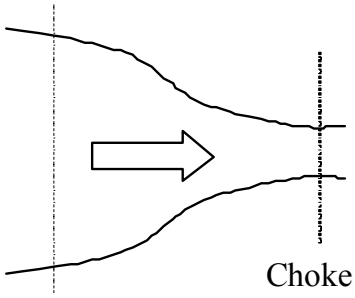
**ECOR 2606 Lab Test #1 v1**

The diagram illustrates a gas flowing through a nozzle. As the cross sectional area of the nozzle gets smaller and smaller, the gas flows faster and faster until, at the choke point, it is flowing at Mach 1 ($M = 1$).




If the Mach number of the flow at some point in the nozzle is known, the cross sectional area at that point can be calculated using the following formula:

$$A = \frac{A^*}{M}\left[\frac{2}{\gamma+1}\left(1+\frac{\gamma-1}{2}M^2\right)\right]^{(\gamma+1)/(2(\gamma-1))}$$

where $A$ is the cross sectional area at the point of interest
$M$ is the Mach number of the flow at this point
$A^*$ is the cross sectional area at the choke point
$\gamma$ is the specific heat ratio for the gas

**Part I (3 marks):**

Write a function m-file (area.m) that, given $M$, $A^*$, and $\gamma$ (gamma), computes and returns $A$. The formula is only valid for $0 < M <= 1$. If $M$ is outside of this range your function should generate an error.

**Part II (7 marks):**

The steps required to solve this part should be placed in a script m-file (script.m).

Assume $A^* = 0.01\ m^2$ and $\gamma = 1.4$.

**** Note **** Your are expected to make use of the function you produced in part I instead of re-implementing the equation within your script file. If you find it necessary to re-implement the equation you may do so but students who do this will not earn full marks.

i) Produce two plots (figures 1 and 2) of $A$ vs $M$ for $M$ from 0.1 to 1. Produce one plot using function *fplot* and the other using function *plot*).

ii) What is the Mach number of the flow at the point in nozzle where $A = 0.03\ m^2$? Determine a precise answer (graphical solutions are NOT acceptable) and output it using function *fprintf*.