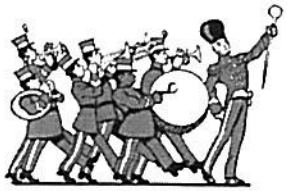
Essential Question: How can we model situations using an arithmetic explicit formula?

Do Now:

During halftime at a football game, a high school marching band marches onto the field to perform a routine. There is one performer in the first row, four performers in the second row, and seven performers in the third row. This pattern continues for n rows.



(a) Create a sequence that represents the number of performers in each row.

1, 4, 7, 10, ...

(b) Write an equation that can be used to find the number of performers in the nth row.

$a(1) = 1$, $d = 3$

$a(n) = 1 + 3(n-1)$

(c) How many performers are in the 6th row?

$n = 6$

$a(6) = 1 + 3(6-1)$

$= 1 + 3(5) \longrightarrow 16$

16 performers are in the 6th row

Problem Solving and Arithmetic Explicit Formulas

1) The first row of a theater has 15 seats in it. Each subsequent row has 4 more seats than the previous row. $a(1) = 15$ $+4$

(a) Write an equation that can be used to find the number of seats in the nth row.

$a(1) = 15$, $d = 4$

$a(n) = 15 + 4(n-1)$

(b) Find the number of seats in the fifth row.

$n = 5$

$a(5) = 15 + 4(5-1)$

$= 15 + 4(4)$

$= 31$

31 seats

(c) If the last row has 83 seats, how many rows are in the theater?

$a(n)$

$a(n) = 15 + 4(n-1)$

$83 = 15 + 4(n-1)$

$-15 \quad -15$

$\frac{68}{4} = \frac{4(n-1)}{4}$

$17 = n-1$ $\quad n = 18$

18 rows

2) The height (in feet) of the water in a tank each hour after opening its drain can be estimated by the sequence displayed in the table below.

Hours (n)	1	2	3	4
Water Height (a_n)	18	15	12	9

(a) Write an explicit formula that represents the arithmetic sequence.

$a_n = 18$

$d = -3$

$a_n = 18 - 3(n-1)$

(b) Find the seventh term. What does this value represent in the context of the situation?

$n = 7$

$a_7 = 18 - 3(7-1)$

$= 18 - 3(6)$

$= 18 - 18$

$= 0$

In 7 hours, the tank has no water left.

(c) Would the eighth term apply in this situation? Explain.

No, it would create a negative term in the sequence

(d) Simplify the explicit formula from part (a). Compare and contrast both formulas.

Simplify in the space below ⇩	Original Formula $a_n = 18 - 3(n-1)$	Simplified Formula $21 - 3n$
$a_n = 18 - 3(n-1)$ $= 18 - 3n + 3$ $= 21 - 3n$	comparison (same) • n is used • -3 is the constant change contrast starting point is different	

(e) What was the height of the water in the tank before the drain was opened?

21 feet (look at y intercept of simplified formula)

3) Caitlin is given a Starbucks card worth $50. After she purchases a latte, the card's value is $45.50. After she purchases a second latte, its value is $41.

(a) Assuming the pattern continues, write an equation $A(n)$, the amount of money on the Starbucks card after n lattes are purchased. Complete the table below to help you.

# of lattes

n	0	1	2	3	4	5	6
$A(n)$	50	45.50	41	36.50	32	27.50	23

worth of card

$A(n) = 45.50 - 4.5(n-1)$ | $A(n) = 50 - 4.5n$

(b) Caitlin buys a latte every Sunday. How many weeks in a row can she afford to buy a latte, using her Starbucks card only?

n

$0 = 45.50 - 4.5(n-1)$

$\frac{-45.50}{-4.5} = \frac{-4.5(n-1)}{-4.5}$

$10.\bar{1} = n-1$

$11.\bar{1} = n$

she can afford to buy a latte 11 weeks in a row.

$A(n) = 50 - 4.5n$

$0 = 50 - 4.5n$

$\frac{-50}{-4.5} = \frac{-4.5n}{-4.5}$

$n = 11.\bar{1}$

TAKEAWAY

Arithmetic sequences represent linear relationships. These sequences can be defined using the formula $a(n) = a(1) + d(n-1)$. In the formula, a_1 represents the first term and d represents the common difference. These sequences can also be defined using the linear function rule $a_n = mn + b$ where m represents the common difference and b represents the term before the first.