Lecture F9 Mud: General Wings

1. **Does elliptic loading correspond to head-on or rear views?** (1 student)
   This doesn't matter. Both views will see the same loading, except flipped left/right.

2. **Why would you want an assymetric loading like in the 1st figure?** (1 student)
   You wouldn't normally design for that kind of loading. I drew it "crazy" looking to indicate that any $\Gamma(y)$ shape can be represented with the Fourier series.

3. **Where's Maple?** (1 student)
   On Athena. See Athena info stuff on the web. Maple does take some practice to get comfortable with, but it can save a lot of grungework in many situations.

4. **How does adding dihedral affect things?** (1 student)
   It has very little effect on the loading, L, D_i, etc. It's mainly an issue for stability and control.

5. **Is it aerodynamics that influences taper, or is it structures?** (1 student)
   Both. Wing design almost always involves aero/structural tradeoffs.

6. **What's the best way to get the $\Gamma(y)$ and downwash $w(y)$ on page 4 of the notes?** (1 student)
   These were done with a Vortex-Lattice program called AVL. It's available on Athena like Xfoil, but it requires considerably more effort to use. You have to create a geometry-description file first.

7. **In the flap case, are the vorticies at the flap ends and not the tips?** (1 student)
   Both. Just behind this wing there will be four vortices. Farther downstream, the two vortices on each side will twist up into a single vortex. There will then be only two vortices present.

8. **How do you know where the lift is by looking at the plots on page 1?** (1 student)
   The lift/span distribution $L'(y)$ is exactly the same as the circulation distribution $\Gamma(y)$, except for a scaling constant.

$$L'(y) \;=\; \rho\, V_\infty \Gamma(y)$$

9. **Does e describe the accuracy of the Fourier analysis?** (1 student)
   No. The accuracy of the Fourier analysis is determined by N, which the number of Fourier terms you decide to use. The span efficiency e, and also δ, describe how much the circulation $\Gamma(y)$ deviates from the elliptic curve $2bV_\infty A_1 \sin\theta$ of the same total lift.

10. **How much can be gained by optimizing e?** (1 student)
    On a wing with a small AR, the e will not depend very much on the wing shape. For large AR, the payoff is bigger. Sailplane designers worry a lot about e. Designers of stunt planes which typically have stubby wings don't worry about e at all.

11. **Would elliptical wings be best for the Dragonflies?** (1 student)
    You won't notice the slight difference in induced drag between a "perfect" elliptical wing and a wing with straight tapers which are well laid out. The straight tapers are vastly easier to build.

12. **I need to understand the concepts better, without too much calculus. Is there a reference?** (1 student)
    I don't know what's out there for lay explanations. Maybe try googling "induced drag"?

13. **Several questions on the PRS?** (3 students)
    Tough to explain here. Maybe in recitation.

14. **No mud** (5 students)