Winter 2018
Instructor: Cheryl Jaeger Balm

Math 1B – Writing Project #2

SVCPE
789 Broadway
Cupertino, CA

Independent Math Contractors, Inc.
123 Main Street
Cupertino, CA

Dear IMC:

As you may know, the Silicon Valley Council on the Protection of the Environment (SVCPE) is charged with the evaluation of all things environmental that may have an impact on the continued health of the residents, animal and human, in our area. Silicon Valley is regarded by some as increasing in size sufficiently fast as to demand appropriate consideration of the environmental impact of such things as the increased traffic attendant with this growth.

One effect of this increase in traffic is an increase in exhaust pollutants in the air, which can lead to the phenomenon known as "acid rain." This occurs when the chemicals NO and NO_2 from car exhaust combine with atmospheric water to create nitric acid (HNO_3), which makes precipitation (rain, snow, etc.) acidic. In an effort to determine if this is likely to soon be a problem in our area, over the past three years we have monitored both the **rate of precipitation** and the **concentration of HNO_3** in that precipitation monthly. The data appears in Tables 1 and 2 below, where Month 1 corresponds to January 2015.

Table 1: Monthly precipitation (cm)

Month	1	2	3	4	5	6
Precipitation	1.73	2.06	6.00	7.05	10.98	11.40
Month	7	8	9	10	11	12
Precipitation	9.99	9.87	10.16	6.23	3.51	2.60
Month	13	14	15	16	17	18
Precipitation	1.77	2.18	5.96	7.50	11.09	10.88
Month	19	20	21	22	23	24
Precipitation	10.04	10.28	9.65	5.93	3.69	2.55
Month	25	26	27	28	29	30
Precipitation	1.73	2.09	5.67	1.34	10.89	10.55
Month	31	32	33	34	35	36
Precipitation	9.28	10.33	9.83	6.09	5.39	2.51

This project was adapted from Writing Projects for Mathematics Courses by Crannell, LaRose, Ratliff and Rykken.

Table 2: Average HNO_3 concentration in precipitation (g/ml)

Month	1	2	3	4	5	6
HNO_3 conc.	0.4003	0.4033	0.4060	0.4078	0.4100	0.4124
Month	7	8	9	10	11	12
HNO_3 conc.	0.4136	0.4171	0.4184	0.4214	0.4248	0.4255
Month	13	14	15	16	17	18
HNO_3 conc.	0.4282	0.4307	0.4331	0.4356	0.4380	0.4409
Month	19	20	21	22	23	24
HNO_3 conc.	0.4440	0.4454	0.4490	0.4513	0.4532	0.4567
Month	25	26	27	28	29	30
HNO_3 conc.	0.4587	0.4603	0.4638	0.4658	0.4700	0.4715
Month	31	32	33	34	35	36
HNO_3 conc.	0.4743	0.4772	0.4805	0.4834	0.4852	0.4879

The critical factor in determining the severity of the acid rain is, of course, the amount of HNO_3 that is deposited on the surfaces on which it falls. We therefore need to establish, based on the data collected, how the monthly rate of chemical deposition is changing over time. To this end, **we are asking you to come up with equations that model the following**:

1) Monthly precipitation (in cm)
2) Monthly concentration of HNO_3 (in g/ml)
3) Monthly amount of acid deposited on a 1 cm^2 area (in g/month)

These models will help us to predict when, if ever, the monthly rate of chemical deposit will cross certain thresholds.

Further, the transportation division has informed us that they are in the process of installing high-gain solar panels to power a number of traffic direction devices about the area, and the surfaces of the panels will eventually become pitted and therefore less clear as they are exposed to the acidity of the precipitation. According to their estimates, it would take overall exposure to an amount of nitric acid (HNO_3) equal to 80 grams for this to have a significant impact on the solar panels' electrical yield.

We therefore need to know, based on the data we have provided in Tables 1 and 2, **at what point the <u>total</u> acidic exposure to which a 1 cm^2 section of a solar panel will have been subjected will equal or exceed 80g of HNO_3**.

It is with great pleasure that we anticipate your final report, which we need no later than March 6 of this year.

Sincerely,
Lakshmi Guiying
Director, SVCPE

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