This tutorial, leading into assignment 2, has two main goals: become proficient at using the Laplace transform; and understanding more about sensors, an important

**Question 1 [4]**

Partial fraction expansion is a topic you have learned about in your prior high school and university math courses. 

\[ Y(s) = \frac{s + 5}{(s + 1)(s + 4)} = \alpha_1 \frac{1}{s + 1} + \alpha_2 \frac{1}{s + 4} \]

\[ \alpha_1 = \quad \alpha_2 = \]

**Question 2 [8]**

Another one: 

\[ Y(s) = \frac{1}{s(s + 4)(s + 5)} = \frac{\alpha_1}{s} + \frac{\alpha_2}{s + 4} + \frac{\alpha_3}{s + 5} \]

\[ \alpha_1 = \quad \alpha_2 = \quad \alpha_3 = \quad \mathcal{L}^{-1}[Y(s)] = y(t) = \]
This flowsheets shows the process where liquid butane is vapourized and combined with compressed air. You can see the butane holding tanks at 19 seconds into this YouTube video: http://bit.ly/19D2xrK

1. Identify 5 types of sensors in the flowsheet.

2. The aim is to control composition of butane, A₁, very close to, but below the combustion limit, in the stream entering the reactor. This is a safety-critical control loop, so you must be able to move away from the combustion limit constraint fast if you get close to it! Which valve should you use?

Answers:

1. (a) 
   (b) 
   (c) 
   (d) 
   (e) 

2. I decide to use value valve ______ . If we open this valve, there us a causal effect on A₁ because it will ____________ (raise/ lower) the percentage of butane entering the reactor. Now explain below, giving several reasons, why you selected the valve.