

# Problem 2

MATLAB Code :

```
function T = invert_u(u)
    fun = @(T) 450 + 1.1*T + 0.0012*T.^2 - u;
    T = fsolve(fun, 100); % initial guess 100 K
end
function dudt = ode_u(t,u)
    qext = 5000 * exp(-0.002*t);
    T = invert_u(u);
    r = 1500*(1 - exp(-0.01*T));
    dudt = qext + r;

end
T0 = 300;
u0 = 450 + 1.1*T0 + 0.0012*T0^2;

[t,u] = ode45(@ode_u, [0 4000], u0);
T = zeros(size(u));

for k = 1:length(u)
    T(k) = invert_u(u(k));
end
qext = 5000*exp(-0.002*t);
r = 1500*(1 - exp(-0.01*T));
idx = find(r > qext, 1, 'first');
t_cross = t(idx)
```

Solving using the MATLAB Code ,we get the time when reaction heat contribution surpasses external heating = 662.7890 sec