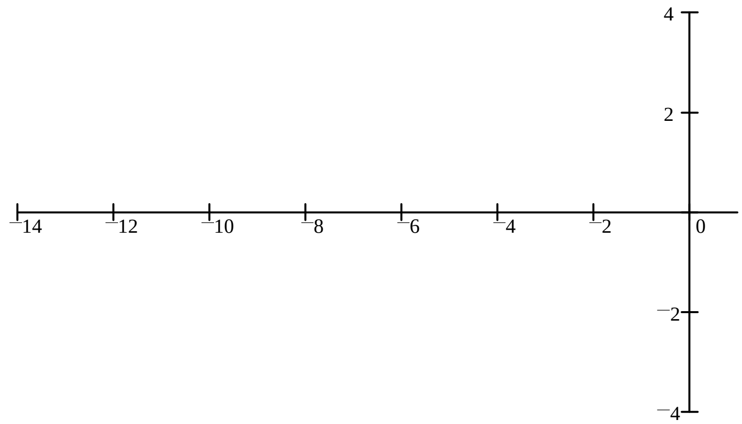
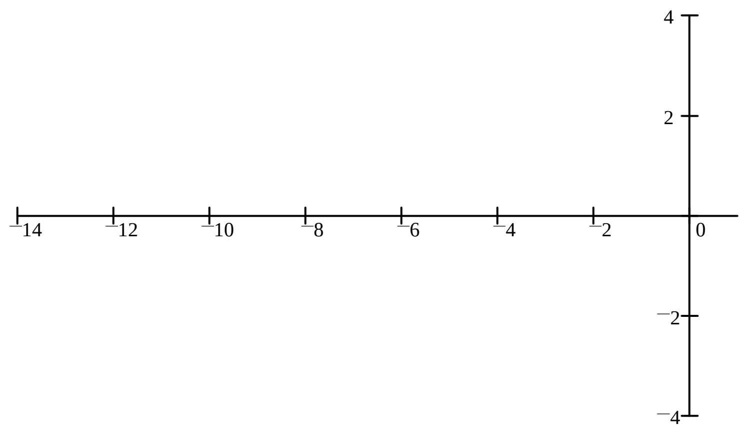
Name: ________________________ ECE 3510 homework RL8 bxt

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: $G(s) = \dfrac{k_p}{(s+6)} \cdot \dfrac{(s+2\cdot a)}{(s+a)}$

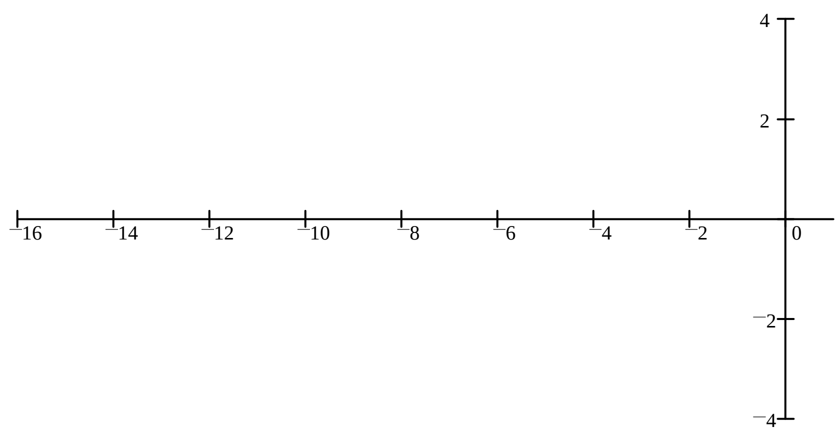
a) Sketch a conventional root-locus plot taking $k_p$ as the gain and $a = 2$.

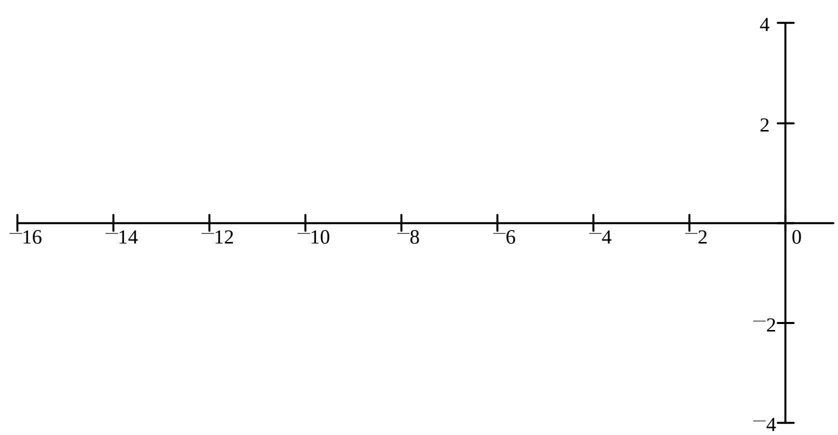



b) Sketch a conventional root-locus plot taking $k_p$ as the gain and $a = 4$.




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



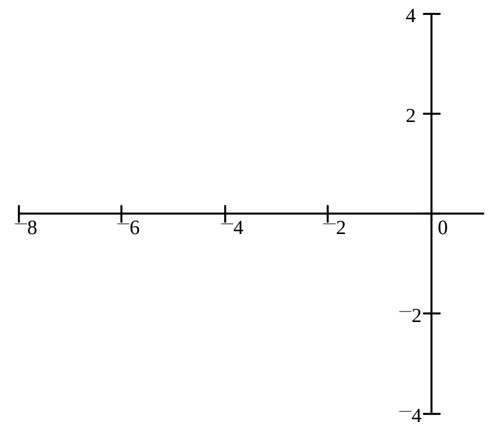

d) Sketch a unconventional root-locus plot taking $a$ as the "gain" and $k_p = 2$.

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

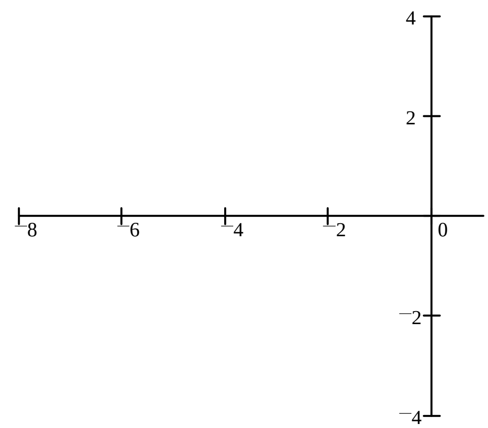
Show that these poles fit on the root locus drawn in part b) as well as the root locus drawn in part d.

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. $G(s) = \dfrac{k_p \cdot a \cdot s}{(s+4)^2 \cdot (s+a)}$

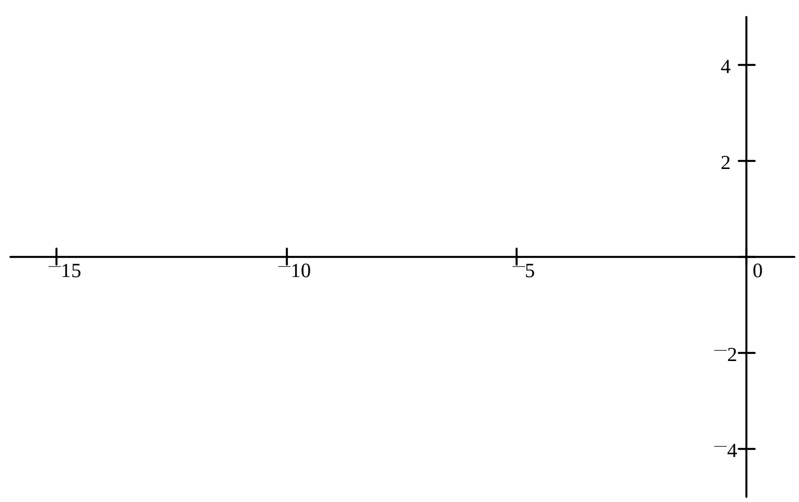
a) Sketch a conventional root-locus plot taking $k_p$ as the gain and some $a < 4$.




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

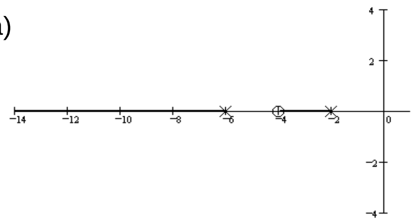



c) Sketch a unconventional root-locus plot taking $a$ as the "gain" and $k_p = 2$.

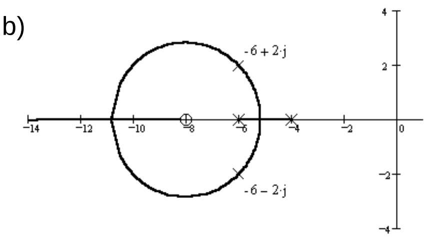


**Answers**

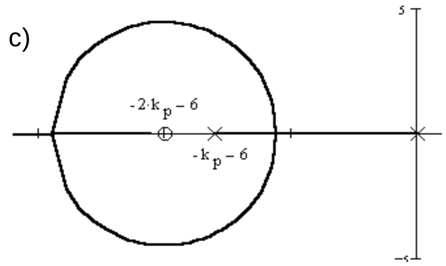
1. a)



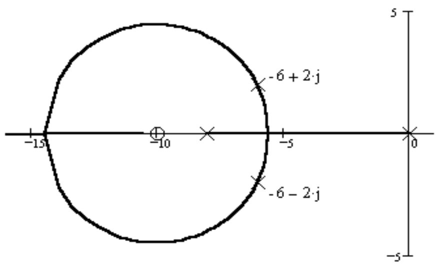
b)




c)




d)

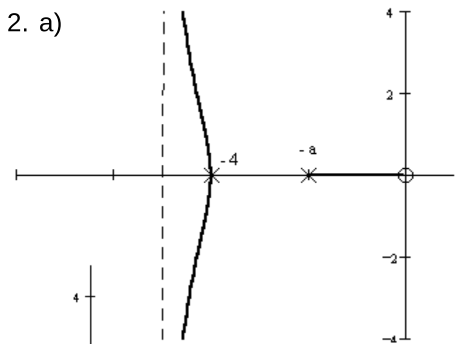



e) $-6 + 2\cdot j$

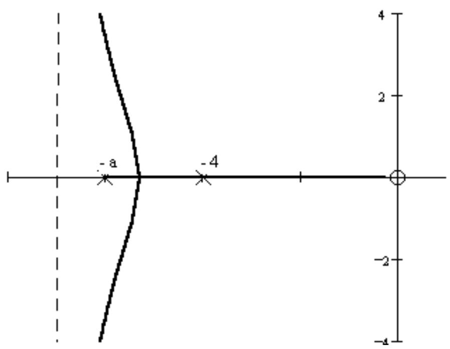
$-6 - 2\cdot j$

see b, above and d, at left

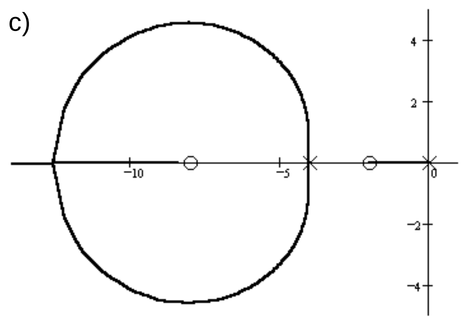
2. a)




b)




c)



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