

## Examples using SOPHT

<Example 1>

Problem:

$$x + y = 1$$

$$x - y = 0$$

Solution:

$$x = y = 0.5$$

Code:

```
// =====  
// Simple Example #1  
// =====  
x + y = 1    // Equation # 1  
x - y = 0    // Equation # 2
```

<Example 2>

Problem:

$$\ln(x) = 0.1x$$

Solution:

$$x_1 = 1.118 \text{ or } x_2 = 35.77$$

Code:

```
// =====  
// Simple Example #2  
// =====  
ln(x) = 0.1*x    // Equation # 1
```

<Example 3>

Problem:

Problem 1.13 in the text book

**NOTE: consider it's a steady state problem**

$$Q|_A = \frac{T(t) - T_\infty}{R_t} = \dot{s}_{e,m} V$$

Solution:

T = 247 (deg) (Note that it is a steady state temperature)

```
//=====
// GOVERNING EQUATIONS
//=====
QA = sdot*V           // Integral Volume Energy Equation
QA=(T-Tinf)/Rt       // Heat Flow, W

//=====
// GEOMETRIC PARAMETERS
//=====
V=1.13e-7             // Volume of Popcorn, m^3, Given

//=====
// CONSTANTS
//=====
Tinf=20               // Far Field Temperature, C
sdot=4e5              // Energy Conversion, W/m^3
Rt=5e3                // Thermal Resistance, K/W
```

<Example 4>

Problem:

Problem 1.13 in the text book

$$Q|_A = \frac{T(t) - T_\infty}{R_t} = -\rho c_v V \frac{dT}{dt} + \dot{s}_{e,m} V$$
$$\frac{dT}{dt} = \frac{\dot{s}_{e,m}}{\rho c_v} - \frac{(T(t) - T_\infty)}{\rho c_v R_t V}$$

Solution:

- (a) 113 (deg) (Please find the calculated sheet)
- (b) 247 (s) (Please find the calculated sheet)

Code:

```
//=====
// GOVERNING EQUATIONS
//=====
Tp'=-QA/rho/cv/V+sdot/rho/cv // Transient Energy Equation
// Prime term (Tp') means d/dt
// Prime term should be alone on the left hand side like above line.
// Otherwise, error message shows up.
QA=(Tp-Tinf)/Rt // Heat Flow, W

//=====
// PROPERTIES
//=====
cv=1000 // Specific Heat of Popcorn, J/kg-K, Given
rho=1000 // Density of Popcorn, kg/m^3, Given

//=====
// GEOMETRIC PARAMETERS
//=====
V=1.13e-7 // Volume of Popcorn, m^3, Given

//=====
// CONSTANTS
//=====
Tinf=20 // Far Field Temperature, C
sdot=4e5 // Energy Conversion, W/m^3
Rt=5e3 // Thermal Resistance, K/W
```