"GIVEN:  A 4-stroke, 4-cylinder IC engine modeled with the Otto Cycle,"

    a$ = 'air'
    rpm = 2800[rev/min]
    P[1] = 14.7[psia]
    T[1] = 80[F]
    Vol_1 = 34[in^3]*convert(in^3,ft^3)
    P[3] = 990[psia]
    CR = 10
    N_r = 2[rev]    "4-stroke engine"

"FIND: (a) the power developed by the engine (hp)
       (b) the thermal efficiency of the cycle
       (c) the mean effective pressure of the engine (hp)"

"SOLUTION:"
"!PROPERTIES"
"State 1: P[1], T[1]"
    v[1] = volume(a$,P=P[1],T=T[1]);
    u[1] = intenergy(a$,T=T[1])
    s[1] = entropy(a$,P=P[1],T=T[1])
"State 2: v[2], s[2]"
    CR = v[1]/v[2]
    P[2] = pressure(a$,v=v[2],s=s[2])
    T[2] = temperature(a$,v=v[2],s=s[2])
    u[2] = intenergy(a$,T=T[2])
    s[2] = s[1]
"State 3: P[3],v[3]"
    T[3] = temperature(a$,P=P[3],v=v[3])
    v[3] = v[2]
    u[3] = intenergy(a$,P=P[3],v=v[3])
    s[3] = entropy(a$,v=v[3],T=T[3])
"State 4: v[4], s[4]=s[3]"
    P[4] = pressure(a$,v=v[4],s=s[4])
    T[4] = temperature(a$,v=v[4],s=s[4])
    v[4] = v[1]
    u[4] = intenergy(a$,T=T[4])
    s[4] = s[3]

"!THERMODYNAMICS"
"The net work delivered per cylinder is,"
    W_net = W_34 - W_12
    W_34 = m*(u[3] - u[4])
    W_12 = m*(u[2] - u[1])

"The mass of air trapped in the cylinder is,"
    m = Vol_1/v[1]

"The thermal efficiency of the cycle is,"
    eta_th = W_net/Q_23
    Q_23 = m*(u[3] - u[2])

"The mean effective pressure of the cycle is,"
    mep = W_net*convert(Btu,in-lbf)/(Vol_disp*convert(ft^3,in^3))
    Vol_disp = m*(v[1] - v[2])

"The power developed by the engine is,"
"!This is a 4-stroke engine, therefore 2 revolutions of the crankshaft are required to execute a cycle.
 In addition, there are 4 cylinders in the engine.  The values calculated above are per cylinder."
    W_dot_net = 4*W_net*(rpm/N_r)*convert(Btu/min,hp)

## Arrays Table: Main

|   | $T_i$ | $P_i$ | $v_i$ | $u_i$ | $s_i$ |
|---|---|---|---|---|---|
|   | [F] | [psia] | [ft³/lbm] | [Btu/lbm] | [Btu/lbm-F] |
| 1 | 80 | 14.7 | 13.6 | 92.09 | 1.362 |
| 2 | 854.3 | 357.9 | 1.36 | 230.6 | 1.362 |
| 3 | 3175 | 990 | 1.36 | 729.5 | 1.577 |
| 4 | 1299 | 47.9 | 13.6 | 318 | 1.577 |