Fun with Sequences!

In 1-6, give the next two terms of the sequence (and any blanks), followed by a formula for the 17^{th} term and for the general (n^{th}) term.

1. 16, 13, 10, __?__ , __?__ , … , __?__ , __?__

2. Arithmetic: 15, __?__ , 18, __?__ , __?__ , … , __?__ , __?__

3. Geometric: 15, 18, __?__ , __?__ , … , __?__ , __?__

4. Geometric: 15, __?__ , 30 , __?__ , … , __?__ , __?__

5. Geometric: 15, __?__ , __?__ , 30, __?__ , … , __?__ , __?__

6. $\frac{3}{2}, \frac{5}{4}, \frac{7}{8}, \frac{9}{16},$ __?__ , __?__ , … , __?__ , __?__

7. Write a general equation describing the pattern, then use algebra to verify that your equation is true:

$$4^2 - 2^2 = 4 \bullet 3$$
$$5^2 - 3^2 = 4 \bullet 4$$
$$6^2 - 4^2 = 4 \bullet 5$$

8. Write a general equation using summation (Σ) notation to describe the pattern:

$$1^3 = 1$$
$$1^3 + 2^3 = (1 + 2)^2$$
$$1^3 + 2^3 + 3^3 = (1 + 2 + 3)^2$$

9. Let $S_n = \sum_{k=1}^{n} \frac{1}{k(k+1)}$.

a. Write out (without Σ) the formulas for S_1, S_2, S_3, and S_4.

b. Make a table giving the value of each sum from (a)

c. Make a conjecture (in the form of a general equation) describing S_n.

10. Use your calculator to graph each sequence below. Sketch a graph and describe the limit.

a. $a_n = \frac{2n^2}{n^2 + 4n}$ b. $\begin{cases} b_1 = 16 \\ b_n = b_{n-1} - \frac{3}{2} \end{cases}$ c. $c_n = \frac{4^{n+2} + 4}{4^n}$ d. $\begin{cases} d_1 = 1 \\ d_n = \dfrac{d_{n-1} + \frac{2}{d_{n-1}}}{2} \end{cases}$

11. For each sequence in #10, let S_n be the sum of the first n terms. Make a table showing S_n for n = 1, 2, 3, 4. (That is: $S_1 = a_1$; $S_2 = a_1 + a_2$, etc.)

12. Solve each inequality by hand (hint: use a GNIS HGRPA), then check on your calculator.

a. $\frac{x^2 + 5x + 2}{x^2 - 2x - 3} < 0$ b. $\frac{x^2 + 4x}{2x + 1} > 3$