b) \( \omega = \frac{2}{3} \omega \) extracts the most power. It leaves the least swirling kinetic energy in the flow \((\sim V_2^2)\) (of the 3 cases shown above).

c) **Argument 2**: If \( \omega = \frac{4}{3} \omega \) all swirling kinetic energy is extracted (i.e. \( V_2 = 0 \)). Can see this from looking at the graphs.

**Argument 2**: Take derivative of Euler equation w.r.t. \( \omega \) & set = 0

\[
\frac{d}{d(\omega)} \left[ (\omega) \tan \beta_1 + (\omega r) \tan \beta'_2 - (\omega r)^2 \right] = 0 \quad \text{with} \quad \beta_1 = \beta'_2
\]

\[
2 \tan \beta_1 = 2 \omega r \quad \therefore \quad \omega r = \frac{2}{3} \omega
\]

\[
= \frac{4}{3} \omega
\]
It begins to act like a compressor when it puts more swirl kinetic energy into flow \( (\omega v_z^2) \) than it started with \( (\omega v_r^2) \).

This happens (graphically) for \( \frac{\omega W}{3} \) which is also when the Euler turbine equation starts giving negative values of \( T_{t_1} - T_{t_2} \) implying an enthalpy rise not an enthalpy drop.

Regarding the aerodynamics for this situation, consider the relative frame velocities

\[ \begin{array}{c}
\vec{V}' \\
\downarrow \\
\omega \\
\end{array} \quad \begin{array}{c}
\vec{w} \\
\downarrow \\
\vec{f_w} \\
\end{array} \]

\[\begin{array}{c}
\vec{V} \\
\end{array} \]

\[\text{stays the same}\]

Negative angle of attack! (usually doesn't work well)