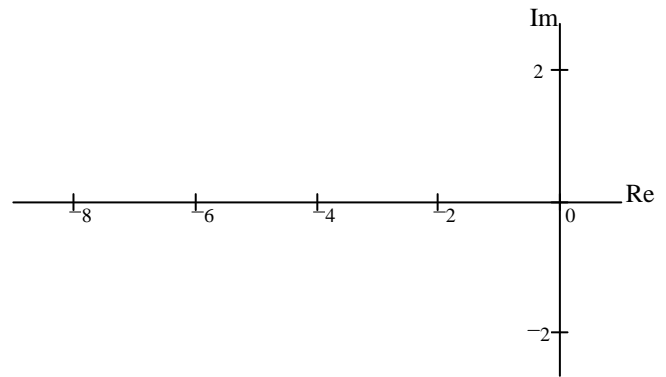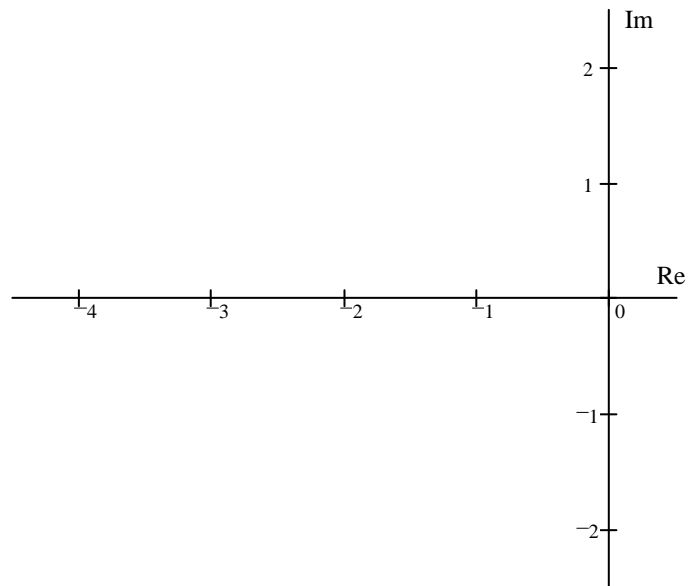1. Sketch (by hand) the root-locus plots for the following open-loop transfer functions:
   Show work.
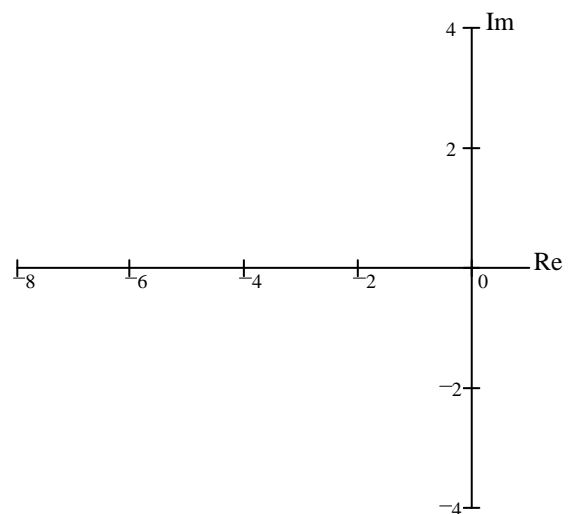
a) $G(s) = \dfrac{s+3}{s\cdot(s+6)}$

b) $\dfrac{4}{s\cdot(s+3)}$
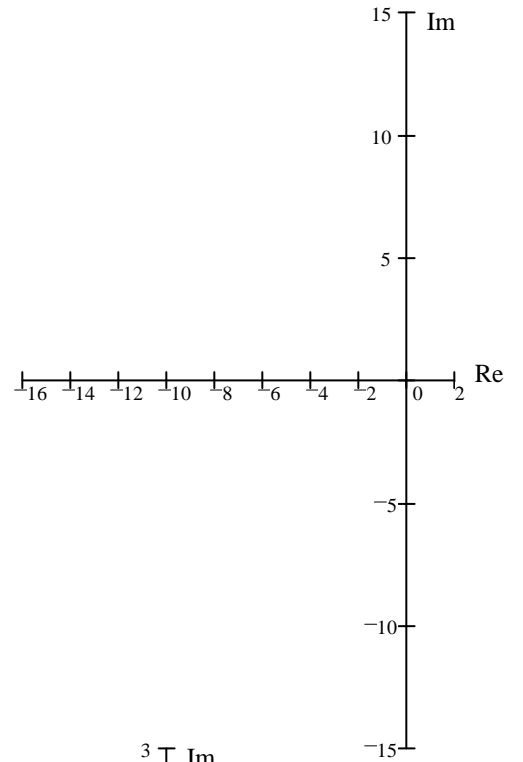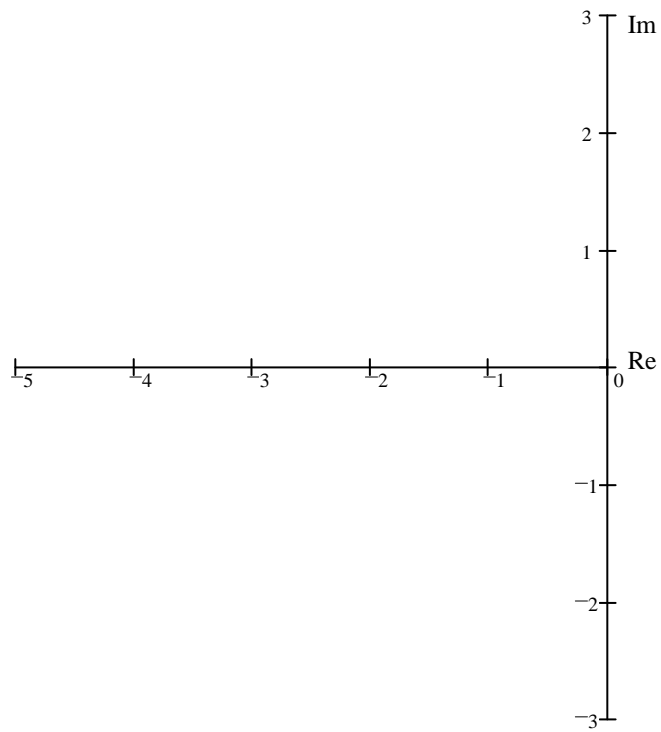
c) $\dfrac{1}{s\cdot(s+2)\cdot(s+4)}$

d) $\dfrac{s+7}{s\cdot(s+2)\cdot(s+4)}$

15 ┬ Im

10 ┼

5 ┼

Re

16 14 12 10 8 6 4 2 0 2

−5┼

−10┼

−15┴

e) $\dfrac{2s+6}{s\cdot(s+2)\cdot(s+4)}$

3 ┬ Im

2 ┼

1 ┼

Re

−5 −4 −3 −2 −1 0

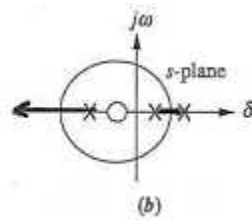−1┼

−2┼

−3┴

f) $\dfrac{8}{(s+2)^3}$

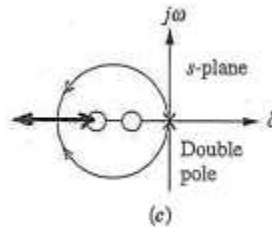Im ┬

2 ┼

Re

−6 −4 −2 0

−2┼

−4┴
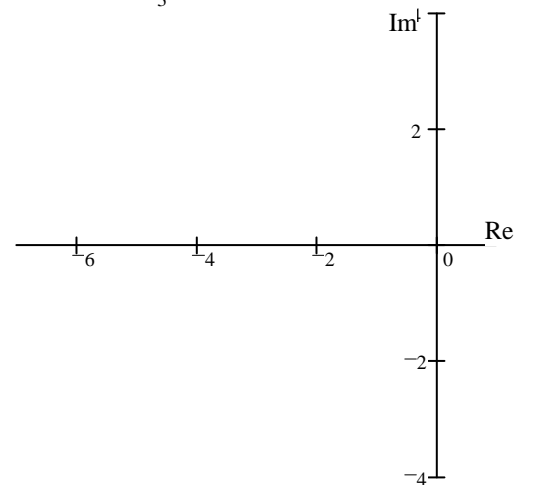
2. Nise **6th** ed., Ch.8, problem 1. For each of the root loci shown below, tell whether or not the sketch can be a valid root locus, if not, explain why not. Give *all* the reasons (you may circle the disqualifying issues on the drawings below).

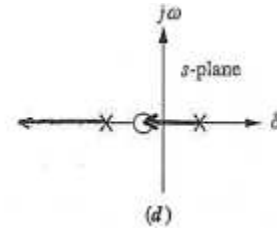(a)   (b)   (c)   (d)

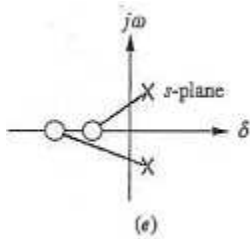a) No: Not symmetric; RL on real axis to left of an even number of poles and zeros

b) No: RL on real axis to left of an even number of poles and zeros. Violates real-axis rule.

c) No: RL on real axis to left of an even number of poles and zeros. Violates real-axis rule.

d) Yes

(e)   (f)   (g)   (h)

e) No: Not symmetric; RL not on real axis to left of odd number of poles and/or zeros

f) Yes

g) No: Not symmetric; real axis segment is not to the left of an odd number of poles

h) Yes

3. Nise, Ch.8, problem 2. Sketch the general shape of the root locus plot of each of the open-loop pole-zero plots shown below. Since ther are no numbers, you may have to estimate a centroid location.

a)

b)

c)

d)

e)

f)

Answers

1. a)

b)
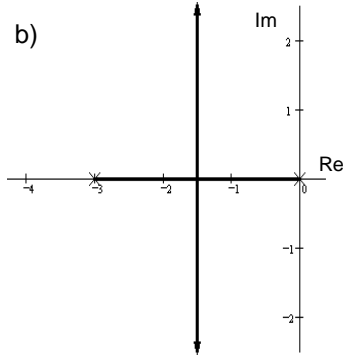
c)
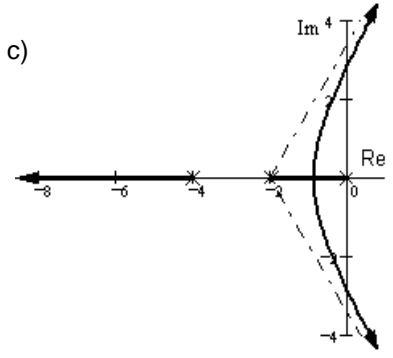
d)
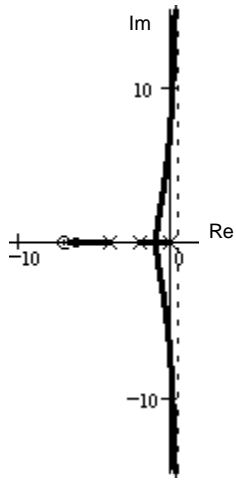
e)

f)

2. a) No: Not symmetric; RL on real axis to left of an even number of poles and zeros
   b) No: RL on real axis to left of an even number of poles and zeros. Violates real-axis rule.
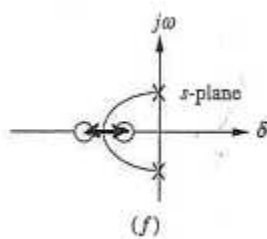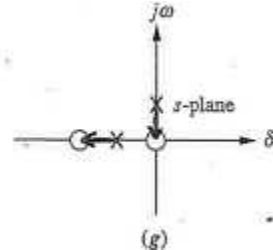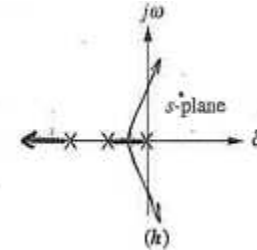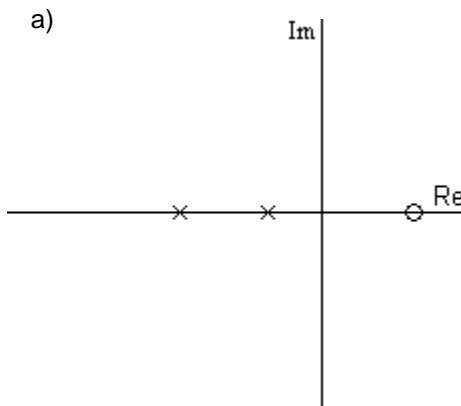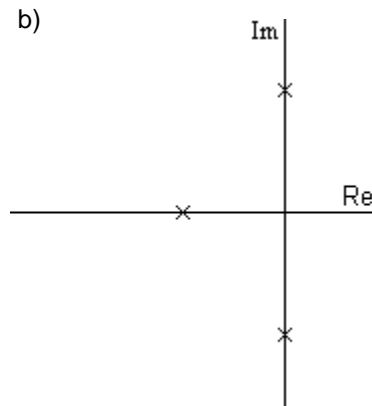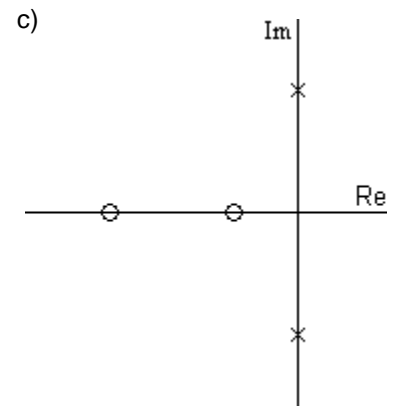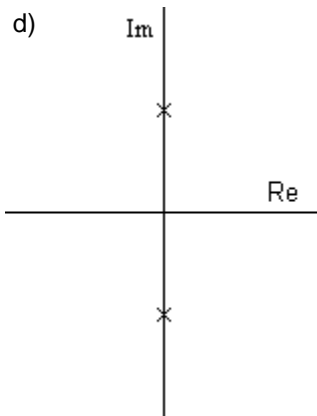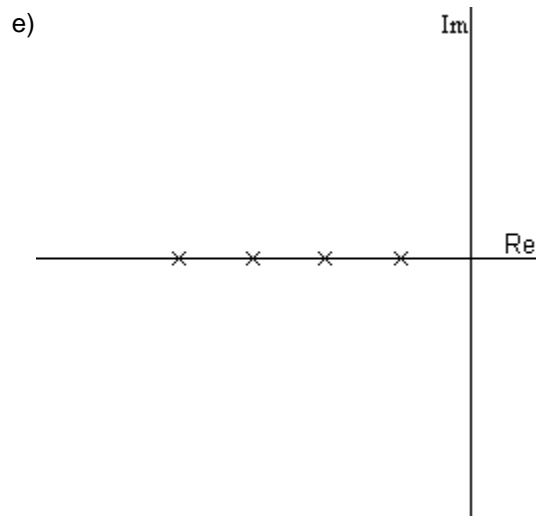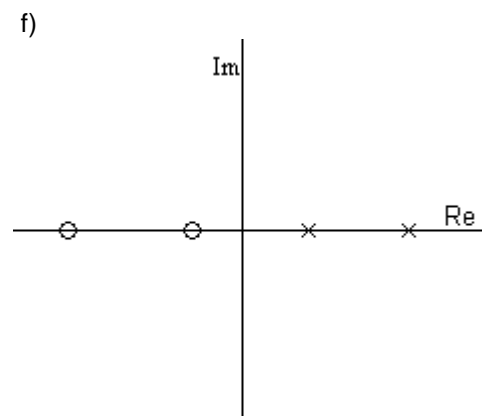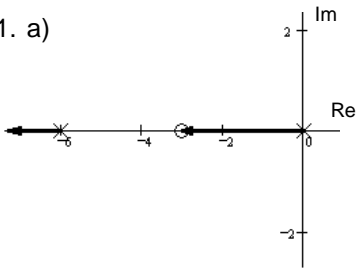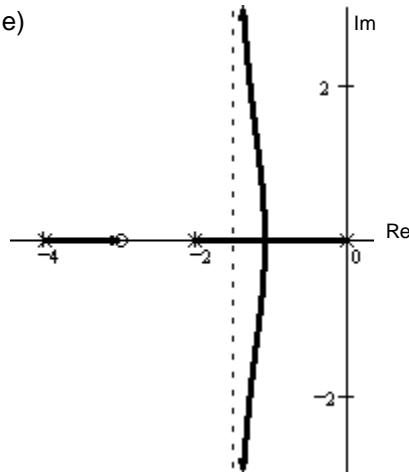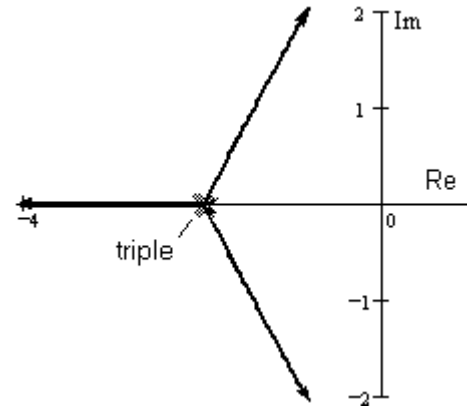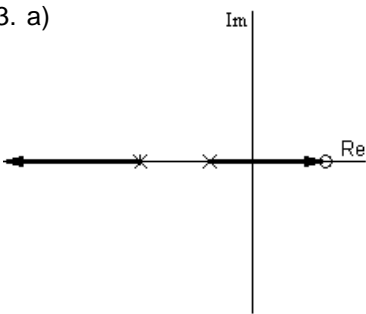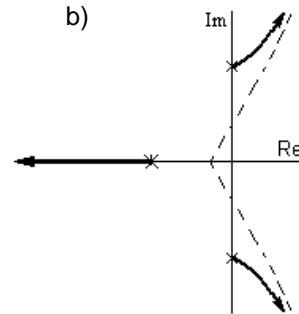   c) No: RL on real axis to left of an even number of poles and zeros. Violates real-axis rule.
   d) Yes
   e) No: Not symmetric; RL not on real axis to left of odd number of poles and/or zeros
   f) Yes
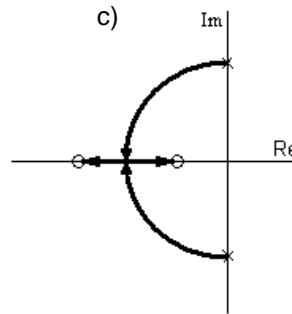   g) No: Not symmetric; real axis segment is not to the left of an odd number of poles
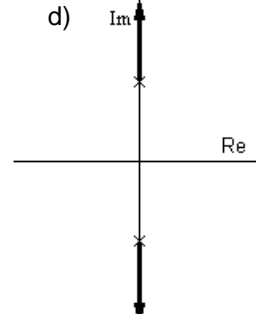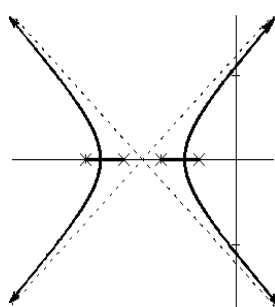   h) Yes

3. a)

b)

c)

d)

e)

f)