Which of the following renders the isentropic relations invalid.

1. **Flow is unsteady**
2. **Velocity is very large**
3. *** Gas is non-perfect**
4. **Changes between states 1 and 2 are finite (rather than infinitesimal)**
5. **Not sure**

Which of the following is NOT an example of a δw or a δq process?

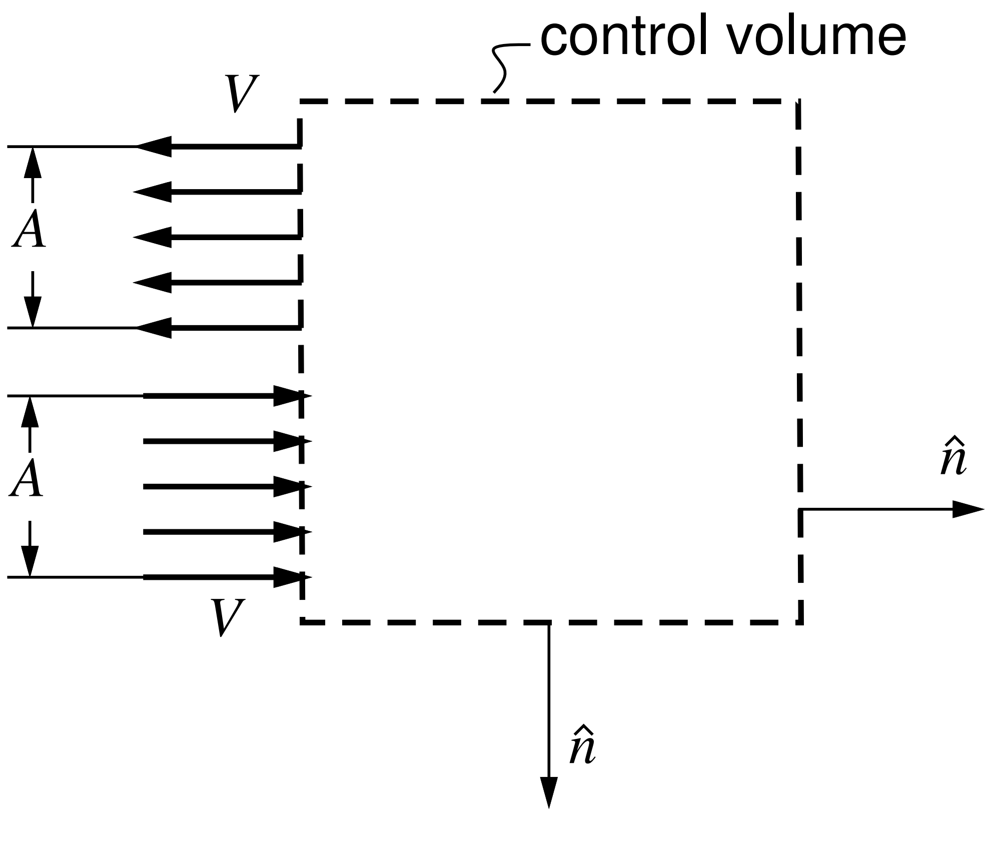
1. **Bit of fuel inside CV ignites**
2. *** Gravity acts on descending CV**
3. **Friction acts along motion of CV**
4. **Pressure acts on contracting CV**
5. **Not sure**

Note:
Only static internal energy changes were being considered, not kinetic energy changes

Two fluid jets of the same density ρ and internal energy e flow as shown. What is the internal energy flow integral for the control volume?

$$\iint \rho \left(\vec{\mathbf{V}} \cdot \hat{\mathbf{n}}\right) \mathbf{e}\, \mathbf{dA}$$

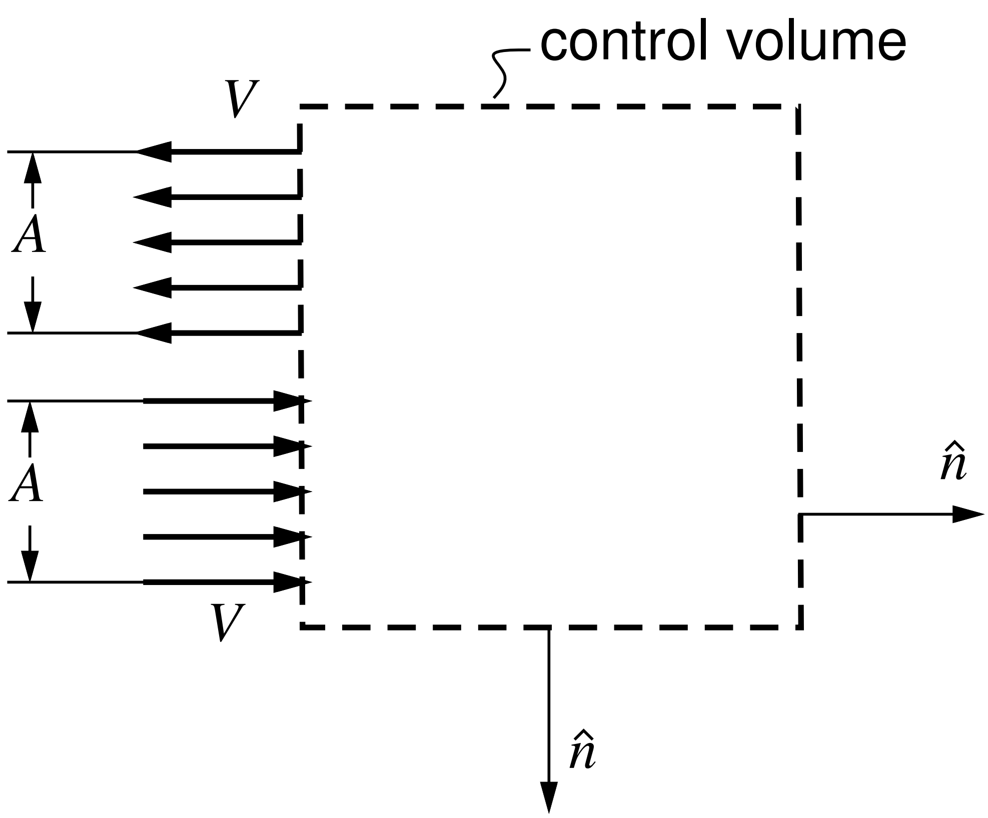
1. $\mathbf{2\rho VA\, e}$
2. $\mathbf{-2\rho VA\, e}$
3. *** 0**
4. **not sure**



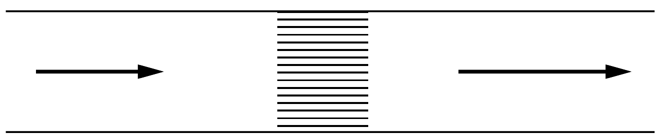
Two fluid jets of the same density ρ flow as shown. What is the kinetic energy flow integral for the control volume?

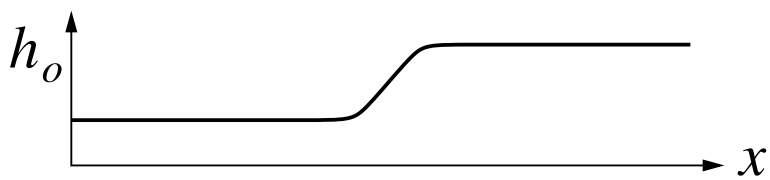
$$\iint \rho \left(\vec{\mathbf{V}} \cdot \hat{\mathbf{n}}\right) \frac{1}{2} \mathbf{V^2} \, \mathbf{dA}$$

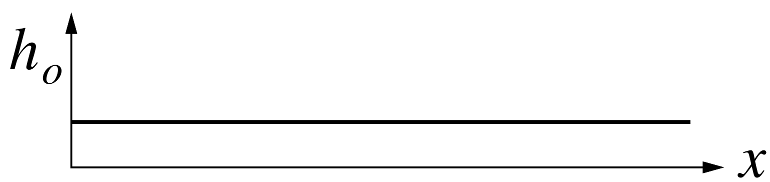
1. $\rho \mathbf{V^3 A}$
2. $-\rho \mathbf{V^3 A}$
3. * 0
4. not sure



Air is forced through a porous plug. What's the expected $h_o(x)$ distribution?



1. 

2. 

3. 

4. Not sure

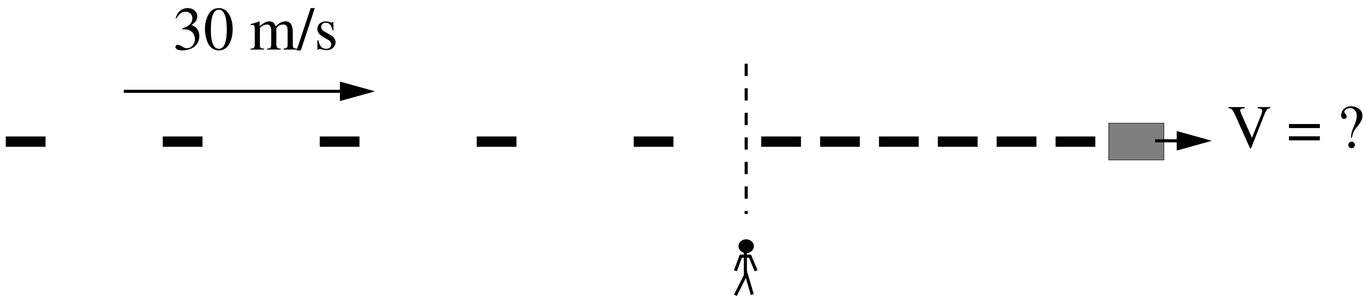
2. *

Air flows out of a nozzle from a pressurized tank at room temperature. The air comes out cold. What is the jet's density relative to ambient?

1. *** Higher**
2. **Same**
3. **Lower**
4. **not sure**

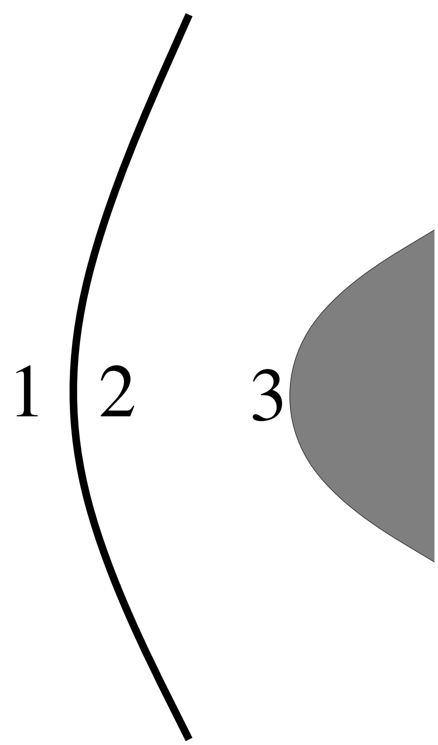
The spacing of the cars is 40m and 4m before and after the "shock". The shock appears stationary to a stopped pedestrian. How fast is the obstructing vehicle moving?

1. **3.3 m/s**
2. *** 3.0 m/s**
3. **2.7 m/s**
4. **not sure**

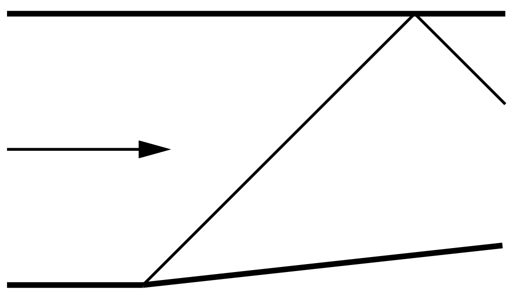


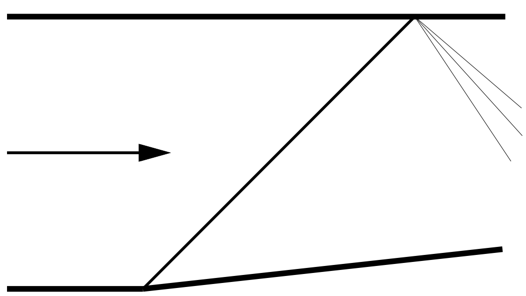
What is true about the temperatures T_1, T_2, T_3, (or enthalpies h_1, h_2, h_3) at the points shown?

1. $T_1 > T_2 > T_3$
2. * $T_1 < T_2 < T_3$
3. $T_1 < T_2 = T_3$
4. Not enough information given
5. Not sure



Which flow pattern is physically correct?

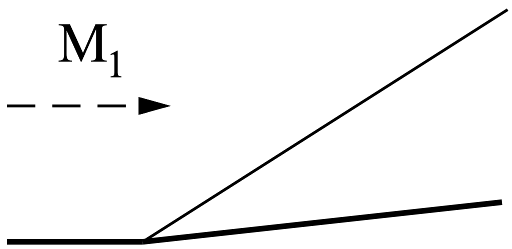
1. 

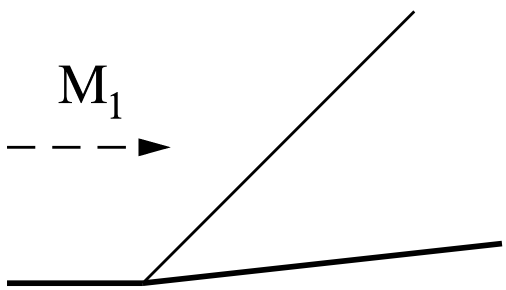
2. 

3. Not sure

1. *

The two flows have the same wall shape. Which flow has a larger M_1 ?

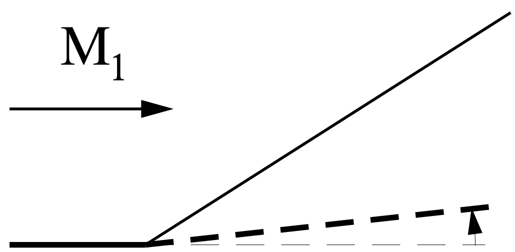
1. 

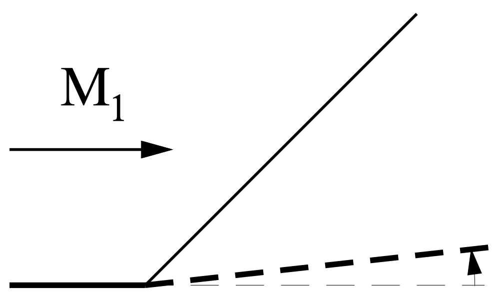
2. 

3. Not sure

1. *

The two flows have the same M_1. Which flow has a larger turning angle?

1. 

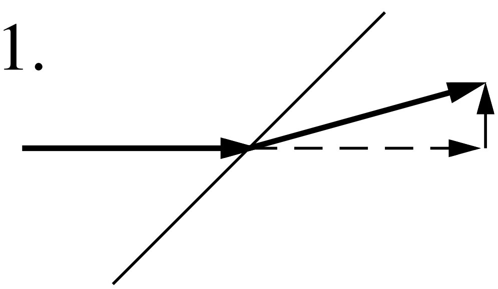
2. 

3. Not sure

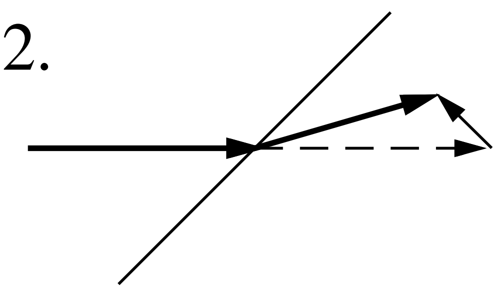
2. *

Which is a physically-possible shock flow?

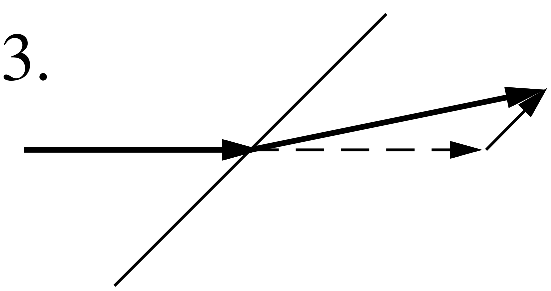
1.



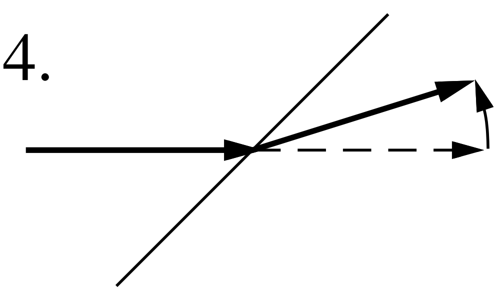
2.



3.



4.



5. All are valid

6. Not sure

2. *

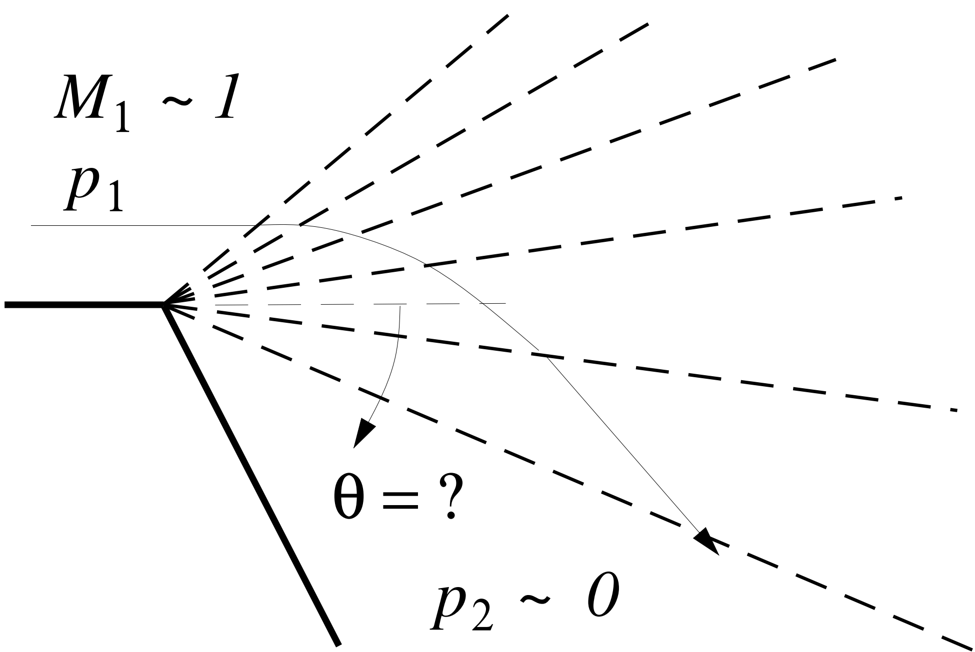
A fan expands from $M_1 \simeq 1$ to near vacuum. Approximately, what is the expected turning angle?

1. $\theta = 45°$

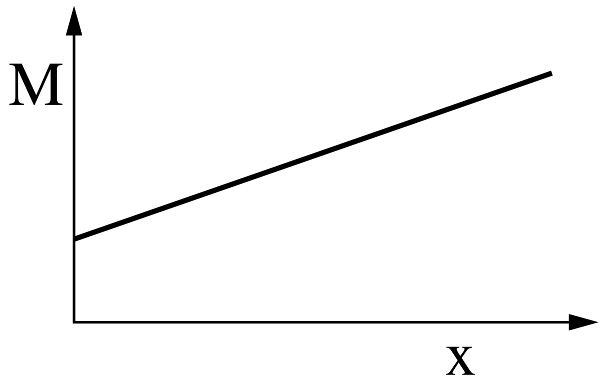
2. $\theta = 90°$

3. * $\theta = 130°$

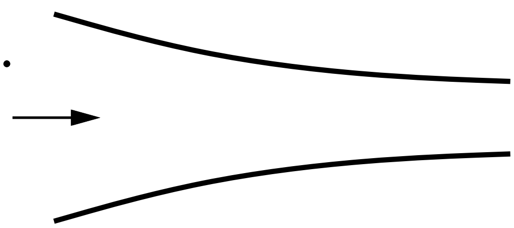
4. **not sure**



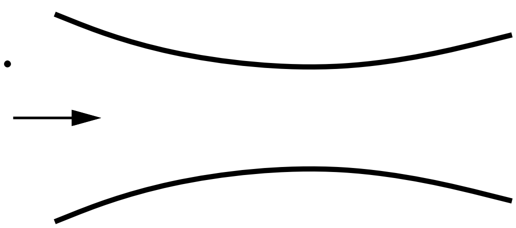
A flow in a duct accelerates smoothly from M = 0.5 to M = 1.5. What must the duct look like?



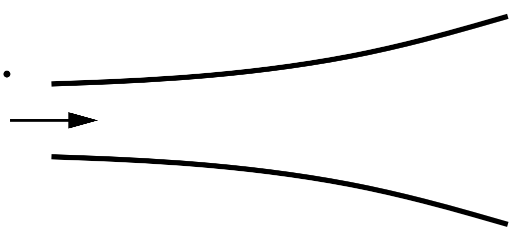
1.



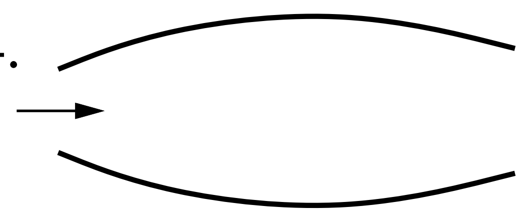
2.



3.



4.



5. Not sure

2. *

Low-speed flow is drawn from a reservoir by the exit pressure p_e.

$$p_r = 100000\,\mathrm{Pa}$$
$$\rho_r = 1\,\mathrm{kg/m^3}$$
$$A = 1\,\mathrm{m^2}$$
$$A_{\mathrm{throat}} = 0.5\,\mathrm{m^2}$$

If $p_e = 99000\,\mathrm{Pa}$, what is $\dot{m}$?

1. $100\,\mathrm{kg/s}$
2. * $45\,\mathrm{kg/s}$
3. $22.5\,\mathrm{kg/s}$
4. **not sure**