Math 404, Fall 2020
Homework #2

1. The calculation that leads to the heat equation on Slide #10 assumes implicitly that the rod's cross-sectional area A is a constant. What form will the heat equation take if A varies with x.

2. An internal heat source produces thermal energy at the rate of $f(x,t)$ per unit mass per unit time. (That can be due to chemical reactions, or electrical current, for instance.) Modify the heat equation to account for the heat source.

3. We have assumed an insulated boundary along the length of the conducting rod. Repeat the calculations by allowing heat to escape from the lateral boundary at a rate $s = \sigma\left[u(x,t) - u_\infty\right]$ per unit length per time, where u_∞ is the (constant) ambient temperature surrounding the rod.

4. The analysis of the case $\eta = 0$ at the bottom of slide #17 was left as an exercise. You do it now.

5. Do problem #4 on page 41 of the textbook.

6. Do problem #6 on page 42 of the textbook.