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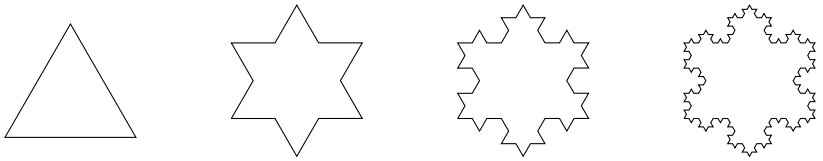
1. [10.2.96a] **Helga von Koch's snowflake curve.** Helga von Koch's snowflake is a curve of infinite length that encloses a region of finite area. To see why this is so, suppose the curve is generated by starting with an equilateral triangle whose sides have length 1.



C_1 C_2 C_3 C_4

Find the length L_n of the nth curve C_n and show that $\lim_{n\to\infty} L_n = \infty$.

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2. [10.3.62] Consider the sequence $\{1/n\}_{n=1}^{\infty}$. On each subinterval $(1/(n+1), 1/n)$ within the interval $[0, 1]$, erect the trapezoid with area a_n having heights $y = 1/(n+1)$ at $x = 1/(n+1)$ and $y = 1/n$ at $x = 1/n$. Find the total area $\sum a_n$ of all the rectangles.

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3. [10.9.43] Use the identity $\sin^2 x = (1 - \cos 2x)/2$ to obtain the Maclaurin series for $\sin^2 x$. Then differentiate this series to obtain the Maclaurin series for $2 \sin x \cos x$. Check that this is the series for $\sin 2x$.

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4. [10.10.60b] Find the first three terms of the Taylor series for

$$\sinh^{-1} x = \int_0^x \frac{dt}{\sqrt{1+t^2}}$$

to estimate $\sinh^{-1} 0.25$. Give an upper bound for the magnitude of the estimation error.

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5. [10.Adv.31b] **Quality Control** In one throw of two dice, the probability of getting a roll of sum 7 is $p = 1/6$. If you throw the dice repeatedly, the probability that a 7 will appear for the first time at the nth throw is $q^{n-1}p$, where $q = 1 - p = 5/6$. The expected number of throws until a 7 first appears is $\sum_{n=1}^{\infty} nq^{n-1}p$. Find the sum of this series.