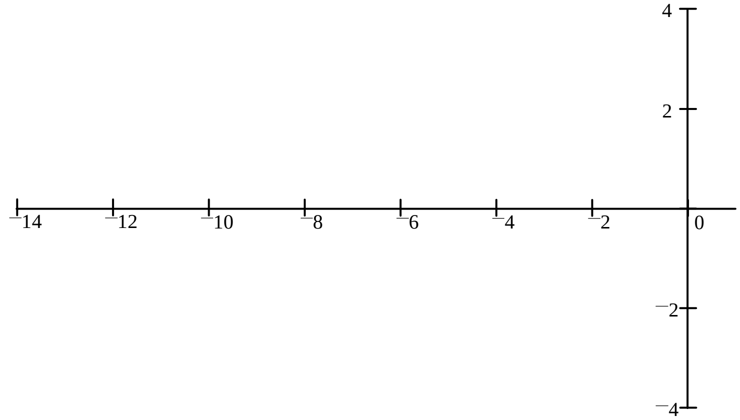
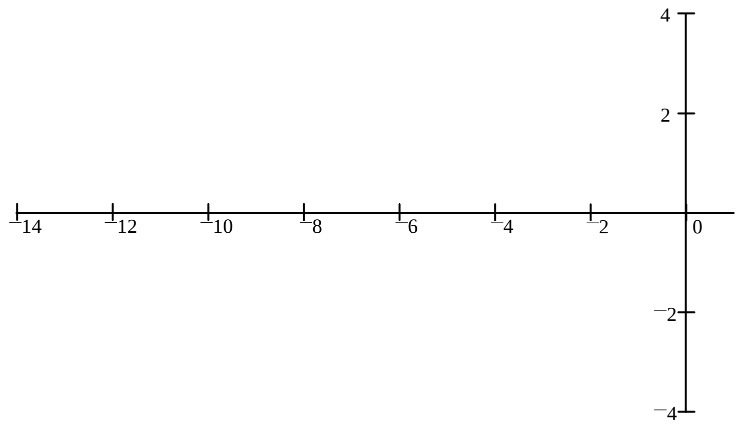
Name: ______________________ ECE 3510 homework RL8 Due: Sat, 3/23/24 bxt

1. A compensator: $C(s) = \dfrac{s + 2 \cdot a}{s + a}$ and a plant: $P(s) = \dfrac{k_p}{s + 6}$ are combined to form an open-loop transfer function: $G(s) = \dfrac{k_p}{(s+6)} \cdot \dfrac{(s + 2 \cdot a)}{(s + a)}$

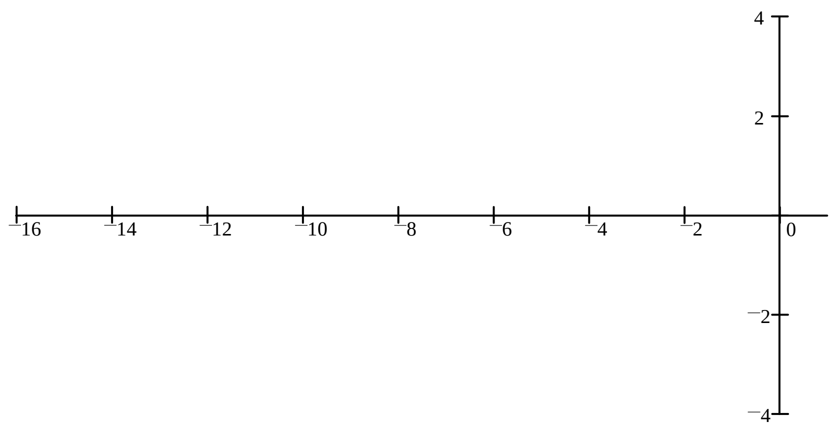
a) Sketch a conventional root-locus plot taking k_p as the gain and $a = 2$.

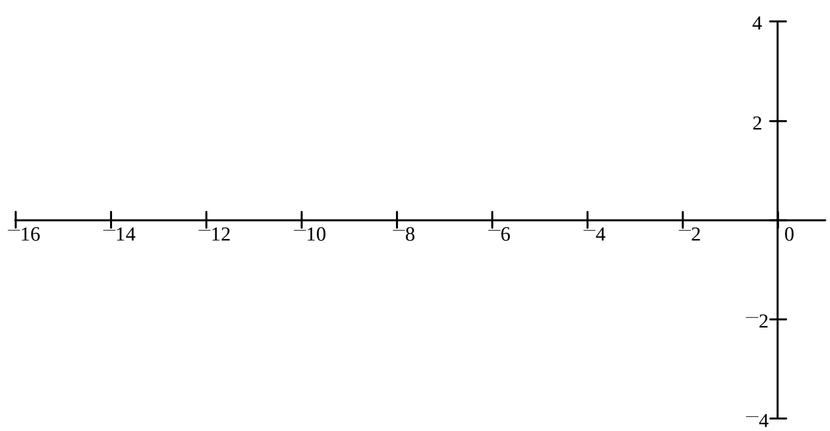


b) Sketch a conventional root-locus plot taking k_p as the gain and $a = 4$.



c) Sketch a unconventional root-locus plot taking a as the "gain". k_p is not specified.





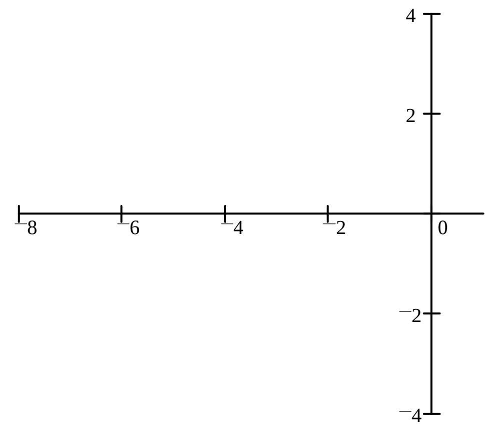
d) Sketch a unconventional root-locus plot taking a as the "gain" and $k_p = 2$.

e) What are the closed-loop poles if $a = 4$ and $k_p = 2$?

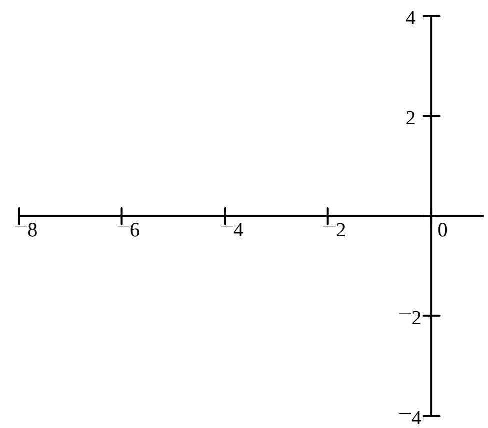
Show that these poles fit on the root locus drawn in part b) as well as the root locus drawn in part d.

2. A compensator: $C(s) = \dfrac{a}{s+a}$ and a plant: $P(s) = \dfrac{k_p \cdot s}{(s+4)^2}$ are combined to form an open-loop transfer function. $G(s) = \dfrac{k_p \cdot a \cdot s}{(s+4)^2 \cdot (s+a)}$

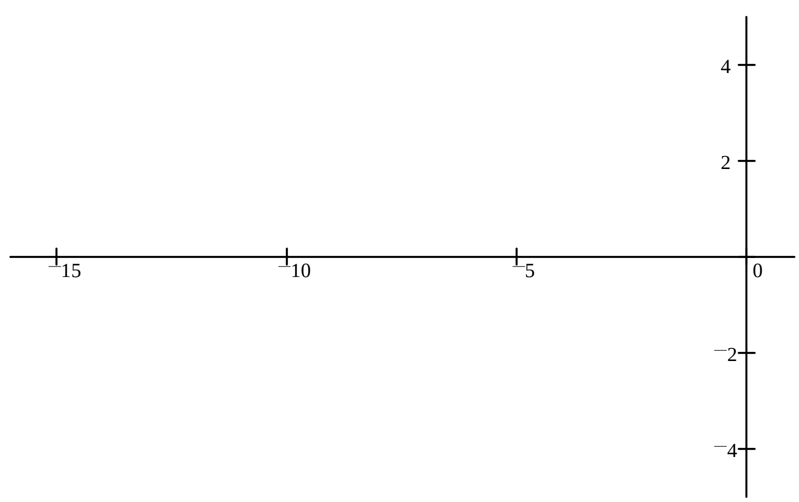
a) Sketch a conventional root-locus plot taking k_p as the gain and some $a < 4$.



b) Sketch a conventional root-locus plot taking k_p as the gain and some $a > 4$.

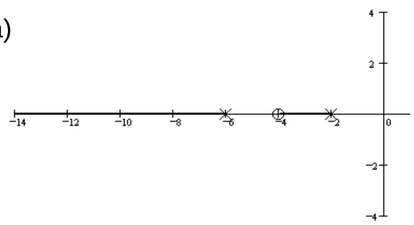


c) Sketch a unconventional root-locus plot taking a as the "gain" and $k_p = 2$.

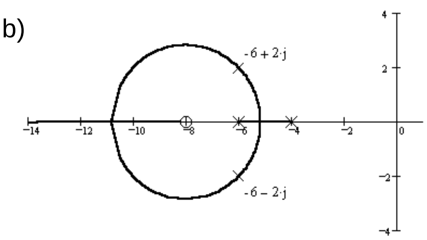


Answers

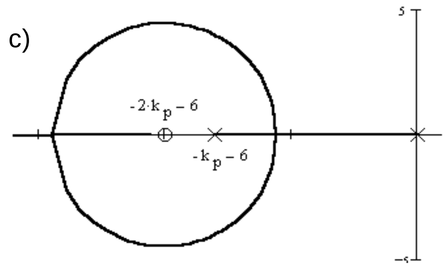
1. a)



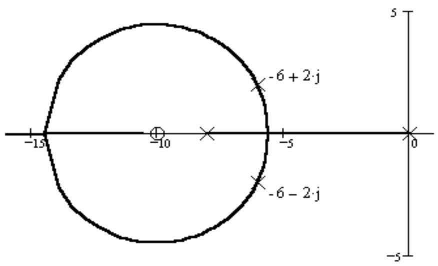
b)



c)



d)

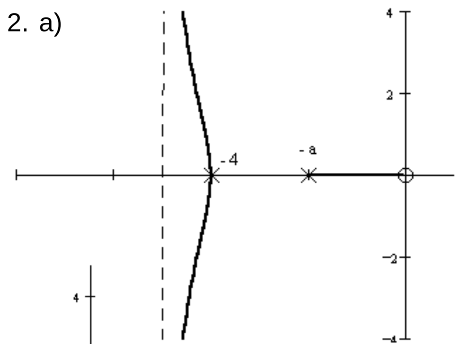


e) $-6 + 2 \cdot j$

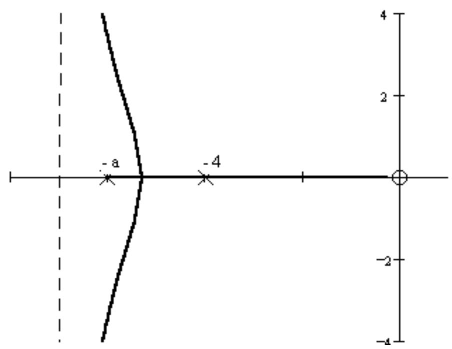
$-6 - 2 \cdot j$

see b, above and d, at left

2. a)



b)



c)