SYST 660 NAME: _____

FUEL CONSUMPTION

1. Derive the equation for THRUST for a fixed wing aircraft
    a. Draw free-body diagram in the horizontal/vertical plane
    b. Label the axes: Horizontal, Flight Path, Body
    c. Label the angles: Pitch, Flight Path, Angle-of-Attack
    d. Label the Forces: Thrust, drag, Weight, Lift
    e. Show which forces are perpendicular to the Horizontal and Flight Path Axes
    f. Derive the equations of motion on the FLIGHT PATH axis using Newtons' Second Law
    g. Solve for Thrust and explain the terms in the equation (i.e. Thrust to overcome Drag, gravity and inertia)
2. Calculate the Fuel Burn for 3 hours of constant speed at level flight at 30,000 ft for the following JET aircraft (737-800). Use BADA Model and data
    a. Calculate the Thrust Specific Fuel Consumption (kg/minute/kgN) for VTAS = 19 m/sec (BADA User Manual page c-22)
    b. Calculate Drag for the following conditions (page C-17 BADA User Manual and BADA for B737 for DRAG and LIFT)
        i. ρ is the air density (kg/m3) = 0.47 kg/m^3
        ii. S is the wing reference area (m^2) = 0.12465 x 10^{-3} m^2
        iii. VTAS is the true airspeed (m/s) = 19 m/sec
        iv. Assume bank angle is zero
        v. m = 0.5 x 10^{+2} tonnes (Note: 1 tonne = 1000kg)
    c. Thrust (N) = Drag for level flight, constant speed
    d. Calculate Nominal Fuel Flow (kg/min) (BADA page c-22)
    e. Calculate Fuel Burn for 3 hours = 3 hours * Nominal Fuel Flow