Course Activity I.2: Snowflake Exploration – Part II
Synthesis Questions

Name: ______________________________________

Procedure: Complete the following synthesis questions. Attach any extra pages of work, explanations, and answers.

1. Perimeter of the Koch Curve. The total **perimeter** of each Koch snowflake can also be expressed as a sum:

   The total **perimeter** of the $\boldsymbol{n}^{\text{th}}$ **Koch Snowflake**:

$$P(n) = 3 + \sum_{k=1}^{n} \left(\frac{4}{3}\right)^{k-1}$$

   a. Write a mathematical expression for the total perimeter of the **Koch *curve***:

      Total Perimeter of the Koch curve =

   b. Is the total perimeter of the Koch curve finite or infinite? (Answer this question by completing the three steps below):

      i. Investigate this question numerically or analytically.
      ii. State your conclusion below.
      iii. Support your conclusion by explaining the results of your investigation and how they led to your conclusion.

2. Other Similar Series. Consider the two series below:

$$\boldsymbol{A}.\ \sum_{k=1}^{\infty} 5\left(\frac{2}{3}\right)^k \qquad\qquad \boldsymbol{B}.\ \sum_{k=1}^{\infty} (1.4)^k$$

For each series (***A*** and ***B***):

- Calculate the $n = 5, n = 20, n = 100$ and $n = 1000$ partial sum approximations.

- Based upon the partial sum approximations that you calculated above, conjecture whether the series is finite or infinite. (If necessary, calculate more partial sum approximations in order to confidently make your conjecture.)

- If you've conjectured that the series is finite, conjecture an exact (finite) value for the series.

- Check your conclusions in the last two questions by calculating the infinite sum in *Mathematica*.

- What's the key common characteristic between the finite-valued series here (A or B) and the series you developed for calculating the (finite) Koch curve area?

- What's the key common characteristic between the infinite-valued series here (A or B) and the series given in #1 above for calculating the (infinite) Koch curve perimeter?