★Remember to always find the explicit formula 1st B-4 finding a specific term value

Name Key　　　　　　　　　　　　　　　　　　　　　　　　Date________
Algebra 1 CC　　　　　　　　　　　　　　　　　　　　　　　Period______

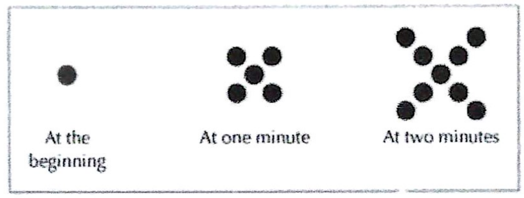
Applications of Sequences

1)

a) Describe the pattern (rule) that you see in the sequence of figures.

Start with 1 and add 4 repeatedly

★ Arithmetic



$a_0 = 1$　　$a_1 = 5$　　$a_2 = 9$

$d = 4$

★ dots grow by 4

b) Assuming the sequence continues in the same way, how many dots are there at 3 minutes?

$9 + 4 = 13$　　$\boxed{13 \text{ dots}}$

c) How many dots are there in t minutes?

Key
$n = t$

$a_1 = 5$
$d = 4$

$a_n = a_1 + d(n-1)$
$a_t = 5 + 4(t-1)$
$a_t = 5 + 4t - 4$
$\boxed{a_t = 4t + 1}$

d) How many dots are there at 100 minutes?

$t = 100$

$a_t = 4t + 1$
$a_{100} = 4(100) + 1$
$a_{100} = 400 + 1$
$\boxed{a_{100} = 401}$

2) Decide if each of the following scenarios describes an arithmetic or geometric sequence. Then, write the formula for the sequence.

a) A (a_0) student comes to school with the flu and infects three other students within an hour before going home. Each newly infected student passes the virus to three new students in the next hour. This pattern continues until all students in the school are infected with the virus.

Type: Geometric　　　　Formula: $a_n = a_1 \cdot r^{n-1}$

$a_1 = 3$
$r = 3$

$a_n = 3^1 \cdot 3^{n-1}$ Add exponents of same base
$a_n = 3^{1+n-1}$
$\boxed{a_n = 3^n}$

b) Round 1 of a tennis tournament starts with 128 players. After each round, half (r) the players have lost and are eliminated from the tournament. Therefore, in round 2 there are 64 players, in round 3 there are 32 players and so on.

Type: Geometric　　　　Formula: $a_n = a_1 \cdot r^{n-1}$

$a_1 = 128$
$r = \frac{1}{2}$

$\boxed{a_n = 128 \cdot \left(\frac{1}{2}\right)^{n-1}}$

y-int
a_0
start/beginning

c) Paul has \$680 in a savings account. He makes a deposit after he receives each paycheck. After one month he has \$758 in the account. The next month the balance is \$836. The balance after the third month is \$914.

$a_1 = 758$

Type: Arithmetic　　　　Formula: $a_1 + d(n-1)$

$a_1 = 758$
$d = 78$

$a_n = 758 + 78(n-1)$
$a_n = 758 + 78n - 78$
$a_n = 78n + 680$

d) The table shows the number of country club members for four years after it began.

Time (years)	0	1	2	3	4
Members	100	200	300	400	500

Type: Arithmetic

Formula: $a_n = a_1 + d(n-1)$

$a_1 = 200$

$d = 100$

$a_n = 200 + 100(n-1)$

$a_n = 200 + 100n - 100$

$a_n = 100n + 100$

d/m a0

$a_1 = .01$

3) You won the lottery!!! You will receive $.01 on day 1, $.03 on day 2, $.09 on day 3, $.27on day 4. This trend will continue for 16 consecutive days.

Geometric $r=3$

formula

a) Write an equation that represents the amount of money that you have won, in terms of days.

$a_1 = .01$

$r = 3$

$a_n = a_1 \cdot r^{n-1}$

$\boxed{a_n = .01 \cdot 3^{n-1}}$

b) Would you rather be given $100,000 today or accept the lottery money after 16 days?

$n=16$

$a_n = .01 \cdot 3^{n-1}$

$a_n = .01 \cdot 3^{(16-1)}$

$a_n = .01 \cdot 3^{15}$

$a_n = .01 \cdot 14,348,907$

$a_{16} = 143489.07$

$143489.07 > 100,000$

lottery \$ after 16 days

4) Joey has a $100 balance on his school cafeteria account. He buys a hot lunch each day of school. After day 1, he has $97.25 left in his account. After the second day he has $94.50 on the account.

$a_1 = 97.25$

Arithmetic

a) Write an equation regarding his account balance if he continues to buy the same lunch each day.

Beginning/start a_0

$a_1 = 97.25$

$d = -2.75$

$a_n = a_1 + d(n-1)$

$a_n = 97.25 - 2.75(n-1)$

$a_n = 97.25 - 2.75n + 2.75$

$a_n = -2.75n + 100$

* makes sense B/c he starts with \$100 + he loses 2.75 per day

b) How many school days can he continue to buy the same lunch, while only using the money that is on his account?

$\frac{100}{2.75} = 36.\overline{36}$

$\boxed{\text{at most 36 days}}$

or

$a_n = -2.75n + 100$

$0 = -2.75n + 100$

$-100 \quad -100$

$-100 = -2.75n$

$\frac{-100}{-2.75} = \frac{-2.75n}{-2.75}$

$n = 36.\overline{36}$

at most 36 days

5) The eleventh term of the sequence 3, -6, 12, -24, ..., is

$\cdot -2 \quad \cdot -2 \quad \cdot -2$

Geometric

$a_1 = 3$

$r = -2$

$a_n = a_1 \cdot r^{n-1}$

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

$n = 11$

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

$a_{11} = 3 \cdot (-2)^{(11-1)}$

$a_{11} = 3 \cdot (-2)^{10}$

$a_{11} = 3 \cdot 1024$

$\boxed{a_{11} = 3072}$

6) What is a common ratio of the geometric sequence whose first term is 5 and third term is 125?

$a_1 = 5$ $\qquad a_n = a_1 \cdot r^{n-1}$

$a_3 = 125$ $\qquad a_3 = 5 \cdot r^{(3-1)}$

$a_3 = 5 \cdot r^2$

$\frac{125}{5} = \frac{5 \cdot r^2}{5}$

$\sqrt{25} = \sqrt{r^2}$ $\quad \boxed{r = 5}$

or

$\boxed{STAT}\ \boxed{1: Edit}$ $(1, 5)\ (3, 125)$

put #'s into L_1 & L_2 then go to $\boxed{STAT}\ \boxed{>}\ \boxed{0: ExpReg}$ and look at the b to tell you the ratio

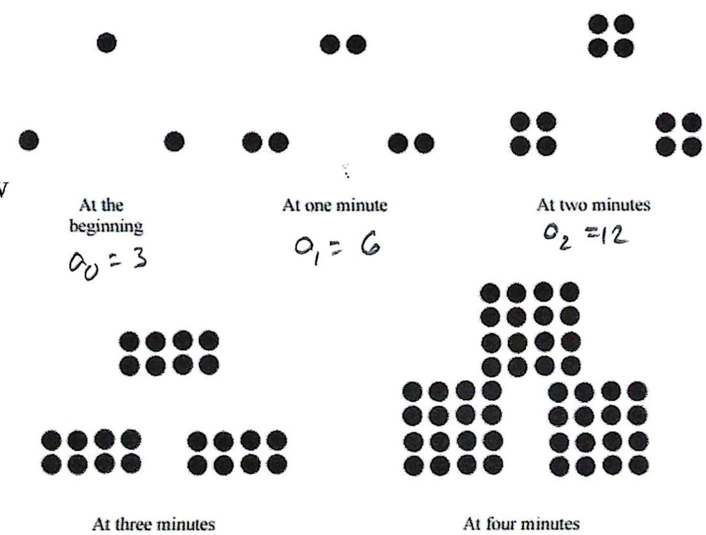
L_1	L_2
1	5
3	125

$b = 5$

7)

a) Describe the pattern you see in the sequence of figures.

start with 3 and multiply by 2 repeatedly



$a_0 = 3$ $\quad a_1 = 6$ $\quad a_2 = 12$ $\quad a_3 = 24$ $\quad a_4 = 48$

Geometric $r = 2$

dots are doubling

b) Assuming the sequence continues in the same way, how many dots are there at 5 minutes?

$48 \cdot 2 = 96$ $\qquad \boxed{96 \text{ dots}}$

c) Write an explicit formula to describe how many dots there will be after t minutes.

$a_1 = 6$ $\qquad a_n = a_1 \cdot r^{n-1}$

$r = 2$ $\qquad \boxed{a_t = 6 \cdot 2^{t-1}}$

Key

$n = t$

8) Determine the common difference of the arithmetic sequence in which $a_1 = 3$ and $a_4 = 15$.

Key

$m = d$

$(1, 3)\ (4, 15)$

$x_1\ y_1\ \ x_2\ y_2$

$m = \frac{y_2 - y_1}{x_2 - x_1}$

$m = \frac{15-3}{4-1}$ $\quad m = \frac{12}{3}$ $\quad m = 4$

$d = 4$

$a_n = a_1 + d(n-1)$

$a_4 = 3 + d(4-1)$

$a_4 = 3 + d(3)$

or $15 = 3 + 3d$

$-3 \quad -3$

$\frac{12}{3} = \frac{3d}{3}$

$\boxed{d = 4}$

$a_1 = 3$

$a_4 = 15$

$\boxed{STAT}\ \boxed{1: Edit}$

put #'s into $L_1\ L_2$

or

L_1	L_2
1	3
4	15

+ then go to $\boxed{STAT}\ \boxed{>}\ \boxed{4: LinReg}$ and look at the a to tell you the slope/diff

$a_1 = 3$ $\qquad d = 1.25$

9) A taxi ride costs \$3.00 for the first mile, and \$1.25 each additional mile.

a) Write an equation representing the cost in terms of miles.

$a_1 = 3$

$d = 1.25$

$a_n = a_1 + d(n-1)$

$a_n = 3 + 1.25(n-1)$

$a_n = 3 + 1.25n - 1.25$

$a_n = 1.25n + 1.75$

b) How much would 20 miles cost?

$n = 20$

$a_n = 1.25n + 1.75$

$a_{20} = 1.25(20) + 1.75$

$a_{20} = 25 + 1.75$

$a_{20} = 26.75$

\$26.75

10)

. Consider the sequence below. If we represent this sequence with the letter *a* then do the following.

$$\overset{+6}{\frown}\ \overset{+6}{\frown}\ \overset{+6}{\frown}$$
1, 7, 13, 19, 25, 31, 37, 43
a_1 a_2 a_3 a_4 a_5 a_6 a_7 a_8

(a) Find $a(5)$ — a_5

$\boxed{25}$

(b) Find $a_2 + a_6$

$7 + 31$

$\boxed{38}$

(c) Find $a(4) + 2a(6)$ — $a_4 + 2(a_6)$

$19 + 2(31)$

$19 + 62$

$\boxed{81}$

(d) Find $\sqrt{a(5)} = \sqrt{a_5}$

$\sqrt{25}$

$\boxed{5}$

(e) Find $\dfrac{a(5) - a(3)}{2}$ — $a_5 - a_3$

$\dfrac{25 - 13}{2}$

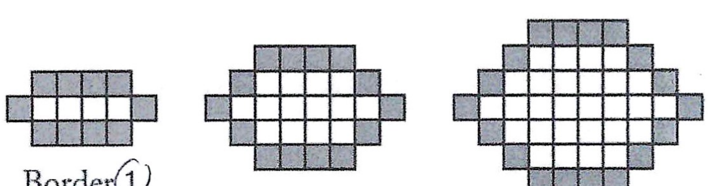
$\dfrac{12}{2} = 6$

11) Given: the sequence 4, 7, 10, 13,... (+3, +3, +3) When using the arithmetic sequence formula an a_1= (n - 1)d to determine the 10th term, which <u>variable</u> would be replaced with the number 3?

d = difference

$\boxed{d = 3}$

12) Fred decides to cover the kitchen floor with tiles of different colors. He starts with a row of four tiles of the same color. He surrounds these four tiles with a border of tiles of a different color (Border1). The design continues as shown below:



Border 1 — $a_1 = 10$ Border 2 — $a_2 = 14$ Border 3 — $a_3 = 18$

Type: Arithmetic

$a_1 = 10$

$d = 4$

Formula: $a_n = a_1 + d(n-1)$

$a_n = 10 + 4(n-1)$

$a_n = 10 + 4n - 4$

$\boxed{a_n = 4n + 6}$