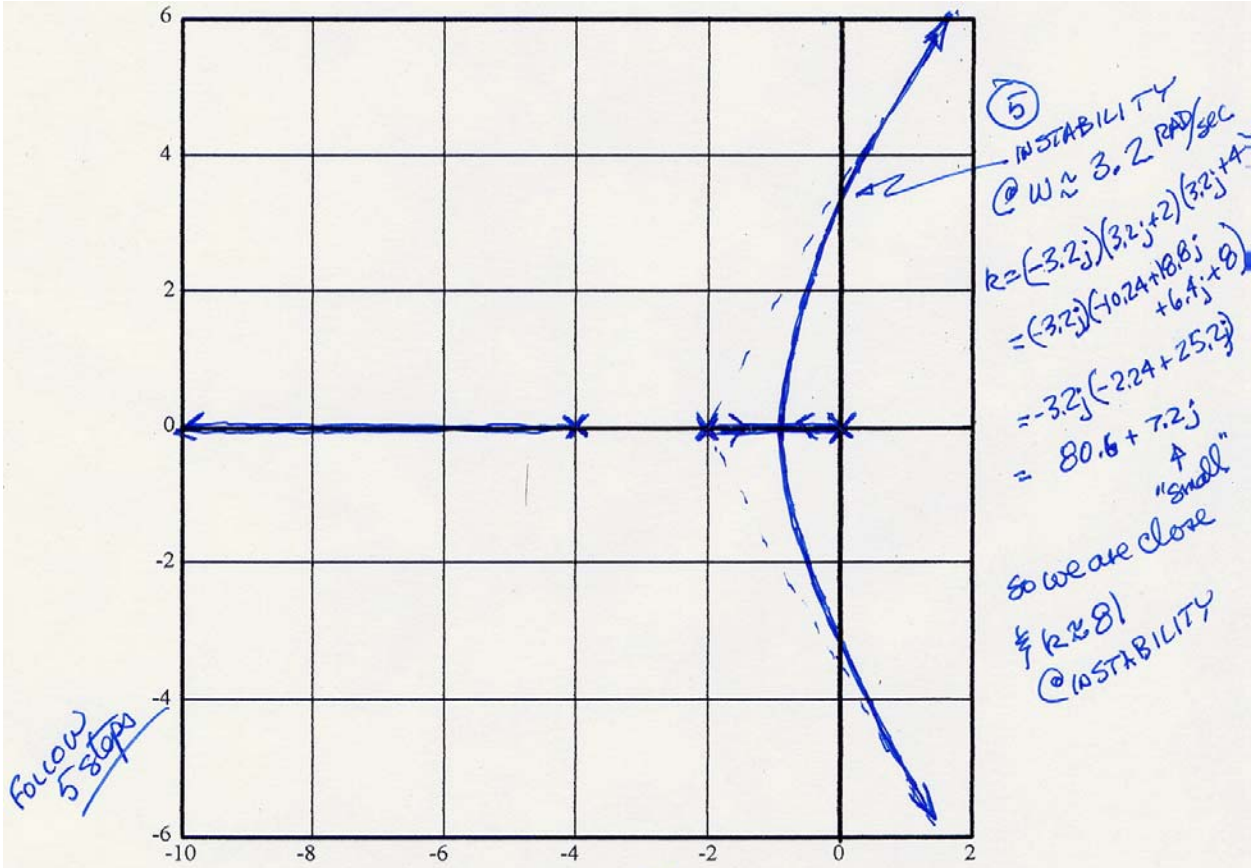
(25 pts) 3.For an open-loop system transfer function, $kG(s)H(s) = k\dfrac{1}{s(s+2)(s+4)}$ plot the root locus diagram on the axes below for $0 < k < \infty$. When they exist, show features such as asymptotes, breakaway points, angles of departure, instability frequencies, etc.



(1) PLOT OPEN-LOOP POLES (NO ZEROS IN TF)
(2) ASYMPTOTES: $n = n_p - n_z = 3-0 = 3$ @ $\pm 60°, 180°$ FROM C.G. @ $\dfrac{(0-2-4)-(0)}{3-0} = \dfrac{-6}{3} = -2$
(3) ROOT LOCUS ON REAL AXIS TO THE LEFT OF AN ODD # OF POLES & ZEROS
ROOT LOCUS LEAVES FROM OPEN-LOOP POLES
(4) BREAKAWAY POINT BETWEEN s=0 AND s=-2 AT LOCAL MAXIMUM k

s	$k = -s(s+2)(s+4)$	
0	$k = 0(2)(4) = 0$	
-0.5	$k = 0.5(1.5)(3.5) = 2.63$	← MAX k
-1.	$k = (1)(1)(3) = 3.00$	SLIGHTLY ~~LESS THAN~~ TO THE LEFT OF -1
-1.5	$k = (1.5)(0.5)(2.5) = 1.875$	
-2	$k = (2)(0)(2) = 0$	

/25 pt's