

Aircraft Dynamics

1. Name the three axes in the Vertical and Longitudinal plane (6 pts)
 - a. _____
 - b. _____
 - c. _____

2. Name the three Angles in the Vertical and Longitudinal plane (6pts)
 - a. _____
 - b. _____
 - c. _____

3. Name the four forces acting the Vertical and Longitudinal plane (6 pts)
 - a. _____
 - b. _____
 - c. _____
 - d. _____

4. Draw a free-body diagram of the aircraft with three axes, three angles and four forces. Show all angles. (12 pts)

5. Using Newtons Law "Sum of the forces equals the Mass times the acceleration" the equations of motion for an aircraft can be defined as follows:

$$\text{mass } dV/dt = \text{Thrust} - \text{Drag} - (\text{Weight} * \sin(\text{Flight Path Angle}))$$

$$m \, dV/dt = T - D - W \sin(\gamma)$$

Use this equation to derive the equation for **THRUST** that represents each point in the Flight Path Acceleration (i.e. dV/dt) vs. Flight Path Angle *phase plane* shown below.

The phase plane shows a sequence of a flight (1) in level flight at constant speed (e.g. 250 knots), (2) level flight accelerating (e.g. 250 knots to 270 knots), (3) Climb at constant speed (e.g. 270 knots)

Show the Thrust for each point in the phase plane. Explain each of the terms in each equation.

(10 pts)

