NAME: _____ PERIOD: _____ DATE: _____

Homework Problem Set

For Problems 1–4, list the first five terms of each sequence.

1. $a_n = a_{n-1} + 6$, where $a_1 = 11$ for $n \geq 1$

$a_{n+1} = a_n + 6$

11, 17, 23, 29, 35

2. $a_n = a_{n-1} \div 2$, where $a_1 = 50$ for $n \geq 1$

50, 25, 12.5, 6.25, 3.125

3. $f(n) = -2f(n-1) + 8$ and $f(1) = 1$ for $n \geq 1$

1, 6, -4, 16, -24

4. $f(n) = f(n-1) + n$ and $f(1) = 4$ for $n \geq 1$

4, 6, 9, 13, 18, 24 ...

For Problems 5–10, write a recursive formula for each sequence given or described below.

5. It follows a plus one pattern: 8, 9, 10, 11, 12, ...

$f(n+1) = f(n) + 1$

$f(1) = 8$, $n \geq 1$

6. It follows a multiply by 10 pattern: 4, 40, 400, 4000, ...

$f(n+1) = 10f(n)$

$f(1) = 4$, $n \geq 1$

7. It has a general formula of $f(n) = -3n + 2$ for $n \geq 1$.

2, -1, -4, -7
0 1 2 3

↳d ↳term 0

$f(n+1) = f(n) - 3$
$f(1) = -1$, $n \geq 1$

8. It has a general formula of $f(n) = -1(12)^{n-1}$ for $n \geq 1$.

$f(1) = -1$ ↑ r

$f(n+1) = 12\, f(n)$
$f(1) = -1$, $n \geq 1$

9. Doug accepts a job where his starting salary is \$30,000 per year, and each year he receives a raise of \$3,000.

$f(n+1) = f(n) + 3000$
$f(1) = 30{,}000$, $n \geq 1$

10. A bacteria culture has an initial population of 10 bacteria, and each hour the population triples in size.

$f(n+1) = 3\, f(n)$
$f(1) = 10$, $n \geq 1$

11. Each sequence below gives an explicit formula. Write the first five terms of each sequence. Then, write a recursive formula for the sequence.

A. $a_n = 2n + 10$ for $n \geq 1$

12, 14, 16, 18, 20

$f(n+1) = f(n) + 2$
$f(1) = 12$, $n \geq 1$

B. $f(n) = \left(\frac{1}{2}\right)^{n-1}$ for $n \geq 1$

1, $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$

$f(n+1) = \frac{1}{2} f(n)$
$f(1) = 1$, $n \geq 1$

12. The nursery rhyme "This is the House that Jack Built" can be considered a recursive poem or story. How is it recursive? What are the beginning conditions? What happens at each stage of the story?

This is the house that
Jack built.

This is the malt
That lay in the house that
Jack built.

This is the rat,
That ate the malt
That lay in the house that
Jack built.

This is the cat,
That killed the rat,
That ate the malt
That lay in the house that
Jack built.

This is the dog,
That worried the cat,
That killed the rat,
That ate the malt
That lay in the house that
Jack built.

This is the cow with the
crumpled horn,
That tossed the dog,
That worried the cat,
That killed the rat,
That ate the malt
That lay in the house that
Jack built . . .

It is recursive because it continues to use the statements before the current one.

Beginning Condition:
"This is the house that Jack built."