**Lecture F06 Mud:**

1. **Which came first, Biot-Savart for E&M or for Fluids?** (2 students)
   Not sure. Biot-Savart was first used for Fluids in the mid 1800's by Helmholtz.

2. **Is there some sort of Gauss's Law for vortices to avoid doing the Biot-Savart integral?** (1 student)
   Nope. Gotta deal with it as is.

3. **How is $V_\theta = \Gamma/2\pi r$ for the straight 3-D vortex in the first example?** (1 student)
   I'm not sure what you mean. Carrying out the Biot-Savart integral on the straight 3-D vortex produced $V_\theta = \Gamma/2\pi h$, where $h$ was the perpendicular distance from the vortex. This is the same as the 2-D result, except that $r$ was replaced with $h$ (following Anderson's notation).

4. **If the circulation is greatest at the tips, is the lift greatest at the tips also?** (1 student)
   I think you're confusing the circulation $\Gamma$ with the wake vortex strength $\gamma = -d\Gamma/dy$. The circulation $\Gamma$ and hence $L' = \rho V_\infty \Gamma$ both go to zero at the tips. In contrast, $\gamma$ is typically maximum near the tips.

5. **Confused about sign conventions for $\Gamma$ and $\gamma$?** (4 students)
   $\Gamma$ on the wing is defined positive about the $y$-axis by righthand rule.
   $\gamma$ in the wake is defined positive about the $x$-axis by righthand rule.

6. **What would $\gamma(y)$ for a wing with a winglet look like?** (1 student)
   First of all, the vortex sheet in this case is not planar, but is upturned on the edges, following the winglets. So $\gamma$ has to be treated as a function of arc length $s$ along the span – first along $y$, and then along $z$ following the winglet. Qualitatively, $\gamma(s)$ looks similar to that of a flat wing. The largest $\gamma$ typically occurs near the winglet's tip. There may also be a "spike" in $\gamma$ at the wing/winglet junction, depending how the wing/winglet system is designed.

7. **In the PRS, if $\Gamma$ is constant, why isn't $d\Gamma/dy = 0$?** (1 student)
   $\Gamma$ is not completely constant – it sharply drops to zero at the tip over a very small distance. So $d\Gamma/dy = 0$ over most of the span, but it's large where $\Gamma$ is sharply dropping to zero.

8. **Are we finding the downwash at one point $y_o$, or over the whole span?** (1 student)
   When doing the integral to compute $w$, we hold $y_o$ fixed. But this $y_o$ is left as "$y_o$" rather than a specific number, so the result is an expression in terms of $y_o$. We can then plug in a range of $y_o$ values into the expression to create points for the $w$ versus $y_o$ plot.

9. **How did you decide that $dw = \gamma\, dy/4\pi(y_o - y)$?** (1 student)
   This is an application of the Biot-Savart law to the vortex filament consisting of a $dy$-wide strip of the wake, with circulation $\gamma\, dy$.

10. **What does the induced angle distribution tell me?** (1 student)
    It will be used to compute the loading on the wing, and hence the lift and induced drag.
11. **Didn't understand PRS?** (3 students)
    I'll go over it in recitation.
12. **No mud** (9 students)