

Name:  
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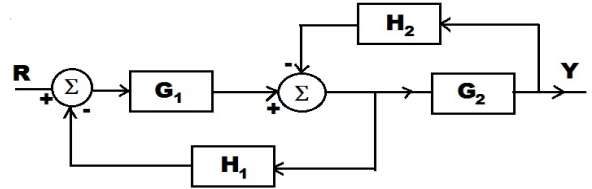
Eskişehir Osmangazi University - Electrical Engineering Department  
Fundamentals of Control Systems  
1st Midterm Examination - Spring 2014

All answers must be written in the appropriate neighborhoods of the questions. Anything written elsewhere will not be graded. Use the back side of the exam sheet if you need scratch paper.

**Question 1.**

[30 pts.] Let  $G_1(s) = G_2(s) = \frac{1}{s}$ ,  $H_1(s) = \frac{1}{s+1}$  and  $H_2(s) = \frac{1}{s+2}$ . Obtain the transfer function  $\frac{Y(s)}{R(s)}$ . Fill all boxes below.

$$\frac{Y(s)}{R(s)} = \frac{s^2 + 3s + 2}{s^4 + 3s^3 + 4s^2 + 3s}$$



**Question 2.**

(a) [20 pts] Given  $\dot{x} = 3x + 2u$ ,  $y = 2x$ ,  $x(0) = 4$  and  $u$  is a unit step function. Find  $y(t)$ .

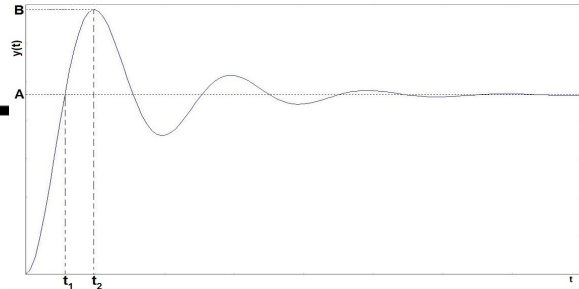
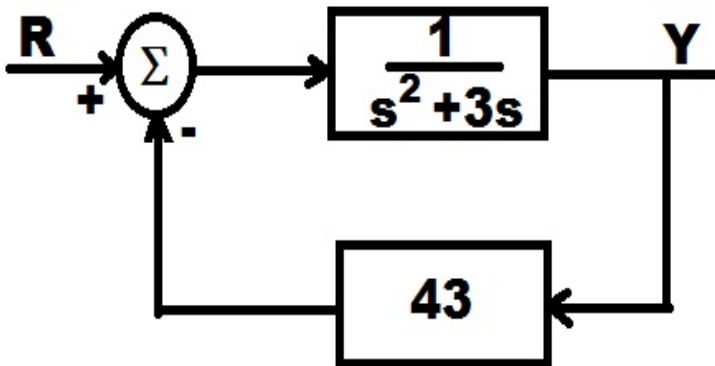
$$y(t) = \frac{28}{3}e^{3t} - \frac{4}{3}$$

(b) [15 pts] Find the transfer function  $\frac{Y(s)}{U(s)}$ . Fill all the boxes below.

$$\frac{Y(s)}{U(s)} = \frac{4}{s-3}$$

**Question 3.**

[35 pts.] Given that  $r(t)$  is a step function with amplitude 20, consider the  $y(t)$  versus  $t$  graph on the right side for the system below. Find  $A$ ,  $B$ ,  $t_1$ , and  $t_2$  values.



$$A = 0.465, \quad B = 0.687, \quad t_1 = 0.283, \quad t_2 = 0.487$$

Good Luck  
A. Karamancioğlu