Fibonacci Sequence

Project on Fibonacci and Lucas sequence.

Exploration 1 *Start by reviewing the Fibonacci Sequence from Strayer Appendix A.2:* $F_1 = 1, F_2 = 1, F_{k+1} = F_k + F_{k-1}$ *for* $k \geq 3$.

Problem 1.1 *Prove that* $\lim_{k\to\infty} \frac{F_{k+1}}{F_k} = \phi$ *where* $\phi = \frac{1+\sqrt{5}}{2}$.
Rubric. 5 points if individual project, 3 points if presenting as a pair.

Problem 1.2 *Prove that for every positive integer* k,

$$F_1 + F_2 + \cdots + F_k = F_{k+2} - 1.$$

Rubric. 5 points if individual project, 3 points if presenting as a pair.

Problem 1.3 *(If presenting as a pair) Strayer Exercise Set A, Exercise 2.*
Rubric. 6 points.

The following problems are from *Number Theory: A Lively Introduction with Proofs, Applications, and Stories* by Erica Flapan, Tim Marks, and James Pommersheim, Chapter 2: Mathematical Induction, Section 2.3 The Fibonacci Sequence and the Golden Ratio [**?**].

Exploration 2 *The following problems are from* Number Theory: A Lively Introduction with Proofs, Applications, and Stories *by Erica Flapan, Tim Marks, and James Pommersheim.*

The Lucas numbers are similar to the Fibonacci numbers, where $L_1 = 1, L_2 = 3, L_{k+1} = L_k + L_{k-1}$ *for* $k \geq 3$.

Problem 2.1 (a) *Make a table of the first* 12 *Lucas numbers.* You do not need to present this part

(b) *Use your results from part (a) to calculate the ratios of pairs of consecutive Lucas numbers.* You do not need to present this part

(c) *Make a conjecture about the value of* $\lim_{k\to\infty} \frac{L_{k+1}}{L_k}$. You do not need to present this part

(d) *Prove your conjecture is correct.* You **do** need to present this part

Learning outcomes:
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Rubric. 5 points if individual project, 3 points if presenting as a pair.

Problem 2.2 *(If presenting as a pair)*

(a) *Calculate* $L_1, L_1 + L_2, L_1 + L_2 + L_3, L_1 + L_2 + L_3 + L_4$. You do not need to present this part

(b) *Make a conjecture about the relationship between* $L_1 + L_2 + L_3 + \cdots + L_n$ *and the number* L_{n+2}. You do not need to present this part

(c) *Prove your conjecture is correct.* You **do** need to present this part

Rubric. 5 points if individual project, 3 points if presenting as a pair.
