## Unit 11 Study Guide (Sequences)

- All sequences can be defined recursively.
- Only sequences that have a common difference or a common ratio can be defined explicitly.
- A recursive rule for a sequence defines the nth term by relating it to one or more previous terms. In order to find the value of a specific term, you need to know the value of one or more previous terms.
- An explicit rule for a sequence can be used to find any specific term in a sequence without finding any of the previous terms.
- Arithmetic Sequences can be defined explicitly by $a_{n}=a_{1}+d(n-1)$ where $a_{1}$ represents the first term in the sequence and d represents the common difference (+ or - ).
- Geometric Sequences can be defined explicitly by $a_{n}=a_{1}$ - $r^{(n-1)}$ where $a_{1}$ represents the first term in the sequence and $r$ represents the common ratio ( $\times$ ).
- Arithmetic and Geometric Sequences can be defined recursively as follows:



## Generating Sequences with Recursive Rules

Rule: $a_{n}=\frac{1}{2} a_{n-1}+5$; $a_{1}=20$
What does the rule say?

$$
a_{n}=\frac{1}{2} a_{n-1}+5
$$

The nth term of the sequence $=\frac{1}{2}$ times the previous term plus 5

$$
a_{1}=20
$$

## The first term of the sequence is 20

How do we generate the sequence?
$a_{2}=\frac{1}{2} a_{1}+5 \quad a_{3}=\frac{1}{2} a_{2}+5$
$a_{4}=\frac{1}{2} a_{3}+5$
$a_{5}=\frac{1}{2} a_{4}+5$
$a_{2}=\frac{1}{2}(20)+5 \quad a_{3}=\frac{1}{2}(15)+5 \quad a_{4}=\frac{1}{2}(12.5)+5 \quad a_{5}=\frac{1}{2}(11.25)+5$
$a_{2}=15 \quad a_{3}=12.5 \quad a_{4}=11.25 \quad a_{5}=10.625$

Sequence: 20, 15, 12.5, $11.25,10.625, \ldots$

