

Daniel Leeds
ENGR 115
Date: 4/1/16

Input Parameters

Measured C outdoor [ppm]	389.5
Assumed C outdoor [ppm]	400
Correction Factor [ppm]	10.5

Analysis

Measurement	Date and Time	Hobo CO2 Concentration
	1 4/1/16 12:20	772.9
	2 4/1/16 12:21	735.7
	3 4/1/16 12:22	727.7
	4 4/1/16 12:23	747.3
	5 4/1/16 12:24	721.6
	6 4/1/16 12:25	703.3
	7 4/1/16 12:26	701.5
	8 4/1/16 12:27	706.3
	9 4/1/16 12:28	701.5
	10 4/1/16 12:29	694.7
	11 4/1/16 12:30	658.7
	12 4/1/16 12:31	667.9
	13 4/1/16 12:32	660
	14 4/1/16 12:33	641
	15 4/1/16 12:34	632.5
	16 4/1/16 12:35	619.7
	17 4/1/16 12:36	623.3
	18 4/1/16 12:37	638.6
	19 4/1/16 12:38	628.8
	20 4/1/16 12:39	605.6
	21 4/1/16 12:40	606.8
	22 4/1/16 12:41	580
	23 4/1/16 12:42	586.1
	24 4/1/16 12:43	586.1
	25 4/1/16 12:44	576.9
	26 4/1/16 12:45	580
	27 4/1/16 12:46	576.3
	28 4/1/16 12:47	569.6
	29 4/1/16 12:48	568.4
	30 4/1/16 12:49	553.7
	31 4/1/16 12:50	562.3
	32 4/1/16 12:51	555.6
	33 4/1/16 12:52	561.7
	34 4/1/16 12:53	551.3

35	4/1/16 12:54	541.5
36	4/1/16 12:55	553.7
37	4/1/16 12:56	553.1
38	4/1/16 12:57	543.3
39	4/1/16 12:58	529.3
40	4/1/16 12:59	584.2
41	4/1/16 13:00	559.8

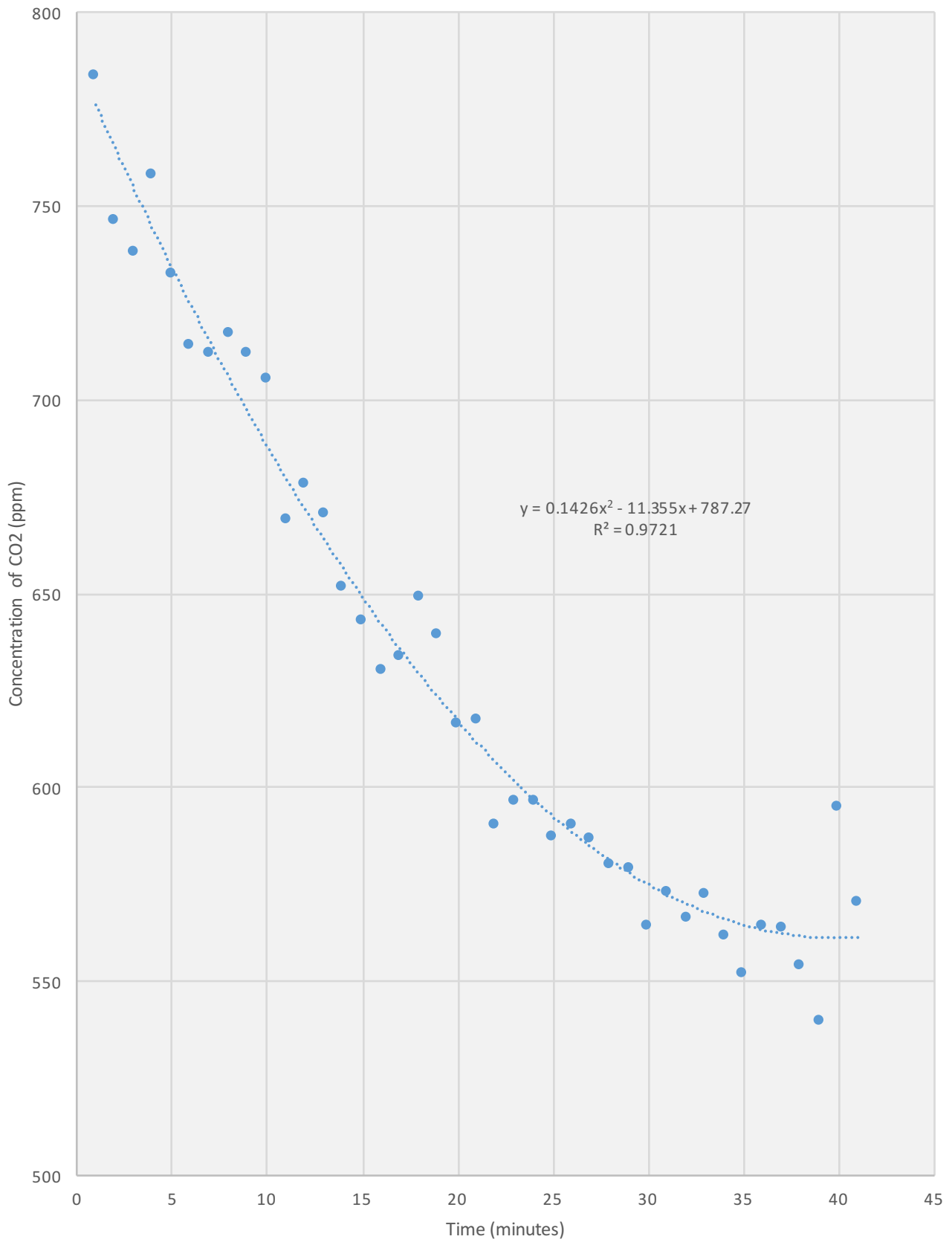
Actual CO2 Concentration

783.4
746.2
738.2
757.8
732.1
713.8
712
716.8
712
705.2
669.2
678.4
670.5
651.5
643
630.2
633.8
649.1
639.3
616.1
617.3
590.5
596.6
596.6
587.4
590.5
586.8
580.1
578.9
564.2
572.8
566.1
572.2
561.8

552
564.2
563.6
553.8
539.8
594.7
570.3

1	#REF!
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3	#REF!
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7	0
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14	0
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18	0
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27	0
28	0
29	0
30	0
31	0
32	0
33	0
34	0
35	0
36	0
37	0
38	0
39	0
40	0
41	0

Concentration of CO2



Daniel Leeds
ENGR 115
Date: 4/8/16

Input Parameters

Measured C outdoor [ppm]	389.5
Assumed C outdoor [ppm]	400
Correction Factor [ppm]	10.5
Room Volume [ft ³]	2194.5
Room Capacity [people]	6

Calculations:

Air Exchange Rate [1/hr]	1.3647
Time to Remove Non-reactive Chemical [hr]	2.198285337
Ventilation Rate [ft ³ /min/person]	8.31898375

Analysis

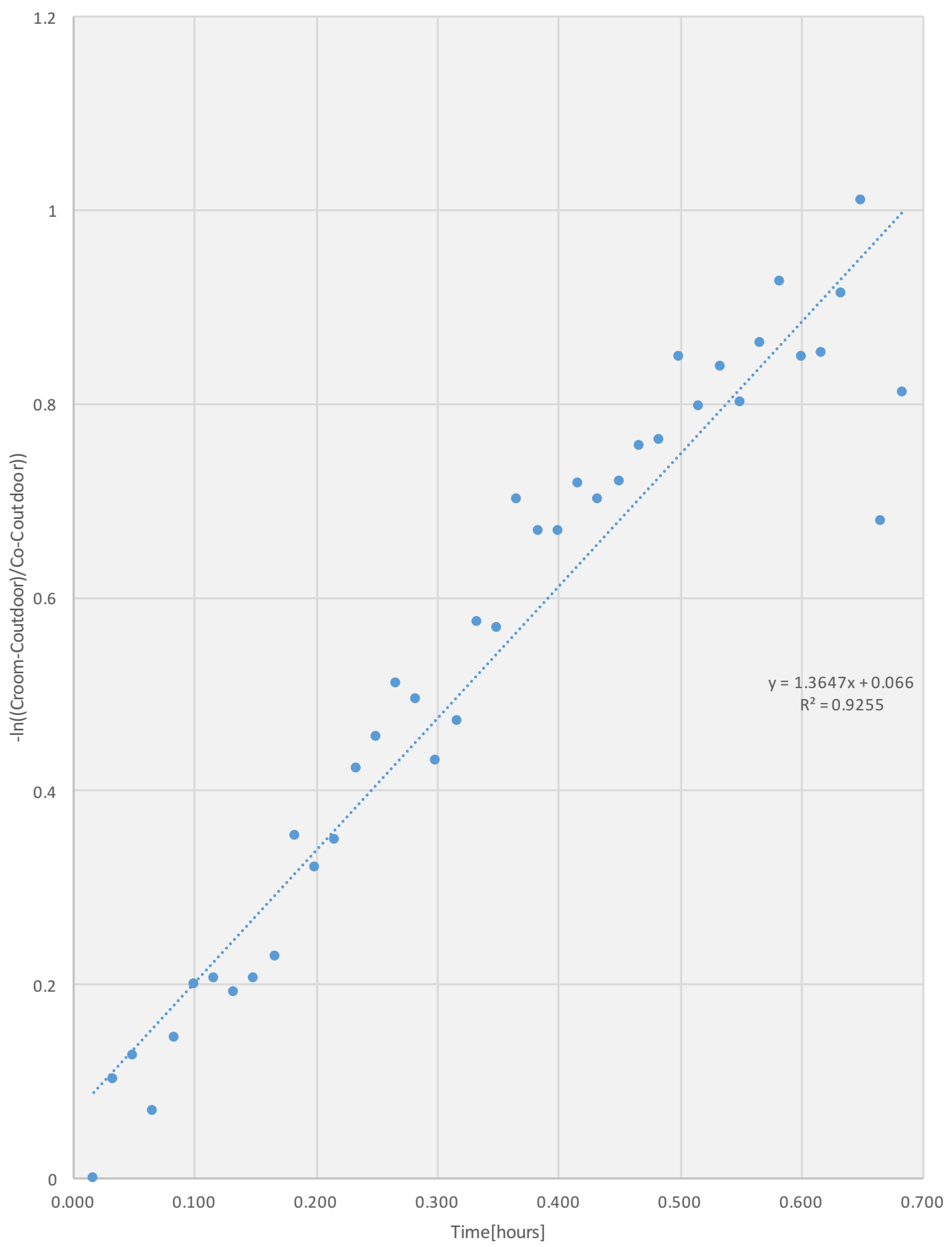
Measurement	Date and Time	Hobo CO2 Concentration
1	4/1/16 12:20	772.9
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21	4/1/16 12:40	606.8
22	4/1/16 12:41	580
23	4/1/16 12:42	586.1
24	4/1/16 12:43	586.1
25	4/1/16 12:44	576.9
26	4/1/16 12:45	580

27	4/1/16 12:46	576.3
28	4/1/16 12:47	569.6
29	4/1/16 12:48	568.4
30	4/1/16 12:49	553.7
31	4/1/16 12:50	562.3
32	4/1/16 12:51	555.6
33	4/1/16 12:52	561.7
34	4/1/16 12:53	551.3
35	4/1/16 12:54	541.5
36	4/1/16 12:55	553.7
37	4/1/16 12:56	553.1
38	4/1/16 12:57	543.3
39	4/1/16 12:58	529.3
40	4/1/16 12:59	584.2
41	4/1/16 13:00	559.8

Actual CO2 Concentration	Experiment Time [hr]	$-\ln((C_{room}(t) - C_{outdoor}) / (C_o - C_{outdoor}))$
783.4	0.017	0
746.2	0.033	0.102062188
738.2	0.050	0.125441394
757.8	0.067	0.06910466
732.1	0.083	0.143642702
713.8	0.100	0.20032299
712	0.117	0.206075643
716.8	0.133	0.190808171
712	0.150	0.206075643
705.2	0.167	0.228111531
669.2	0.183	0.353624233
678.4	0.200	0.320019902
670.5	0.217	0.348806732
651.5	0.233	0.421635841
643	0.250	0.456017387
630.2	0.267	0.510130334
633.8	0.283	0.494612782
649.1	0.300	0.431224408
639.3	0.317	0.471360836
616.1	0.333	0.573337567
617.3	0.350	0.567799943
590.5	0.367	0.699426636
596.6	0.383	0.667907623
596.6	0.400	0.667907623
587.4	0.417	0.715833461
590.5	0.433	0.699426636

586.8	0.450	0.719040305
580.1	0.467	0.755566578
578.9	0.483	0.76225184
564.2	0.500	0.847993634
572.8	0.517	0.796943974
566.1	0.533	0.836488814
572.2	0.550	0.800422239
561.8	0.567	0.862717826
552	0.583	0.92519831
564.2	0.600	0.847993634
563.6	0.617	0.851654406
553.8	0.633	0.913425774
539.8	0.650	1.008866001
594.7	0.667	0.677618918
570.3	0.683	0.811517243

Air Exchange Rate for Library Room 312



1. What is the air exchange rate (λ) of the room you tested? Be sure to include the units for the air exchange rate in your answer
2. In general it takes $3/\lambda$ hours to remove a non-reactive chemical from indoor air. Based on this time, what recommendations would you make to the occupants of the room?
3. Compare your ventilation rate for a typical number of occupants to the ASHRAE recommended ventilation rate. Based on this comparison, are the occupants wasting energy heating and cooling the air or are the occupants being too cheap and not supplying enough air? Justify your answer.

4. Given the ASHRAE standard ventilation standard, what is the maximum number of people you would recommend having in this room at one time? Use your model to determine this number.

$\lambda = 1.3647 \text{ 1/hour}$ This means that the volume of the room tested exchanges 1.3647 times per hour.

If there is worry of contaminants in the air in this room it is a good idea to leave for at least 2 hours. According to the calculation, it will take 2.20 hours for the room to be completely free of the airborne chemical.

Assuming that 6 people are present in the room, the ventilation rate is roughly $8.32 \text{ ft}^3/\text{person}/\text{minute}$. This is more than half of the ASHRAE recommended ventilation rate so it is advisable to either increase ventilation or reduce the amount of people present in the room. I think that for a room that is 231 square feet (21 ft. x 11 ft.) it is reasonable to say that the ventilation should be increased in order to maximize the usability of such a large space.

In order to be in compliance with the ASHRAE ventilation standard, the most people I could recommend having in the room at one time is 3.

Plot Title: Library 312

"Date Tim GMT-07:0C ppm (LGR S/N: 9789942

1	4/1/2016 11:41	654.5	654.5
2	4/1/2016 11:42	682.5	682.5
3	4/1/2016 11:43	636.1	636.1
4	4/1/2016 11:44	406	406
5	4/1/2016 11:45	402.9	402.9
6	4/1/2016 11:46	409.6	409.6
7	4/1/2016 11:47	382.2	382.2
8	4/1/2016 11:48	385.8	385.8
9	4/1/2016 11:49	378.5	378.5
10	4/1/2016 11:50	386.4	386.4
11	4/1/2016 11:51	449.9	449.9
12	4/1/2016 11:52	544.6	544.6
13	4/1/2016 11:53	562.3	562.3
14	4/1/2016 11:54	550.7	550.7
15	4/1/2016 11:55	557.4	557.4
16	4/1/2016 11:56	573.3	573.3
17	4/1/2016 11:57	617.8	617.8
18	4/1/2016 11:58	623.3	623.3
19	4/1/2016 11:59	640.4	640.4
20	4/1/2016 12:00	641	641
21	4/1/2016 12:01	642.9	642.9
22	4/1/2016 12:02	659.3	659.3
23	4/1/2016 12:03	670.9	670.9
24	4/1/2016 12:04	683.8	683.8
25	4/1/2016 12:05	700.9	700.9
26	4/1/2016 12:06	710.6	710.6
27	4/1/2016 12:07	679.5	679.5
28	4/1/2016 12:08	704.5	704.5
29	4/1/2016 12:09	703.3	703.3
30	4/1/2016 12:10	711.2	711.2
31	4/1/2016 12:11	734.4	734.4
32	4/1/2016 12:12	744.2	744.2
33	4/1/2016 12:13	733.8	733.8
34	4/1/2016 12:14	728.3	728.3
35	4/1/2016 12:15	766.8	766.8
36	4/1/2016 12:16	768	768
37	4/1/2016 12:17	774.7	774.7
38	4/1/2016 12:18	735.7	735.7
39	4/1/2016 12:19	736.9	736.9
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41	4/1/2016 12:21	735.7	735.7
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43	4/1/2016 12:23	747.3	747.3

44 4/1/2016 12:24 721.6	721.6
45 4/1/2016 12:25 703.3	703.3
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53 4/1/2016 12:33 641	641
54 4/1/2016 12:34 632.5	632.5
55 4/1/2016 12:35 619.7	619.7
56 4/1/2016 12:36 623.3	623.3
57 4/1/2016 12:37 638.6	638.6
58 4/1/2016 12:38 628.8	628.8
59 4/1/2016 12:39 605.6	605.6
60 4/1/2016 12:40 606.8	606.8
61 4/1/2016 12:41 580	580
62 4/1/2016 12:42 586.1	586.1
63 4/1/2016 12:43 586.1	586.1
64 4/1/2016 12:44 576.9	576.9
65 4/1/2016 12:45 580	580
66 4/1/2016 12:46 576.3	576.3
67 4/1/2016 12:47 569.6	569.6
68 4/1/2016 12:48 568.4	568.4
69 4/1/2016 12:49 553.7	553.7
70 4/1/2016 12:50 562.3	562.3
71 4/1/2016 12:51 555.6	555.6
72 4/1/2016 12:52 561.7	561.7
73 4/1/2016 12:53 551.3	551.3
74 4/1/2016 12:54 541.5	541.5
75 4/1/2016 12:55 553.7	553.7
76 4/1/2016 12:56 553.1	553.1
77 4/1/2016 12:57 543.3	543.3
78 4/1/2016 12:58 529.3	529.3
79 4/1/2016 12:59 584.2	584.2
80 4/1/2016 13:00 559.8	559.8
81 4/1/2016 13:01 428	428
82 4/1/2016 13:02 404.8	404.8
83 4/1/2016 13:03 434.1	434.1
84 4/1/2016 13:04 366.9	366.9
85 4/1/2016 13:05 389.5	389.5