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

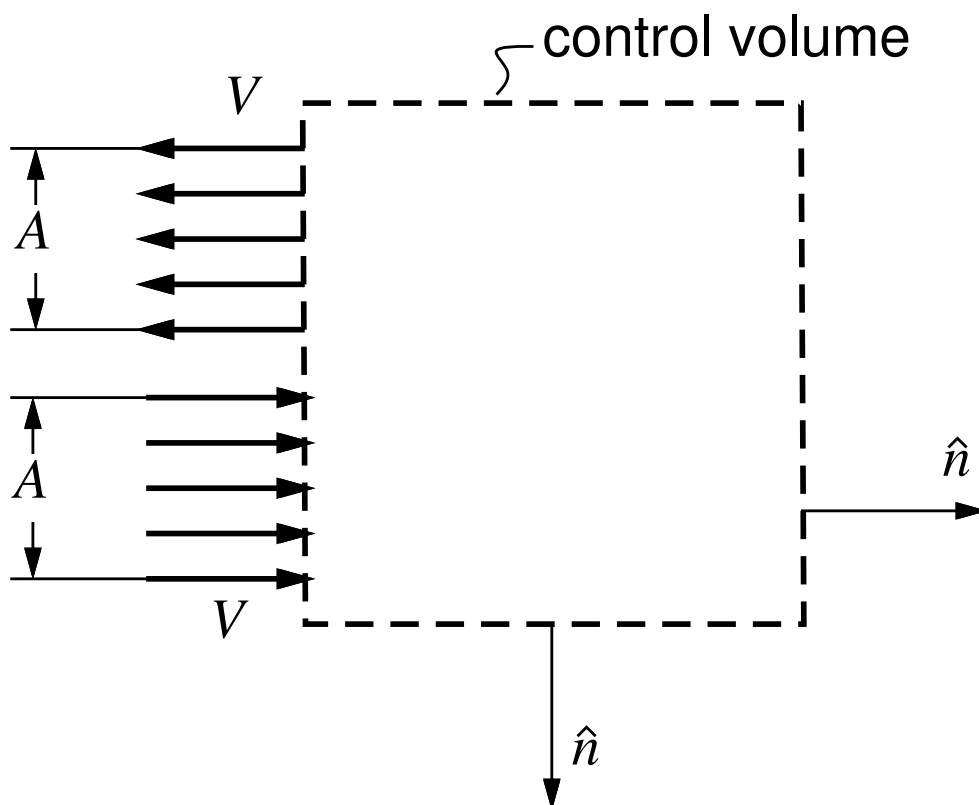4. Pressure acts on contracting CV

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?
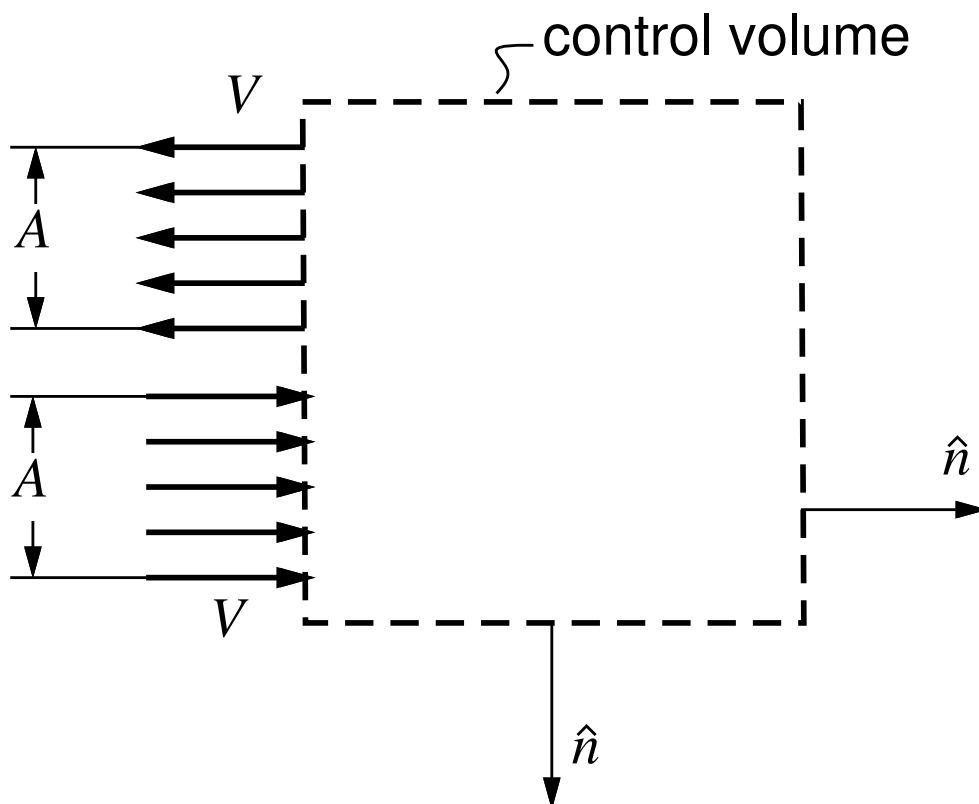
$$\iint \rho\left(\vec{\mathbf{V}}\cdot\hat{\mathbf{n}}\right)\,\text{e}\,d\mathbf{A}$$

1. $2\rho\text{VA}$ e
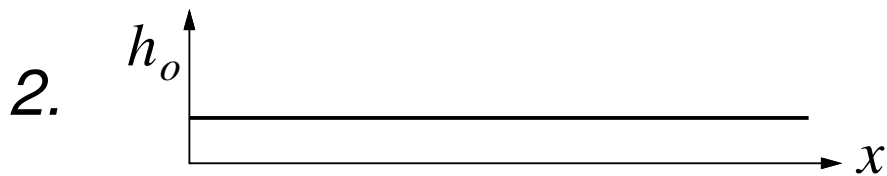
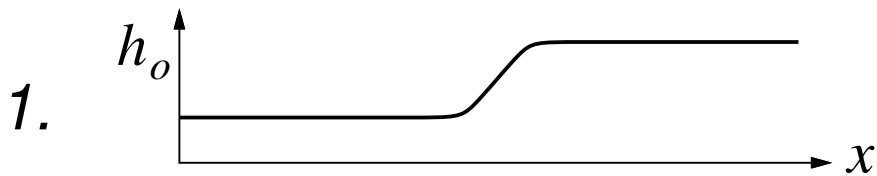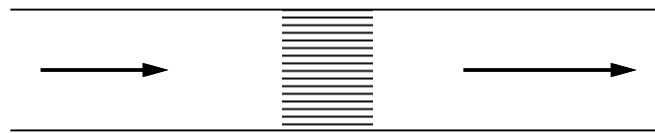2. $-2\rho\text{VA}$ e

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?

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

1. $\rho V^3 A$

2. $-\rho V^3 A$

3. * 0

4. not sure

control volume

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?
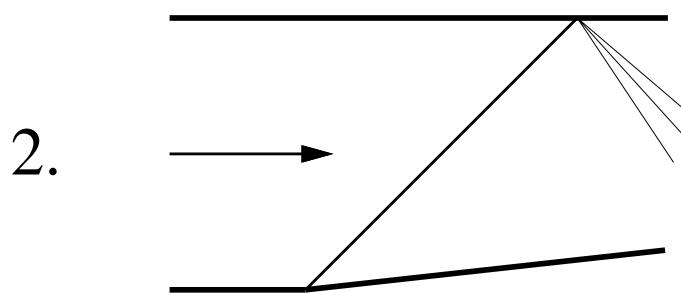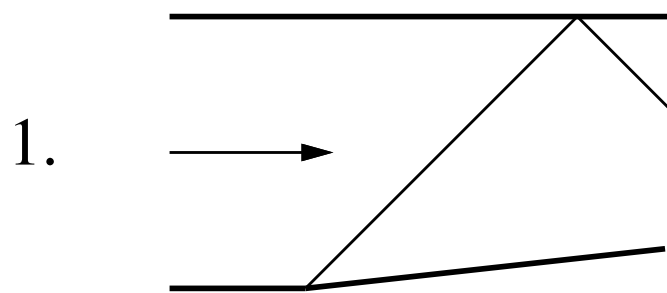
1. 3.3 m/s

2. * 3.0 m/s

3. 2.7 m/s

4. not sure

30 m/s

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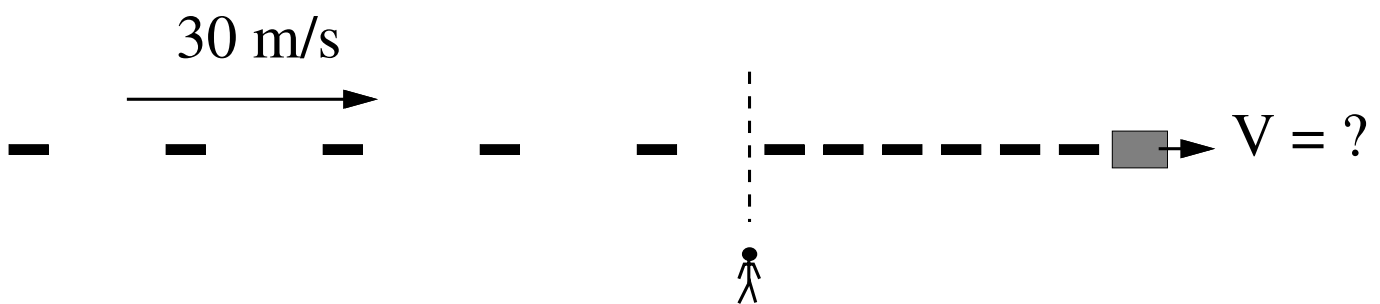
What is true about the temperatures T_1, T_2, T_3, (or enthalpies h_1, h_2, h_3) at the points shown?

1. $T_1 > T_2 > T_3$

2. * $T_1 < T_2 < T_3$

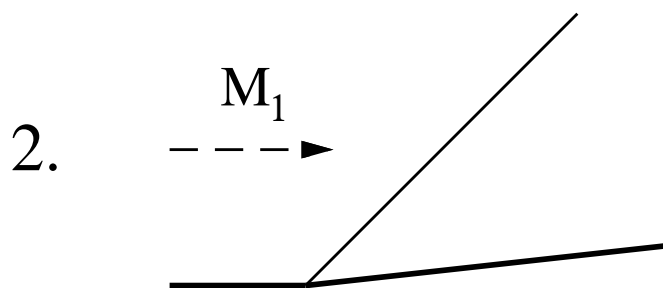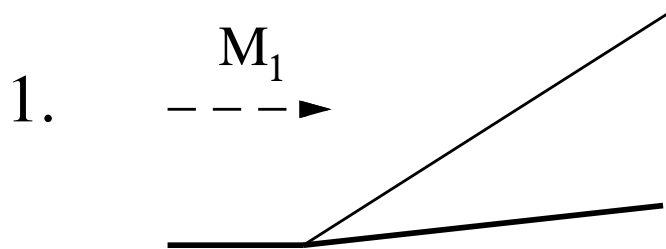3. $T_1 < T_2 = T_3$

4. Not enough information given

5. Not sure

1 2   3
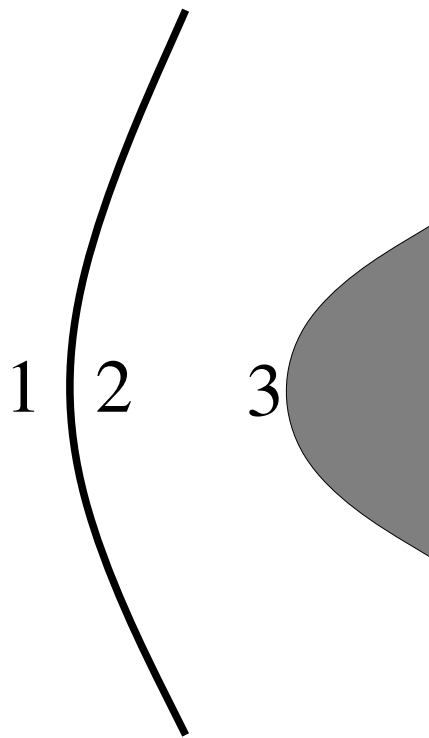
Which flow pattern is physically correct?
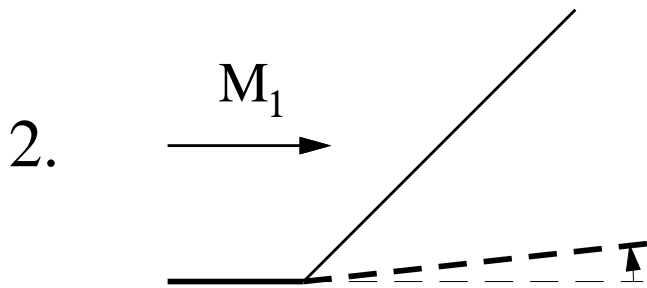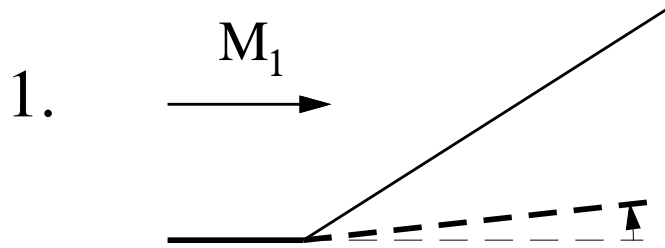
1.

2.

3. Not sure

1. *

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

1. M_1

2. M_1

3. Not sure

1. *

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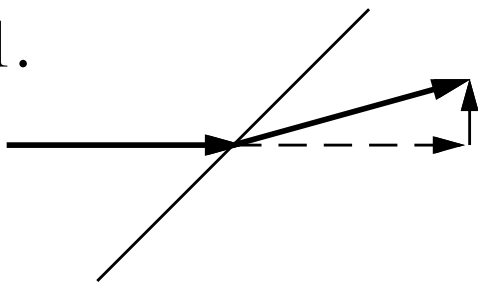
1. M_1

2. M_1

3. Not sure

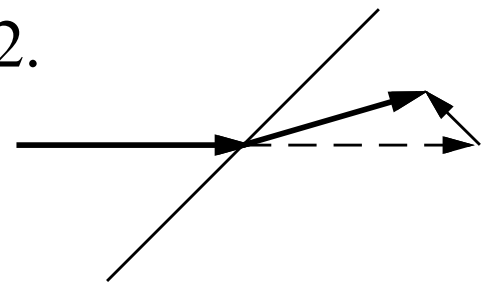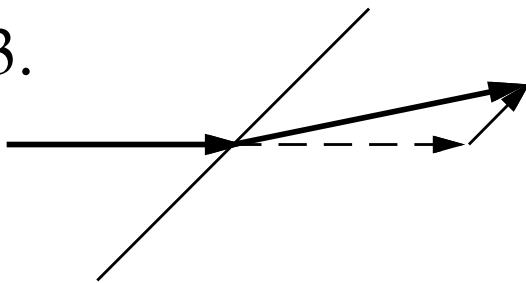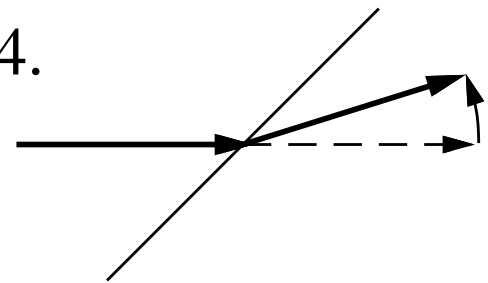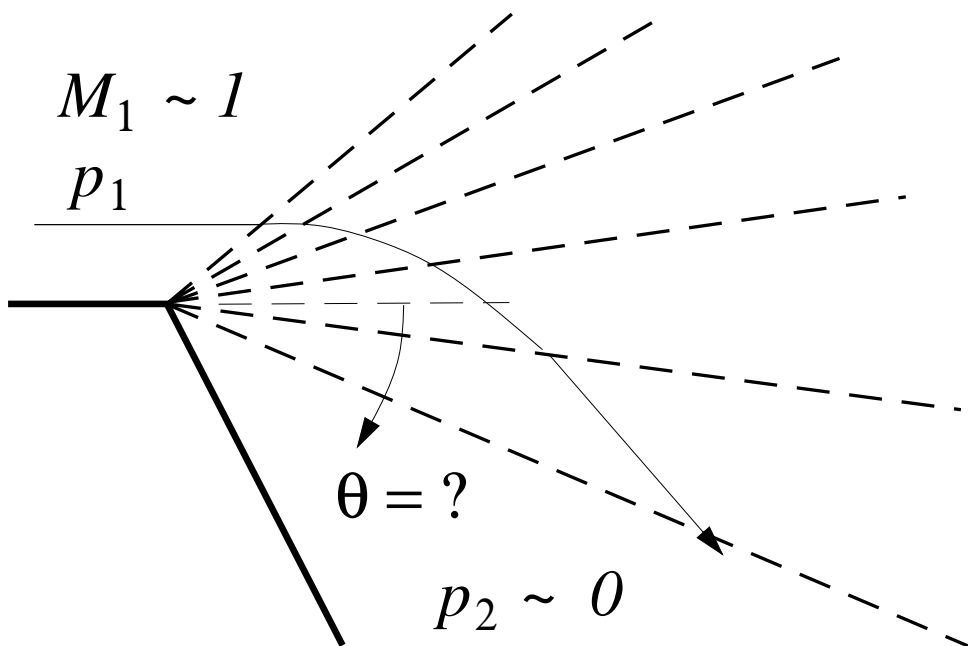**2.** *

Which is a physically-possible shock flow?
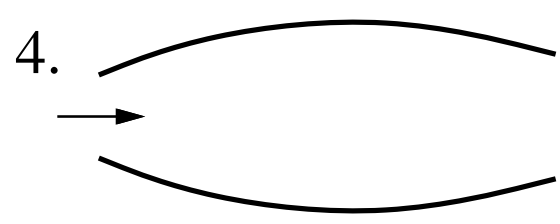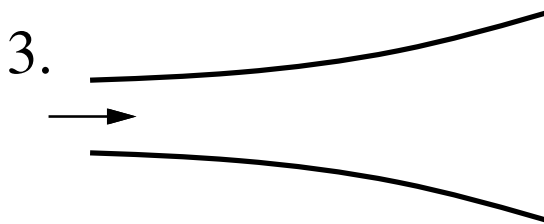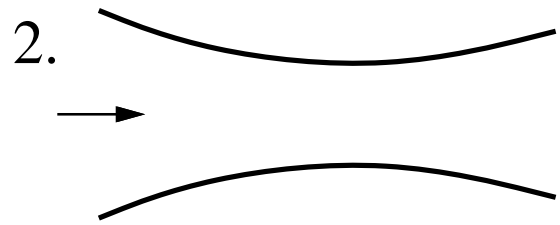
1.

2.

3.

4.

5. All are valid

6. Not sure

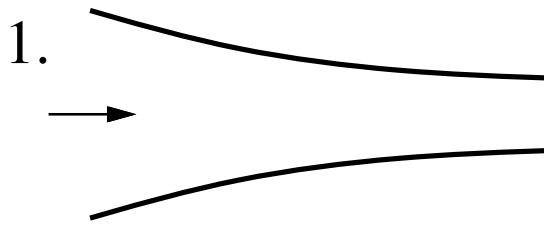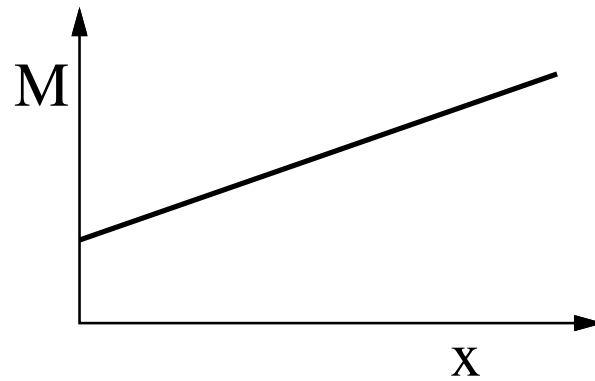**2.** *

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

$M_1 \sim 1$

p_1

$\theta = ?$

$p_2 \sim 0$

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

M

x

1.

2.

3.

4.

5. Not sure

2. *

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

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

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

1. $100\,\text{kg/s}$

2. * $45\,\text{kg/s}$

3. $22.5\,\text{kg/s}$

4. not sure