

### Problem 312C

Heat is being added to the steady, frictionless flow of a perfect gas (ratio of specific heats,  $\gamma$ ) in a pipe of constant, uniform cross-sectional area. The speed of sound and Mach number of the flow are denoted by  $c$  and  $M$  respectively and vary with position,  $x$ , measured along the pipe.

If the rate of heat addition is  $Q$  per unit time per unit length of the pipe and the mass flow rate of gas is denoted by  $m$  find an expression for  $dM/dx$  in terms of  $Q$ ,  $m$ ,  $\gamma$ ,  $c$  and  $M$ .