1. Two trains begin 200 miles apart, and are both traveling at 50mph toward each other. A fly begins at one train and travels back and forth between the two trains at 75mph until the trains meet and the fly is crushed. What is the total distance that the fly travels? Here are two ways to answer the question.\(^1\)

(a) The fly begins 200 miles from the second train. How far does it travel before meeting the second train? From there, how far does it travel before meeting the first train? From there, how far does it travel before meeting the second train again? You should have a geometric series. Find its sum.

(b) How long before the trains collide? The fly is going 75mph, so how far does it travel?

2. The Koch snowflake is obtained by taking the limit of the sequence of figures below:

(a) Find the area of the Koch snowflake. Call the area of the triangle in the first figure \(A\).

(b) Find the perimeter of the Koch snowflake. Call the length of the line segments in the first figure \(L\).

3. Suppose you take out a loan of some amount \(P\) at an annual interest rate \(r\) compounded monthly, and that you make payments of \(A\) dollars per month. In order to pay off the loan in exactly \(N\) years (12\(N\) monthly payments), what should the monthly payment \(A\) be in terms of \(P\), \(r\) and \(N\)?

Hint: After 1 month, the balance left is \(B_1 = (1 + \frac{r}{12}) P - A\) (Why?), after 2 months, the balance is \(B_2 = (1 + \frac{r}{12})^2 P - (1 + \frac{r}{12}) A - A\). What is the balance after \(n\) months? Use the formula for a finite geometric series to simplify this. Now plug in \(n = 12N\) and set this equal to zero and solve for \(A\).

\(^1\)There is amusing anecdote about this problem and the mathematician John von Neumann. The story is that at a party someone proposed the two trains and a fly question to von Neumann, who immediately gave the correct answer. Thinking that von Neumann had done it the easy way (b), he said “Interesting. Most people try to sum the infinite series.” “What do you mean?” von Neumann replied. “That’s how I did it.”