1) Find the Laplace transform of the following function.

\[ u(t) = \begin{cases} 
  t & 0 \leq t < 1 \\
  t - 2 & 1 \leq t < 2 \\
  0 & 2 \leq t < \infty
\end{cases} \]

2) Find the transfer function of the following Closed Loop system.

3) For the closed loop system given below, what is \( y(\infty) \) and DC gain of the system?

4) Many luxury automobiles have thermostatically controlled air conditioning systems for the comfort of the passengers. Sketch a block diagram of an air-conditioning system where the driver sets the desired interior temperature on a dashboard panel. Identify the function of each element of the thermostatically controlled cooling system.

Each question has equal weighting. You can use your auxiliary equation sheets, yet no examples are allowed on it.
1) 
\[ U(s) = \frac{1}{s^2} - \frac{2}{s} e^{-s} - \frac{1}{s^2} e^{-2s} \]

2) 
\[ \frac{Y(s)}{R(s)} = \frac{CGH}{1 + H} \frac{CGH}{1 + H + CGH} = \frac{C.G}{H + 1} \frac{x}{l + H + CGH} \]

3) 
\[ \frac{Y(s)}{R(s)} = \frac{1}{s} \left[ \frac{16}{s + 0.8} \left[ 1 + \frac{9.16}{s + 0.8} \right] \right] = \frac{16}{[s(s + 0.8)]} \frac{16}{1 + \frac{32}{s + 0.8} + \frac{16}{s(s + 0.8)}} \]

\[ Y(s) = \frac{16}{s^2 + 3.8s + 16} \]

4) 
\[ \text{Diagram of a control system} \]

DC Gain = \lim_{s \to 0} \frac{Y(s)}{R(s)} = 1 \quad \text{(10)}

Tr inner temperature
To outside
Tr is reference
U is control action
Q is heat generated by heater and released to the car inner environment.