ASTB Personal Study Guide

MATH SKILLS:

- 16 ounces = 1 pound
- 8 pints = 1 gallon
- 4 quarts = 1 gallon
- 2000 lbs = 1 ton
- Shapes
  - (# of sides - 2)*180 = Total # of degrees
  - Supplemental angle - add up to 180 degrees
  - Complementary angle - add up to 90 degrees
- Words to Equations:
  - If 2 times r exceeds one-half of t by 5, which of the following represents the relationship between r and t.
    - 2r - .5t = 5
    - or.. 4r - t = 10
  - If 3 times x exceeds 1/3 of y by 9, which of the following is the equation that shows the relationship between x and y?
    - 3x- 1/3*y = 9
    - or.. 9x - y = 27
- Questions about how fast people can do a job together
  - Time actually needed / Time needed to do the job alone = 1
  - Ex. One recruiter can complete a certain assignment in 40 minutes; another can complete the same assignment in one hour. How long would it take to complete the assignment if they worked together?
    - x/40 + x/60 = 1, x=24 minutes
- Question with an acid solution. Take the pure acid volume as X.
  - P1*V1 + P2*V2 = P3*V3
  - P1*V1 would be X*1
  - P2*V2 is volume of first*percentage of first
  - P3*V3 = (X+volume of first solution)*volume of final
  - Solve for X
  - Example: How much pure acid must be added to 12 ounces of a 40% acid solution in order to produce a 60% acid solution?
    - 100x + 480 = 60(12+x), x=6
- A can complete a project in 20 days and B can complete the same project in 30 days. If A and B start working on the project together and A quits 10 days before the project is completed, in how many days will the project be completed?
  - Explanatory Answer If A can do complete a project in 20 days, then A will complete 1/20 the of the project in a day. Similarly, B will complete 1/30th of the project in a day. Let the total number of days taken to complete the project be x days. Then, B would have worked for all x days, while A would have worked for (x – 10) days. Therefore, A would have completed $\frac{x-10}{20}$ th of the project and B would have complete $\frac{x}{30}$ th of the project. $\frac{x-10}{20}+\frac{x}{30}=1$; Solving for x, we get x = 18.
- Questions about discount price
  - Amount of discount / Original price = % of reduction
  - Reduction * 100 = final answer %
- When you divide by a decimal, make it a whole number and move the dividend's decimal the same amount. Don't change the decimal in the final answer.

- A businesswoman spends 1/5 of her income for rent, and 3/8 of the remainder goes towards salary. How much does she have remaining?
    - First take 1/5 away from 1, giving her 4/5. Multiply 4/5 * 3/8 = 12/40 = 3/10.
    - 3/10 is the final answer
- Traveling / Gas mileage / average speed question
    - Take the gallons of gas used * miles per gallon to get total miles traveled
    - Take miles traveled / average speed = hours
- A purchaser paid 17.16 for an article that had recently been increased in price by 4%. What was the price before the increase?
    - x / 100 = 17.16 / 104
    - Solve for x = 16.50
- A naval detachment has enough rations to feed 16 people for 10 days. If 4 more people join the detachment, for how many fewer days will the rations last?
    - First get the total rations, 16*10 = 160.
    - 4 more people = 20 people. So divide 160/20 = 8 days
    - 8 is 2 less days.
- A field can be plowed by 9 machines in 5 hours. If 3 machines are broken and cannot be used, how many hours will it take to plow the field?
    - 9*5 = 45 total machine hours to finish job
    - 3 broken, so 6 will be used
    - 45 / 6 = 7.5 hours
- In a 3-hour examination of 320 questions, there are 40 mathematics problems. If twice as much time should be allowed for each mathematics problem as each of the other questions, how many minutes should be spent on he mathematics problems?
    - Let x = minutes to be spent on each problem
    - 40*x + 1/2*x*280 = 180
    - Solve for x, x = 1 minute
    - Plug back in to initial, 40*1= 40 minutes
- A tank that holds 450 gallons of water can be filled by 1 pipe in 15 minutes, and emptied by another in 30. How long would it take to fill the tank if both pipes are open?
    - 450 / 15 = 30 gallons per minute fill rate
    - 450 / 30 = 15 gallons per minute empty rate
    - 30 gpm - 15 gpm = 15 gpm with both pipes open
    - So 450gallons/15gpm = 30 minutes
- If a driver completes a trip of 120 miles at a rate of 30mph, at what rate would the driver have to travel on the return trip in order to average 40mph for the round trip?
    - 30mph for 4 hours = 120 miles. So round trip is 240 miles.
    - 240 miles @ 40mph would take 6 hours.
    - She used up 4 hours on the way there, so she has to complete the last 120 miles in 2 hours.
    - D=R*T, R=60mph
- A bridge crosses a river that is 1520 feet wide. One bank of the river holds 1/5 of the bridge and the other holds 1/6. How long is the bridge?
    - (1/6)*x + (1/5)*x + 1520 = x
    - Common denominator: 5x + 6x + 45600 = 30x
    - Solve for x = 2,400 feet long

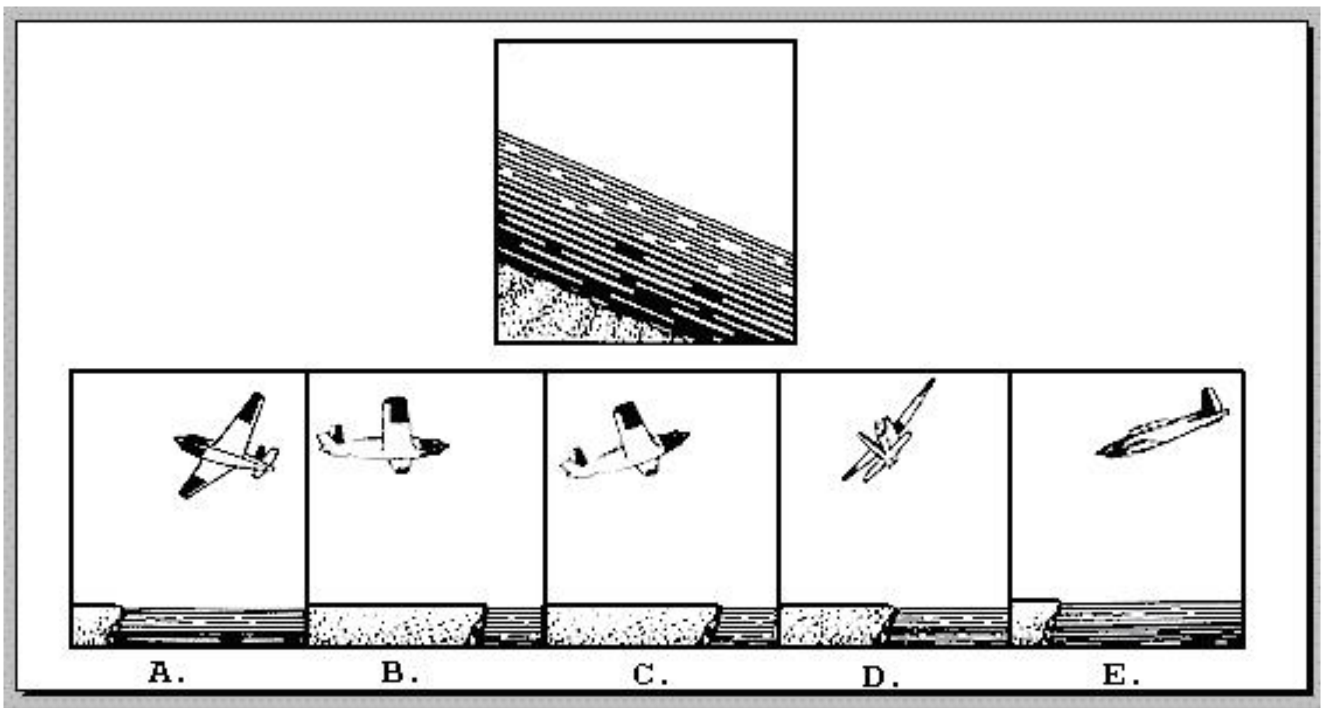
MECHANICAL COMPREHENSION:

- Only MOVABLE pulleys provide mechanical advantage.
- Gear revolutions
  - r = (D*R)/d ; r*d=R*D
    - D: # of teeth on gear A
    - R: revolutions of gear A
    - d: number of teeth on gear B
    - r: revolutions of gear B
- Hydrometers use floats to measure specific gravity. Specific gravity is the weight of a liquid compared with the weight of the water. The liquid with the highest specific gravity will cause the float to rise higher in the glass tube.
- Levers
  - First class: Fulcrum is in the middle (scissors, pliers)
  - Second class: Fulcrum is at one end, load is in between (nutcracker, wheelbarrow)
  - Third class: Fulcrum is at one end, effort is in between (tongs, tweezers)
- In pulleys, the smaller pulley will turn faster than those larger than it. It has to “keep up” and therefore turns faster.
- Mechanical advantage in pistons
  - a2*d2=a1*d1
    - A= area, d=displacement
    - Smaller D/ bigger D = mechanical advantage
- Axe is classified as a wedge, which is an inclined plane
- The farther away the fulcrum is from the resistance arm, the greater amount of force that is required to lift the weight and the higher the resistance arm will travel.
- No electricity flows through burnt out bulbs, but a voltimeter can bypass it if connected on both sides. It tells you the total voltage in a circuit.
- Current stays the same in series
  - Current is constant in series, voltage is not
  - Voltage is constant in parallel, current is not
  - V=I*R (current*resistance=Voltage)
  - The circuit with the greater resistance is usually in series, because it forces the current through all resistors.
- In a 2 pulley system, the movable pulley will only move up half the distance, and spin half as much as the fixed pulley.
- To find an rpm necessary
  - Take number of rods on the wheel, divide that from the needed contacts per minute. (ex. twice per second = 120 contacts per minute. 10 projection rods on wheel. 120/10=12. must rotate at 12 rpm.
- If a driver wheel is present, the adjacent wheels will rotate according to how close to the center the driver wheel makes contact with them. The closer to the center, the faster it will move.
- By increasing the length of the lever arm, the effort is increased enabling a valve to blow off at a higher pressure. Move the weight further away to do this.
  - Think of the picture from the practice exams.. Lever left causes less effort and lets valve blow up at lower pressure. Lots of L's!
- Learn how to read a micrometer...
- Pendulums
  - The one with the longer string takes the longest to complete 1 swing.
  - The weight doesn't matter for swing time. If string length is the same, swing time is the same.
- If a board is placed in the water with 1 weight at each end, the end with the weight closest to the center will tend to float more than the one furthest from the center.

- If weights hang from a string attached to a bar, less pull is exerted by the weight of less weight. The length of the string doesn't matter.
- Buoyancy
  - The deeper you go with an inflated ball, the more difficult it is to hold it under water.
  - The deeper you go with the same ball, the more buoyant the ball is.
- Rate of heat exchange is faster through objects of greater temperature difference.
- Water flows faster through narrow areas than it does through wider. Think of putting your thumb on the end of a hose to make it spray…
  - But…the same amount of water will flow through the smaller and larger part of the pipe in a given time.
- If you place an object evenly on 2 scales, each scale will read half of the total weight.
- 4-Stroke Engine
  - Intake, Compression, Combustion, Exhaust
- Wheel and axle question, such as bucket being raised from well.
  - Mechanical Advantage = Radius of Axle to handle / radius of drum
  - Make sure you're using the RADIUS, not the diameter
- Pressure
  - Pressure = Force / Area
  - Fluid pressure
  - Atmospheric pressure
- Statics and Equilibrium
  - Moment = Force * Distance
- Energy
  - The difference between kinetic and potential (and when one converts to the other)
  - Potential - energy stored in an object
  - Kinetic - energy in motion
- Electrical Theory
  - V=I*R; Finds voltage drop across a circuit or single resistor
  - I=Q/T; Current = charge / time
  - Current
    - Direct - flows continuously in the same direction
    - Alternating - periodically reverses direction
  - Devices
    - Ammeter - measures current flow in a circuit
    - Voltmeter - measures voltage
    - Multimeter - measures both
  - Units
    - Charge = coulomb, C
    - Current flow = ampere, A
  - Power = volts * amperes
- Vise
  - Ideal MA = (2*pi*length of handle)/(pitch of thread)
- Metrology (measuring)
- Newton’s Laws
  - First – object in motion will stay in motion, object at rest will stay at rest
  - Second – force = mass * acceleration
  - Third – for every action there is an equal and opposite reaction
- Weight = mass * gravity
- Heat
  - Convection - occurs in liquids and gases by circulating currents caused by a difference in density

    - Conduction - occurs in solids and stationary fluids.
        - Depends on the temperature difference
    - Placing salt into water increases the specific gravity of the solution and lowers its freezing point.
    - Heating a closed container of boiling water increases the pressure of the water vapor (steam) inside the container and increases the temperature of the water.
    - ALWAYS moves from hot object to cold object.
    - The rate of transfer is greater for the greater temp difference.
- Compressing air in a closed space will decrease the volume and raise the temperature.
- If springs are holding up a box
    - 2 springs holding the box attached as 1 longer spring
        - They are each holding the entire weight of the box
    - 2 springs holding the box at different ends of the box
        - Each spring holds 1/2 the weight of the box
- A square metal plate is hanging by 4 wires (one on each corner). One breaks, and it's hanging by only 3 wires now. Does each wire now carry the same amount of weight, or do the 2 diagonally across from each other hold an equal amount that is more than the lone wolf in the other corner?
    - The lone wolf does no support. The 2 diagonals carry it alone.
- Aircraft will take off on a treadmill, regardless of treadmill setting.

SPATIAL APPERCEPTION:



Probably going to look something like this, the answer to the above is B. I recommend putting your pencil in the dead center. If your pencil is in water, diving; if it is in the air, climbing; if it is on the horizon line; no pitch.

AVIATION/NAUTICAL INFORMATION:

- Port = left; starboard = right; fore = in front of; aft = behind
- Red right returning nun even
    - On your way inland, the right side has a red light, numbered evenly increasing, the buoys are nun, triangle tops
    - Left hand is green, odd numbered, and the buoys are can, cylinders, square.
- Boating Right of way
    - 2 powered vessels
        - Head on, both vessels give-way starboard (right)
        - Crossing paths, vessel on operators left is give-way vessel. vessel on operators right is stand-on and can maintain course.
        - Overtaking, the one overtaking is the give-way, pass on either side
    - Power vs sail
        - Powered is always give-way vessel, sailing vessel is stand-on
        - Overtaking, whichever one is overtaking is the give-way, pass on either side
    - Sail vs sail
        - Wind on same side; the leeward (downwind) is the stand-on vessel and maintains course
        - Wind on different sides; head on, the vessel with wind on its starboard side is the stand-on.
    - If operating power driven, you must give way to
        - Any vessel not under command
        - Vessel restricted in ability to maneuver
        - Engaged in commercial fishing
        - Sailing vessel unless it is overtaking
    - Sailing vessel must give way to
        - Same as above minus the last one.
- Aircraft Right of way
    - Aircraft in distress always has the right of way
    - Approaching head on - both aircraft give way to the right
    - Overtaking aircraft - must pass slower aircraft to the right and stay well clear
    - When aircraft of same category are converging, the aircraft to the others right has right of way.
        - When two aircraft are converging or approaching from the side, the aircraft to the left must give way to the aircraft on the right.
    - General rule regarding converging aircraft of different categories, the least maneuverable aircraft has right of way.
        - Balloon > Glider > Aircraft Refueling > Airship > Airplane / Rotorcraft
    - When approaching for a landing, the aircraft of lower altitude has right of way.
    - Aircraft in approach for landing has right of way over others in the pattern and those on the ground.
- Axis
    - Longitudinal - along the fuselage
        - Provides lateral stability
        - Movement about: banking
    - Lateral - along the wings
        - Provides longitudinal stability
        - Movement about: pitching
    - Vertical - perpendicular, through the top and bottom of the fuselage
        - Movement about: yawing
- Wing span = wing tip to wing tip

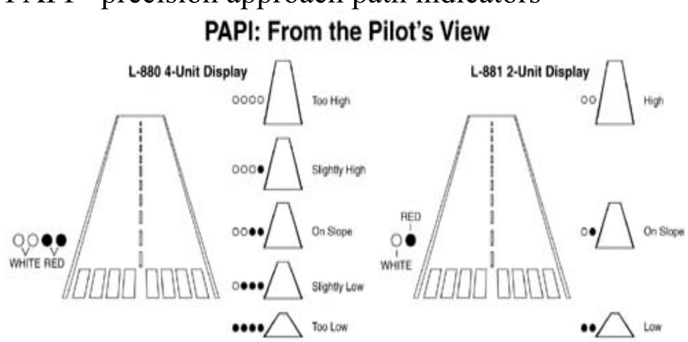
- Longer wings result in a shallower glide angle, in comparison to short wings.
    - If wing area is doubled, lift and drag will be doubled
- During takeoff, a headwind will shorten the takeoff run and increase the angle of climb. A tailwind during takeoff will increase the takeoff run and decrease the angle of climb.
- Windlass - designed for handling the anchor chain
- Nautical mile - 6076 ft
    - Nautical / Statute mile ratio = 8/7
- Standard Weights
    - Gasoline - 6 lb / gallon
    - Oil - 7.5 lb / gallon
    - Water - 8.35 lb / gallon
- Objects not established for the sole purpose of assisting a navigator in fixing a position are not considered to be an "aid to navigation"
- Fog generally forms at night when warmer air moves over colder water.
    - Determined by differences between the wet-and-dry bulb temperatures. Fog usually forms when the wet-bulb depression is less than 4 degrees.
- Lights: red=port, green=starboard, white indicates the direction it is going, yellow is for special circumstances
- Ship Terminology
    - Freeboard – from water level to deck
    - Draft – from water level to bottom of boat
    - Forecastle – bow half of deck
    - Fantail – stern half of deck
    - Keel - The principal structural member of a ship, running lengthwise along the center line from bow to stern, to which the frames are attached.
    - Lubbers Line - the direction of the ship's bow. fore and aft line of the ship.
    - Course Line - line drawn from the fix in direction in which a ship is moving
- The heading of a ship causes water to push against the side of the rudder, creating a force that swings the stem of the ship to the opposite side. The faster the vessel is moving, the greater the pressure against the rudder and the quicker the turning effect.
- Air weights
    - Humid air is lighter than dry air
    - Warm air is lighter than cold air (heat rises)
- Dead reckoning - relying solely on your compass for direction.
- Terrain association - using the surrounding terrain to guide you along your way.
- Landing into the wind (wind comes from ahead of you) reduces your ground speed (aircraft speed relative to the ground)
- Plane is most likely to stall in great degree of bank turns, or high angles of attack.
- Variable Swept wings
    - Swept position - reduce drag at high speed
    - Extended position - to provide decreased ground speed during landing; to provide increased lift at low speed.
- Father of the Navy - John Paul Jones
- Key Terms
    - Camber - curvature of the top of a wing or airfoil
    - Angle of attack - angle formed by the chord line of the wing and the oncoming airflow
    - Aspect ratio - ratio of the distance between the wing tips of an airplane to its average wing width
        - Aspect ratio = b^2/s ; where b is wing span, s is surface area of wing
        - High aspect ratio - long and skinny wings
        - Low aspect ratio - short and stubby wings

    - Wing load - Ratio of wing surface area to aircraft weight
    - Fly by wire - control linkages between the cockpit and the planes control surfaces are electronic rather than mechanical
    - Trim tabs - small control surfaces that permit the pilot to balance control forces in steady flight to relieve pressure on the aircrafts controls and thus, pilot fatigue.
    - Autorotation - a maneuver used by helicopter pilots to make an emergency landing when he or she has lost engine power during flight.
    - Compass deviation - the error of a magnetic compass due to local magnetism. It is dependent upon your heading; The difference between your desired grid or map heading and the heading you must follow on your compass due to the effects of local magnetism.
    - Variation - difference between true bearing and magnetic bearing.
- Sonic boom is caused by an abrupt change in pressure across the shock wave.
- F-14 backseater is the Radar Intercept Officer (RIO)
- Airports
    - Blue light = taxiway
    - White light = runway
    - Runway numbers - first two numbers of the compass heading (runway 36 is north, not 00).
    - Airport Lights
        -

	Aircraft in flight	**Aircraft on the ground**	**Ground vehicles or personnel**
Flashing white	N/A	Return to starting point	Return to starting point
Steady green	Cleared to land	Cleared for takeoff	Cleared to cross/proceed
Flashing green	Cleared to approach airport, or return to land	Cleared to taxi	N/A
Steady red	Continue circling, give way to other aircraft	Stop	Stop
Flashing red	Airport unsafe, do not land	Immediately taxi clear of runway in use	Clear the taxiway/runway
Alternating red and green	Exercise extreme caution	Exercise extreme caution	Exercise extreme caution
Blinking runway lights	Vehicles, planes, and pedestrians immediately clear landing area in use		

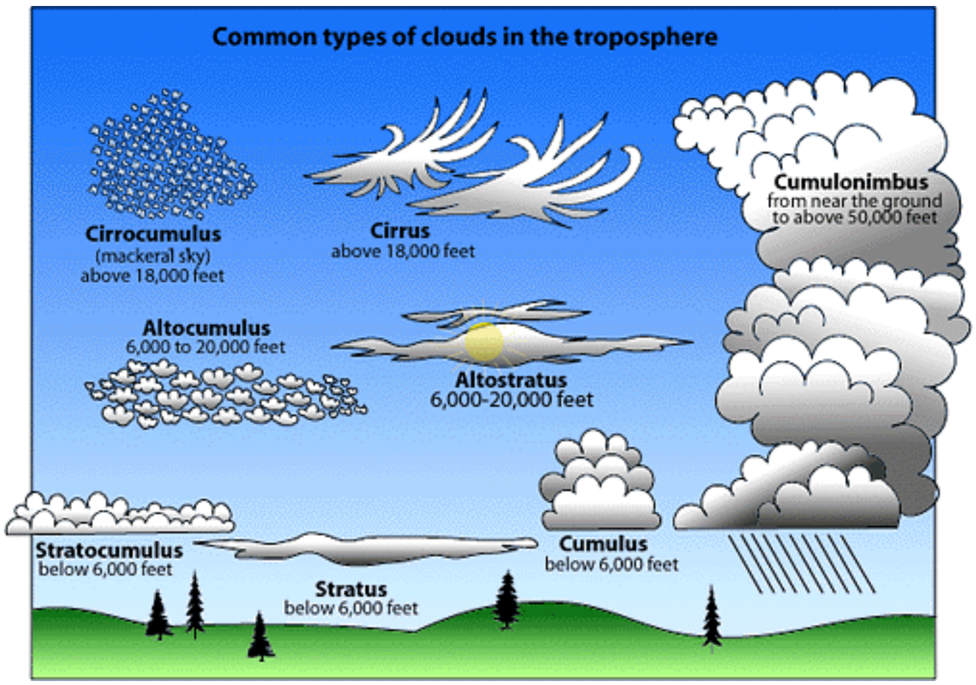
- Pedigree - when the moon is closest to the earth
- Boat Naming (N at the end of CV, SS, CG means nuclear powered)
    - CG - Guided Missile Cruiser
    - CA - Gun Cruiser
    - CV - Aircraft Carrier
    - L** - Amphibious / Landing Craft Carriers
    - BB - Battleship
    - S* - Submarine
    - A* - Combat Logistics
    - M* - Mine warfare
- Helicopters
    - First conflict to see wide use was Korean War
- Sailboats
    - Yawl - double mast sailing vessel where the mizzen or rear mast is aft of the rudder post.

    - Sloop - a single mast sailing vessel
- Tides
    - Spring tide - the large ride and fall of the tide at or soon after the new or full moon (high tides are very high, low tides are very low)
    - Neap tide - Those tides midway between spring tides that attain the least height
    - Ebb tide - when the tide falls after high tide
- Space program
    - Chronologically: Mercury, Gemini, Apollo
    - Alan Shepard - first American in space
    - John Glen - US Marine, 149 combat missions between WWII and Korean War. 5 distinguished flying crosses. First to fly supersonic across the US. First American to orbit the earth in space in the Project Mercury Gemini capsule Friendship 7.
    - Yuri Gagarin - Russian cosmonaut, first man in space.
    - Apollo 11 landed on the moon in 1969 w/ Neil Armstrong, Edwin Aldrin Jr, and Michael Collins
        - 17 total Apollo missions
    - Pioneer 10 - First American spacecraft to explore the outer solar system
    - Ed White - first American to walk in space
- Dumping fuel during an emergency landing is done to increase maneuverability by reducing landing weight.
- Weather
    - Characteristics of warm front - Steady, long period of rain. Fog (warmer air over cooler water).
    - Atmosphere (lowest to highest)
        - Troposphere (20,000 ft at poles, 60,000 ft at equator)
        - Stratosphere (120,000 ft, 20 miles)
        - Mesosphere (300,000 ft, 50 miles)
        - Thermosphere / Ionosphere / Aurora (above and beyond)
        - Boundry between the troposphere and stratosphere is called the tropopause.
        - Ozone layer is in the higher end of the stratosphere.
    - Air
        - 78% Nitrogen ; Oxygen 21% ; Argon 1% ; The rest is traces of Carbon Dioxide, hydrogen, and other rare gases.
        - You typically need oxygen if you fly above 10,000 ft.
- Officers
    - Company grade - Ensigns and Lieutenants, Captains also
    - Flag officers - Commodores and Admirals
- Bonhomme Richard was a sailing frigate in the United States Navy.
- Latitude / Longitude
    - Latitude are lines across the globe. Measured from equator.
    - Longitude are lines from the poles. Measured from prime meridian in Greenwich, England.
        - UTC - coordinated universal time, the time at the prime meridian, through the observatory at Greenwich, England, longitude 000 degrees.
    - Time zones are divided into 15-degree intervals of longitude. 360/15=24 time zones
- Transponder
    - 7500 for hijacking
    - 7600 for loss of communication
    - 7700 for emergency
    - 7777 for military flight or interceptor
- Health Effects to Flying
    - Hypoxia - too little oxygen in the blood stream, resulting in a blackout

        - Vertigo - can also occur after long flights where the mind gets used to turbulence, resulting in a person's feeling as if he is moving up and down
- Airspace
    - Class A - 18,000 ft MSL up to FL600 (= really high ??)
    - Class B - surface to 10,000 ft MSL, surrounds major airports
    - Class C - surface to 4,000 ft AGL, around busy airports
    - Class D - surface to 2,500 ft AGL, surrounds airports with operational control tower
    - Class G - surface to either 1,200 ft AGL or 700 ft AGL
    - Class E - everything else
- Airports
    - Taxiway markings are yellow
        - Centerline is solid yellow line
        - Edges are double solid yellow
        - Holding lines are double solid yellow and double dashed yellow lines across width of taxiway
        - Runway holding position sign: red with white characters
    - Runway markings
        - Displaced Threshold – start of landing
          portion of runway, white block with white arrows
        - Chevrons – only usable in case of an emergency
        - Large white X – marks an unusable runway
    - Lights
        - Taxiway lighting - either green lights on the centerline or blue lights on the edge
        - Runway - threshold is green, sideline is white, runway end is red.
        - Obstructions - red lights
        - VASI - visual approach slope indicators
            - Red = low; White, amber = high; Green = on slope; even number of white and red = on slope.
        - PAPI - precision approach path indicators
        - 

    - Traffic Pattern
        - Normal pattern is flown @ 1,000 ft AGL, 5 legs
            - Upwind leg
            - Crosswind leg
            - Downwind leg
            - Base leg
            - Final approach
- For any helicopter, the higher the density altitude, the less the rate of climb.
- Lift varies directly with the density of air. As air density increases, lift and drag increase.
- Instruments:
    - Beaufort Scale - estimates wind speed
    - Fathometer - electronic device used in making deep-sea soundings.
    - Sextant - precision instrument used in celestial navigation to measure angles.

    - Capstan - An apparatus used for hoisting weights, consisting of a vertical spool-shaped cylinder that is rotated manually or by machine and around which a cable is wound.
- 4 methods of determining position
    - Piloting, dead reckoning, celestial navigation, electronic navigation.
- Docks
    - Pier - right angle to the shore
    - Wharf - parallel to the shore
    - Slip - space between adjacent piers
- Clouds



    - **Nimbus:** rain bearing clouds

    - **Alto:** meaning high, also middle level clouds existing at 5,000 to 20,000 ft.

    - **Cumulus:** In Latin, this means "heap." Cumulus clouds look like a heap of cotton balls or whipped cream.
        - They are often low in the air and look like cotton wool or like cauliflower on top with a flat base. Cumulus is Latin for 'heap'. Clusters of small white cumulus clouds are usually a sign of fine weather. Sometimes cumulus clouds develop into the storm cloud cumulonimbus, which brings lightning and thunder. Cumulonimbus Clouds are called 'the King of Clouds'. The base of a cumulonimbus cloud is often low but it may be as high as 10 kilometers.
    - **Stratus:** It's Latin for "covering" or "blanket." Stratus clouds look like a flat blanket in the sky. Formed in layers.
        - These appear as light grey clouds that look like even sheets and cover all or part of the sky. They are composed of fine water droplets that become larger as they collide with each other and are often very low in the air.
    - **Cirrus:** It's Latin for "curl." Cirrus clouds look like curls of white hair. Ringlets, fibrous clouds.
        - These are the whitest, highest clouds made of tiny ice crystals. They are often wispy in appearance.
    - **Levels**
        - High level (base @ 20,000 ft)
            - Ice crystals, below freezing upper atmosphere

        - Cirrus, cirrocumulus, cirrostratus
    - Middle level (base above 6,500 ft)
        - Altocumulus, altostratus, nimbostratus
    - Low level (base below 6,000 ft)
        - Stratocumulus, stratus, cumulus, nimbostratus
    - Towering, vertical rising (mushroom clouds)
        - Cumulonimbus, towering cumulus
- Winds
    - Land breeze - at night the land cools faster than the water, therefore the air above it cools and descends; the air aver the sea rises; surface air moves to sea; higher air moves inland.
    - Sea breeze - during the day, more common on hot sunny days; the land heats and causes the air over the land to rise; the air above the water is cooler and moves in over land and creates a circular pattern
    - Windward - toward the wind, toward the point in which the wind blows
    - Leeward - on the side away from the wind (downwind)
- Thunderstorm
    - Cumulus stage - warm air rises in cumulus clouds, strong updrafts
    - Mature stage - precipitation begins, typically last 20-40 minutes
    - Dissipating stage - downdrafts of cold air overcome rising warm air, the temperature in the clouds warm to match that of the surrounding environment.
- Atmospheric Temperature
    - If it is higher than standard, true altitude will be higher than your indicated altitude.
    - If it is colder than standard, true altitude will be lower than indicated.
    - Mean sea level temperature is +15 degrees Celsius **or** +59 degrees Fahrenheit.
    - Mean sea level pressure is 29.92 inches Hg (mercury)
    - Standard Temperature Lapse
        - Temperature decreases at the rate of approx.. 3.5 degrees F or +2 degrees C per thousand feet up to 36,000 feet which is approx. -65 F or -55 C. Above this point the temperature is considered constant up to 80,000 ft.
    - Standard Pressure lapse
        - Pressure decreases at a rate of approximately 1 "HG per 1,000 feet of altitude gain to 10,000 feet.
- Engine
    - High performance - more than 200 horsepower
    - The horsepower out-put of the engines decrease because its fuel-air mixture is reduced. The propeller develops less thrust because the blades, as airfoils, are less efficient in the thin air. The wings develop less lift because the thin air exerts less force on the airfoils. As a result, the take-off distance is substantially increased, climb performance is substantially reduced and may, in extreme situations, be non-existent.
    - Humidity also plays a part in this scenario. Although it is not a major factor in computing density altitude, high humidity has an effect on engine power. The high level of water vapor in the air reduces the amount of air available for combustion and results in an enriched mixture and reduced power.

- Airspeed
    - Indicated (IAS) - displayed on your airspeed indicator
    - Calibrated - IAS corrected for installation error and instrument error
    - True (TAS) - CAS corrected for altitude and nonstandard temperature.
    - Groundspeed (GS) – the actual speed of the airplane over the ground. It is TAS adjusted for wind. GS decreases with a headwind, and increases with a tailwind.
- Air Pressure

- If you fly from high pressure to low pressure without resetting altimeter, indicated will read higher altitude than your true altitude.
- If you fly from low to high pressure, true altitude will be higher than indicated.

- Different types of altitude
  - Indicated - altitude measured and displayed by the altimeter.
  - Pressure - vertical distance above the standard datum plane
  - Density - corrects pressure altitude for nonstandard temperature
  - True - actual height of an object above mean sea level
  - Absolute - actual height of the airplane above the earth's surface over which it is flying
  - Misc:
    - Actual air speed is faster than indicated air speed at high altitudes, where the air is less dense.
    - The higher you go, the less dense the air. This means less lift, but also less drag.
    - You get best lift when the air is dry, you're at a low altitude, and it's cold out (all things that effect density)
  - When flying from high pressure to low pressure without adjusting Altimeter actual height of the aircraft above the ground would be lower than the indicated altitude.
    - "GOING FROM A HIGH TO A LOW, LOOK OUT BELOW"
    - "FROM HOT TO COLD, LOOK OUT BELOW"
      - When flying into a cooler air mass while maintaining a constant indicated altitude, true altitude is lower.
    - Local altimeter settings can be obtained by monitoring local automated weather observing system/automated surface observation system (AWOS/ASOS) or automatic terminal information service (ATIS) broadcasts….or by utilizing Air Traffic Control (ATC)
- Different types of drag
  - Parasite - caused by any aircraft surface that deflects or interferes with the smooth airflow around the airplane. Divided into 3 parts. (if airspeed is doubled, parasite drag is increased 4 times; = airspeed squared)
    - Form drag - results from the turbulent wake caused by separation of airflow from the surface of the structure. Relative to both the size and shape of the structure which protrudes into the relative wind.
    - Interference - occurs when varied currents of air over an airplane meet and interact. Such as the mixing of the air over structures such as wing and tail surface brace struts and landing gear struts.
    - Skin friction - caused by roughness of the airplanes surface.
  - Induced - Generated by the airflow circulation around the wing as it creates lift. Vortices acting at the downwash and the wing tip. Known as 'drag due to lift'.
    - When are vortices produced? (during lift, drag, or thrust?)
      - Only when a wing produces lift (I think)
  - Ground effect - Occurs close to the ground where the earths surface restricts the downward deflection of the airstream from the wing, decreasing induced drag.
  - Total - Sum of parasite and induced drag.
- Historical Events
  - Navy Founded
    - Continental Navy - October 13, 1775
    - US Navy - 1798

  - Ader Eole
    - First true aeroplane
    - Steam powered

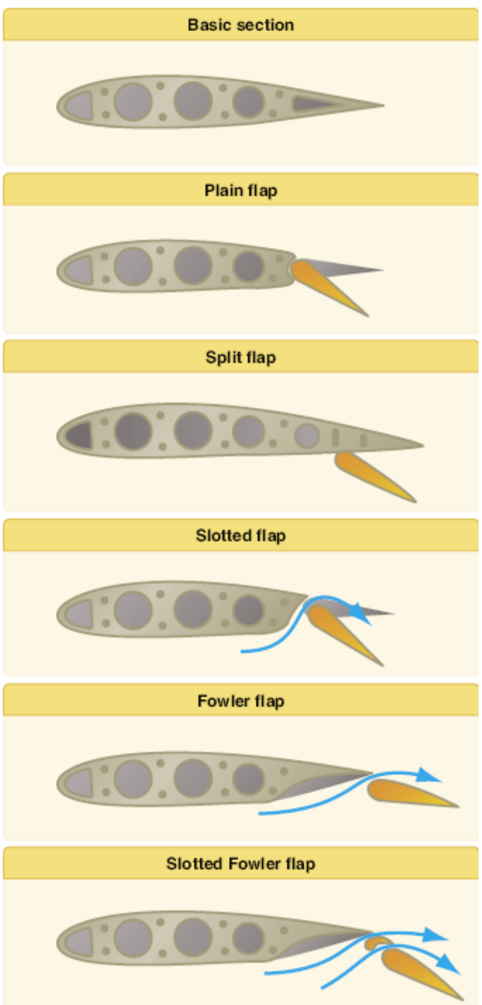
        - Developed by Clement Ader in 1890
    - LZ1
        - First Zeppelin
        - July 2, 1900 was its first flight - 18 minutes long
    - LZ127
        - First to circumnavigate the globe
        - 21 days, 5 hours, 31 minutes
    - Wright Flyer
        - First successful powered, piloted aircraft
        - Dec 17, 1903.
        - 12 seconds, 120 ft.
    - FW-61
        - Built in 1936, max speed 66 knots.
        - Range of 124 nautical miles
    - First nonstop flight across atlantic
        - Took off June 14, 1919
        - Vickers Vimmy IV
        - Alcock and Brown
    - Charles Lindbergh Jr.
        - First solo non-stop flight across atlantic
        - May 20 - 21, 1927
    - Amelia Mary Earhart
        - First woman to:
            - Receive distinguished flying cross.
            - Fly the Atlantic / Alone / and Twice
            - Fly an Autogyro (small rotorcraft)
            - Cross the US in an Autogyro
            - Fly non-stop across the US
            - Fly non stop from Hawaii to the continental US
    - First jet to fly combat missions
        - Messerschmitt ME-262
        - Late 1944

    - Chuck Yeager
        - First man to break the sound barrier
        - Bell X-1 rocket plane in 1947
    - Eugene Ely - 1910
    - USS Pennsylvania - 1911
    - Pearl Harbor - December 7, 1941
    - D-Day - June 6, 1944
    - Atomic bomb
        - August 6, 1945 on Hiroshima
        - August 9, 1945 on Nagasaki
- Airplane Construction
    - Monocoque: uses stressed skin to support almost all loads much like an aluminum beverage can.
    - Semi-monocoque: partial or one-half, uses a substructure to which the airplanes skin is attached composed of formers (doughnut like disks) and stringers (cables attached to disks and bulkhead)
    - Wing Curvatures are called “cambers.”
- Aircraft Operational Categories (sorted by their limit load factors)

    - Normal
    - Utility (mild acrobatics, including spins)
    - Acrobatic
    - Transport
- Abbreviations
    - Electronic Flight Display (EFD)
    - Primary Flight Display (PFD)
        - Included instruments on the PFD.
            - Airspeed tape
            - Attitude indicator
            - Altimeter
            - Vertical Speed Indicator
            - Heading Indicator
            - Turn Indicator
            - Tachometer
            - Slip/Skid Indicator
            - Turn Rate Indicator
    - Multi-function Display (MFD)
    - Aeronautical Decision-Making (ADM)
    - Vertical Speed Indicator (VSI) sometimes called Vertical Velocity Indicator (VVI)
    - Air Speed Indicator (ASI)
    - Asymmetric loading of the propeller (P-factor)
    - Air-Traffic Control (ATC)
    - Automated weather observing system (AWOS)
    - Automated surface observation system ASOS)
    - Automatic terminal information service broadcasts (ATIS)
    - Notice to Airmen (NOTAM)
- Types of Instruments
    - Performance
        - Indicate the aircrafts actual performance. Include altimeter, airspeed or vertical speed indicator, heading indicator, and turn-and-slip indicator
    - Control
        - Display immediate attitude and power changes and are calibrated to permit adjustments in precise increments.
    - Navigation
        - Indicate the position of the aircraft in relation to a selected navigation facility or "fix."
- Density Altitude
    - Density altitude is the vertical distance above sea level in the standard atmosphere at which a given density is to be found.
        - A decrease in air density means a high-density altitude; an increase in air density means a lower density altitude.
- Effects of Pressure on Density
    - Pressure and Density are directly proportional.
    - If pressure is doubled then density is doubled; if pressure is lowered, then density is lowered.
- Effects of Temperature on Density
    - Increasing the temperature of a substance decreases its density; decreasing the temperature increases the density.
    - In the atmosphere, both temperature and pressure decrease with altitude.
        - Pilots can expect air density to decrease with altitude.

- Effects of Humidity (moisture) on Density
  - Water vapor is lighter than air; consequently, moist air is lighter than dry air.
  - Warm air holds more water vapor, while colder air holds less.
    - As humidity rises the air becomes less dense, increasing density altitude and decreasing aircraft performance.

- Newton's Basic Laws of Motion
  - Symmetric airfoils DO produce lift
  - First Law: "Objects persist in their state of rest until acted on by an outside force."
  - Second Law: "Force is equal to the change in momentum per change in time. For a constant mass, force equals mass times acceleration."
  - Third Law: "For every action there is an equal and opposite reaction."
- Bernoulli's Principle of Differential Pressure
  - As the velocity of a moving fluid (liquid or gas) increases, the pressure within the fluid decreases.
- Four stroke Engine
  - Intake
  - Compression
  - Power
  - Exhaust



- Flaps
  - Slotted flap is the most popular.
  - Fowler Flaps are a type of slotted flap.