

Performance Tasks for Part 1

Financial Applications of Sequences and Series

THE FOLLOWING ACTIVITIES SHOULD EACH TAKE LESS THAN A PERIOD TO COMPLETE.

1. Building a Pyramid

Build a model of a square pyramid using sugar cubes. Build the model so that it has at least six layers. Suppose you were to continue to build the model:

- (a) How many sugar cubes would be in the 75th layer from the top?
- (b) How many sugar cubes would you need to construct a model with 100 layers?
- (c) Analyze this problem and create an algebraic model to describe this situation. Explain how you arrived at the algebraic model and how the algebraic model can be used to make predictions. Use an example to illustrate.

2. Population Growth

The People's Republic of China has the largest population of any country in the world. According to the 1994 World Population Prospects, approximately 1.1 billion people lived in China in 1990. In 1990, the population of China was growing at a rate of 1.5% per year.

- (a) Suppose the population rate continued to grow at 1.5% per year. Create an algebraic model that relates the population, P , to the number of years, n , after 1990.
- (b) Predict when the population will reach the two billion mark.
- (c) Suppose that seven million people leave China each year for other countries. Adjust your model for the growth of the population of China to take this new information into account.

3. A Picture Is Worth a Thousand Words

Perhaps a picture could help save someone a thousand dollars. Imagine that you are a financial consultant and you want to provide your client with graphical representations of the effects of varying different options on a mortgage. Choose a current mortgage rate to work with and provide graphs showing the effects of changing payment periods and lengths of amortization. You may decide to look at several aspects to compare the mortgages—amounts of interest paid, length of time to pay off the mortgage, principal owing at various time intervals, and so on.

4. Retirement Plans

Sara and Ritu have just finished school and have started their first full-time jobs. Sara has decided that she is going to start putting \$100/month away in a Retirement Plan. Ritu thinks that Sara is crazy because Sara is only 22 and should enjoy her money now and worry about saving for retirement later. Ritu is not going to worry about saving money until she is 45.

- (a) Suppose both young women retire at age 60. How much money will Ritu have to contribute monthly, to retire with the same savings as Sara? Assume that they can invest their money at 9% compound monthly.
- (b) Write a convincing argument for one of the young women's positions.

THE FOLLOWING ACTIVITIES COULD EACH TAKE MORE THAN A PERIOD TO COMPLETE.

5. Buying a Car

Harpreet is going to buy her first car for \$17 500. She will make a down payment \$3500 and finance the rest at 9% compounded monthly. She will make regular monthly payments for four years. She estimates that her car will depreciate in value at a rate of 18% per year. Provide a complete analysis of this situation by determining the amount of her monthly payments, the total interest that she will be paying, and the value of her car when she has completed her payments. Include graphs, charts, and tables with your analysis.

6. Prescribing Medicine

When doctors prescribe medication for their patients, several factors influence the amount of medication prescribed and the timing of the doses. Investigate the effect on a patient who must take a 30-mg dose of a painkiller every 4 h. The half-life of the drug for a particular patient is 2 h. This means that it takes 2 h for half of the drug to be metabolized while the other half remains in the patient's system.

- (a) Use charts, graphs, and algebraic models to investigate this situation.
- (b) The patient must take this medication for ten days. Predict how much of this medication will be in the patient's system after ten days.
- (c) If the patient stops taking the medication after ten days, how much of the medication will be in the patient's system ten days after the medication is stopped?