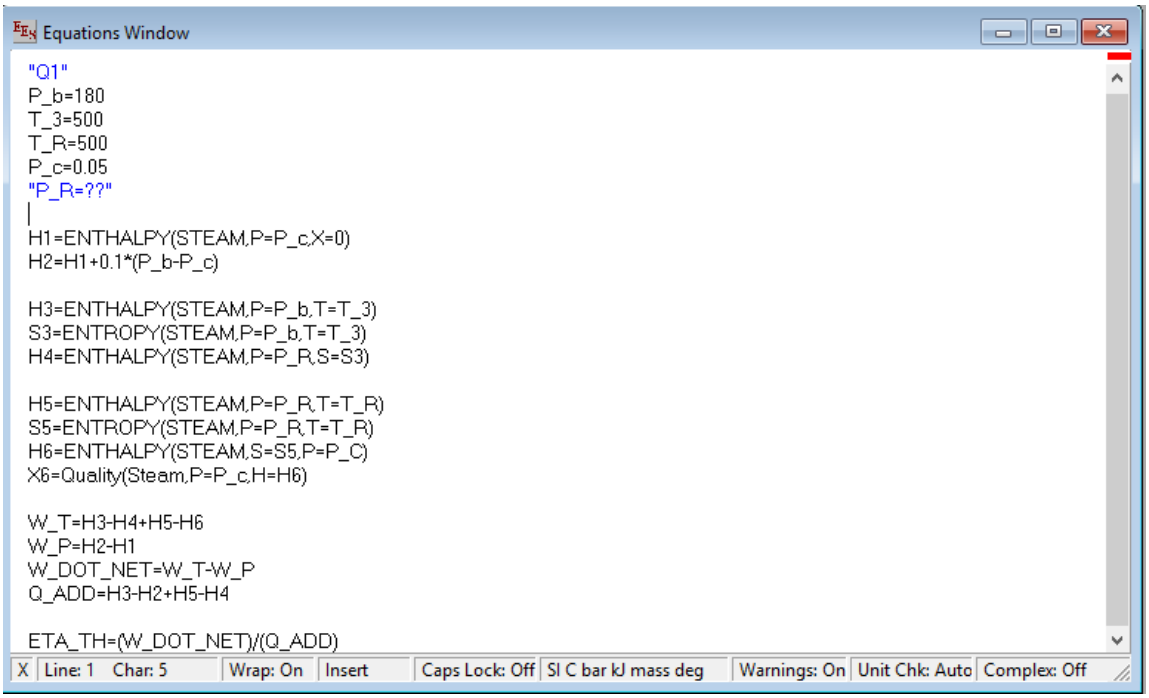
1. Find out the optimum reheat pressure of simple ideal Rankine cycle working between boiler pressure of 180 bar and condenser pressure of 0.05 bar if the maximum temperature is 500 degrees and keeping the operation of the turbine safe.

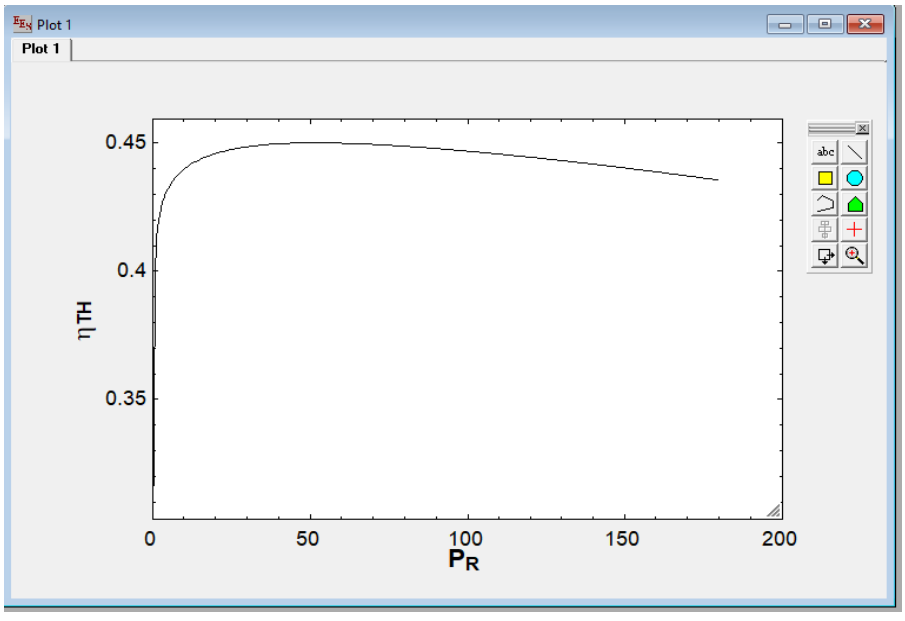
Using EES

The Problem is Solved as the following



Using table method in EES to vary the value of Reheat Pressure we found that best reheat pressure to get best efficiency

As chart shows



And using tables to check the safety also

1..300	1 η_{TH}	2 P_R	3 X6
Run 74	0.4497	43.96	0.8294
Run 75	0.4497	44.56	0.8285
Run 76	0.4497	45.16	0.8276
Run 77	0.4497	45.77	0.8268
Run 78	0.4497	46.37	0.8259
Run 79	0.4498	46.97	0.8251
Run 80	0.4498	47.57	0.8243
Run 81	0.4498	48.17	0.8234
Run 82	0.4498	48.77	0.8226
Run 83	0.4498	49.37	0.8218
Run 84	0.4498	49.98	0.821
Run 85	0.4498	50.58	0.8203
Run 86	0.4498	51.18	0.8195
Run 87	0.4498	51.78	0.8187
Run 88	0.4498	52.38	0.818
Run 89	0.4498	52.98	0.8172
Run 90	0.4498	53.58	0.8165
Run 91	0.4498	54.19	0.8157
Run 92	0.4498	54.79	0.815
Run 93	0.4498	55.39	0.8143
Run 94	0.4498	55.99	0.8136
Run 95	0.4498	56.59	0.8129
Run 96	0.4497	57.19	0.8122
Run 97	0.4497	57.8	0.8115
Run 98	0.4497	58.4	0.8108
Run 99	0.4497	59	0.8101

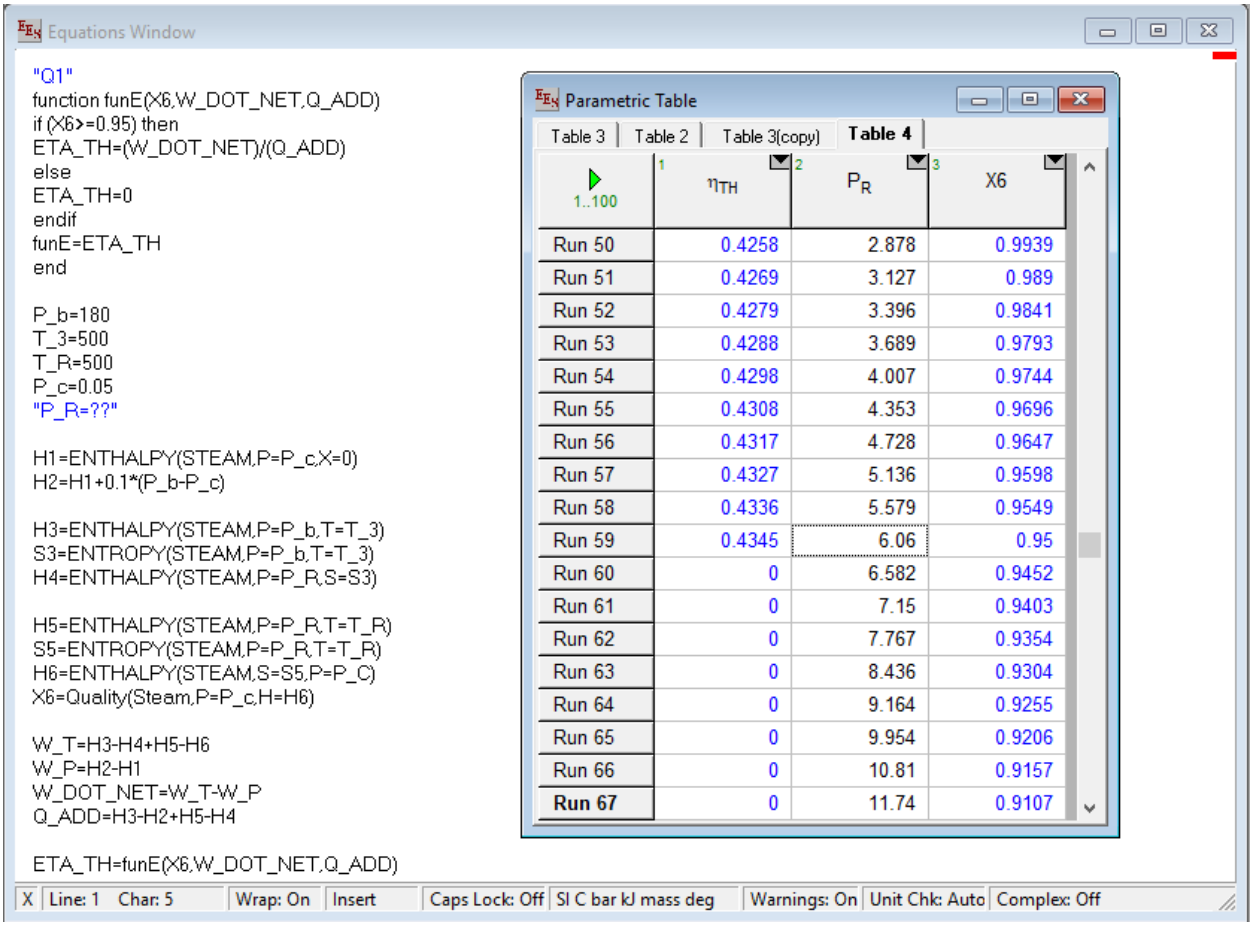
We found best efficiency will be within range of **Pressure of reheat** is **46.97** to **56.59 bar** so the **efficiency** is max with value of **0.4498=44.98%** but on the other hand that not safe as in the best case when **P=46.97 bar** and **efficiency=0.4498** the **dryness fraction X=82.51%** and that is **unsafe** for turbine blades

So we put the quality of output steam in considers and get it value **>=0.95**

Which in it's best cases we will have the **pressure** at **6.053 bar** and then the **efficiency** will be **43.45%** and steam **quality** here **X=95.01%** which is **safe**

Run 28	0.4333	5.452	0.9563
Run 29	0.4337	5.653	0.9542
Run 30	0.4341	5.853	0.9521
Run 31	0.4345	6.053	0.9501
Run 32	0.4348	6.253	0.9482
Run 33	0.4352	6.453	0.9463
Run 34	0.4355	6.653	0.9445

It also can be solved with EES to get the best safe value directly using if condition



as we used if condition we got the most accurate and **ignore** any **unsafe** results by make their efficiency is Zero so the **Optimum** and **safe** value of **pressure** is **6.06 Bar** and having **efficiency** of **43.45%**