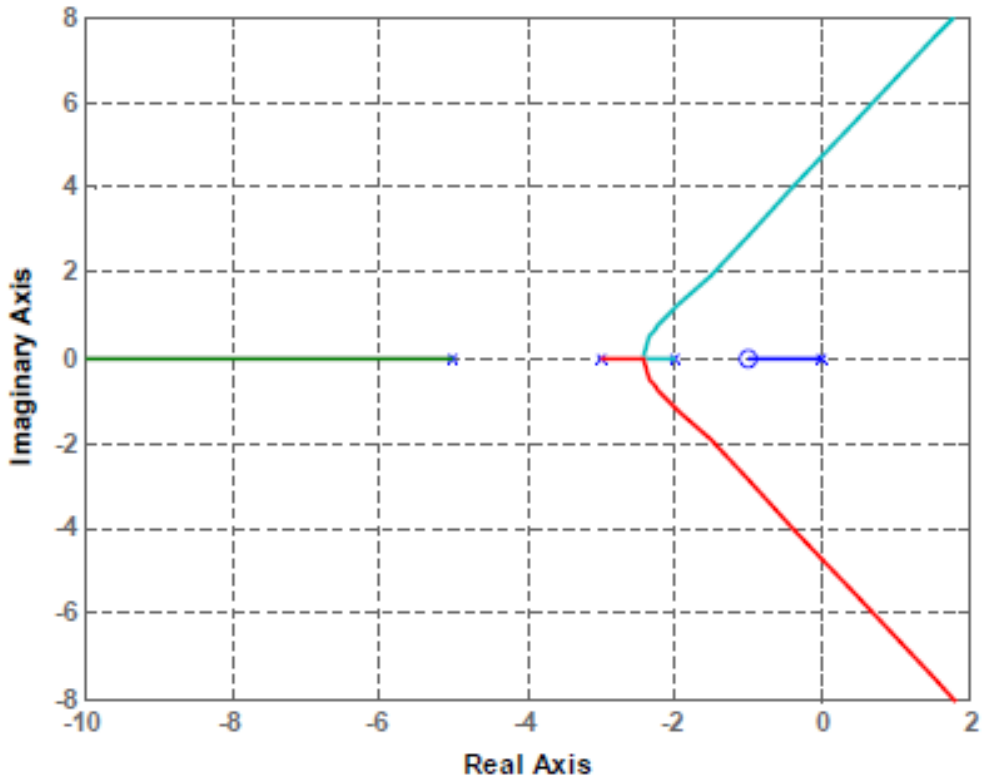
18.

a. Root locus crosses the imaginary axis at $\pm j3.162$ at $K = 52$.

b. Since the gain is the product of pole lengths to -5, $K = (1)\left(\sqrt{4^2+1^2}\right)\left(\sqrt{4^2+1^2}\right) = 17$.

19.

a.



b. $\sigma_a = \dfrac{(0-2-3-5)-(-1)}{3} = -3$; Angle $= \dfrac{(2k+1)\pi}{3} = \dfrac{\pi}{3}, \pi, \dfrac{5\pi}{3}$

c. Root locus crosses imaginary axis at j4.73 with K = 194.

d. K = 16.9