Which of the following is NOT an example of Aerodynamics in action?

1. **Thrust of a rocket**
2. **Curve of a baseball**
3. **Drag of a car**
4.* **Buoy floating down a river**
5. **Sailboat underway**
6. **Lift on an aircraft**

Or . . .

7. **All of the above involve Aerodynamics**

There is a thin boundary layer on a flat wall. The pressure and speed just above the boundary layer are p_∞ and V_∞. What is the pressure p at the wall?

1. $p = p_\infty + \frac{1}{2}\rho V_\infty^2$

2.* $p = p_\infty$

3. **There's no way to know for sure.**

An airfoil at a certain angle of attack has $M' = -10$, $L' = 0$. This is an example of ...

1.* This is a pure aerodynamic moment (couple)

2. An impossible situation

The PS02 airfoil with 1m chord has:

$$\mathbf{Re} = 10^6 \qquad \mathbf{c_d} = 0.006$$

What is the diameter of a round cylinder with nearly the same drag/span D' in the same flow?

1. **1 mm**
2. *** 5 mm**
3. **20 mm**
4. **100 mm**
5. **None of the above**

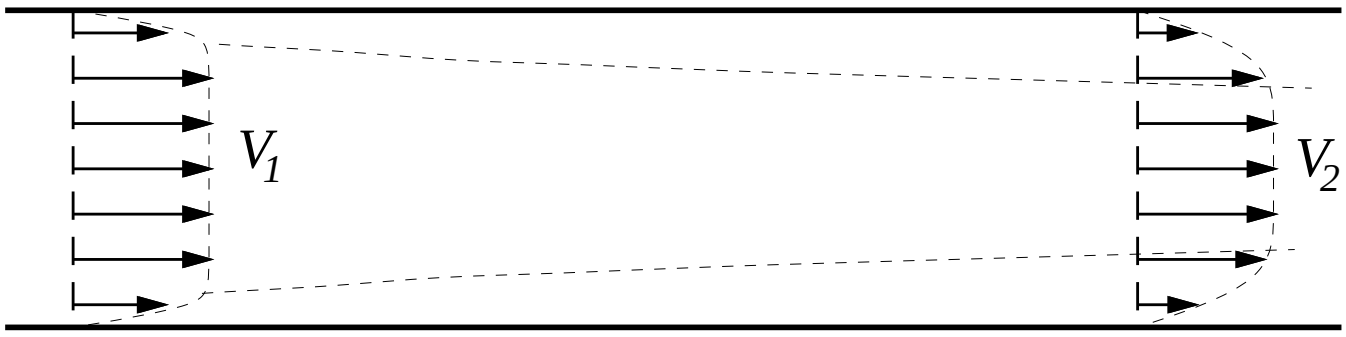
Boundary layers grow on the walls of the low-speed constant-area channel. How do the centerline velocities V_1 and V_2 compare?

1.* $V_1 < V_2$

2. $V_1 = V_2$

3. $V_1 > V_2$

4. No way to tell for sure



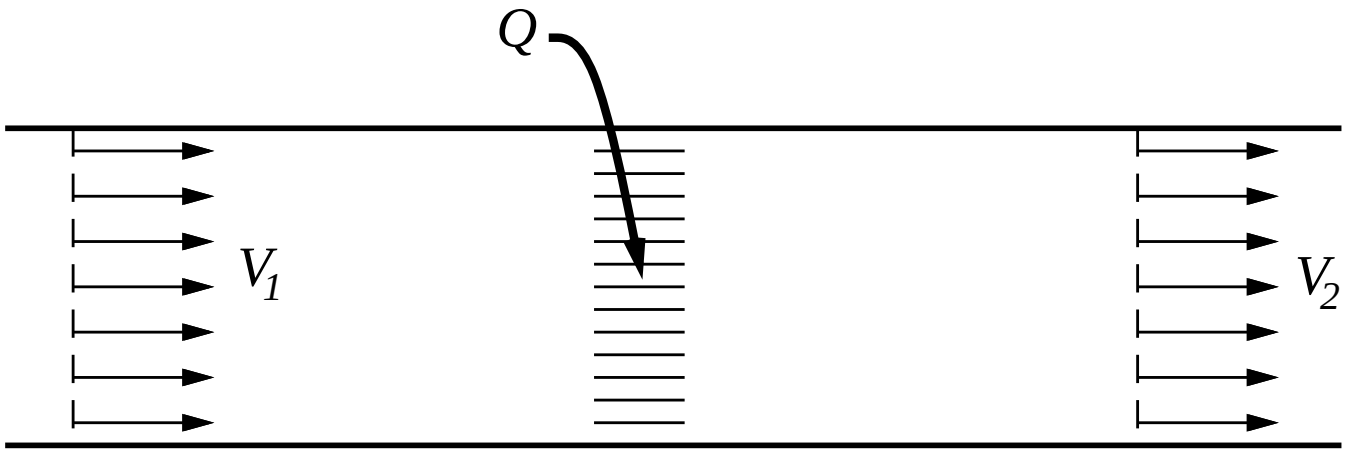
A heater is placed in a slow-flowing channel. How do the two velocities V_1 and V_2 compare?

1.* $V_1 < V_2$

2. $V_1 = V_2$

3. $V_1 > V_2$

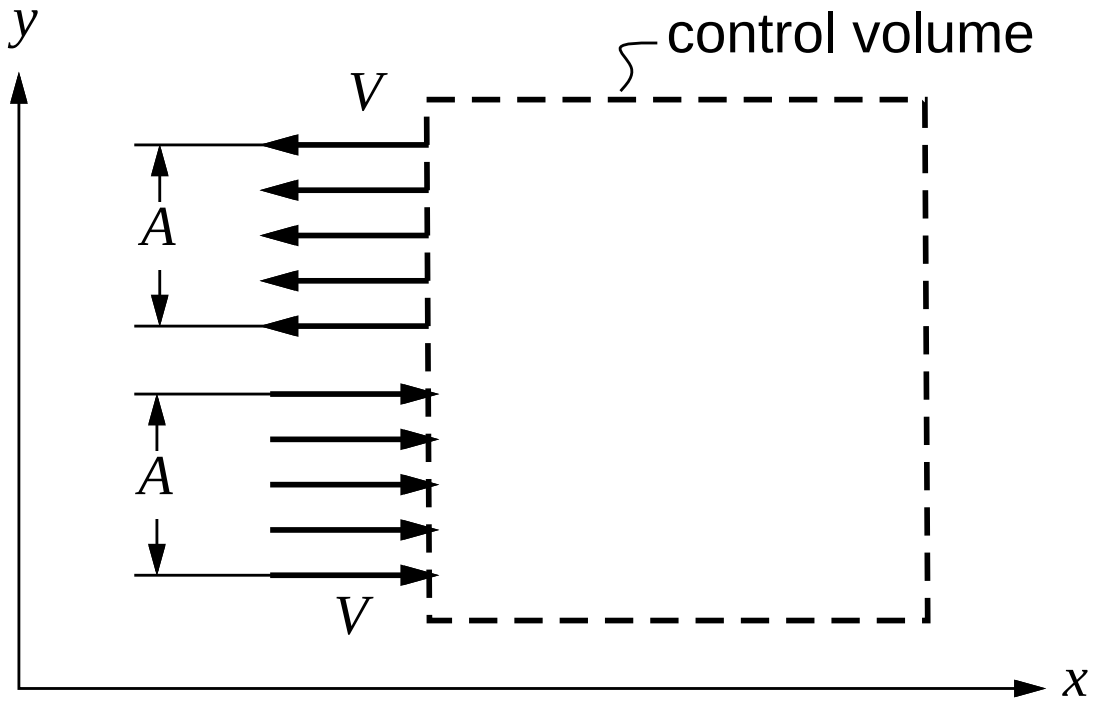
4. No way to tell for sure



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

$$\oint \rho \vec{\mathbf{V}} \cdot \hat{\mathbf{n}} \, \mathbf{dA}$$

1. $\mathbf{2\rho VA}$
2. $\mathbf{2\rho VA}\,\hat{\imath}$
3. $\mathbf{\rho VA/2}$
4.* **0**



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

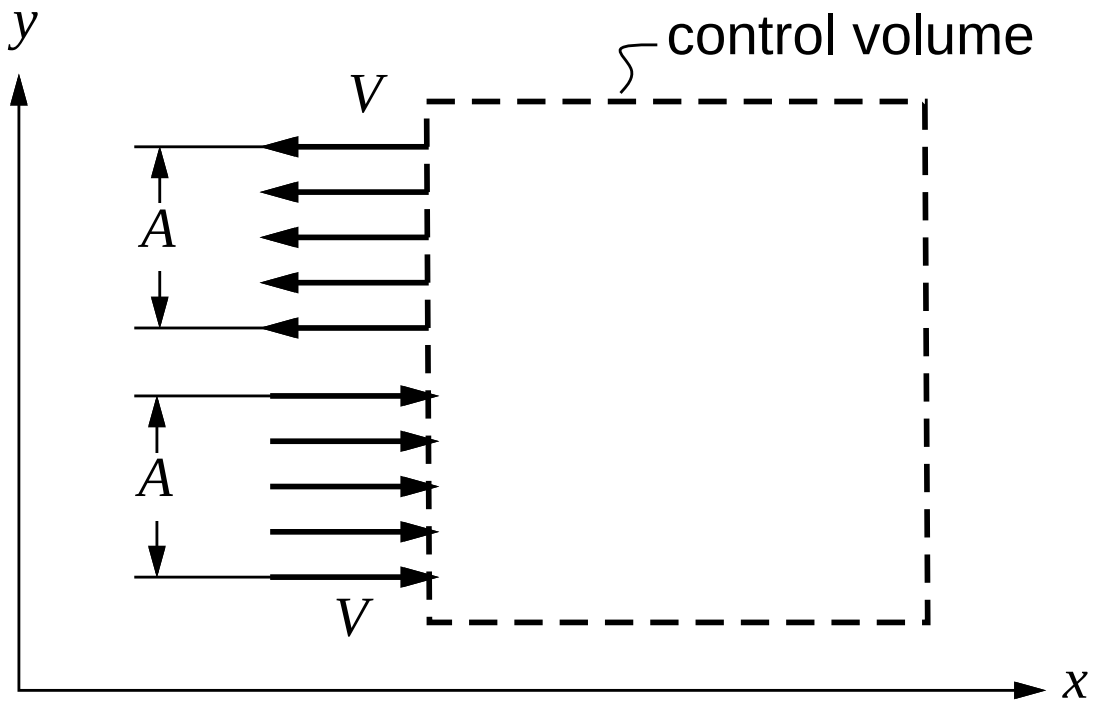
$$\oint \rho \left(\vec{\mathbf{V}} \cdot \hat{\mathbf{n}}\right) \vec{\mathbf{V}} \, \mathbf{dA}$$

1. $\rho \mathbf{V^2 A} \, \hat{\imath}$

2. $2\rho \mathbf{V^2 A} \, \hat{\imath}$

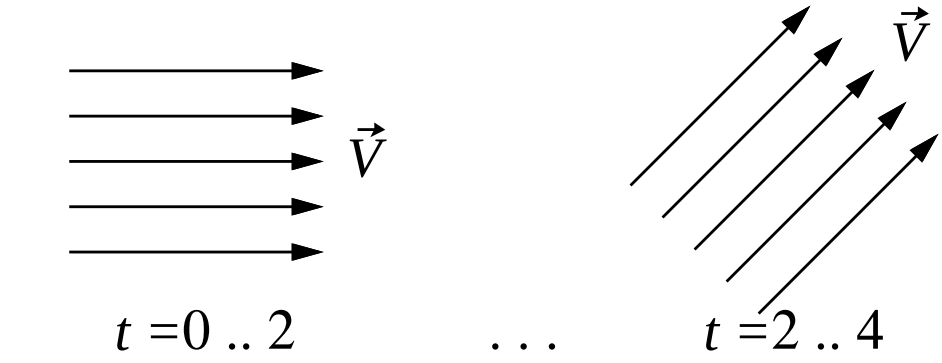
3.* $-2\rho \mathbf{V^2 A} \, \hat{\imath}$

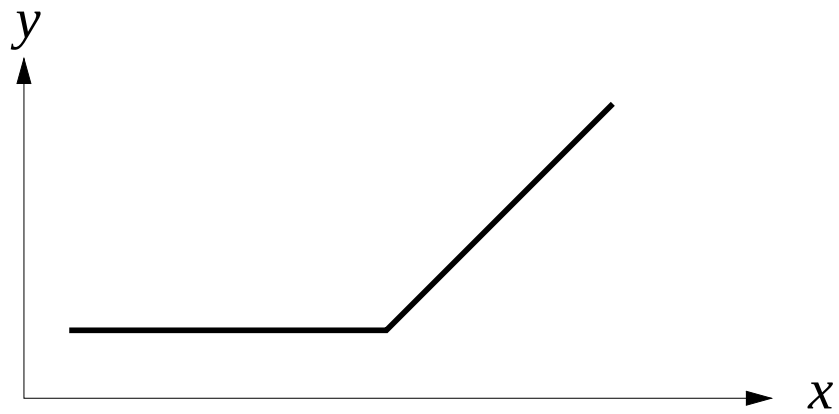
4. $\mathbf{0}$



A uniform velocity field points in the x direction for times t = 0 . . . 2, and 45° up from the x direction for times t = 2 . . . 4.
What is the curve in the x-y plot?

1. **Streamline**
2. *** Pathline**
3. **Streakline**





The force on the body $\vec{R}$ is computed in two ways:

a) Using the true pressure p

b) Using the corrected pressure p_c

What can you say about the difference $\vec{R}_p - \vec{R}_{p_c}$?

1. It's zero.

2.* Depends only on the body volume.

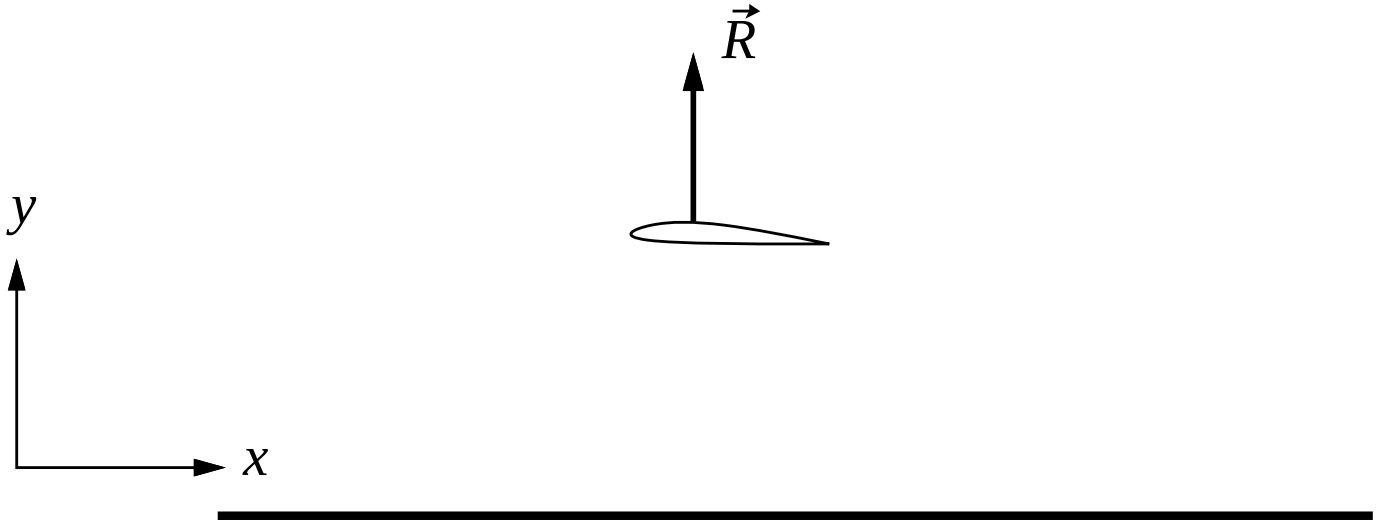
3. Depends on the body shape in a complicated way.

A wing with lift force $\vec{\mathbf{R}} = \mathbf{L}\hat{\jmath}$ flies overhead. What is the resulting force applied to the ground?

1. 0

2. $\mathbf{L}\hat{\jmath}$

3.* $-\mathbf{L}\hat{\jmath}$



Traffic leaves a toll gate located at x = 0. At some location x, every car's speed is u(x). What is a car's acceleration at location x ?

1. u^2/x
2. du/dt
3.* u du/dx
4. Cannot be determined from the given information