ENCH 501 Transport Phenomena University of Calgary Name_____

Quiz #2 / Time Allowed: 45 minutes Only a "cheat sheet" is allowed. September 27, 2016 AJ

a.) (6 points) Weekly production rates from an oil well (in thousand barrels per week) are reported as follows:

x, Week	Y_1, x1000 bbl			
1	15.2			
2	14.42			
3	15.1			
4	13			
5	15.7			
6	9.8			
7	11.2			
8	14			
9	7.8			
10	18.1			
11	11.5			
12	13.6			
13	15.3			
14	13.8			
15	12			
16	14.9			
17	11.7			
18	10.3			
19	13.6			
20	12.3			
21	14.1			
22	11			
23	16.3			
24	12.24			
25	10.2			
26	15.8			
27	11.9			
28	12.7			

There is scatter in the data but the trend is fitted with a regression equation $y = -0.0256x + 13.409$. Determine the standard deviation for the data. (This is needed to estimate the range of potential income in subsequent weeks, if the regression equation is unchanged.)

b.) (4 points) The manager has requested that you present the data over every 4 weeks instead of weekly. That is, sum all the production for each 4-week period and divide by 4 to obtain the average weekly production rate for the period. She requested that you use the same regression equation. Is the standard deviation for this data set different from that for part a)? Show your steps.

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a.) (6 points)

Weekly production rates from an oil well (in thousand barrels per week) are reported as follows:

x, Week	Y_1, x1000 bbl	y	$y-y_1$	$(y-y_1)^2$
1	15.2	13.3834	-1.8166	3.300036
2	14.42	13.3578	-1.0622	1.128269
3	15.1	13.3322	-1.7678	3.125117
4	13	13.3066	0.3066	0.094004
5	15.7	13.281	-2.419	5.851561
6	9.8	13.2554	3.4554	11.93979
7	11.2	13.2298	2.0298	4.120088
8	14	13.2042	-0.7958	0.633298
9	7.8	13.1786	5.3786	28.92934
10	18.1	13.153	-4.947	24.47281
11	11.5	13.1274	1.6274	2.648431
12	13.6	13.1018	-0.4982	0.248203
13	15.3	13.0762	-2.2238	4.945286
14	13.8	13.0506	-0.7494	0.5616
15	12	13.025	1.025	1.050625
16	14.9	12.9994	-1.9006	3.61228
17	11.7	12.9738	1.2738	1.622566
18	10.3	12.9482	2.6482	7.012963
19	13.6	12.9226	-0.6774	0.458871
20	12.3	12.897	0.597	0.356409
21	14.1	12.8714	-1.2286	1.509458
22	11	12.8458	1.8458	3.406978
23	16.3	12.8202	-3.4798	12.10901
24	12.24	12.7946	0.5546	0.307581
25	10.2	12.769	2.569	6.599761
26	15.8	12.7434	-3.0566	9.342804
27	11.9	12.7178	0.8178	0.668797
28	12.7	12.6922	-0.0078	6.08E-05

$\sigma_{est} = \sqrt{\frac{\Sigma (y-y_1)^2}{N-1}}$

$= \sqrt{\frac{140.056}{27}}$

$= \pm 2.278$ thousand barrels/week

For week 21, for example,

$y = 12.871 \pm 2.278$ thousand barrels.

sum = 140.056

There is scatter in the data but the trend is fitted with a regression equation y = -0.0256x + 13.409. Determine the standard error for the data.

b.) (4 points)

The manager requested that you present the data over every 4 weeks. That is, sum all the production for each 4-weeks period and divide by 4 to obtain the average weekly production rate for the period. She requested that you use the same regression equation. Is the standard error for this data set different from that for part a)? Show your steps.

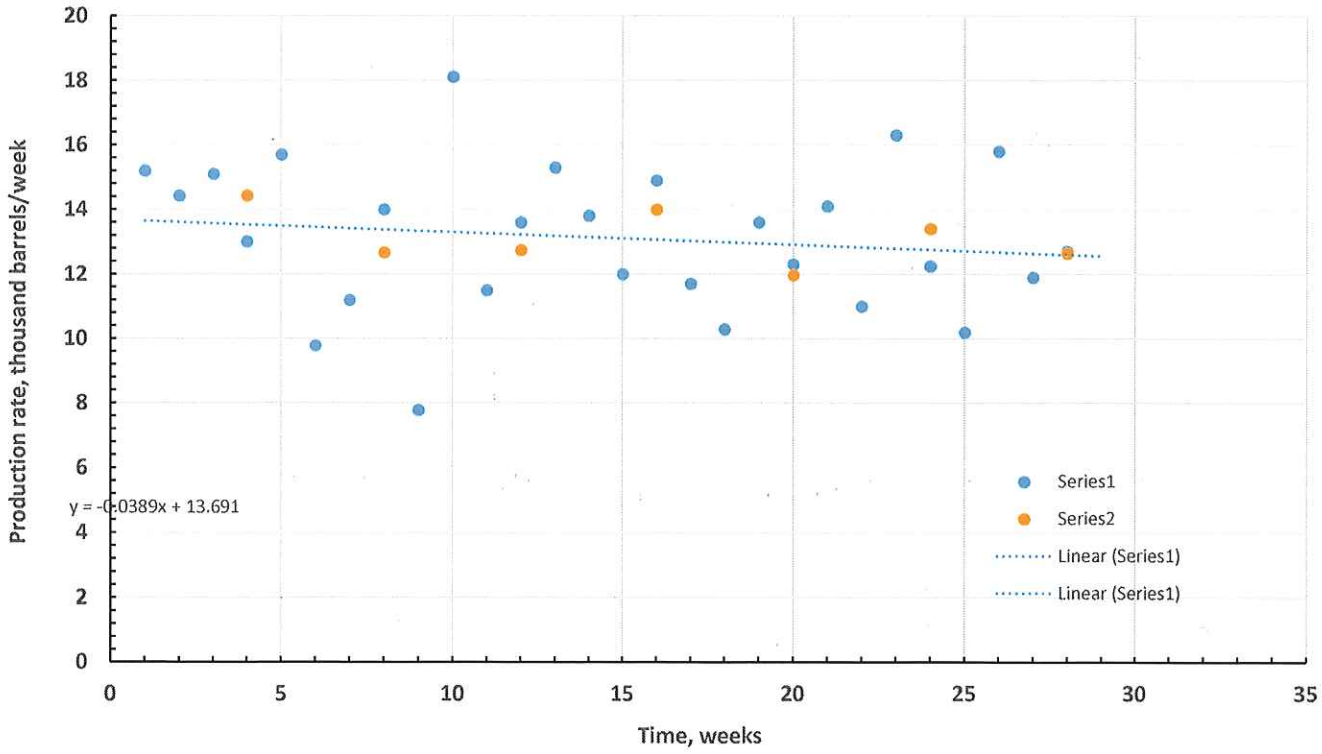
b) For part b, there are 7 data sets. Thus N = 7.

x	y_1	y	$y-y_1$	$(y-y_1)^2$
4	14.43	13.3066	-1.1234	1.262028
8	12.675	13.2042	0.5292	0.280053
12	12.75	13.1018	0.3518	0.123763
16	14	12.9994	-1.0006	1.0012
20	11.975	12.897	0.922	0.850084
24	13.41	12.7946	-0.6154	0.378717
28	12.65	12.6922	0.0422	0.001781
			Sum	3.897626

$$\sigma_{est} = \sqrt{\frac{\Sigma (y-y_1)^2}{N-1}} = \sqrt{\frac{3.897626}{6}}$$

$= \pm 0.806$ thousand barrels per week

Same data but the fluctuations seem less severe.


Production rate, thousand barrels/week
Time, weeks
y = -0.0389x + 13.691
Series1
Series2
Linear (Series1)
Linear (Series1)
0
2
4
6
8
10
12
14
16
18
20
0
5
10
15
20
25
30
35