1. Write the first three terms and the 100th term of $a_n = 2 + 3(n-1)$.

$a_1 = 2+3(1-1) = \boxed{2}$

$a_2 = 2+3(2-1) = \boxed{5}$

$a_3 = 2+3(3-1) = \boxed{8}$

$a_{100} = 2+3(100-1) = \boxed{299}$

← Notice how a_n increases by 3 everytime n increases by 1.

2. Find the first four terms of the sequence defined recursively by $a_1 = 1$, $a_2 = 1$, $a_n = a_{n-1} + a_{n-2}$

"add previous two terms"

$a_1 = \boxed{1}$

$a_2 = \boxed{1}$

$a_3 = a_{3-1} + a_{3-2} = a_2 + a_1 = 1+1 = \boxed{2}$

$a_4 = a_{4-1} + a_{4-2} = a_3 + a_2 = 2+1 = \boxed{3}$

Called Fibonacci Sequence

3. Find the following sum.

$$\sum_{i=1}^{5} 2 = 2+2+2+2+2 = \boxed{10}$$

← In general, $\sum_{k=1}^{n} c = c \cdot n$

4. Find the following sum.

$$\sum_{k=-2}^{2} k2^k = \left((-2)\cdot \underbrace{2^{-2}}_{\frac{1}{4}}\right) + \left((-1)\cdot \underbrace{2^{-1}}_{\frac{1}{2}}\right) + \left(0\cdot 2^0\right) + \left(1\cdot 2^1\right) + \left(2\cdot 2^2\right)$$

$$= \left(-\tfrac{1}{2}\right) + \left(-\tfrac{1}{2}\right) + (0) + (2) + (8)$$

$$= \boxed{9}$$

5. Find a formula for the nth term of the sequence $1, -3, 9, -27, 81, \ldots$ ← Patterns: Alternating pos/neg. Multiply by 3 to get next term

$$\boxed{a_n = (-1)^{n-1} \cdot 3^{n-1}}$$

(or $a_n = (-3)^{n-1}$, etc.)

6. Find a formula for the nth term of the sequence $10, 6, 2, -2, -6, \ldots$ ← Pattern: subtract 4 to get next term

$$\boxed{a_n = -4n + 14}$$

7. Write the sum using sigma notation.

$$\frac{1}{2\ln 2} - \frac{1}{3\ln 3} + \frac{1}{4\ln 4} - \frac{1}{5\ln 5} + \cdots + \frac{1}{100\ln 100}$$

$$= \boxed{\sum_{k=2}^{100} \frac{(-1)^k}{k\ln k}}$$

Q: What word can you make by adding letters to each side of XYG? (Hint: add one letter to the left side, and two letters to the right side.)

8. Find the first three terms of $a_n = \frac{(-1)^n \cdot 3n}{2^{n-1}}$. Then find the 9th term.

$$a_1 = \frac{(-1)^1 \cdot 3(1)}{2^{1-1}} = \boxed{-3}$$

$$a_2 = \frac{(-1)^2 \cdot 3(2)}{2^{2-1}} = \boxed{3}$$

$$a_3 = \frac{(-1)^3 \cdot 3(3)}{2^{3-1}} = \boxed{-\frac{9}{4}}$$

$$a_9 = \frac{(-1)^9 \cdot 3(9)}{2^{9-1}} = \boxed{-\frac{27}{256}}$$

10. Find the first four terms of the sequence defined recursively by $a_1 = -2, \quad a_n = 3a_{n-1} + 5$.

$$a_1 = \boxed{-2}$$

$$a_2 = 3a_{2-1} + 5 = 3a_1 + 5 = 3(-2) + 5 = \boxed{-1}$$

$$a_3 = 3a_2 + 5 = 3(-1) + 5 = \boxed{2}$$

$$a_4 = 3a_3 + 5 = 3(2) + 5 = \boxed{11}$$

12. Find the first four partial sums of the sequence $a_n = \left(\frac{2}{3}\right)^{n-1}$.

$$a_1 = \left(\tfrac{2}{3}\right)^{1-1} = 1$$

$$a_2 = \left(\tfrac{2}{3}\right)^{2-1} = \frac{2}{3}$$

$$a_3 = \left(\tfrac{2}{3}\right)^{3-1} = \frac{4}{9}$$

$$a_4 = \left(\tfrac{2}{3}\right)^{4-1} = \frac{8}{27}$$

$$S_1 = \boxed{1}$$

$$S_2 = 1 + \frac{2}{3} = \boxed{\frac{5}{3}}$$

$$S_3 = 1 + \frac{2}{3} + \frac{4}{9} = \boxed{\frac{19}{9}}$$

$$S_4 = 1 + \frac{2}{3} + \frac{4}{9} + \frac{8}{27} = \boxed{\frac{65}{27}}$$

14. Find the sum.

$$\sum_{k=-1}^{5}(3k^2+1) = (3(-1)^2+1)+(3(0)^2+1)+(3(1)^2+1)+(3(2)^2+1)+(3(3)^2+1)+(3(4)^2+1)+(3(5)^2+1)$$

$$= 4+1+4+13+28+49+76$$

$$= \boxed{175}$$

16. Find a formula for the nth term of the sequence $9, -\frac{27}{\sqrt{3}}, \frac{81}{\sqrt{5}}, -\frac{243}{\sqrt{7}}, \ldots$

$$\boxed{a_n = \frac{(-1)^{n-1}\cdot 3^{n+1}}{\sqrt{2n-1}}}$$

alternating signs $\to (-1)^n$
top: mult. by 3 $\to 3^n$
bottom: add 2 $\to 2n$

18. Find a formula for the nth term of the sequence $\frac{1}{8}, -\frac{1}{16}, -\frac{3}{32}, -\frac{5}{64}, \ldots$

$$\boxed{a_n = \frac{-2n+3}{2^{n+2}}}$$

top: subtract 2 $\to -2n$
bottom: mult. by 2 $\to 2^n$

20. Write the sum using sigma notation.

$$-9-\frac{3}{2}+\frac{3}{4}+\frac{9}{8}+\frac{15}{16}+\frac{21}{32}+\frac{27}{64}$$

top: add 6 $\to 6n$
bottom: mult. by 2 $\to 2^n$

$$\boxed{\sum_{k=1}^{7}\frac{6k-15}{2^{k-1}}}$$

22. Write the sum using sigma notation.

$$-\frac{9}{8}+\underset{\uparrow\,\frac{16}{16}}{1}-\frac{25}{32}+\frac{36}{64}-\frac{49}{128}$$

alternating $\to (-1)^n$
top: squares $\to n^2$
bottom: mult. by 2 $\to 2^n$

$$\boxed{\sum_{k=1}^{5}\frac{(-1)^k(k+2)^2}{2^{k+2}}}$$