University of Notre Dame

Aerospace and Mechanical Engineering

AME 437: Control Systems Engineering
Homework 9 Solutions

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1. I did this problem in class.
2. Using Matlab

```
>> rlocus([1 4],[1 2 0])
```

provides Figure 1.

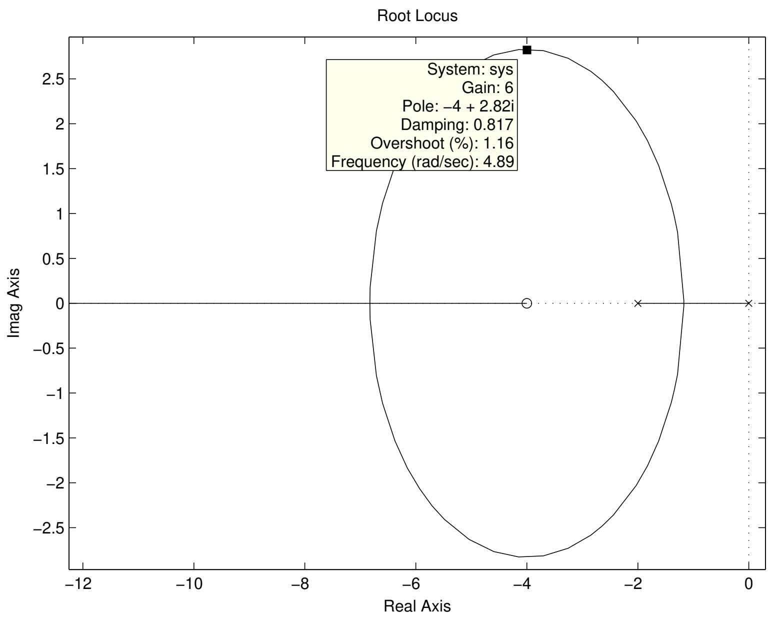

Figure 1. Root locus plot for problem 2.

Picking the indicated point, $s = -4 + 2.82i$ (and already knowing the answer is 6), observe

$$\|K\| = \frac{\|s+p_1\|\|s+p_2\|}{\|s+z_1\|} = \frac{\sqrt{(4-2)^2+2.82^2}\sqrt{4^2+2.82^2}}{2.82} = 6,$$

which is simply measuring the length of the lines in Figure 2.

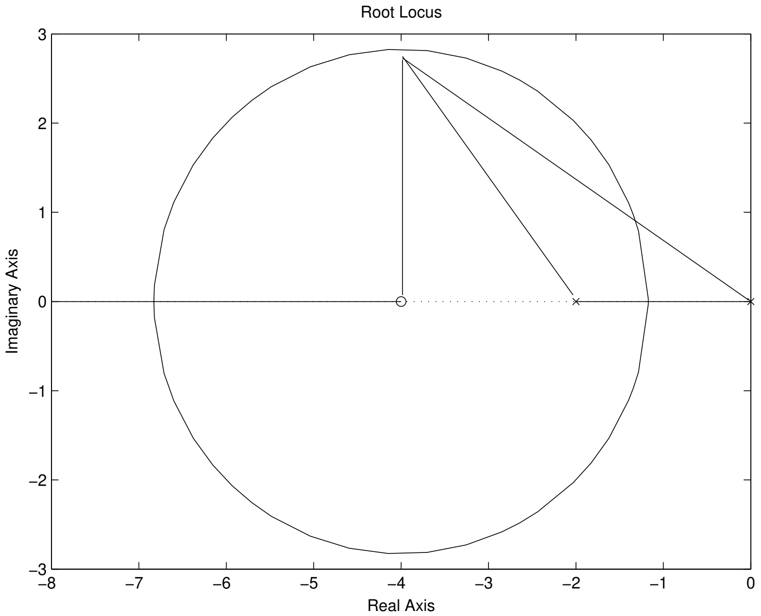

Figure 2. Magnitude criterion for problem 2.

3. Theodore Roosevelt:

$$2003 - \frac{3000000000}{60 \times 60 \times 24 \times 365} = 2003 - 95.13 = 1908.$$