Math 440 Exam 1 Practice Test

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1 Heat / Diffusion Derivation (Assume the $\int$ Method)

1.0.1 Derive the 1d heat equation without sources or sinks, such that c, ρ are constant.

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1.0.2 Derive the 1d heat equation with sources or sinks, such that c, ρ are constant.

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1.0.3 Derive the 1d heat equation without sources or sinks, such that c, ρ are not constant.

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1.0.4 Derive the 2d heat equation without sources or sinks, such that c, ρ are constant.

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1.0.5 Derive the 3d heat equation without sources or sinks, such that c, ρ are constant.

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1.0.6 What is the difference between the heat diffusion derivation and the diffusion derivation?

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2 State and Explain the Physical Meaning of the Following BCs

2.0.1 Prescribed Temperature: at $x = 0$, $u(0,t) = u_\beta(t)$.

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2.0.2 Prescribed Flux: $-K_0(0)\frac{\partial u}{\partial x}(0,t) = \phi(t)$

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2.0.3 Newton's Law of Cooling: $K_0(0)\frac{\partial u}{\partial x}(0,t) = -H[u(0,t) - u_\beta(t)]$

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3 Find an Equilibrium Temperature Distribution for a 1D Rod with a Given Q and Specified BCs

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4 Find an Equilibrium Temperature Distribution; For What β Does the Steady State Exist?

4.0.1 (1.4.7) Parts a-d

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5 State & Explain

5.0.1 Fourier's Law

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5.0.2 Fick's Law

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