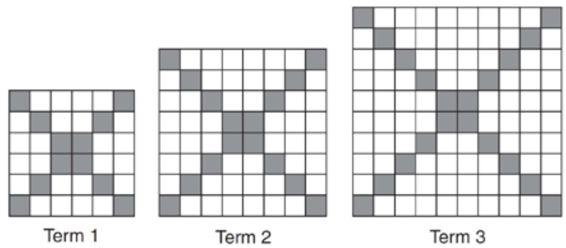
F.LE.A.2: Sequences 1a

1 The diagrams below represent the first three terms of a sequence.



Assuming the pattern continues, which formula determines a_n, the number of shaded squares in the nth term?

1) $a_n = 4n + 12$
2) $a_n = 4n + 8$
3) $a_n = 4n + 4$
4) $a_n = 4n + 2$

2 For the sequence $-27, -12, 3, 18, \ldots$, the expression that defines the nth term where $a_1 = -27$ is

1) $15 - 27n$
2) $15 - 27(n - 1)$
3) $-27 + 15n$
4) $-27 + 15(n - 1)$

3 Which function could be used to represent the sequence $8, 20, 50, 125, 312.5, \ldots$, given that $a_1 = 8$?

1) $a_n = a_{n-1} + a_1$
2) $a_n = 2.5\left(a_{n-1}\right)$
3) $a_n = a_1 + 1.5\left(a_{n-1}\right)$
4) $a_n = \left(a_1\right)\left(a_{n-1}\right)$

4 Which function defines the sequence $-6, -10, -14, -18, \ldots$, where $f(6) = -26$?

1) $f(x) = -4x - 2$
2) $f(x) = 4x - 2$
3) $f(x) = -x + 32$
4) $f(x) = x - 26$

5 A theater has 35 seats in the first row. Each row has four more seats than the row before it. Which expression represents the number of seats in the nth row?

1) $35 + (n + 4)$
2) $35 + (4n)$
3) $35 + (n + 1)(4)$
4) $35 + (n - 1)(4)$

6 What is the nth term of the sequence $-1, 3, 7, 11, \ldots$?

1) $a_n = -1 - 4(n - 1)$
2) $a_n = -1 + 4(n - 1)$
3) $a_n = 4 - (n - 1)$
4) $a_n = 4 + (n - 1)$

7 Given $f(9) = -2$, which function can be used to generate the sequence $-8, -7.25, -6.5, -5.75, \dots$?

1) $f(n) = -8 + 0.75n$
2) $f(n) = -8 - 0.75(n - 1)$
3) $f(n) = -8.75 + 0.75n$
4) $f(n) = -0.75 + 8(n - 1)$

8 The third term in an arithmetic sequence is 10 and the fifth term is 26. If the first term is a_1, which is an equation for the nth term of this sequence?

1) $a_n = 8n + 10$
2) $a_n = 8n - 14$
3) $a_n = 16n + 10$
4) $a_n = 16n - 38$

9 The sequence $a_1 = 6, a_n = 3a_{n-1}$ can also be written as

1) $a_n = 6 \cdot 3^n$
2) $a_n = 6 \cdot 3^{n+1}$
3) $a_n = 2 \cdot 3^n$
4) $a_n = 2 \cdot 3^{n+1}$

10 In 2014, the cost to mail a letter was 49¢ for up to one ounce. Every additional ounce cost 21¢. Which recursive function could be used to determine the cost of a 3-ounce letter, in cents?

1) $a_1 = 49;\ a_n = a_{n-1} + 21$
2) $a_1 = 0;\ a_n = 49a_{n-1} + 21$
3) $a_1 = 21;\ a_n = a_{n-1} + 49$
4) $a_1 = 0;\ a_n = 21a_{n-1} + 49$

11 A sunflower is 3 inches tall at week 0 and grows 2 inches each week. Which function(s) shown below can be used to determine the height, $f(n)$, of the sunflower in n weeks?

I. $f(n) = 2n + 3$
II. $f(n) = 2n + 3(n - 1)$
III. $f(n) = f(n - 1) + 2$ where $f(0) = 3$

1) I and II
2) II, only
3) III, only
4) I and III

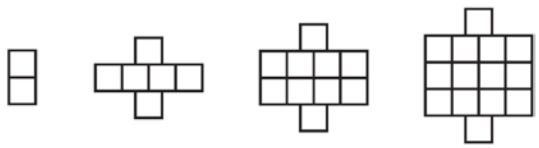
12 The average depreciation rate of a new boat is approximately 8% per year. If a new boat is purchased at a price of \$75,000, which model is a recursive formula representing the value of the boat n years after it was purchased?

1) $a_n = 75{,}000(0.08)^n$
2) $a_0 = 75{,}000$
   $a_n = (0.92)^n$
3) $a_n = 75{,}000(1.08)^n$
4) $a_0 = 75{,}000$
   $a_n = 0.92(a_{n-1})$

13 If the pattern below continues, which equation(s) is a recursive formula that represents the number of squares in this sequence?

1) $y = 2x + 1$
2) $y = 2x + 3$
3) $a_1 = 3$
$a_n = a_{n-1} + 2$
4) $a_1 = 1$
$a_n = a_{n-1} + 2$

14 A pattern of blocks is shown below.



If the pattern of blocks continues, which formula(s) could be used to determine the number of blocks in the *n*th term?

I	II	III
$a_n = n + 4$	$a_1 = 2$ $a_n = a_{n-1} + 4$	$a_n = 4n - 2$

1) I and II
2) I and III
3) II and III
4) III, only

15 Savannah just got contact lenses. Her doctor said she can wear them 2 hours the first day, and can then increase the length of time by 30 minutes each day. If this pattern continues, which formula would *not* be appropriate to determine the length of time, in either minutes or hours, she could wear her contact lenses on the *n*th day?

1) $a_1 = 120$
$a_n = a_{n-1} + 30$
2) $a_n = 90 + 30n$
3) $a_1 = 2$
$a_n = a_{n-1} + 0.5$
4) $a_n = 2.5 + 0.5n$

16 Which recursively defined function has a first term equal to 10 and a common difference of 4?

1) $f(1) = 10$
$f(x) = f(x - 1) + 4$

2) $f(1) = 4$
$f(x) = f(x - 1) + 10$

3) $f(1) = 10$
$f(x) = 4f(x - 1)$

4) $f(1) = 4$
$f(x) = 10f(x - 1)$

17 What is a formula for the nth term of sequence B shown below?

$$B = 10, 12, 14, 16, \ldots$$

1) $b_n = 8 + 2n$
2) $b_n = 10 + 2n$
3) $b_n = 10(2)^n$
4) $b_n = 10(2)^{n-1}$

18 A sequence has the following terms: $a_1 = 4$, $a_2 = 10$, $a_3 = 25$, $a_4 = 62.5$. Which formula represents the nth term in the sequence?

1) $a_n = 4 + 2.5n$
2) $a_n = 4 + 2.5(n - 1)$
3) $a_n = 4(2.5)^n$
4) $a_n = 4(2.5)^{n-1}$

19 Which recursively defined function represents the sequence $3, 7, 15, 31, \ldots$?

1) $f(1) = 3,\ f(n + 1) = 2^{f(n)} + 3$
2) $f(1) = 3,\ f(n + 1) = 2^{f(n)} - 1$
3) $f(1) = 3,\ f(n + 1) = 2f(n) + 1$
4) $f(1) = 3,\ f(n + 1) = 3f(n) - 2$

20 The formula of the nth term of the sequence $3, -6, 12, -24, 48\ldots$ is

1) $a_n = -2(3)^n$
2) $a_n = 3(-2)^n$
3) $a_n = -2(3)^{n-1}$
4) $a_n = 3(-2)^{n-1}$

21 What is the formula for the nth term of the sequence $54, 18, 6, \ldots$?

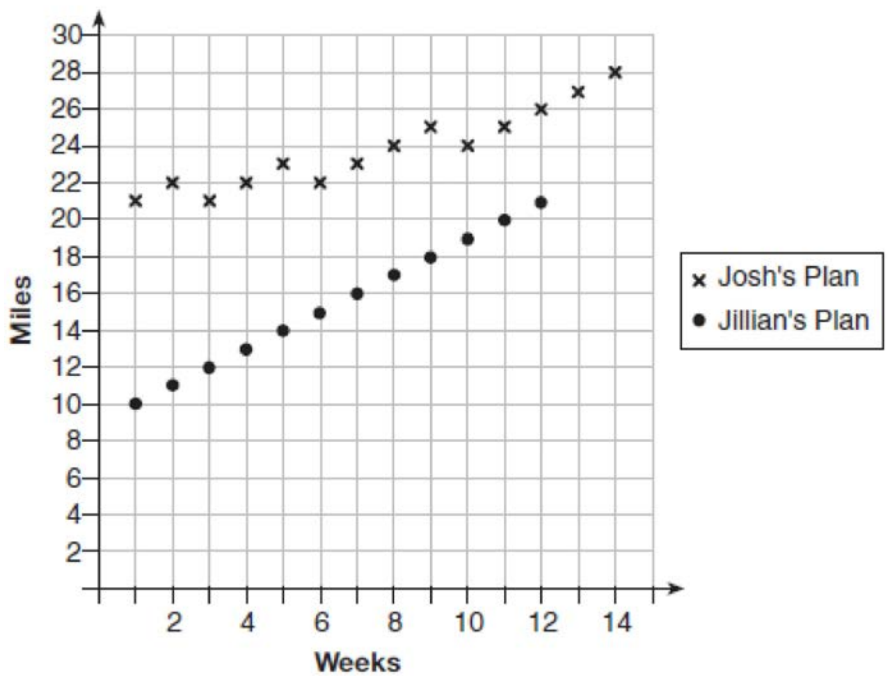
1) $a_n = 6\left(\frac{1}{3}\right)^n$
2) $a_n = 6\left(\frac{1}{3}\right)^{n-1}$
3) $a_n = 54\left(\frac{1}{3}\right)^n$
4) $a_n = 54\left(\frac{1}{3}\right)^{n-1}$

22 In an arithmetic sequence, $a_4 = 19$ and $a_7 = 31$. Determine a formula for a_n, the n^{th} term of this sequence.

23 While experimenting with her calculator, Candy creates the sequence 4, 9, 19, 39, 79, ... Write a recursive formula for Candy's sequence. Determine the eighth term in Candy's sequence.

24 Simon lost his library card and has an overdue library book. When the book was 5 days late, he owed $2.25 to replace his library card and pay the fine for the overdue book. When the book was 21 days late, he owed $6.25 to replace his library card and pay the fine for the overdue book. Suppose the total amount Simon owes when the book is *n* days late can be determined by an arithmetic sequence. Determine a formula for a_n, the *n*th term of this sequence. Use the formula to determine the amount of money, in dollars, Simon needs to pay when the book is 60 days late.

25 Elaina has decided to run the Buffalo half-marathon in May. She researched training plans on the Internet and is looking at two possible plans: Jillian’s 12-week plan and Josh’s 14-week plan. The number of miles run per week for each plan is plotted below.



Which one of the plans follows an arithmetic pattern? Explain how you arrived at your answer. Write a recursive definition to represent the number of miles run each week for the duration of the plan you chose. Jillian’s plan has an alternative if Elaina wanted to train instead for a full 26-mile marathon. Week one would start at 13 miles and follow the same pattern for the half-marathon, but it would continue for 14 weeks. Write an explicit formula, in *simplest form*, to represent the number of miles run each week for the full-marathon training plan.

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Answer Section

1 ANS: 2 REF: 061424ai
2 ANS: 4 REF: 081820ai
3 ANS: 2 REF: 011919ai
4 ANS: 1 REF: 081610ai
5 ANS: 4 REF: 061520a2
6 ANS: 2 REF: 061624a2
7 ANS: 3 REF: 061720aii
8 ANS: 2 REF: 081416ai
9 ANS: 3 REF: 081618aii
10 ANS: 1 REF: 011708ai
11 ANS: 4 REF: 061421ai
12 ANS: 4 REF: 081810aii
13 ANS: 3 REF: 011818ai
14 ANS: 3 REF: 061522ai
15 ANS: 4

$a_1 = 2.5 + 0.5(1) = 3$

REF: 011916aii

16 ANS: 1 REF: 081514ai
17 ANS: 1

common difference is 2. $b_n = x + 2n$

$$10 = x + 2(1)$$
$$8 = x$$

REF: 081014a2

18 ANS: 4

$\frac{10}{4} = 2.5$

REF: 011217a2

19 ANS: 3 REF: 011618ai
20 ANS: 4 REF: 011715a2
21 ANS: 4 REF: 061026a2
22 ANS:

$\frac{31-19}{7-4} = \frac{12}{3} = 4$ $x + (4-1)4 = 19$ $a_n = 7 + (n-1)4$

$$x + 12 = 19$$
$$x = 7$$

REF: 011434a2

23 ANS:
$a_1 = 4$ $a_8 = 639$

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

REF: 081729aii

24 ANS:
$\frac{6.25 - 2.25}{21 - 5} = \frac{4}{16} =$ \$.25 fine per day. $2.25 - 5(.25) =$ \$1 replacement fee. $a_n = 1.25 + (n-1)(.25)$. $a_{60} =$ \$16

REF: 081734aii

25 ANS:
Jillian's plan, because distance increases by one mile each week. $a_1 = 10$ $a_n = n + 12$

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

REF: 011734aii