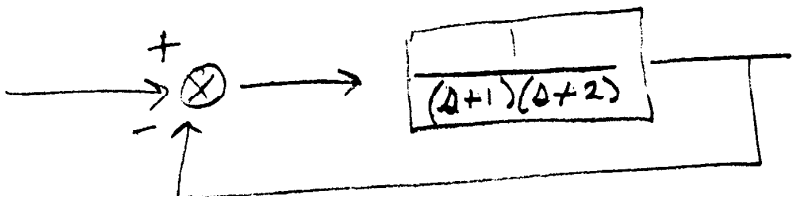
ECE 365 / ME 442 Q10 08/10/00

KEY

Design a Lead Controller so that this system has 10% OS a is Ts.



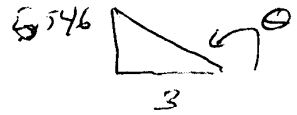

Hint: The Desired closed-loop poles are

$$-4 \pm j5.546$$

I Choose to cancel the pole at (s+2). my controller is

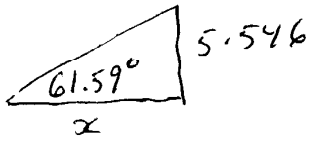
$\frac{K(s+2)}{s+p}$ use angle criterion to find p

angle from pole at −1 to $-4 + j5.546$




$\theta = 118.41°$ therefore

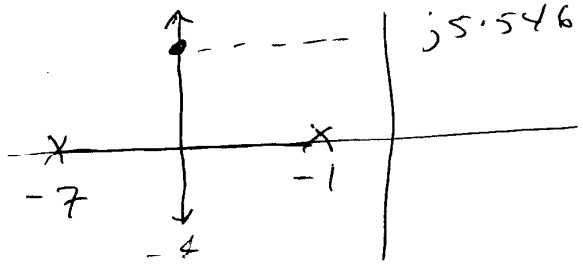
$\phi p = 180 - 118.41° = 61.59°$




$x = 3$ and p is at $-7$

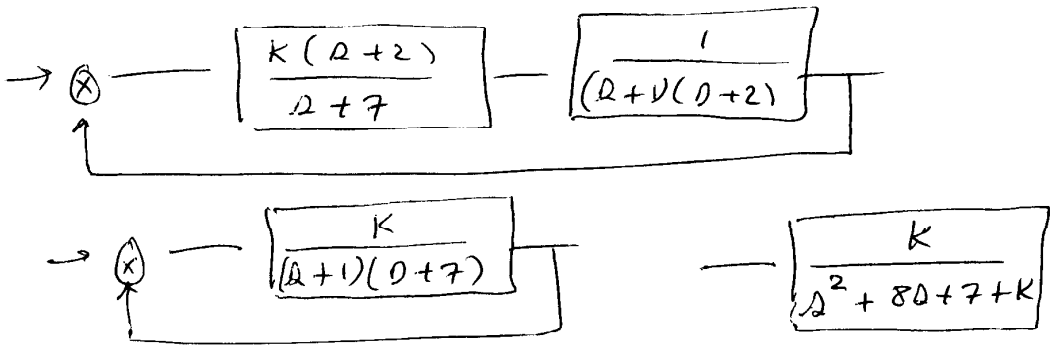
$$\frac{K(s+2)}{(s+7)}$$

HET – Q10
Cont'd




Find K:

Closed loop TF found via Simplification




roots at $\frac{-8 \pm \sqrt{64-4(7+K)}}{2} = -4 \pm \frac{\sqrt{36-4K}}{2}$

$= -4 \pm j5.546$

So $\frac{\sqrt{36-4K}}{2} = 5.546j$ $\quad \sqrt{36-4K} = 11.0192j$

$36-4K = -123.03$

$K = 39.76$

Controller

$$\frac{39.76(s+2)}{(s+7)}$$

KEY - Q10

Con't (2)

OR use magnitude criterion

$$K = \frac{\prod |s - p_i|}{\prod |s - z_i|}$$

$$= \frac{|-4+j5.546-(-2)|\,|-4+j5.546-(-7)|}{1}$$

$$= |-3+j5.546|\,|3+j5.546|$$

$$= 6.3054 \cdot 6.3054$$

$$= 39.76$$