Food for thought: remainders

(An intro activity for remainders. Remember, we don't expect you to already know these answers. We expect you to try things, guess, make mistakes, and evaluate your own reasoning.)

Question. A biology student is monitoring the growth of a bacteria in the lab. Since this is a lab, they know that the colony of bacteria is supposed to stabilize when its weight reaches 12g. The student has made the following observations on the weight of the colony.

time (minutes)	weight (grams)
0	8
10	9.2
20	9.5
30	9.8
40	10.1
50	10.9
60	11.4
70	11.8

a) If the student continues monitoring, do you expect that the weight will stabilize at 12g? Why or why not? What evidence supports your conclusion?

b) Give an example of a data set that would support the opposite conclusion that you got in a).

Question. A chemist is monitoring the pH level of a certain compound as other chemicals are added. The chemist also wants the total amount of change in pH stays below a particular level.

a) How is this situation related to summing an infinite series? What would the sum S mean?

b) Why might the chemist want to know the difference between the full sum S and the current partial sum S_n? Give some numerical examples to illustrate your thinking.

Question. Let's consider the series

$$\sum_{n=0}^{\infty} \left(\frac{1}{3}\right)^n.$$

a) what is the sum S of this series?

b) What are the values of the partial sums S_3, S_{10}, and S_{15}?

c) What is the diffenence between the full sum S and each of the partial sums you calculated?

Question. let's consider the series

$$\sum_{n=0}^{\infty} \left(\frac{-1}{3}\right)^n.$$

a) what is the sum S of this series?

b) What are the values of the partial sums S_3, S_{10}, and S_{15}?

c) What is the diffenence between the full sum S and each of the partial sums you calculated?

Question: What do you observe by comparing & contrasting the last two problems?

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Instructor Notes

Main goal:

Overall picture:

Note: the first example is a sequence but should introduce the idea of an error.

Note: the instructor will need to give language and notation to the concept of an error.

Note: The idea of finding S from S_n is not present here.

Good language:

Suggested timing: