

TEST NAME: **BF.2**
TEST ID: **439388**
GRADE: **09**
SUBJECT: **Mathematics**
TEST CATEGORY: **My Classroom**

Student: _____

Class: _____

Date: _____

1. The 12th term of an arithmetic sequence is 87 and the 20th term is 135. Which number represents the value of the common difference, d , of the sequence?

- A. 4
- B. 6
- C. 8
- D. 48

2. A sequence is shown below:

$2, 6, 18, 54, \dots$

Which recursive formula models the sequence?

- A. $\text{NEXT} = \text{NOW} + 4$
- B. $\text{NEXT} = 3 \cdot \text{NOW}$
- C. $\text{NEXT} = \frac{2}{3} \cdot 3^{\text{NOW}}$
- D. $\text{NEXT} = 2 \cdot 3^{\text{NOW}}$

3. A sequence is defined by the formula $a_1 = 4$ and $a_n = a_{n-1} + 6$ for n greater than 1. Which of the following describes a_8 ?

- A. $a_8 = 4 + 7(6)$
- B. $a_8 = 6 + 7(4)$
- C. $a_8 = 6 + 8(4)$
- D. $a_8 = 4 + 8(6)$

4. At the beginning of the school year, Jason's dad gave him \$50 to put into his lunch account. Jason spends \$2 each day on his lunch. Which recursive formula models the amount of money that Jason has in his account?

- A. $\text{NEXT} = \text{NOW} + 2$
- B. $\text{NEXT} = \text{NOW} - 2$
- C. $\text{NEXT} = 50 - 2 \cdot \text{NOW}$
- D. $\text{NEXT} = 52 - 2 \cdot \text{NOW}$

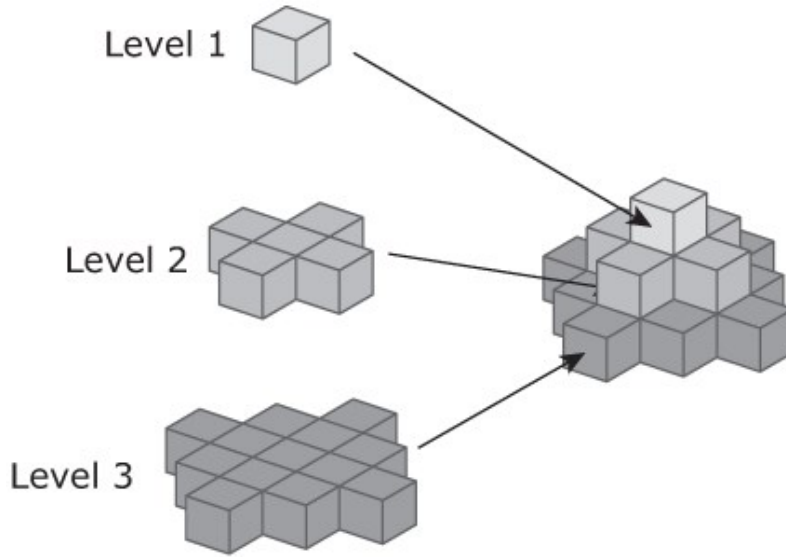
5. A sequence is shown below.

6, 36, 216, 1,296, . . .

Which recursive formula models the sequence?

- A. $\text{NEXT} = 6 \cdot \text{NOW}$
- B. $\text{NEXT} = 30 \cdot \text{NOW}$
- C. $\text{NEXT} = 6 + \text{NOW}$
- D. $\text{NEXT} = 30 + \text{NOW}$

6. Sidney found a box of sugar cubes in the kitchen and decided to build a pyramid, following a certain pattern (see below).



Sidney denoted the top cube as "level 1," the five cubes directly below that as "level 2," and so on.

Part 1.

Use a table similar to the one below to list the number of cubes for the first 5 levels. It may be helpful to sketch each level separately.

Level	1	2	3	4	5
Cubes in Level	1	5	?	?	?
Total Cubes	1	6	?	?	?

Part 2.

Develop a mathematical sequence that will allow you to calculate C_n , the number of cubes needed to build the n th level.

(Hint: How much larger is C_3 than C_2 ? How much larger is C_4 than C_3 ?)

Part 3.

Develop a formula to calculate T_n , the total number of cubes needed to build an n -level pyramid.

Part 4.

After building three levels, Sidney has 250 cubes left in his box. Does he have enough to build at least 8 levels? Support your answer numerically.

7. A sequence is shown below:

0.5, 0.05, 0.005, . . .

Which recursive formula models the sequence?

A.
$$\text{NEXT} = 0.5 \cdot \left(\frac{1}{10}\right)^{\text{NOW}}$$

B.
$$\text{NEXT} = 5 \cdot \left(\frac{1}{10}\right)^{\text{NOW}}$$

C.
$$\text{NEXT} = \frac{\text{NOW}}{10}$$

D.
$$\text{NEXT} = \frac{10}{\text{NOW}}$$

8. The first four triangular numbers are 1, 3, 6, and 10. Which expression can be used to find n th triangular number?

A. $n + 1$

B. $\frac{n^2 + 3n}{2}$

C. $\frac{n(n+1)}{2}$

D. $\frac{n \cdot n + 1}{2}$

9. The sequence a_1, a_2, a_3, \dots is defined explicitly as $a_n = -3n - 2$.

What is the recursive form of this sequence?

A. $a_1 = -5, a_n = -3a_{n-1}$

B. $a_1 = -5, a_n = 3a_{n-1}$

C. $a_1 = -5, a_n = a_{n-1} - 3$

D. $a_1 = -5, a_n = a_{n-1} + 3$

10. Determine the first three terms of the sequence and whether the given formula is explicit or recursive.

$$a_n = \frac{1}{2}(n)(n-1), n = 1, 2, 3, \dots$$

- A. Explicit: 0, 1, 3
 - B. Explicit: 1, 3, 6
 - C. Recursive: 0, 1, 3
 - D. Recursive: 1, 3, 6
11. A sequence is shown below.

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

Which recursive formula models the sequence?

- A. NEXT = 2 • NOW
 - B. NEXT = $\frac{1}{2}$ • NOW
 - C. NEXT = $\frac{1}{16}$ • 2^{NOW}
 - D. NEXT = $\frac{1}{8}$ • 2^{NOW}
12. The explicit formula for a function is $f(n) = -3n + 8$. What is the starting value for the recursive form of the function?
- A. 8
 - B. 5
 - C. -3
 - D. -11

13. If $A_1 = 3$ and $A_{(n+1)} = 2A_n$, which equation represents the explicit formula for the sequence?

- A. $A_n = 2 \cdot 3^n$
- B. $A_n = 2 \cdot 3^{n-1}$
- C. $A_n = 3 \cdot 2^n$
- D. $A_n = 3 \cdot 2^{n-1}$

14. Which recursive formula models the sequence shown below?

-3, 1, 5, 9, . . .

- A. NEXT = NOW + 4
- B. NEXT = NOW - 4
- C. NEXT = 4 • NOW
- D. NEXT = 4 • NOW + 7

15. The sequence below shows the number of cells in a sample at the end of the four hours.

6, 12, 24, 48

Which recursive formula models the sequence?

- A. NEXT = NOW + 6
- B. NEXT = 2 • NOW
- C. NEXT = 2 • NOW + 4
- D. NEXT = 3 • NOW + 3

16. The sequence below shows the number of raffle tickets that Samantha sold each day during a month.

3, 7, 11, 15, . . .

Which explicit formula models the number of tickets Samantha sold on day x ?

- A. $t(x) = x + 4$
 - B. $t(x) = 3x + 4$
 - C. $t(x) = 4x - 1$
 - D. $t(x) = 4x + 3$
17. The recursive formula $\text{NEXT} = 3 \bullet \text{NOW}$ models the number of goldfish in a pond each year. If there are 36 goldfish in the pond after 3 years, how many goldfish will be in the pond after 6 years?
- A. 324
 - B. 936
 - C. 972
 - D. 2,916
18. Marcus dropped a ball from a height of 400 cm. The sequence below shows the height of the ball, in cm, during its first four bounces.

240, 144, 86.4, 51.84, ...

Which formula could be used to determine the height of the ball after n bounces?

- A. $h(n) = 400(0.60)^n$
- B. $h(n) = 400(0.60)^{(n-1)}$
- C. $h(n) = 240(0.60)^n$
- D. $h(n) = 240(0.60)^{(n-1)}$

19. Look at the recursive function below.

$$a_1 = 900$$
$$a_n = a_{n-1} - 60$$

Which explicit formula represents this function?

- A. $a_n = 840n$
- B. $a_n = 900n - 60$
- C. $a_n = 900 - 60n$
- D. $a_n = 960 - 60n$

20. The function below describes an arithmetic sequence, where $A(n)$ is the n th term and n is the term number.

$$A(n) = 6 + 3(n - 1)$$

Which table **best** fits the sequence?

A.

n	1	2	3	4
$A(n)$	6	12	15	18

B.

n	1	1.5	2	2.5
$A(n)$	6	7.5	9	10.5

C.

n	2	3	4	5
$A(n)$	6	9	12	15

D.

n	2	3	4	5
$A(n)$	9	12	15	18

21. The Snowflake Curve is a famous example of a complex curve created through a recursive process.

The curve itself cannot be drawn. It is the limit of a series of curves that grow more and more complex.

Snowflake Curve 1: This is the unit segment in the xy -coordinate plane, between $(0, 0)$ and $(1, 0)$.



Snowflake Curve 2: This is a set of 4 segments, from $(0, 0)$ to $(\frac{1}{3}, 0)$, to $(\frac{1}{2}, \frac{\sqrt{3}}{6})$, to $(\frac{2}{3}, 0)$, and from there to $(1, 0)$.



In general, for $n > 0$, the Snowflake Curve $(n + 1)$ replaces each segment in Curve n with four new segments, each one-third the length of the original, in the process forming an equilateral triangle at the center of each segment.



The length of the Snowflake curve increases at each iteration. What is the length of Snowflake Curve 9, to the nearest 0.01 unit?

- A. 1.98
- B. 3.67
- C. 9.99
- D. 13.32

22. The recursive formula for a sequence is shown below.

$$\text{NEXT} = 5 \cdot \text{NOW}, \text{ starting at } 9$$

Which explicit formula can be used to determine the value of the n th term in the sequence?

- A. $f(n) = 5n$
- B. $f(n) = 5n + 9$
- C. $f(n) = 1.8(5)^n$
- D. $f(n) = 9(5)^n$

23. A certain recursive equation is defined by the formula $\text{NEXT} = \text{NOW} + 4$, starting at 7. What is the explicit form of this equation?

- A. $f(n) = n + 4$
- B. $f(n) = n + 7$
- C. $f(n) = 4n + 3$
- D. $f(n) = 4n + 7$

24. A geometric sequence is shown below.

$$24, 12, 6, \dots$$

Which is the explicit formula for this sequence?

- A. $a_n = 24 - \frac{1}{2}(n - 1)$
- B. $a_n = 24 - \frac{1}{2}n$
- C. $a_n = 24\left(\frac{1}{2}\right)^n$
- D. $a_n = 24\left(\frac{1}{2}\right)^{n-1}$

25. As part of his language assignment, Ken reads 12 pages from his book on the first day. After that, he reads 6 more pages each day. Write a recursive rule for the number, a_n , of pages read by Ken at the beginning of the n th day.

26. A sequence is shown below.

12, 15, 18, 21, . . .

Which recursive formula models the sequence?

- A. $\text{NEXT} = \text{NOW} + 3$, starting at 12
- B. $\text{NEXT} = 3 \cdot \text{NOW} + 3$, starting at 12
- C. $\text{NEXT} = 3 \cdot \text{NOW} + 9$, starting at 12
- D. $\text{NEXT} = 3 \cdot \text{NOW} + 12$, starting at 12

27. An arithmetic sequence is shown below.

5, 8, 11, 14, 17, ...

Which recursive formula models the sequence?

- A. $\text{NEXT} = \text{NOW} + 2$, starting at 5
- B. $\text{NEXT} = \text{NOW} + 3$, starting at 5
- C. $\text{NEXT} = 2 \cdot \text{NOW} + 3$, starting at 5
- D. $\text{NEXT} = 3 \cdot \text{NOW} + 2$, starting at 5

28. A scientist is studying the growth of a certain bacteria population in a dish. At 12:00 P.M., the scientist begins the study with 4 bacteria. After each hour of the study, the scientist records the time and the number of bacteria in the dish. The scientist's records for the first few hours of the study are shown in the table below.

Time	Number of Bacteria
1 P.M.	12
2 P.M.	36
3 P.M.	108
4 P.M.	324

Part A. Write a recursive formula to represent the bacteria growth in this study. Let A_0 represent the number of bacteria at the beginning of the study, and let n represent the number of hours that have passed since the study began.

Part B. Write an explicit formula to represent the bacteria growth in this study. Again, let A_0 represent the number of bacteria at the beginning of the study, and let n represent the number of hours that have passed since the study began.

Part C. Using your recursive formula and assuming the bacteria population continues to grow at the same rate, determine the number of bacteria in the dish at 8:00 P.M. Show your work. Next, using your explicit formula and assuming the bacteria population continues to grow at the same rate, determine the number of bacteria in the dish at 8:00 P.M. Show your work.

Part D. Compare and contrast the methods you used when using the different formulas in part C. Which type of formula would you use if you had to determine the number of bacteria in the dish at 10:00 A.M. on the following day? Explain.

Use words, numbers, and/or pictures to show your work.

29. What is the explicit formula for the sequence that is modeled recursively by the rule NEXT = NOW + 3 starting at 12?

A. $a_n = 3n + 12$

B. $a_n = 3n + 9$

C. $a_n = 15 - 3n$

D. $a_n = 9 - 3n$

30. The sequence a is defined by $a_1 = 4$ and $a_n = a_{n-1} + 3$. What is the explicit form of the sequence if written in a simplified format without parentheses?

31. Which formula is the recursive form of $f(n) = 7 \cdot 5^{(n-1)}$?

A. NEXT = $7 \cdot$ NOW, starting at 5

B. NEXT = $5 \cdot$ NOW, starting at 7

C. NEXT = NOW + 5, starting at 7

D. NEXT = NOW + 35, starting at 0

32. The first term of an arithmetic sequence is 3. The n th term of the sequence is found by using the formula $a_n = a_{n-1} + 4$. Which other formula could be used to find the n th term?

A. $y = 3n + 1$

B. $y = 3n - 4$

C. $y = 4n + 3$

D. $y = 4n - 1$

33. A geometric sequence is shown. What is the explicit formula for the sequence?

4, 12, 36, 108, ...

A. $a_n = 4 \cdot 3^{n-1}$

B. $a_n = 4 \cdot 3^n$

C. $a_n = 3 \cdot 4^{n-1}$

D. $a_n = 3 \cdot 4^n$

