FENG703 Biochemical process modelling – assignment 1

Question 1

a)

**F**

**V0**

Rate of change of volume is dV/dt = F

So total mass balance is V= F\*t + V0

b)

Rate of substrate consumption is k1S.V

Rate substrate generation is FSf

So d(VS) = FSf – k1SV  
 t

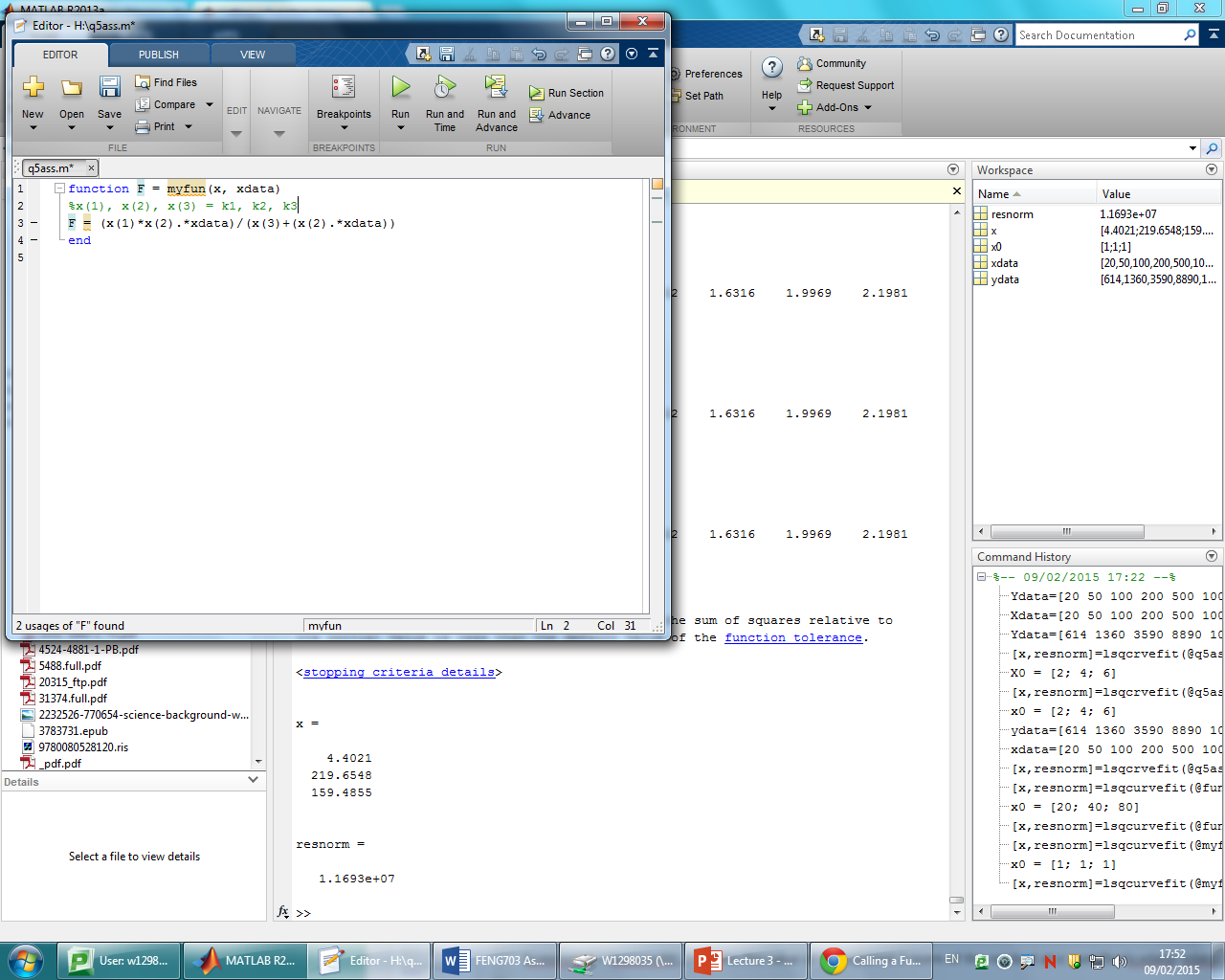
V(ds/dt) + s(dV/dt) = FSf - k1SV

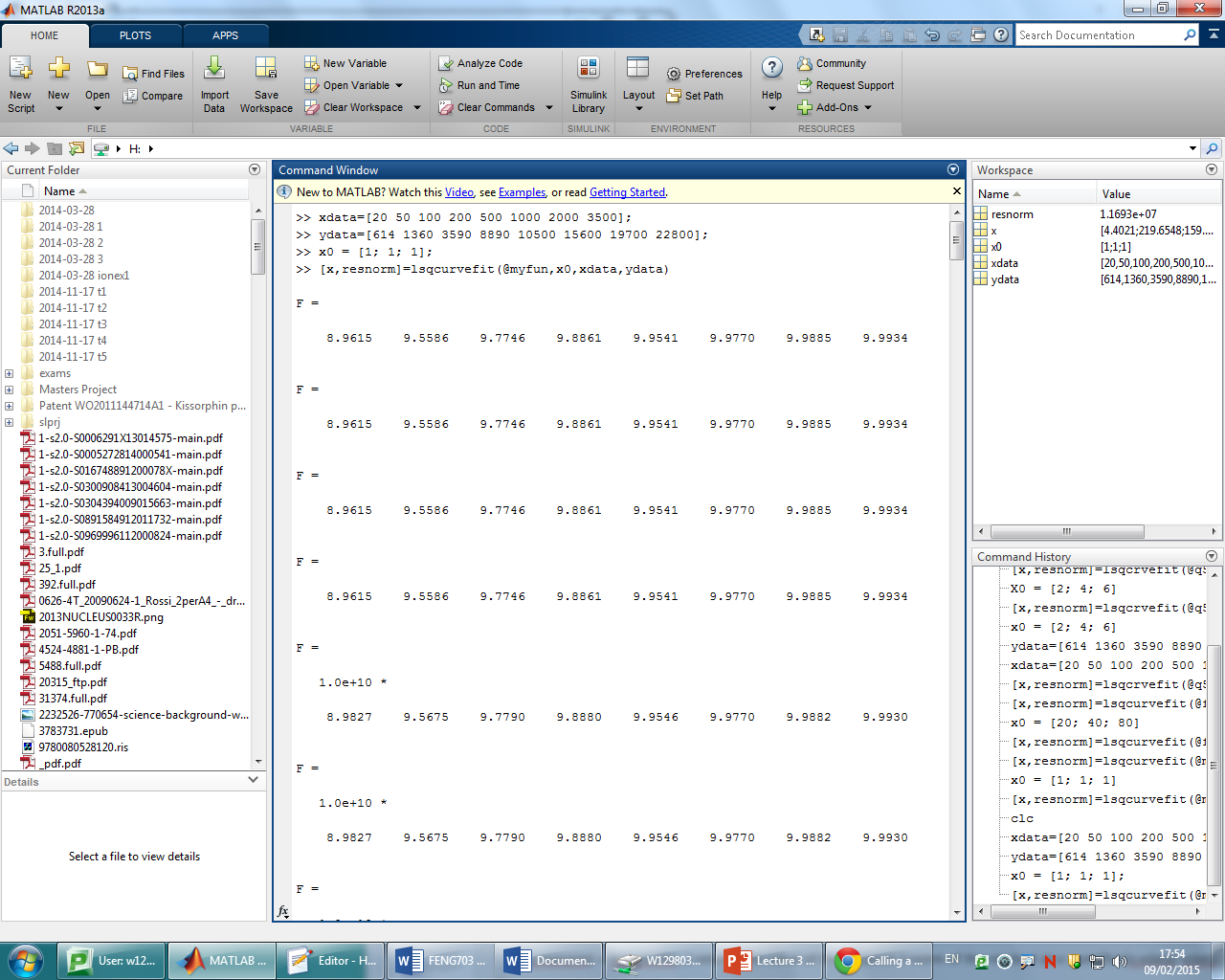
V(ds/dt) + FS = FSf - k1SV

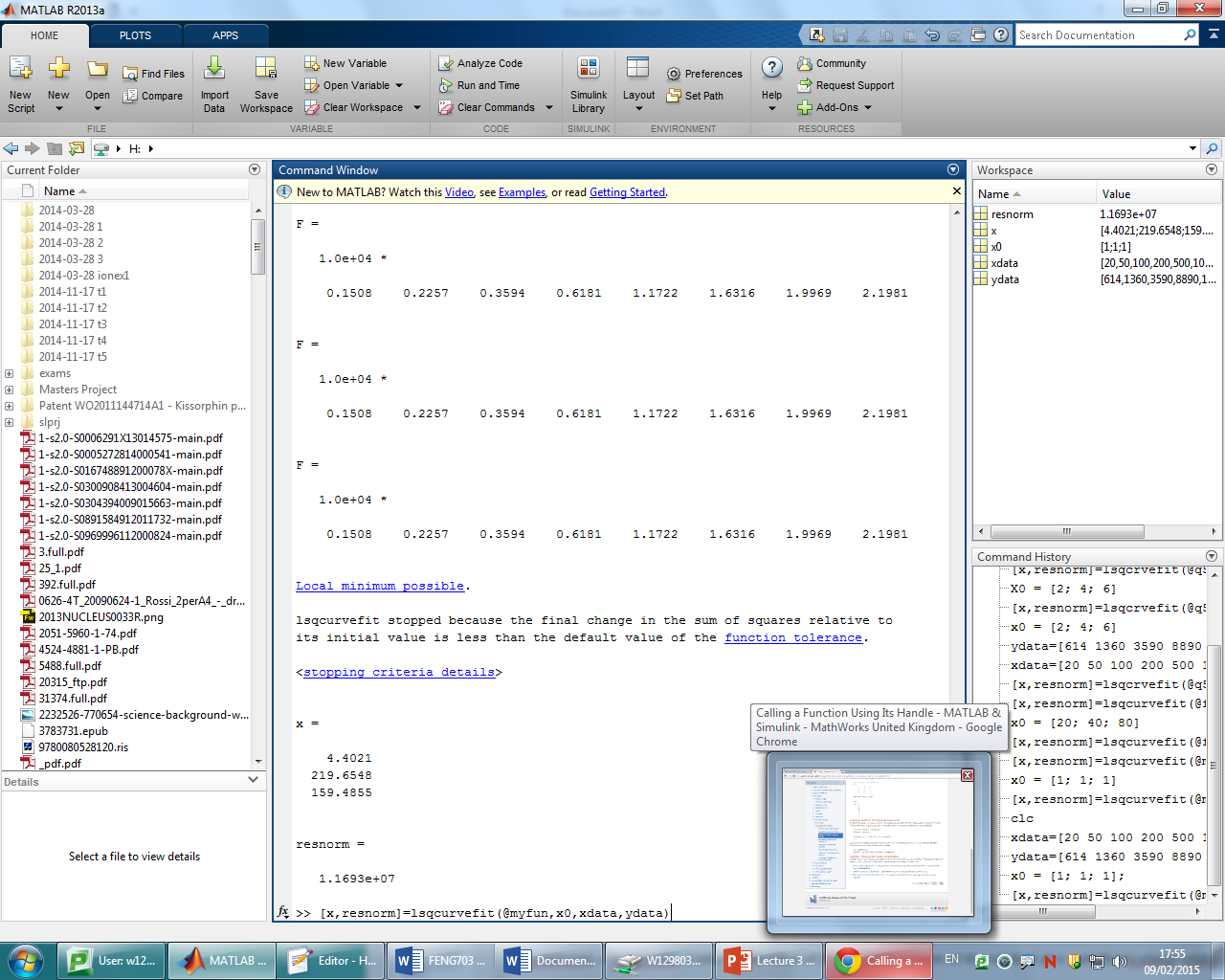
V(ds/dt) = F(Sf – S) - k1SV

(ds/dt) = F/V(Sf – S) - k1S

Question 2

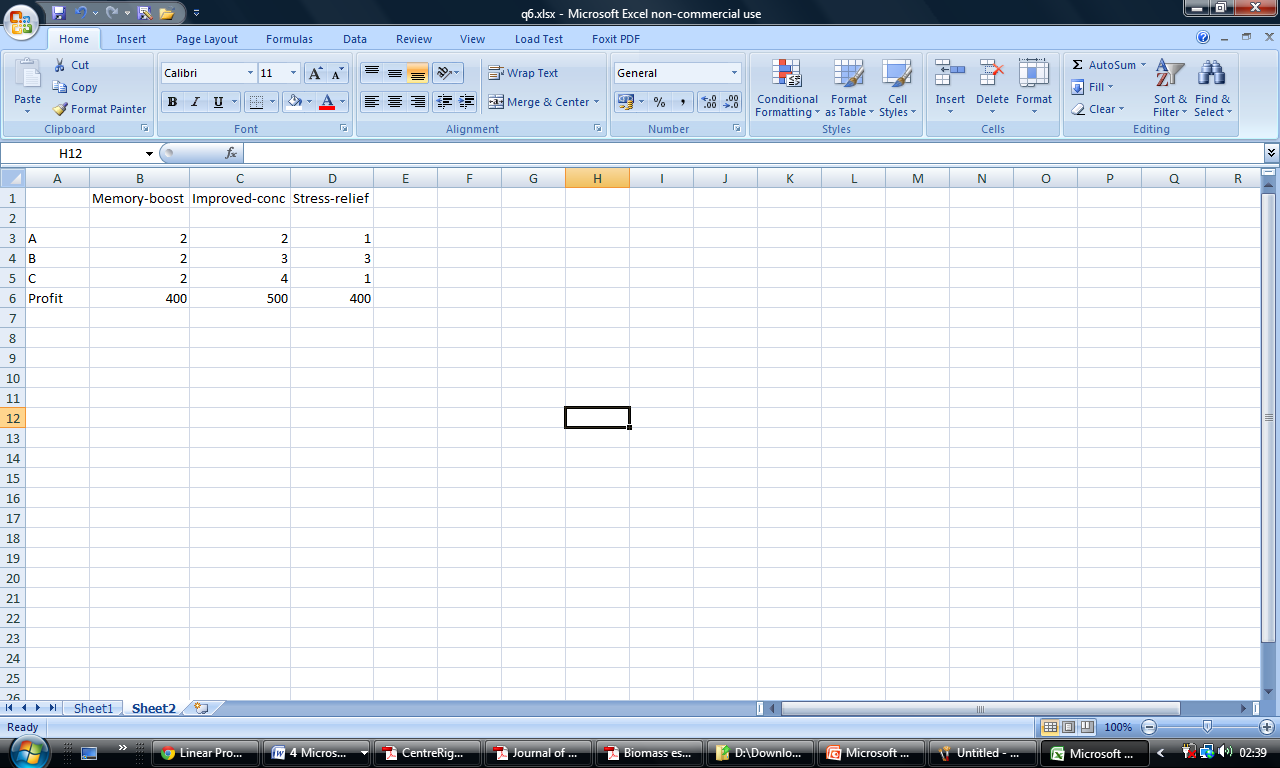


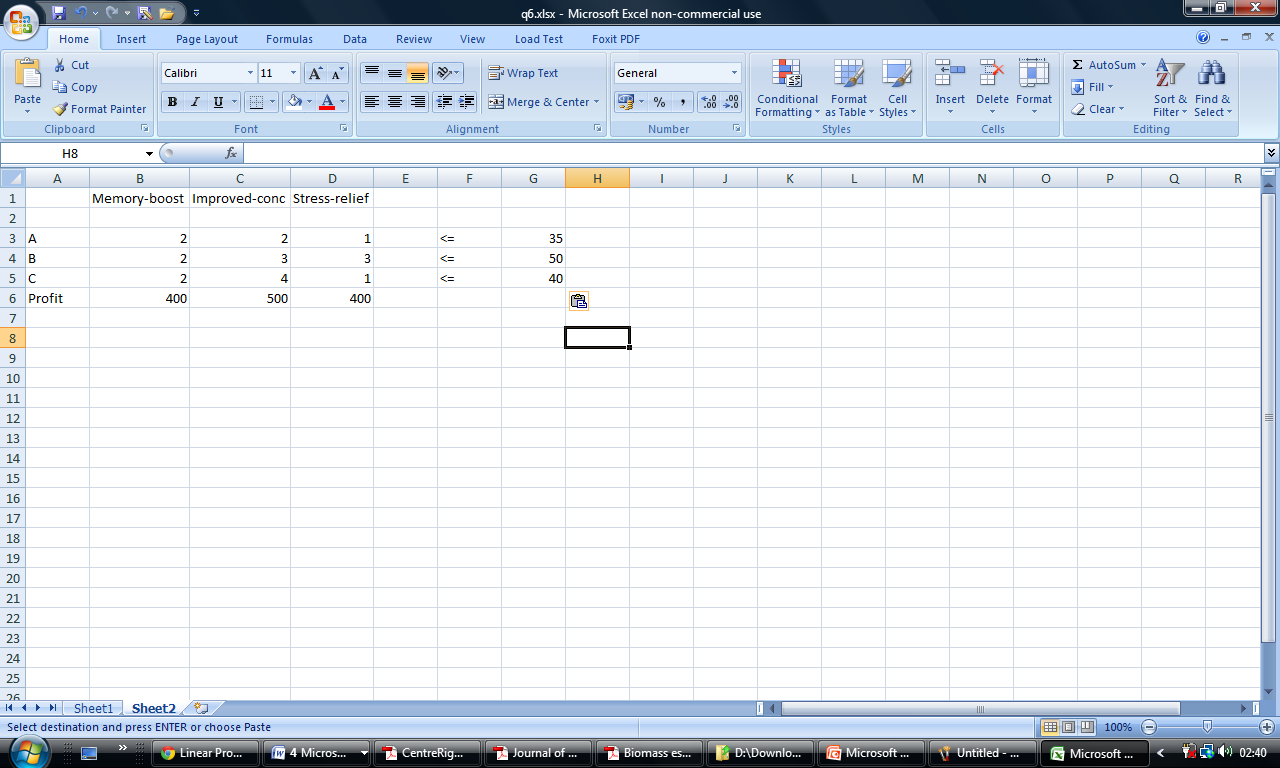


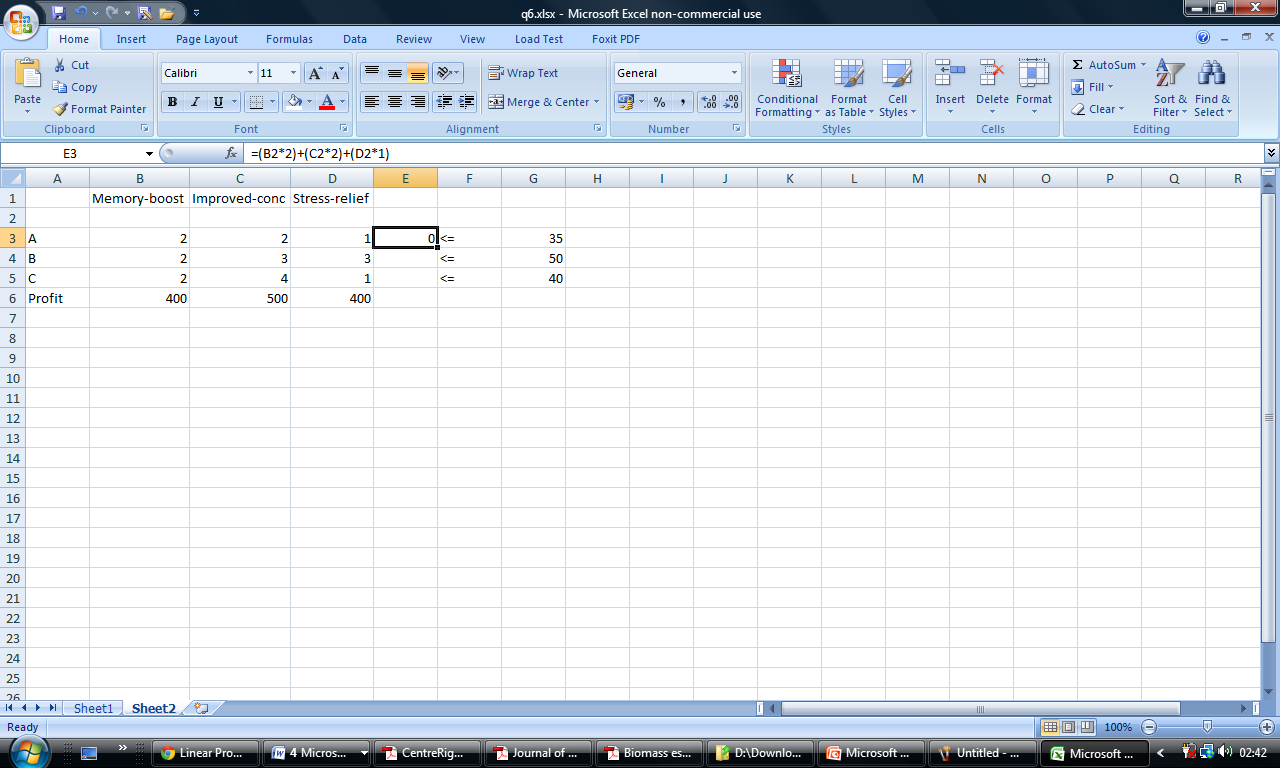


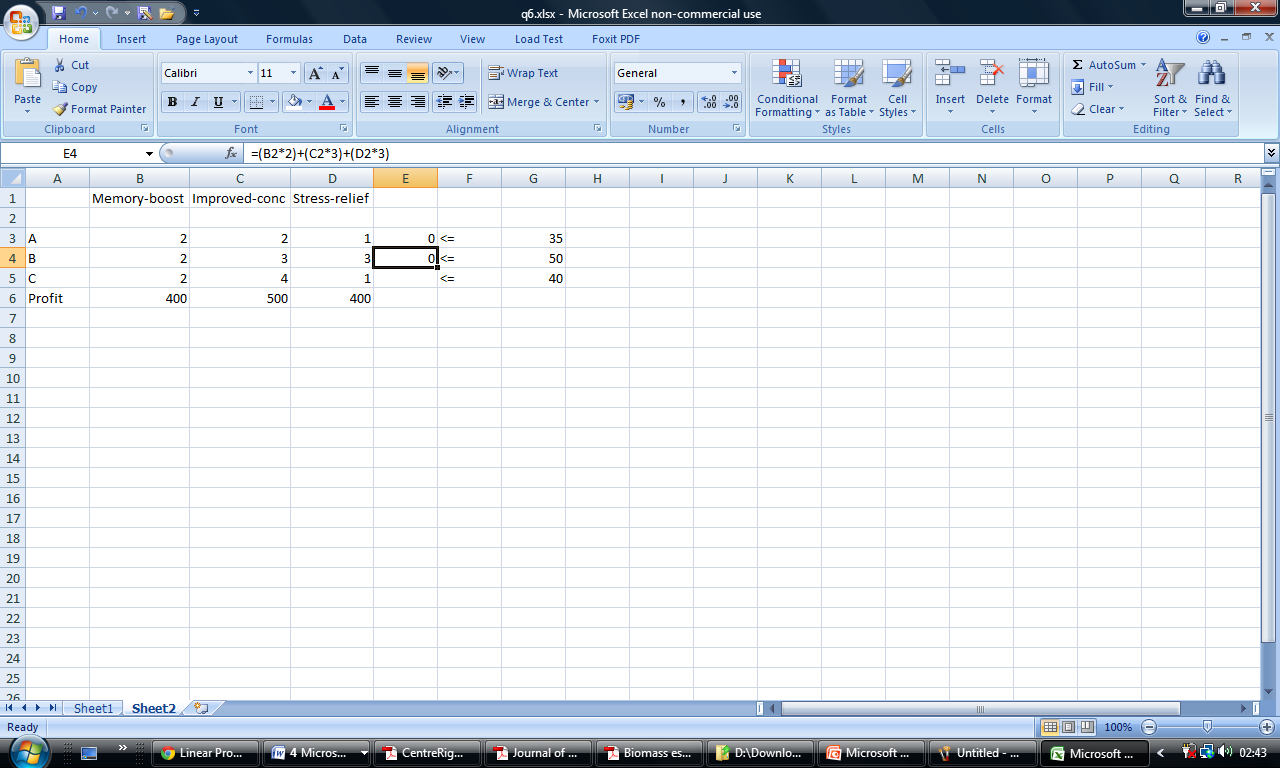
So K1 = 4.40, K2 = 219.65, K3 = 159.48

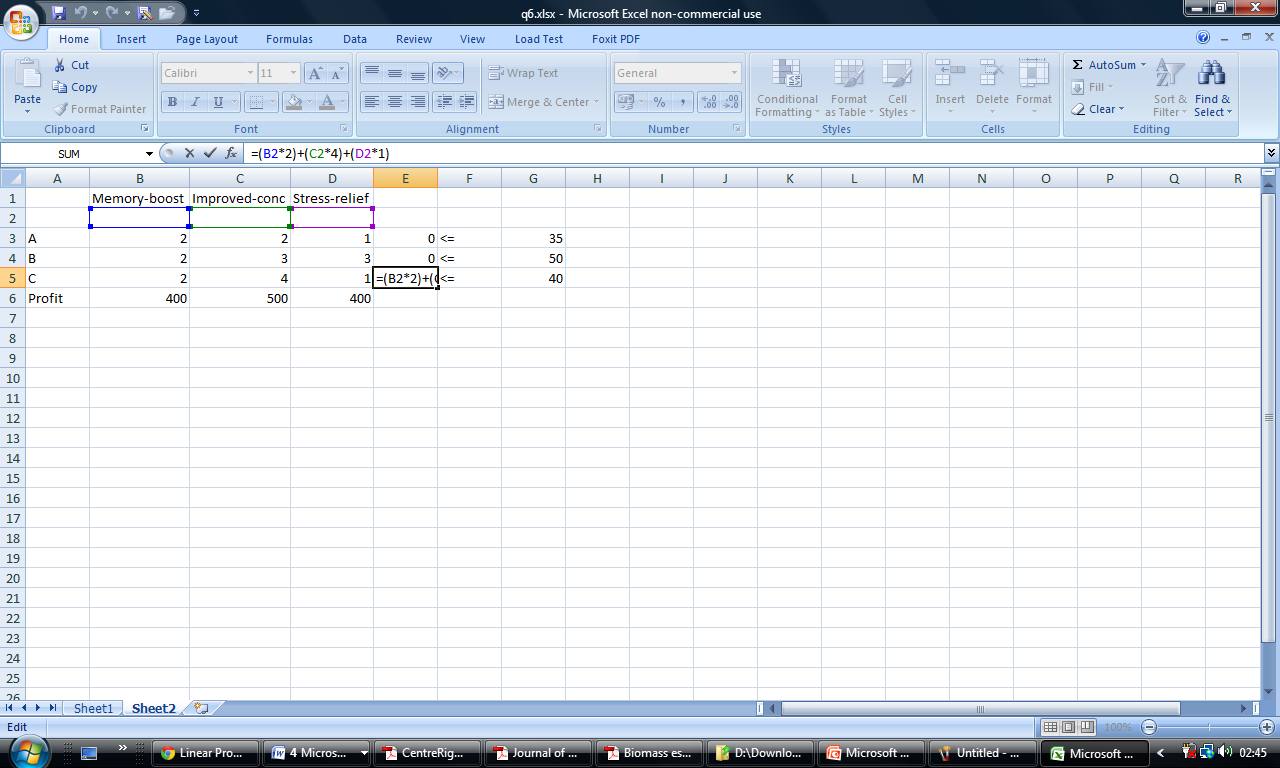
Question 3

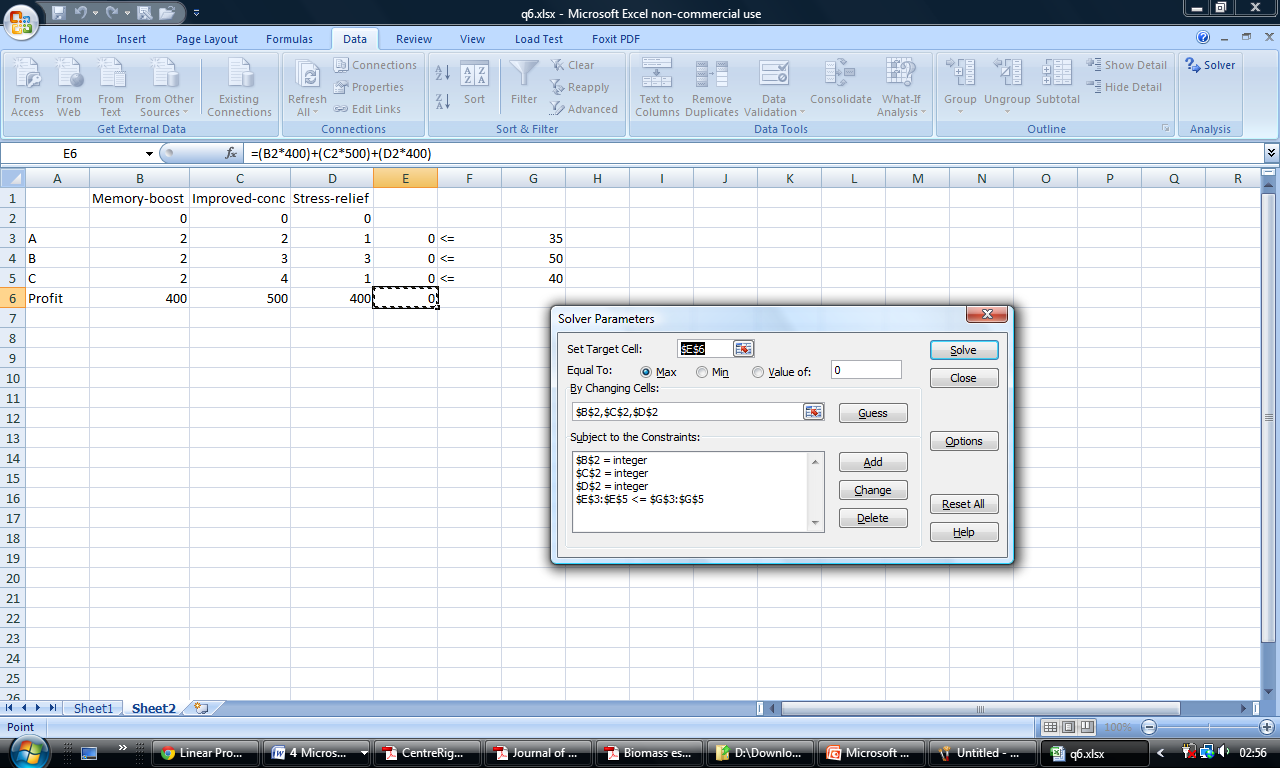


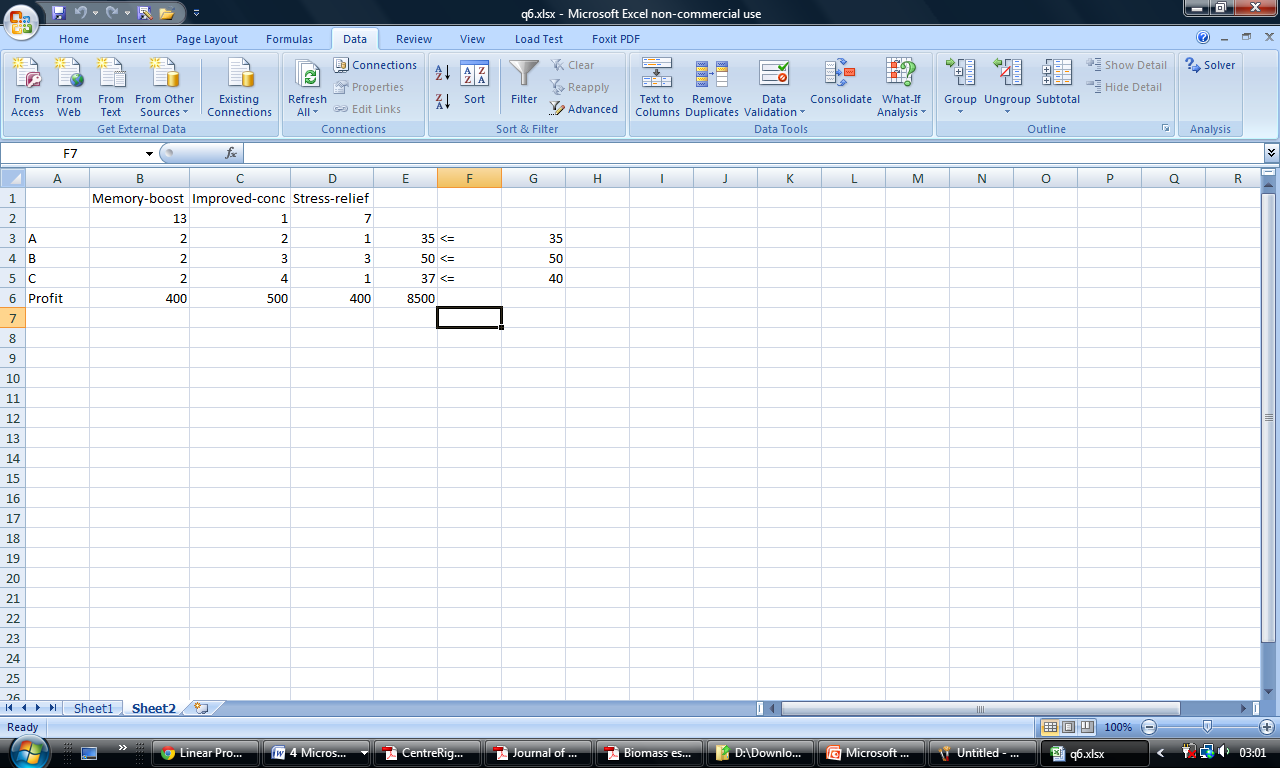










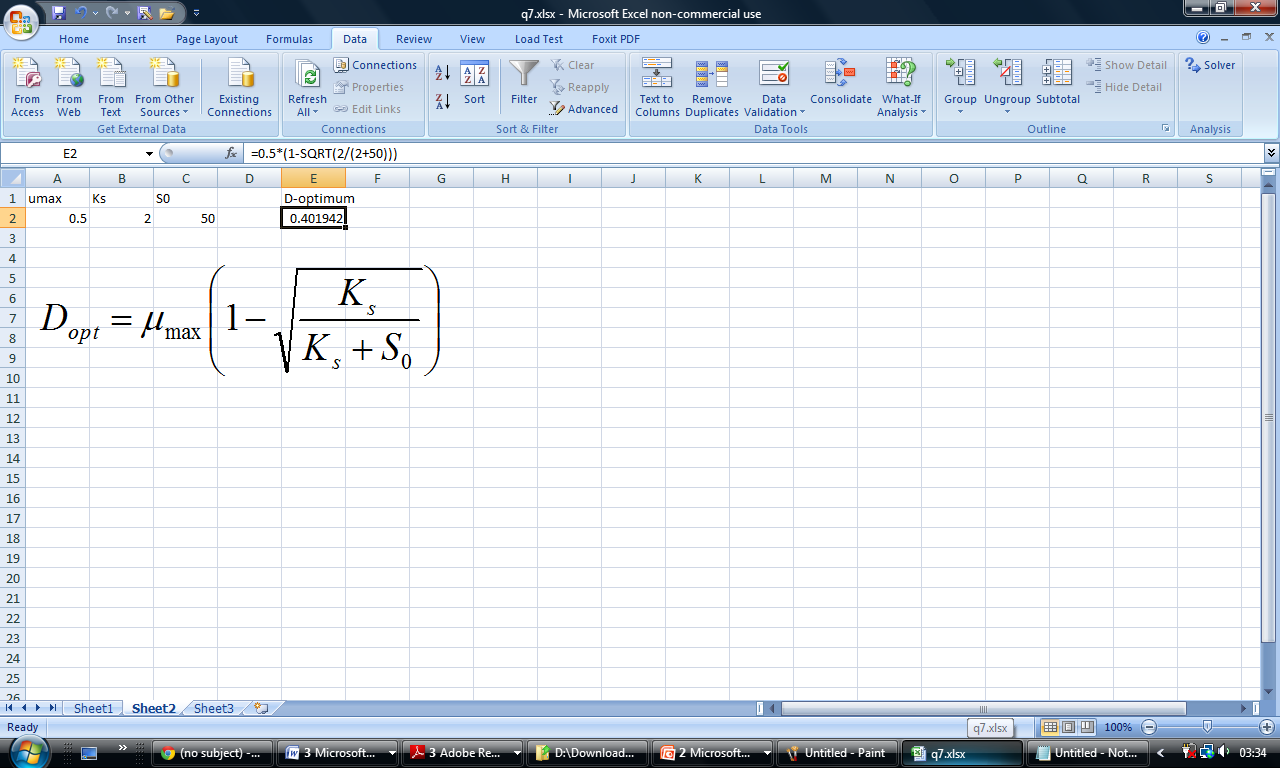


Therefore in order to maximise its profit the company should produce 13 batches of Memory boost protein, 1 batch of Improved concentration protein and 7 batches of stress relief protein.

Question 7

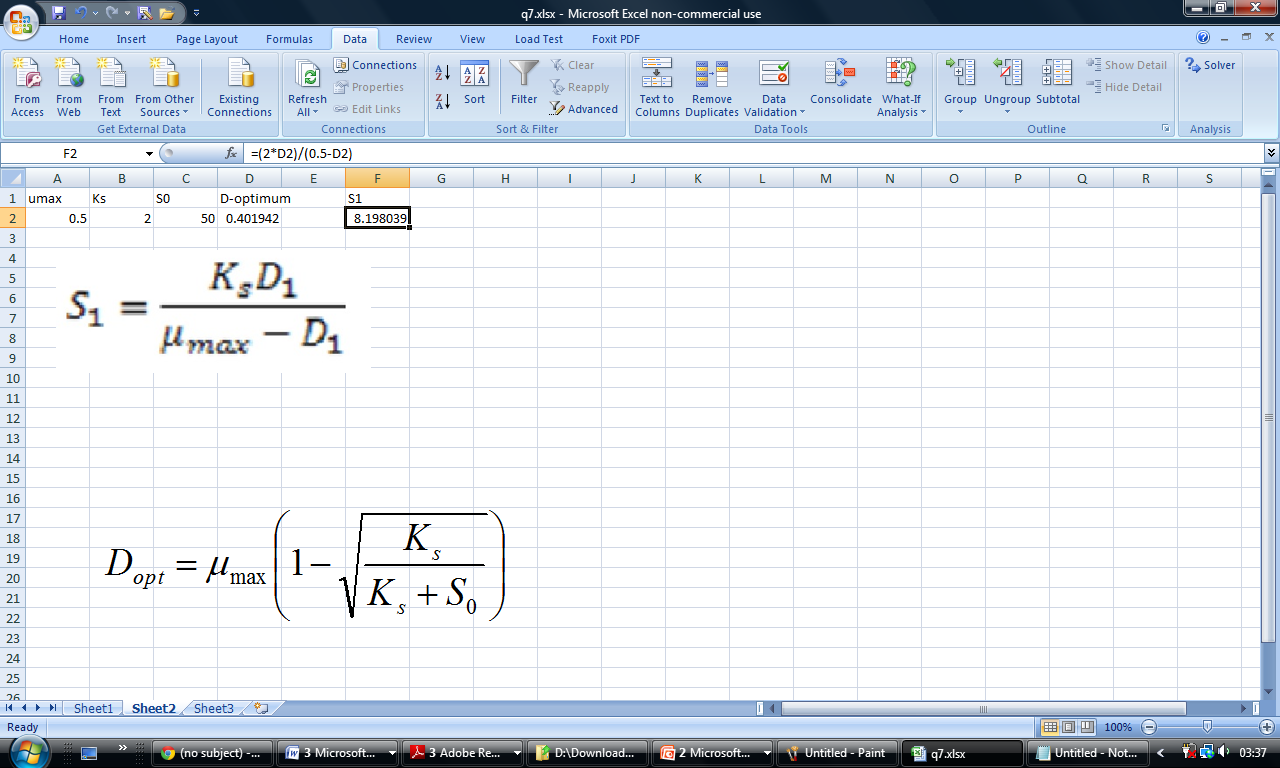
a)

As growth rate is highest for highest substrate concentration Dopt should be worked out for the first stage of the chemostat

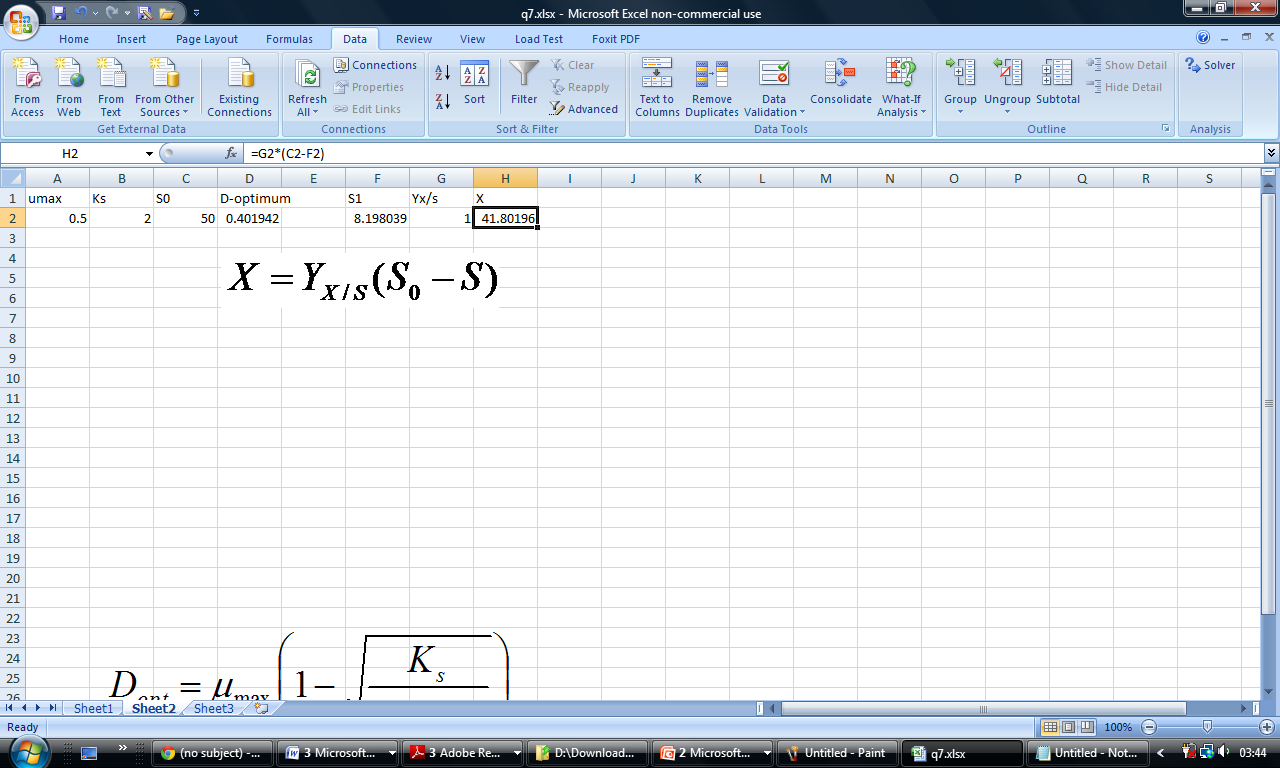


So the maximum dilution rate for optimal growth is Dmax =0.402 L/h

b



So the level of substrate leaving the first reactor is S1 = 8.20g

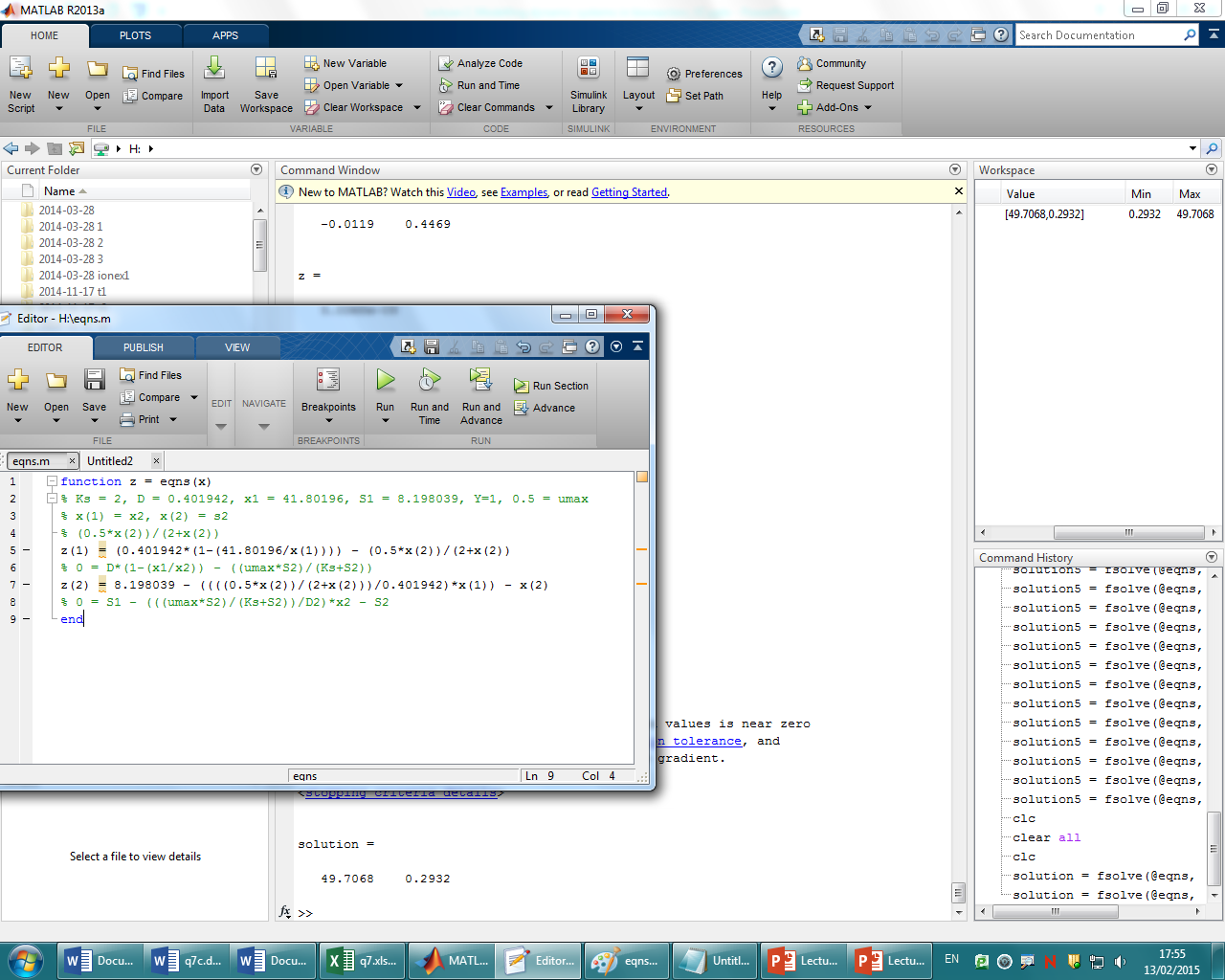


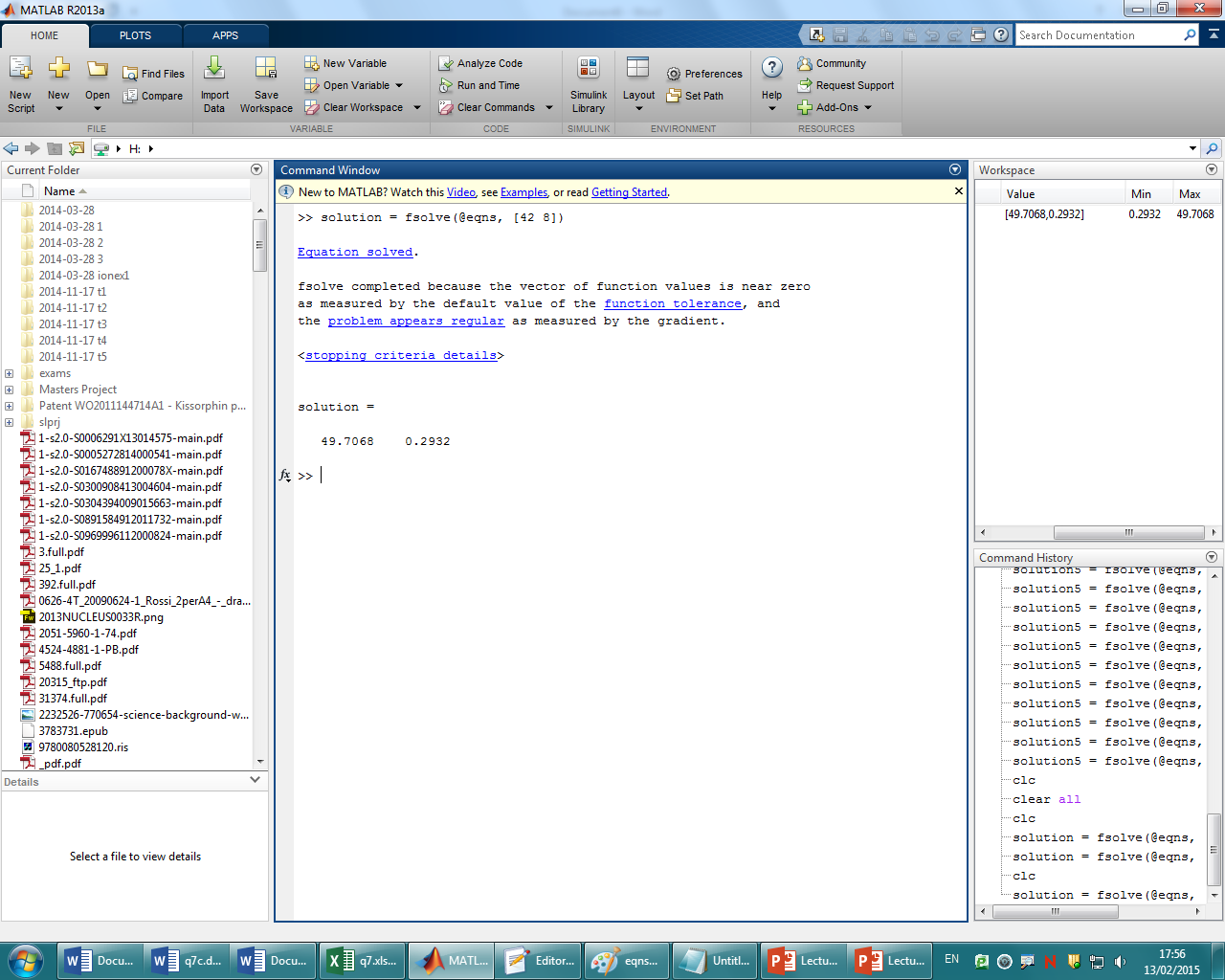
Therefore amount of biomass leaving first reactor is X1 = 41.80g

C

Equations are



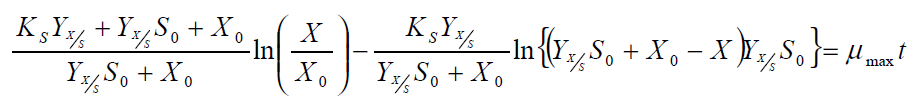


So X2 = 49.71g, S2=0.29g

Question 8

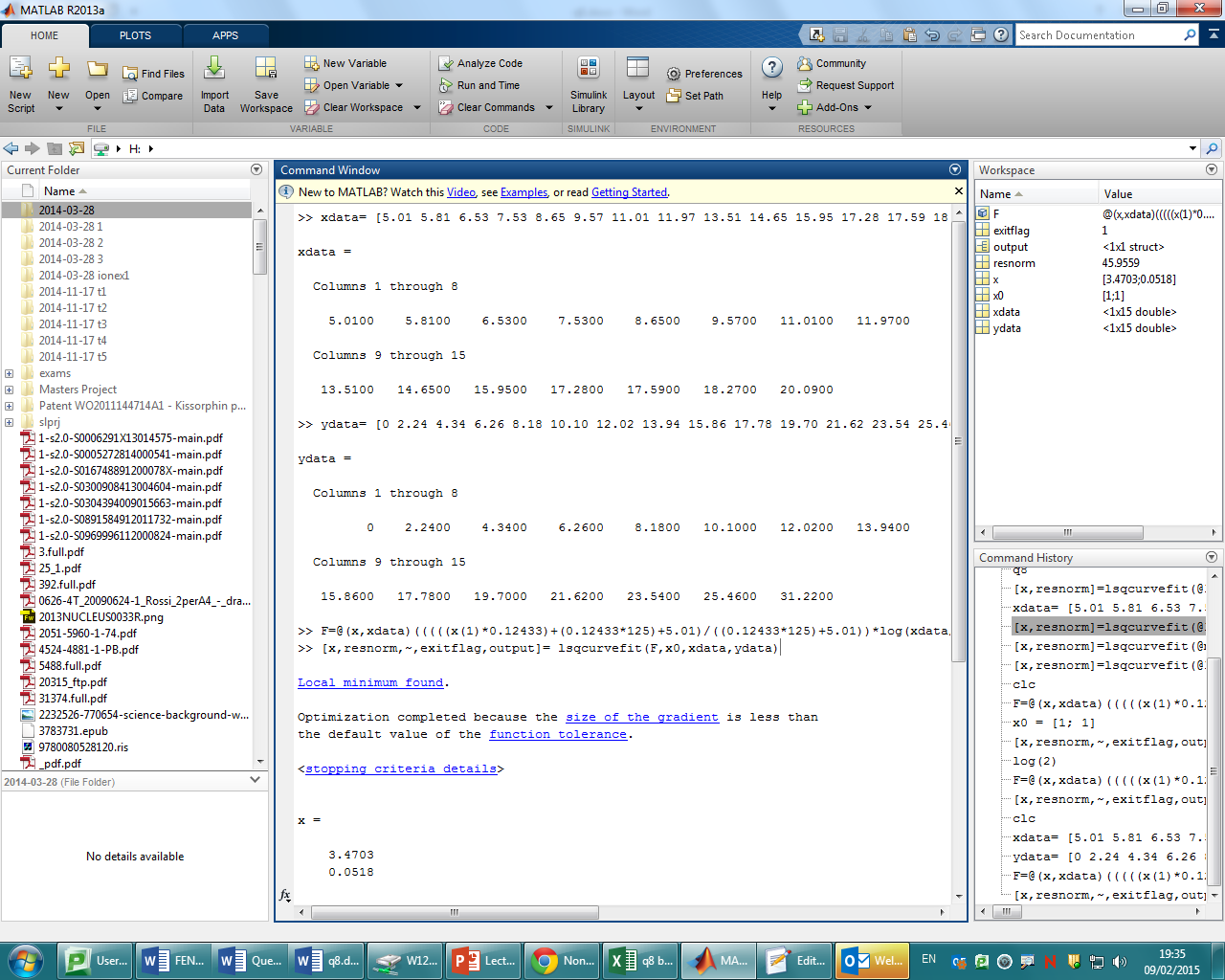
Equations are:

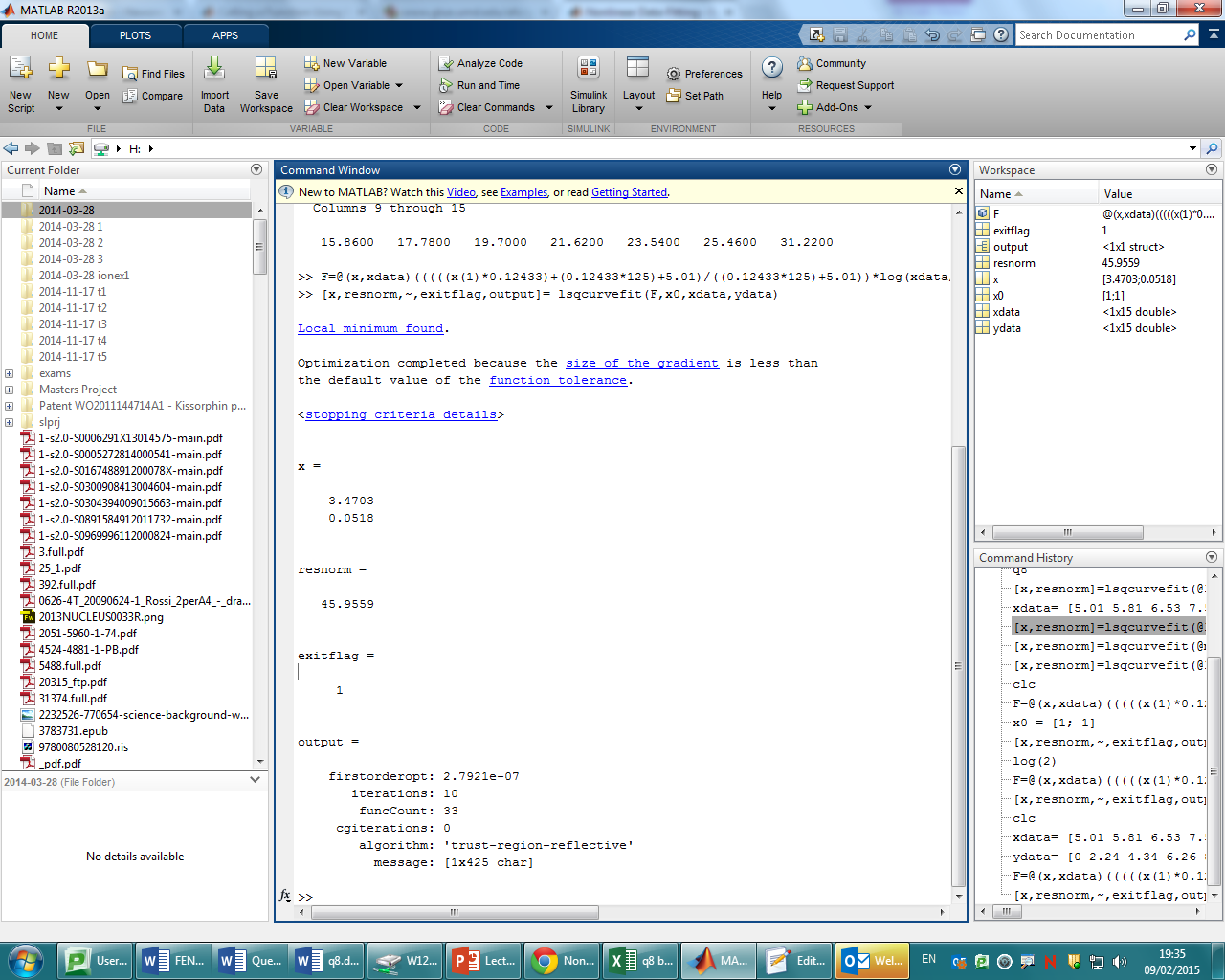
Yx/s = Xf – X0/S0-Sf = (20.09 - 5.01)/(125 - 3.71) = 0.124

 So:









Therefore Ks = 3.47 g.dm-3, μmax = 0.0518 hr-1

**References**

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