Lecture F04 Mud:

1. **Why does $x/c = (1 - \cos\theta)/2$?** (1 student)
   By definition. That how θ was defined.

2. **Can you just substitute θ_o for θ?** (1 student)
   It's important to make the distinction between what a variable <u>is</u>, and what you call it. We have been working with two different types of variables, shown in the 3rd figure in the F02 notes:
   1) physical distance along the chord, called x or ξ
   2) angle coordinate on the half-circle above the chord, called θ or θ_o
   In the F04 stuff it really didn't matter which name we use. Earlier on, we had to use two different names for each variable type, since we were simultaneously dealing with two different points (x and ξ, or θ_o and θ).

3. **How can you use TAT for a cambered airfoil?** (1 student)
   TAT applies to cambered airfoils, as in the example in class.

4. **Where is the vortex sheet on the airfoil??** (1 student)
   All the vorticity on a real airfoil resides in the thin top and bottom boundary layers. In a panel method, these are assumed to have zero thickness (i.e. assumed to be vortex sheets), and are placed on the airfoil top and bottom surfaces. In TAT, the top and bottom sheets are combined into one sheet, and placed on the x-axis.

5. **For general (non-parabolic) camber airfoils, can we go straight from A_0, A_1, A_2 to c_ℓ and c_m?** (1 student)
   Yep. The formulas

$$c_\ell = \pi(2A_0 + A_1) \qquad\qquad c_{m,c/4} = \frac{\pi}{4}(A_2 - A_1)$$

   are valid for any camberline shape.

6. **Where did the formula for ΔC_p come from?** (2 students)
   From combining the C_p definition with the Kutta-Joukowsky Theorem:

$$\Delta C_p \equiv \frac{\Delta p}{\frac{1}{2}\rho V_\infty^2} \quad , \quad \Delta p = \rho V_\infty \gamma \quad \longrightarrow \quad \Delta C_p = 2\frac{\gamma}{V_\infty}$$

7. **Do you know how many A_n's are needed before doing the integrating?** (1 student)
   Depends. If you only need c_ℓ or $\alpha_{L=0}$, then you only need A_0 and A_1. If you also need c_m, you in addition need A_2. The higher A_3, A_4 ... are needed only if you need the details of the surface pressure loading $\Delta C_p(x)$. No way to know how many are actually needed without calculating them to see how fast they decrease.

8. **Why does the lift contribution vary along the airfoil?** (1 student)
   The pressure loading Δp or ΔC_p varies along the airfoil.

9. **When are the higher A_n's nonzero?** (1 student)
   For the $Z(x)$ camber shapes of most common airfoils, all the A_n's will be nonzero, although they will probably decay fast. For a non-smooth camberline with "kinks" like that due to a flap deflection, the A_n's will decay more slowly. They become identically zero only for the special cases of a symmetric airfoil or parabolic-camber airfoil like in the examples.

10. **How did you know what n and m were in the final example?** (1 student)
    The general orthogonality formula works for any integers n and m. For our particular application we had $m = 1$, and $n = 1, 2, 3 \ldots$.

11. **No mud** (14 students)