WARMUP

1) $\overset{2^1}{2}, \overset{2^2}{4}, \overset{2^3}{8}, 16, \underline{32}, \underline{64}$ nth term 2^n

2) $25, 5, 1, \frac{1}{5}, \underline{\frac{1}{25}}, \underline{\frac{1}{125}}$

3) 1, 1, 2, 3, 5, <u>8</u>, <u>13</u> "Fibonacci Sequence"

4) M, V, E, M, <u>J</u>, <u>S</u>, <u>U</u>

5) O, T, T, F, <u>F</u>, <u>S</u>, <u>S</u>

6) J, F, M, A, <u>M</u>, <u>J</u>

Section 11.1 Sequences

A <u>sequence</u> is a function whose domain is the set of positive integers.

<u>ex</u>: $\{a_n\} = \left\{\frac{n-1}{n}\right\}$

a_n: nth term

$$a_1 = \frac{1-1}{1} = 0$$

$$= \left\{0, \frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \ldots\right\}$$

$$a_2 = \frac{2-1}{2} = \frac{1}{2}$$

$$a_3 = \frac{3-1}{3} = \frac{2}{3}$$

$$a_4 = \frac{4-1}{4} = \frac{3}{4}$$

$$a_5 = \frac{5-1}{5} = \frac{4}{5}$$

ex: Write the general term $\{a_n\}$

a) $e, \frac{e^2}{2}, \frac{e^3}{3}, \frac{e^4}{4}, \ldots$ $\quad \{a_n\} = \left\{\frac{e^n}{n}\right\}$

b) $1, 3, 5, 7, 9, \ldots$ $\quad \{a_n\} = \{2n-1\}$

$\overset{2\cdot1}{2}, \overset{2\cdot2}{4}, \overset{2\cdot3}{6}, 8, 10, \ldots$ $\quad \{a_n\} = \{2n\}$

A sequence written in <u>recursive form</u> gives one or more of the first terms and defines the next term based on the prior terms.

ex: $a_1 = 1$

$a_n = 4a_{n-1}$

"next term = 4 times current term"

$a_2 = 4a_1 = 4\cdot1 = \underset{a_2}{4}$

$a_3 = 4a_2 = 4\cdot4 = 16$

$a_4 = 4a_3 = 4\cdot16 = 64$

$\{1, 4, 16, 64, 256, \ldots\}$

ex: $a_1 = 1$

$a_2 = 1$

$a_n = a_{n-1} + a_{n-2}$

$a_3 = a_2 + a_1 = 1+1 = 2$

$a_4 = a_3 + a_2 = 2+1 = 3$

$a_5 = a_4 + a_3 = 3+2 = 5$

$\{1, 1, 2, 3, 5, \ldots\}$ ⇒ Fibonacci Sequence

Summation Notation

$$\sum_{k=1}^{n} a_k = a_1 + a_2 + a_3 + \dots + a_n$$

"sigma" ↳ sum up terms starting with $k=1$ and ending when $k=n$.

ex: $\sum_{k=1}^{5} k! = 1! + 2! + 3! + 4! + 5!$

$= 1 + 2 + 6 + 24 + 120$

$= 153$

$n! = 1 \cdot 2 \cdot 3 \cdot \dots \cdot (n-1) \cdot n$

n factorial

$5! = 1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 = 120$

ex: $1^2 + 2^2 + 3^2 + \dots + 9^2 = \sum_{k=1}^{9} k^2$

p864-865

5-30 by 5's, 45-60 by 5's

5) $\{(-1)^{n+1} n^2\}$

$a_1 = (-1)^{1+1} \cdot 1^2 = (-1)^2 \cdot 1^2 = 1 \cdot 1 = 1$

$a_2 = (-1)^{2+1} \cdot 2^2 = (-1)^3 \cdot 4 = -1 \cdot 4 = -4$

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

$a_4 = (-1)^{4+1} \cdot 4^2 = -16$

$a_5 = (-1)^{5+1} \cdot 5^2 = 25$

$\{1, -4, 9, -16, 25, \dots\}$