Lift, Drag, Airfoils

Empennage

Rudder

Vertical Stabilizer

Elevators

Horizontal Stabilizer

Wings

Ailerons

Fuselage
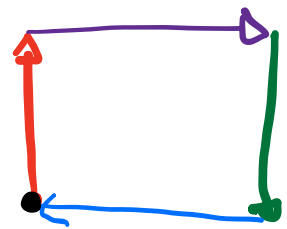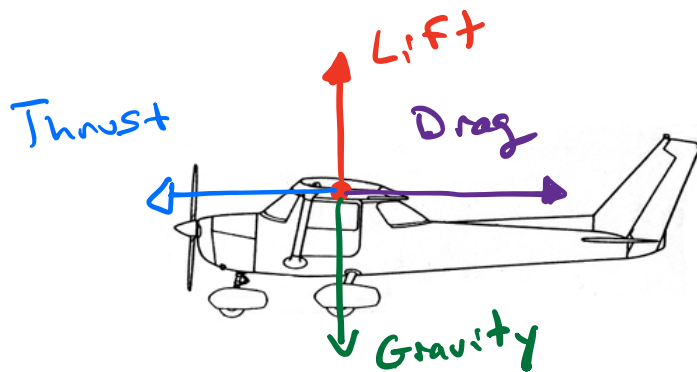
1. Object in motion wants to stay in motion.

→ 2. F_{net} = mass * acceleration

3. Action, equal and opposite reaction

Lift

Thrust

Drag

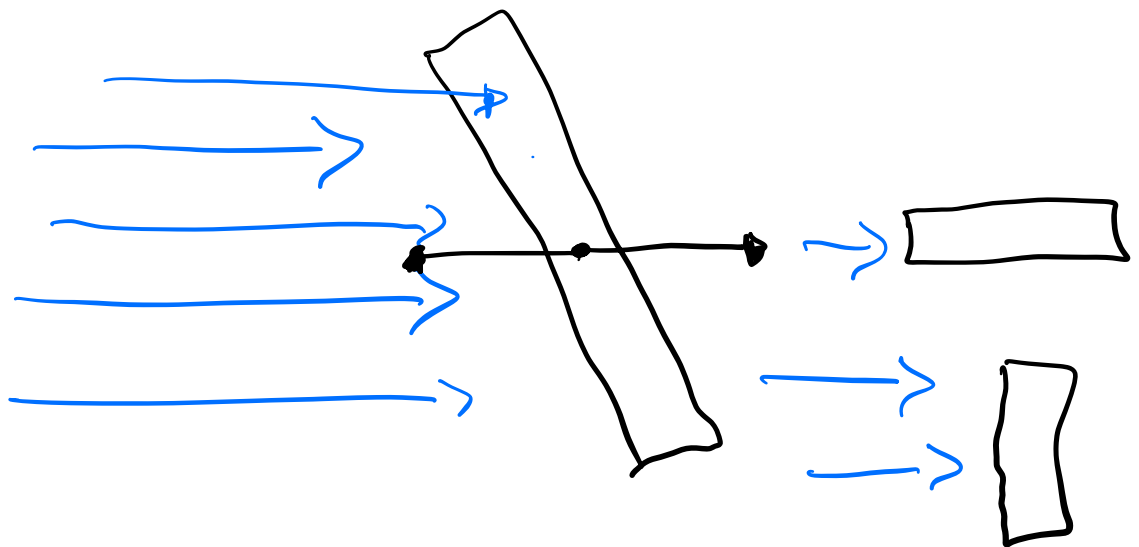Gravity

$F_{net} = 0$

Unaccellerated Flight.

1. Bernoulli
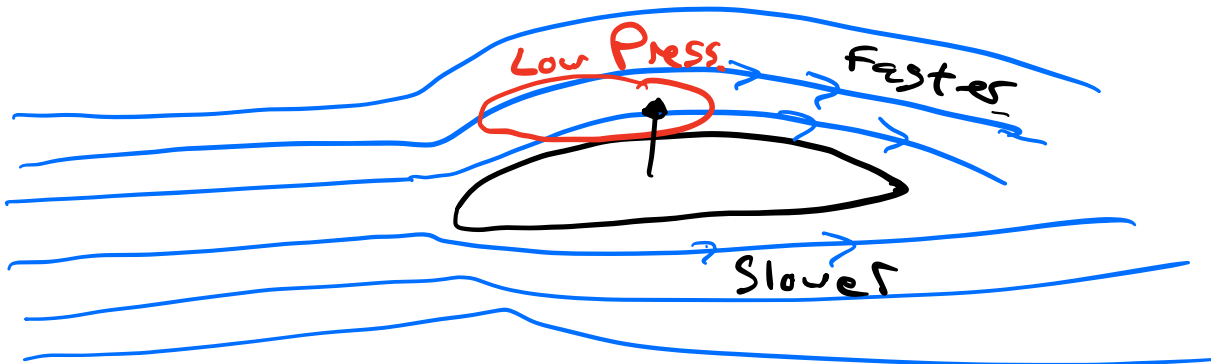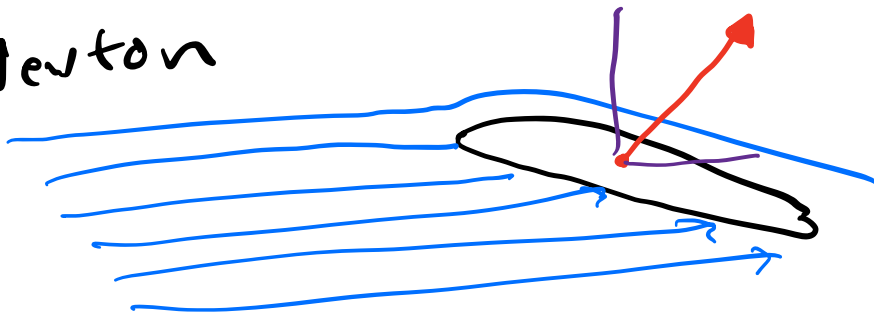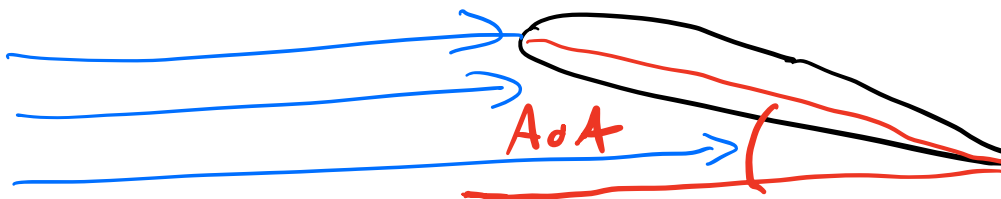
V

air

↓ Press.

V

air

V

air

V

air

Velocity ↑

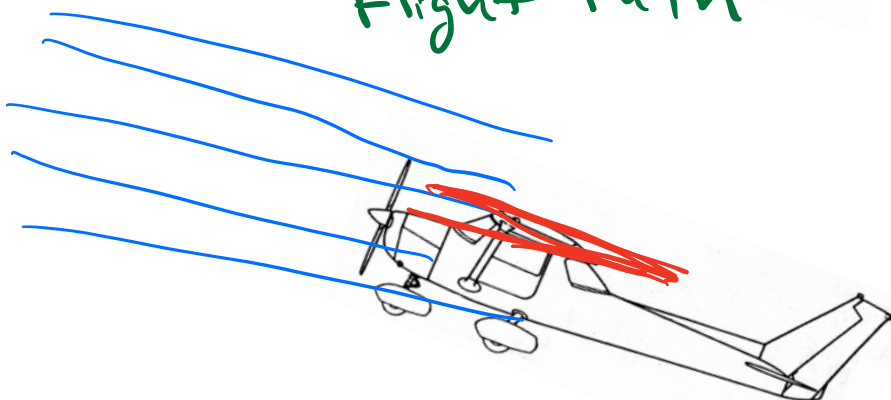Pressure ↓
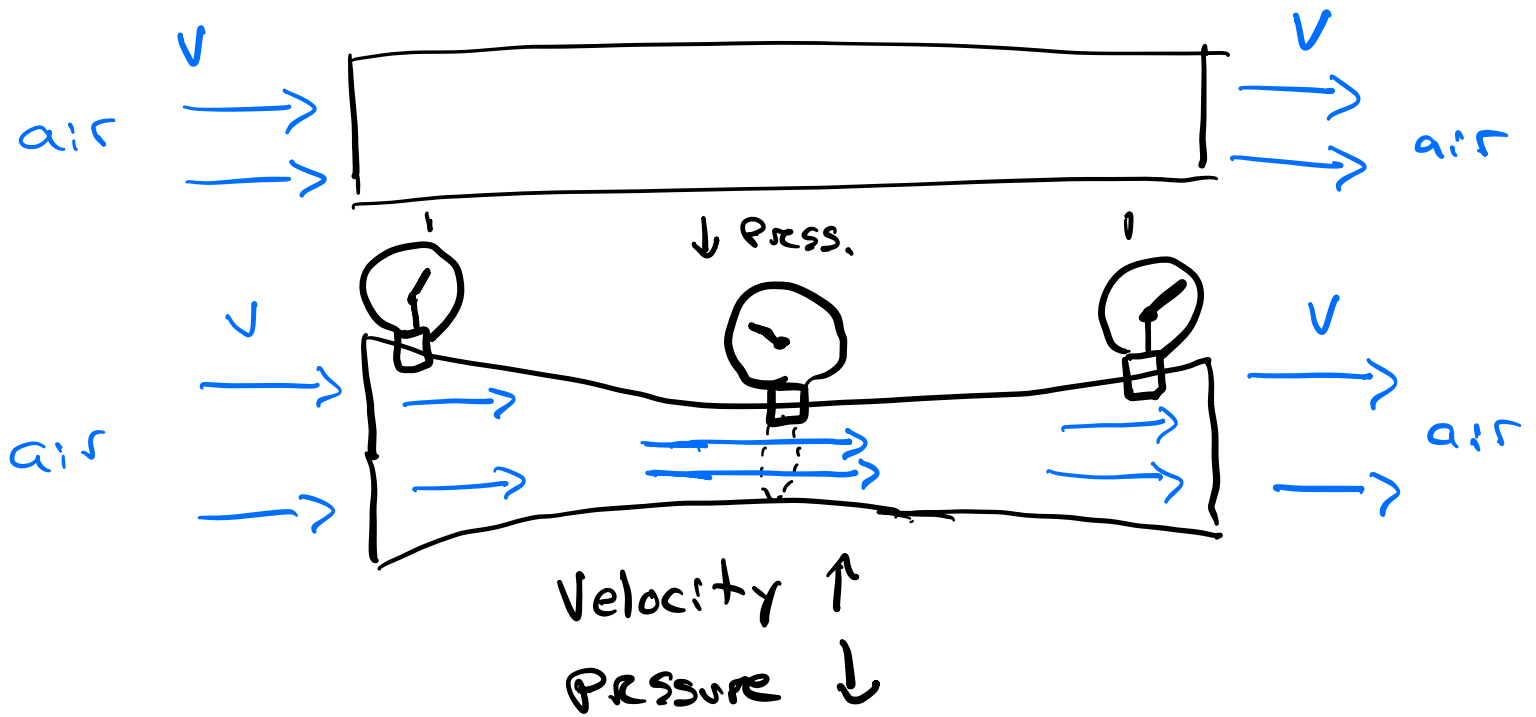
2. Barn | Newton

Bernoulli

Chord Line

Mean camber Line

Low Press.

faster

Slower

Newton

Relative Wind

Chord Line

AoA

Chord Line

AoA

Flight Path
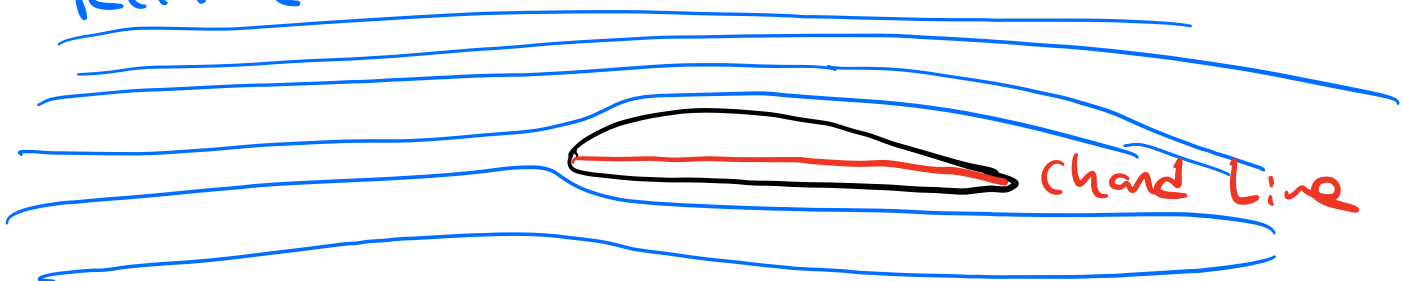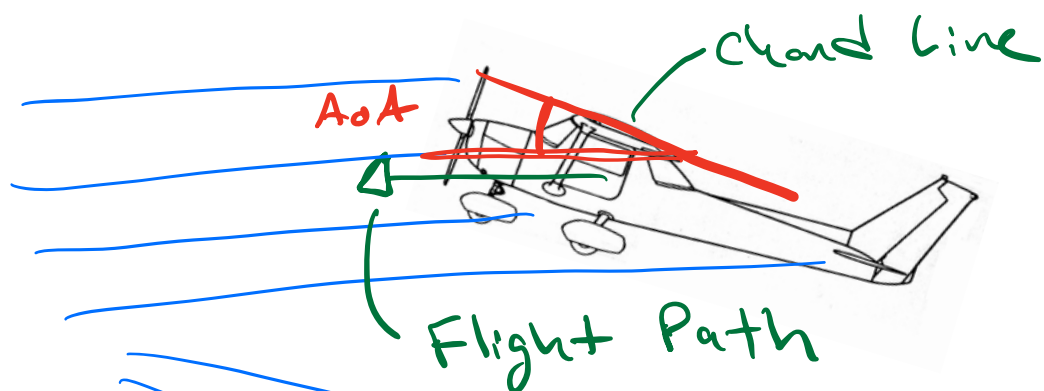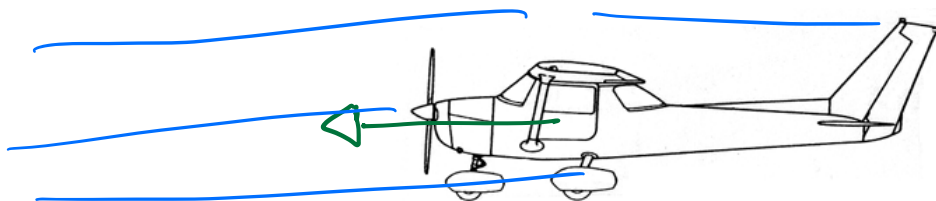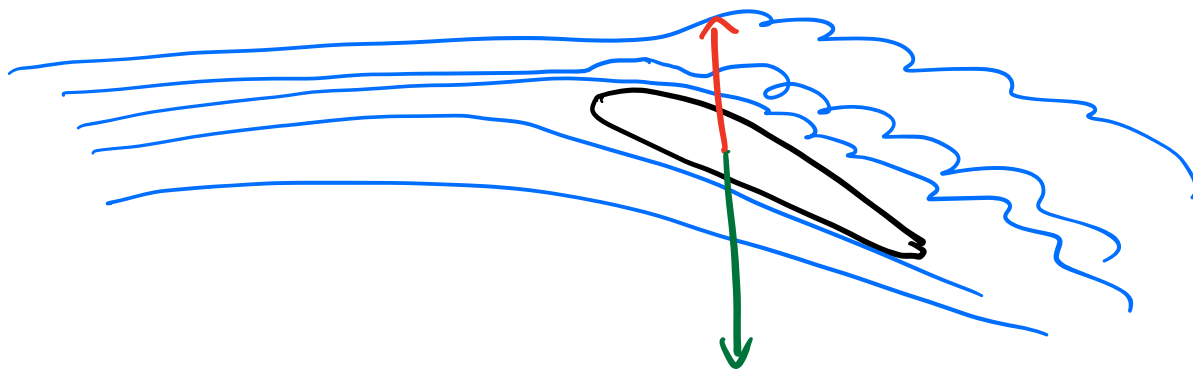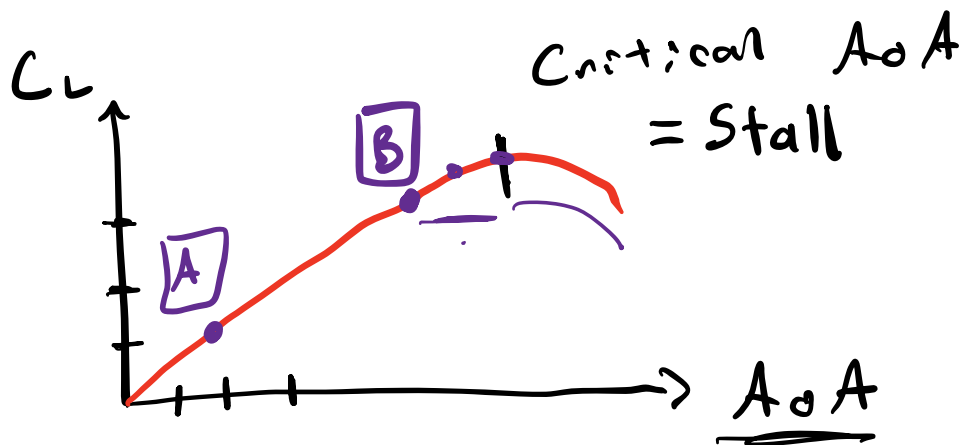
Lift Equation

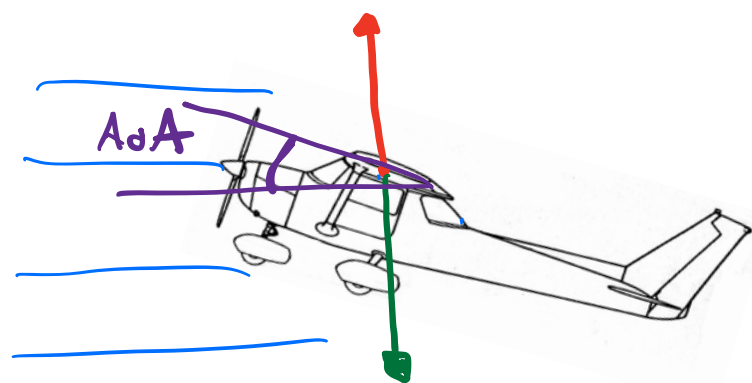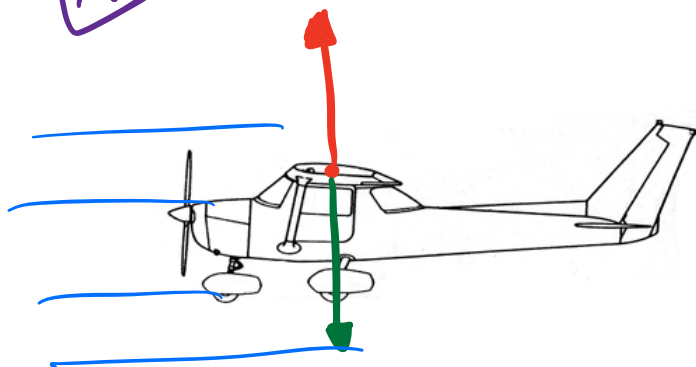$$L = \frac{\frac{1}{2} \rho V^2 S C_L}{2}$$

ρ = Air density
V = Velocity
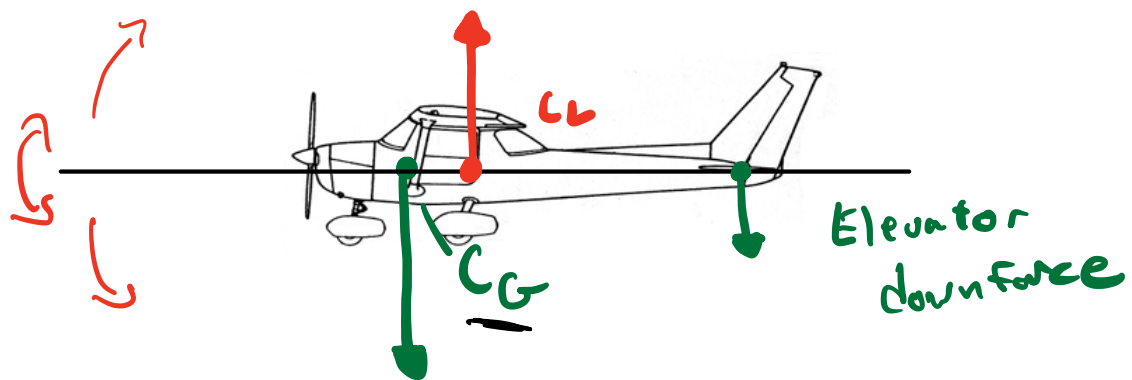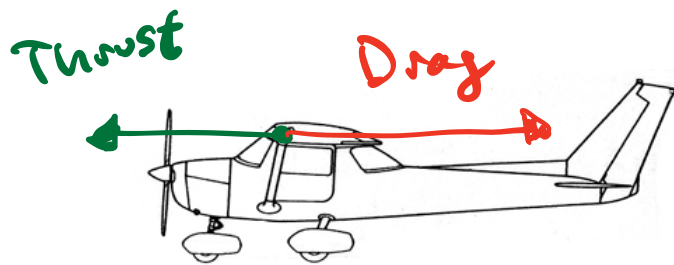S = Surface area
C_L = Coefficient of Lift

Critical AoA = Stall

A

AoA

Slow

Basic Torque

1 unit   1 unit

1 ft   2 ft

2 unit   1 unit
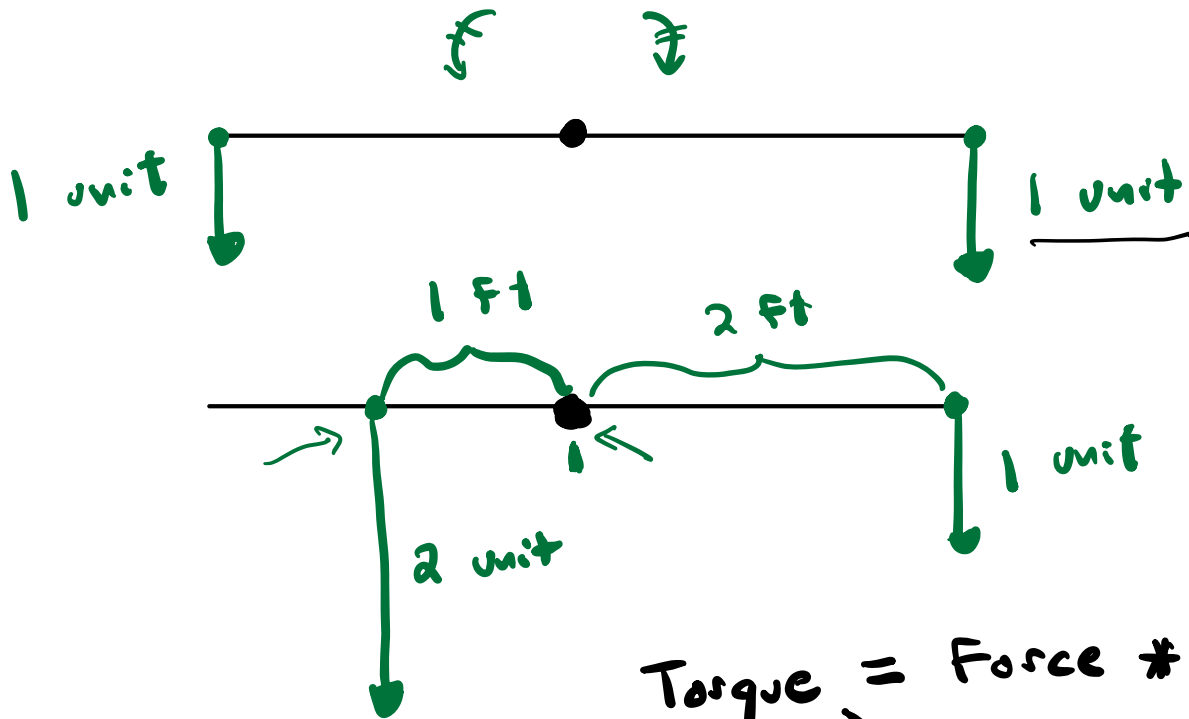
Torque = Force * Radius
(moment)

C L

Elevator
downforce

C G

Thrust/Drag

Thrust   Drag

Parasite

Induced Drag

Low Press

high press

Wingtip Vortices

Low
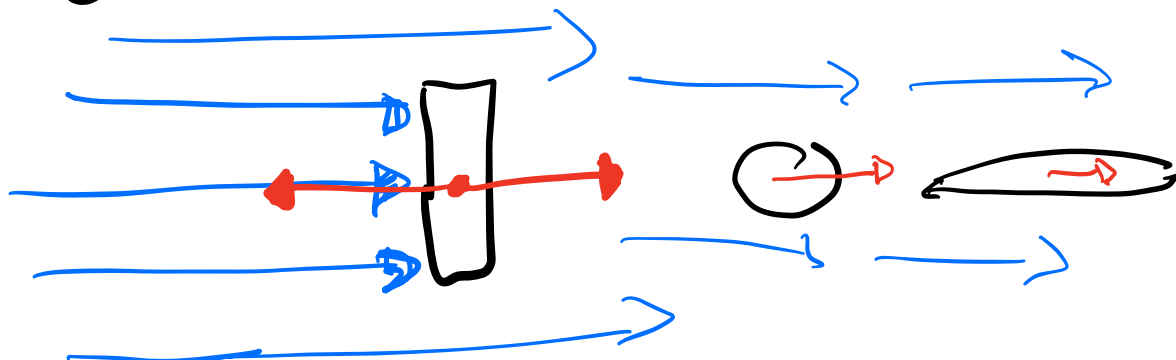
high

Induced Drag

Ground Effect

↓ Induced Drag
↑ Lift

Drag

(Max glide)

Total Drag

Best L/D

Region of reverse command

∴ V²
Parasite Drag

Induced Drag

A/S

50   100   150   +

← Increase power →

Increase power
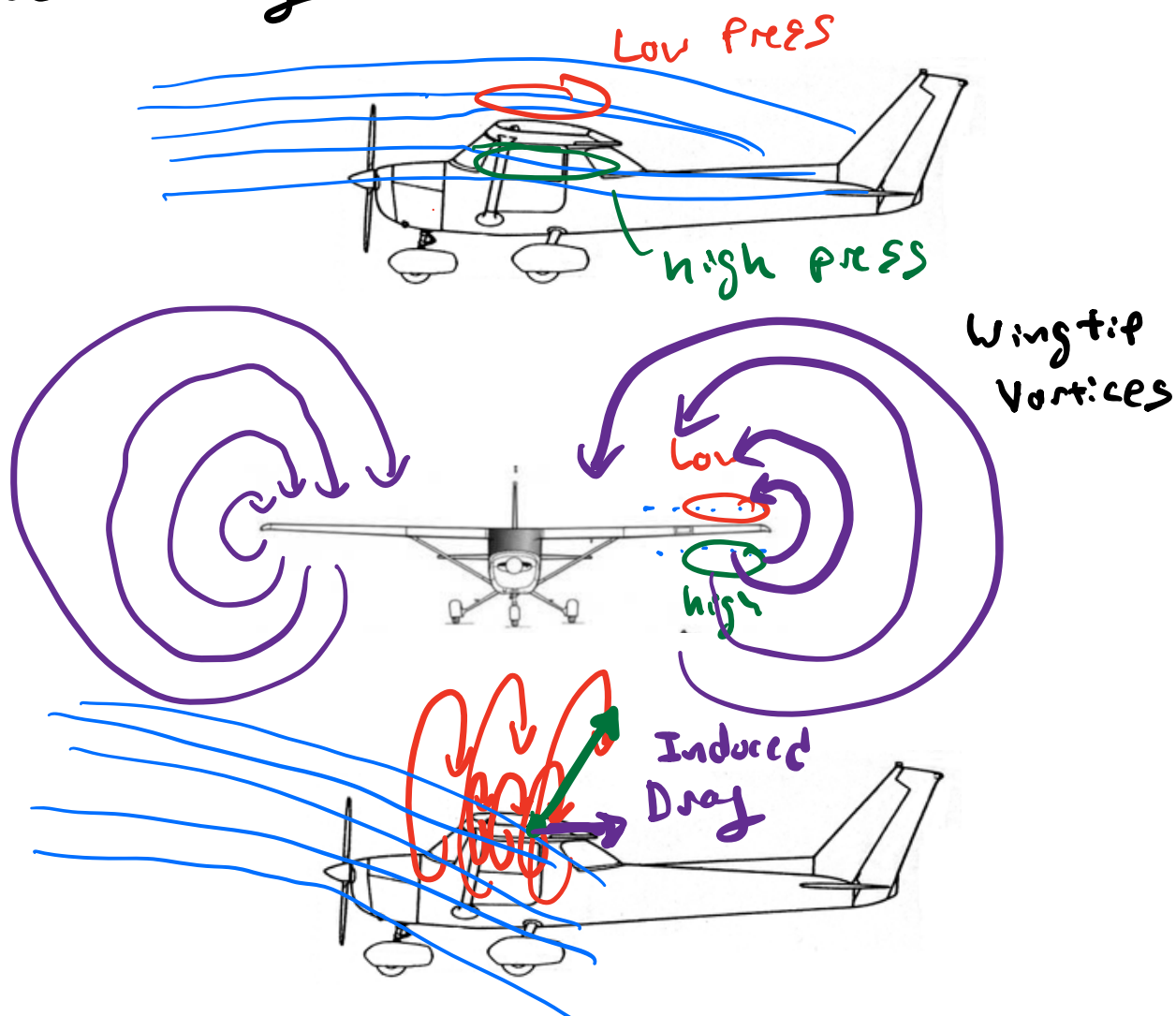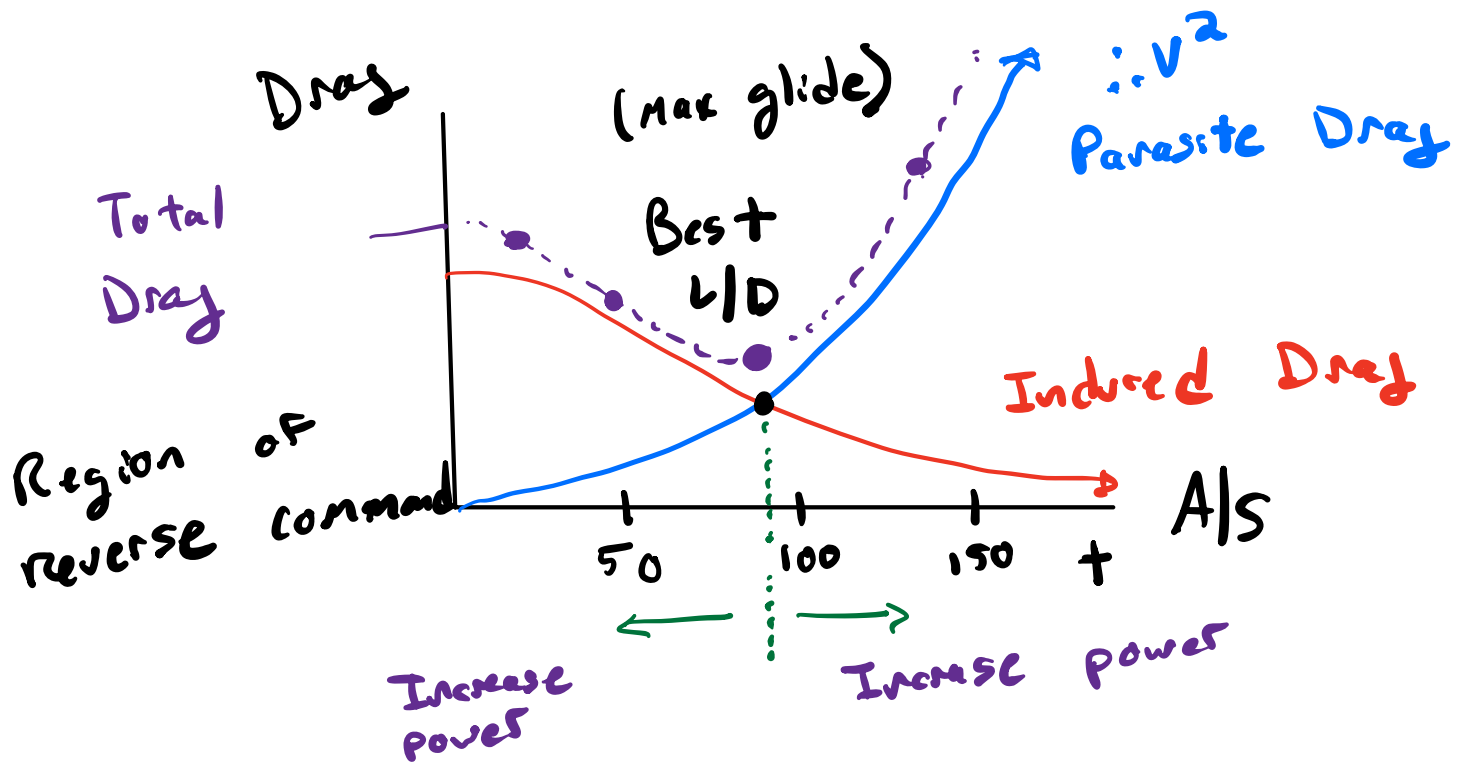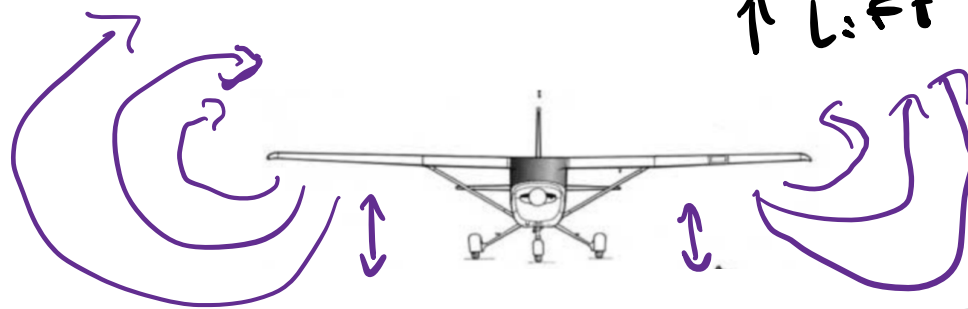
Wing Design
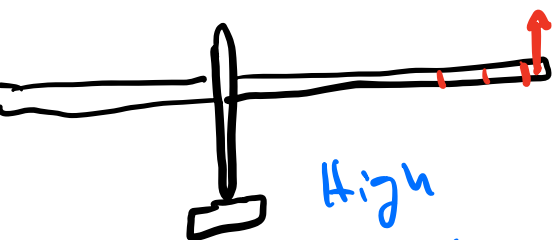
Aspect Ratio $= \dfrac{S}{C}$

Glider

High
Aspect
Ratio

(Slow)
Max lift
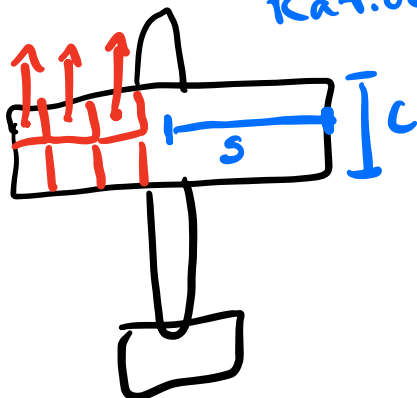
Wing
Loading

Trainer

Low
Aspect
Ratio

Concord
(Fast)