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1. Linear algebraic equations can arise in the solution

of differential equations. For example, the following heat

equation describes the equilibrium temperature

T = T(x)(oC)

at a point x (in meters m) along a long thin **rod**,

d2T/dx2 = h′(T − Ta), (1)

where Ta = 10oC denotes the temperature of the surrounding

air, and h′ = 0.03 (m−2) is a heat transfer coefficient. Assume

that the rod is 10 meters long (i.e. 0 ≤ x ≤ 10) and has

boundary conditions imposed at its ends given by T(0) = 20oC

and T(10) = 100oC.

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a) Using standard ODE methods, which you do not need to repeat here,

the general form of an analytic solution to (1) can be derived as

T(x)=A+Beλx +Ce−λx, (2)

where A, B, C, and λ are constants. Plug the solution of type (2)

into both sides of equation (1). This should give you an equation

that must be satisfied for all values of x, for 0 ≤ x ≤ 10, for some

fixed constants A, B, C, and λ. Analyze this conclusion to determine

what the values of **A and λ** must be.

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1m 5 m 10 m

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20oC 100oC

= 0