



Enriching Recursion Lessons with Activities

Activity # 1: Frogs in a Pond

- Start with 16 “frogs” in your pond.
- Each year half the frogs, rounded down, leave and then 2 more frogs join the pond.
- Repeat this process, keeping track of the number of frogs in the pond each year (I suggest a table). Take note of what eventually happens in the pond.
- Start over considering different starting number of frogs. Pay attention to any differences in the process. Some values you may want to try: 4, 30, 5, 24, 3, 6
- Start over with 16 frogs considering what happens if a third of the frogs, rounded down, leave and then 2 (or a different number) frogs join. Repeat varying initial number of frogs.
- Consider other variations in how frogs leave and/or enter the pond. Consider how this affects what eventually happens in the pond.

Activity # 2: Credit Card Debt

In a spreadsheet or on a calculator, work out the following scenario:

- You make purchases for a total of \$10,000 on a credit card and then do not make any more charges.
- Each month, the credit card company charges you a monthly interest rate of 2%.
- Assume after the interest is added in, you make a monthly payment. For your monthly payment, consider the following possibilities:
 - If you pay \$100 per month, what happens? Why?
 - If you pay \$200 per month, what happens? Why?
 - Suppose you pay \$210 per month. How long does it take to pay off the credit card? How much did you end up paying in interest?
 - Suppose you pay \$300 per month. How long does it take to pay off the credit card? How much did you end up paying in interest?

Take-Home Activity: Water Reservoir

- Work in groups of three (two, if necessary) – one person will be in charge of draining; one person filling; and one person monitoring/directing/timing. To affect the speed at which the water drains, you will use your fingers to compress the straw.
- First, be sure your straw starts bent upward! Try each of the following scenarios, pausing in between.
- While both draining and filling your cup, make the water level slowly lower to just above the straw.
- While allowing water to drain out at as constant a rate as possible, adjust the speed at which you fill water in order to get the water to stabilize at the top line drawn on your cup.
- Drain out water until the cup is just above the straw. While pouring water in at as constant a rate as possible, adjust the speed at which the water drains out in order to get the water to stabilize at the top line drawn on your cup.



- By varying the speed at which the water is poured in and the water drains out, get the water to stabilize at the bottom line drawn on your cup.
- By varying the speed at which the water is poured in and the water drains out, get the water to oscillate between the top line and the bottom line drawn on your cup.

Sample of Follow-up Questions to the Activities

From <http://www.dlt.ncssm.edu/stem/content/lesson-1-introduction-recursion>

1. The Fish and Wildlife Division monitors the trout population in a stream that is under its jurisdiction. Its research indicates that natural predators, together with pollution and fishing, are causing the trout population to decrease at a rate of 20% per month. The Division proposes to introduce additional trout each month to replenish the stream. Assume the current population is 300. Use tables and graphs to investigate the long-term result of introducing 100 trout into the stream each month.
2. An individual takes a 400 mg dose of ibuprofen and will continue to take 400 mg every four hours. At the end of every four-hour period, the person's body has filtered out 67% of the ibuprofen. What will happen to the level of ibuprofen in the body over time?
3. Most of the water flowing into Lake Erie comes from Lake Huron, and most of the water flowing into Lake Ontario is from Lake Erie. Each year, 11% of the water in Lake Huron flows into Lake Erie, while 36% of the water in Lake Erie flows into Lake Ontario, and 12% of the water in Lake Ontario flows out to the sea. For generations, factories on the lakes had been dumping a pollutant into the water. Presently, there are 4000 units of pollutant in Lake Huron, 2000 units in Lake Erie, and 3000 units in Lake Ontario. For the most part, this form of pollution has stopped. Only two such factories remain. One, on Lake Huron, is dumping 25 units of pollutant into the water each year; the other on Lake Ontario is dumping 20 units of the pollutant into the water each year. What is the long-term level of pollutant in the lakes?
4. You are shopping for a 4-year loan to buy a \$15,000 boat.
 - a) The loan you are considering is at 8% annual interest. What would your annual payment need to be to pay the loan off in 4 years (to the nearest dollar)?
 - b) You cannot afford more than \$3600 a year on the loan. How much can you borrow (to the nearest dollar) at 8% annual interest?
 - c) Suppose you want to borrow \$15,000 but cannot afford more than \$4,000 a year on the loan. What is the highest interest rate (to the nearest tenth of a percent) you can accept?