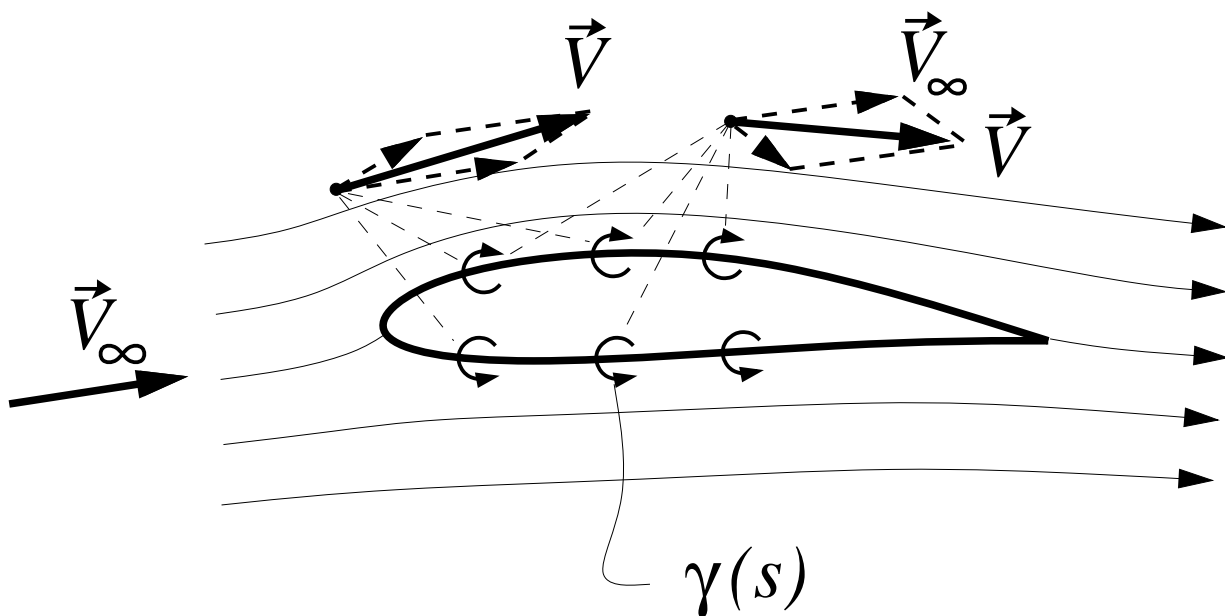


The velocity field \vec{V} about the airfoil is represented as a superposition of a freestream and a vortex sheet.

I feel the following about this concept.

1. Very uncertain
2. Somewhat uncertain
3. Somewhat comfortable
4. Very comfortable

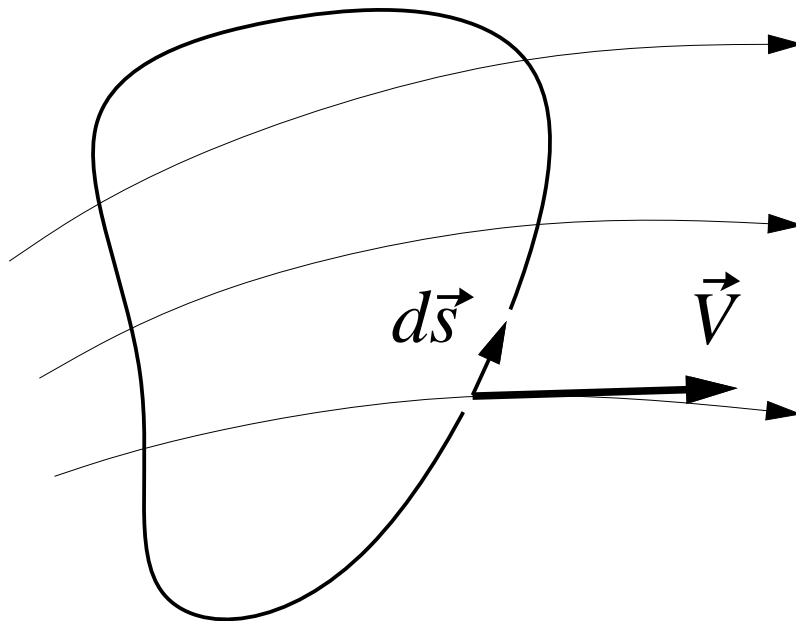


The circulation of $\vec{V}_1(x, y)$ about the circuit of perimeter s_{tot} is Γ_1 .

A constant $\Delta\vec{V}$ is now added to make $\vec{V}_2 = \vec{V}_1 + \Delta\vec{V}$.

What is \vec{V}_2 's circulation Γ_2 about the same circuit?

1. $\Gamma_2 = \Gamma_1 - |\Delta\vec{V}| s_{\text{tot}}$
- 2.* $\Gamma_2 = \Gamma_1$
3. $\Gamma_2 = \Gamma_1 + |\Delta\vec{V}| s_{\text{tot}}$

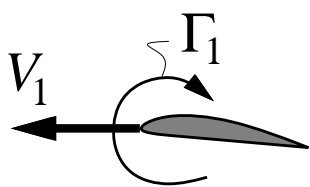


An airfoil in steady motion at speed V_1 has circulation Γ_1 .

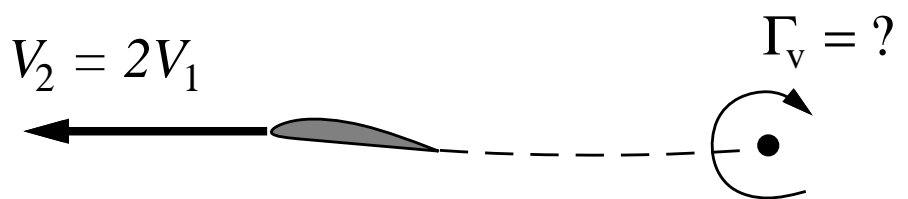
The speed is suddenly increased to $V_2 = 2V_1$.

What is the circulation Γ_v of the shed vortex?

1. $\Gamma_v = -\Gamma_1/2$
- 2.* $\Gamma_v = -\Gamma_1$
3. $\Gamma_v = -2\Gamma_1$



Initial steady motion



After velocity increase

A vortex sheet is γ placed on the x axis in a freestream V_∞ . The average x-velocity $(\vec{V}_u + \vec{V}_\ell) \cdot \hat{i} / 2$ on the sheet itself, will

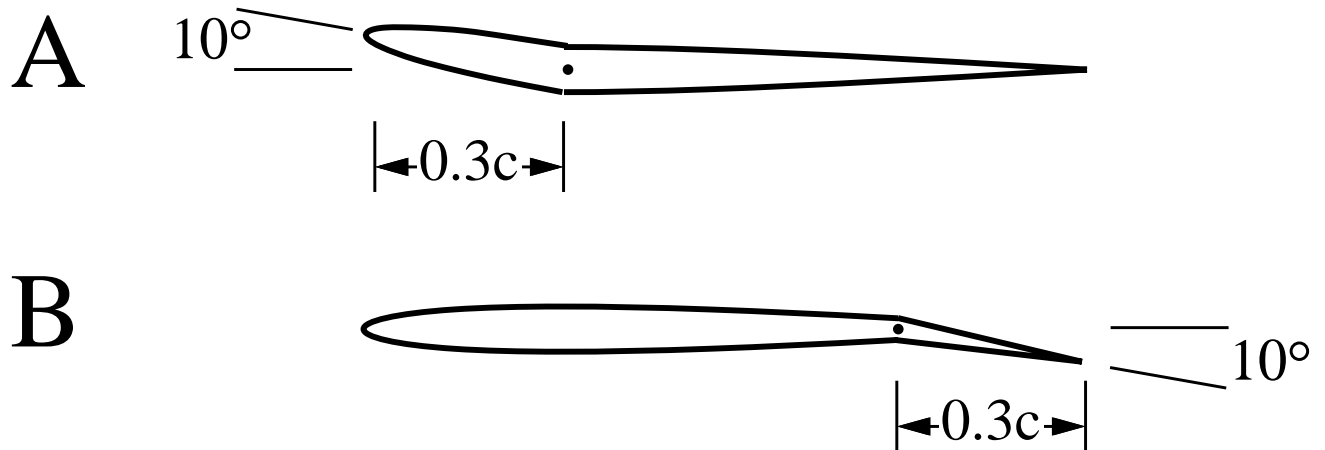
1. Increase
2. Decrease
- 3.* Not change

Which type of control surface deflection will cause the largest change in the magnitude of the zero-lift angle?

1. A

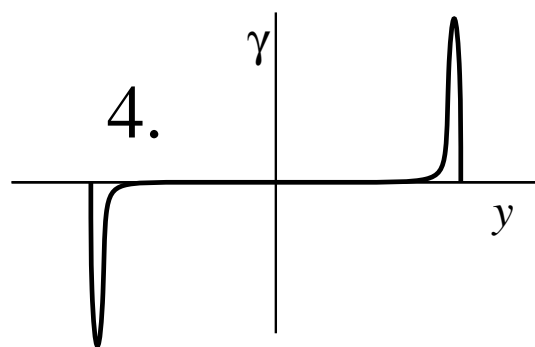
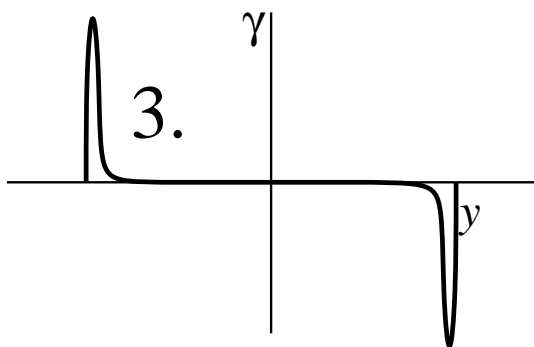
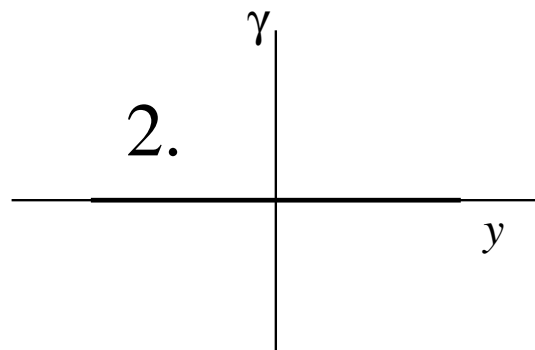
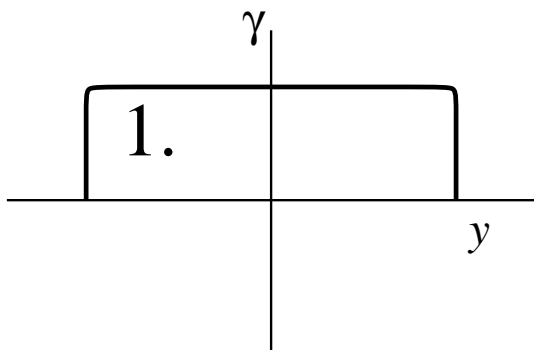
2.* B

3. It will be the same for A and B



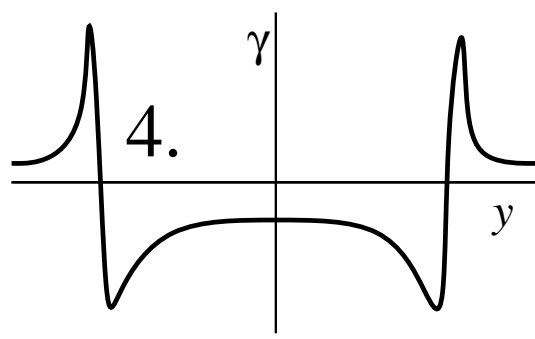
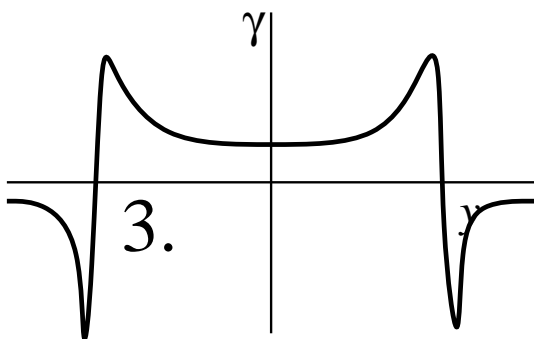
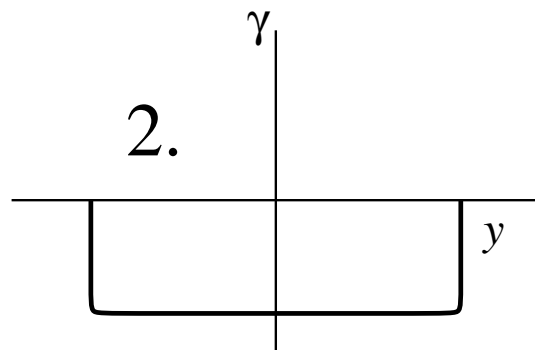
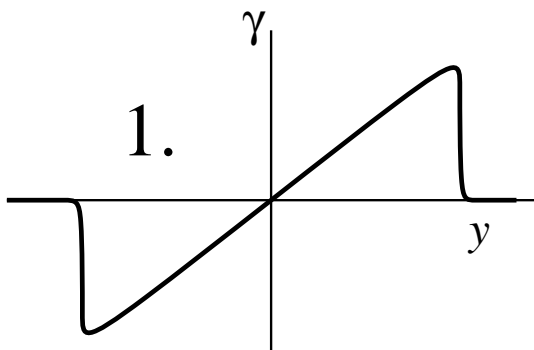
A wing has nearly-uniform circulation $\Gamma(y)$ over the span. What is the associated vortex sheet strength $\gamma(y)$?

4.*



A wing has nearly-uniform circulation $\Gamma(y)$ over the span. What is the associated downwash $w(y)$?

4.*

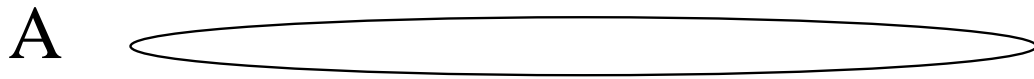


Two wings are operating at the same velocity and lift. Wing B has doubled chords compared to wing A. How do their D_i 's compare?

1. $(D_i)_A > (D_i)_B$

2.* $(D_i)_A = (D_i)_B$

3. $(D_i)_A < (D_i)_B$



Two wings with the same area are operating at the same velocity and lift. Wing A has a 5% larger span. How do their C_{Di} 's compare?

1.* $(C_{Di})_A \simeq 0.90 (C_{Di})_B$

2. $(C_{Di})_A \simeq 0.95 (C_{Di})_B$

3. $(C_{Di})_A \simeq (C_{Di})_B$



To design a wing with an elliptic load distribution at a given V_∞ and b , which variable is NOT in our power to manipulate?

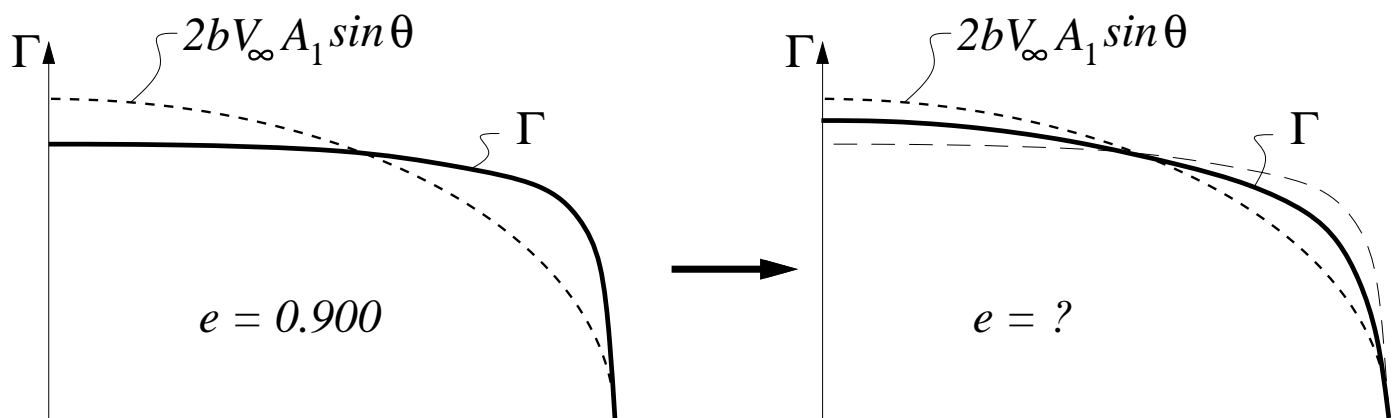
1. $\alpha_{\text{geom}}(\mathbf{y})$ geometric twist
2. $\alpha_{L=0}(\mathbf{y})$ zero-lift angle
- 3.* $\alpha_i(\mathbf{y})$ induced angle
4. $c(\mathbf{y})$ chord
5. $c_\ell(\mathbf{y})$ lift coefficient
6. They can all be manipulated
7. Not sure

In our elliptic-loaded wing design example, we increase the constant chord by 10%. What will NOT change in our wing?

1. $\alpha_{\text{geom}}(\mathbf{y})$ geometric twist
- 2.* $\alpha_i(\mathbf{y})$ induced angle
3. $c_l(\mathbf{y})$ lift coefficient
4. Not sure

A wing with a non-elliptic loading has $e = 0.900$ ($\delta \simeq 0.10$). The deviation from elliptic loading is halved. What is the new e ?

1. 0.900
2. 0.925
3. 0.950
- 4.* 0.975
5. Not sure



For a particular aircraft, changing the aspect ratio by +10% changes $C_L^{3/2}/C_D$ by +8%, but also changes total weight by +6%. To reduce flight power, the aspect ratio should be

1. Increased
- 2.* Decreased
3. Not sure