MATH440 PA Tuesday Week 2

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1 Equilibrium Temperature Distributions

The equilibrium temperature distribution, $u(x)$ (which does not depend on time), can be represented as a line connecting the boundaries of a system. In our example, the boundaries are both ends of the rod $u(0) = T_1$ and $u(L) = T_2$, where T_n is the temperature of the rod at an arbitrary x value. In class we found that: $u(x) = \left(\frac{T_2 - T_1}{L}\right) x + T_1$, where the slope $\frac{T_2 - T_1}{L}$ represents the temperature gradient of the rod. If $T_1 = T_2$, then the slope is zero resulting in a flat line across the rod (rod has a uniform temperature). If $T_1 < T_2$, then the slope of the line is positive, resulting in an increasing line from left to right (rod is warmer toward the right boundary). If $T_1 > T_2$, then the slope of the line is negative, resulting in a decreasing line from left to right (rod is warmer toward the left boundary). Below are three diagrams that showcase these distributions: