Week 3

1.solve the same question while the thickness of the brick is increased to 32cm

$R_{conv,1} = \dfrac{1}{h_1 A} = \dfrac{1}{10*0.25*1} = 0.4 \, ^{\circ}C/W$

$R_{foam} = \dfrac{L}{kA} = \dfrac{0.03}{0.026*0.25*1} = 4.6 \, ^{\circ}C/W$

$R_{plaster} = \dfrac{L}{kA} = \dfrac{0.02}{0.22*0.25*1} = 0.36 \, ^{\circ}C/W$

$R_{center\ plaster} = \dfrac{L}{kA} = \dfrac{0.32}{0.22*0.015*1} = 96.96 \, ^{\circ}C/W$

$R_{brick} = \dfrac{L}{kA} = \dfrac{0.32}{0.72*0.22*1} = 2.02 \, ^{\circ}C/W$

$R_{conv,2} = \dfrac{1}{h_2 A} = \dfrac{1}{25*0.25*1} = 0.16 \, ^{\circ}C/W$

$\dfrac{1}{R_{middle}} = \dfrac{1}{R_{center\ plaster}} + \dfrac{1}{R_{brick}} + \dfrac{1}{R_{center\ plaster}} = \dfrac{50}{96.96}$

$R_{middle} \approx 1.94 \, ^{\circ}C/W$

$R_{total} = R_{conv,1} + R_{foam} + R_{plaster} *2 + R_{middle} + R_{conv,2} = 7.82 \, ^{\circ}C/W$

$Q = \dfrac{T_{\infty 1} - T_{\infty 2}}{R_{total}} = \dfrac{20 - (10)}{7.82} \approx 3.84W$ (per 0.25m^2)

$Q_{total} = 3.84/0.25*15 = 230.4W$

2.replacing the glass fiber one with urethane rigif foam and while replacing the fiberboard with plywood

$R_{withwood} = 0.03+0.14+0.11+0.63+0.079+0.12 = 1.109 \, \dfrac{m^2\,^{\circ}C}{w}$

$R_{withinsulation} = 0.03+0.14+0.11+3.528+0.079+0.12 = 4.007 \, \dfrac{m^2\,^{\circ}C}{w}$