35 decrease by 20%

$$35 - 20\% \text{ of } 35$$

$$1(\underline{35}) - 0.20(\underline{35})$$

$$35(1 - 0.20)$$

$$35(.80)$$

factoring

percent

out of    100

20 percent

$$20/100 = 0.20$$

take away 20%
have 80% left

Increase by per

$$a(1 + per)$$

decrease by per

$$a(1 - per)$$

3C

300 decreased by 18%

$$300(1 - 0.18) = 300(.82) = 246$$

# Section 1.1   Recursive formulas

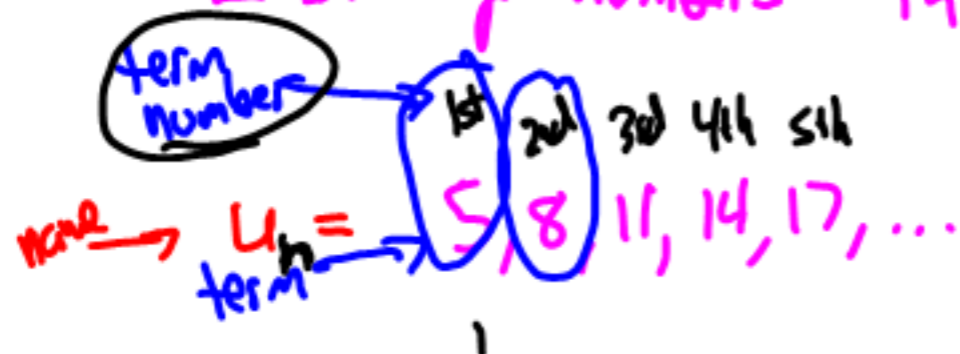- vocabulary
  - sequences
  - term
  - arithmetic
  - geometric
  - recursion
  - Recursive formula

Sequences

$\rightarrow$ way you do a problem

sequential $\Rightarrow$ in a certain order

$\downarrow$

numbers

List of numbers in a specific order.

term numbers

name $\rightarrow$ $U_n = $ 1st 2nd 3rd 4th 5th

$5, 8, 11, 14, 17, \ldots$

term

Does not need to be a pattern.

$29, 3, 13, 14, 6$ $\Rightarrow$ Can reuse $3, 6, 13, 14, 29$

Position $\Rightarrow$ term number

Sequence notation

sequence name $U_1 = 5$ $U_5 = 17$

term number

Calculator $( u(1) = 5 )$

# Recursion

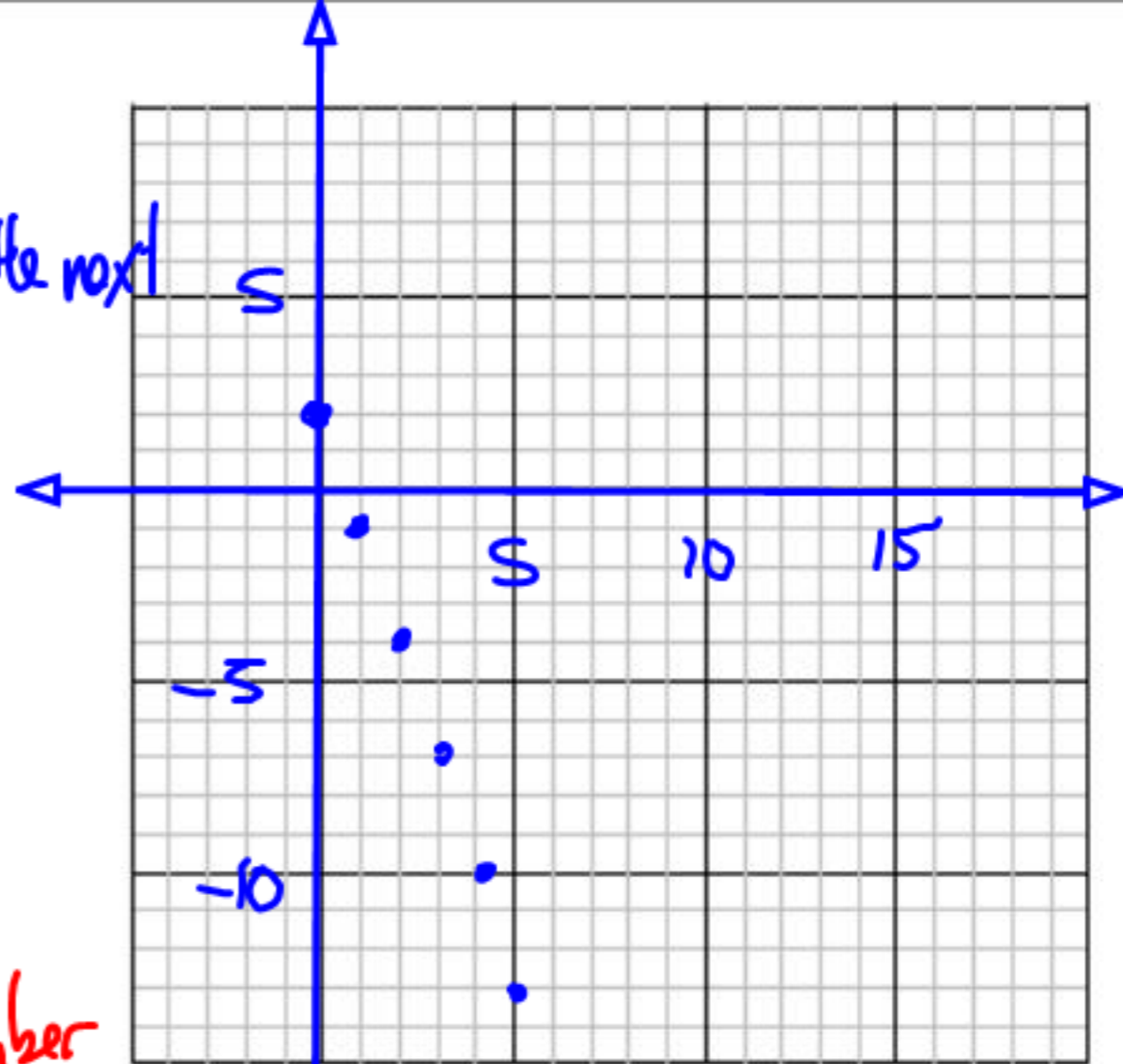- use the last number to find the next
- do the same thing every time

$$u_n = 5, 8, 11, 14, 17, \ldots$$

with $+3$ between each term

start at 5

rule: add 3 to the last number

arithmetic sequence
(add the same number)

graph $y = \dfrac{2}{1} - \dfrac{3}{1}x$

point ← graph

- down 3 right 1
repeat

$start = 1$

$rule \quad ans \times 2$

number before

$\Rightarrow$ week 1

recursive $\begin{cases} u_1 = 1 \\ u_n = 2 \cdot u_{n-1} \end{cases}$

start = 1

rule    ans × 2
        number before

| $n$ | $u_n$ |
|---|---|
| 1 | 1 |
| 2 | 2 |
| 3 | 4 |
| 4 | 8 |
| 5 | 16 |
| 6 | 32 |

$\Rightarrow$ week 1

recursive
formula

$u_3 = 2u_2$

$u_4 = 2 \cdot u_3$

$u_5 = 2 \cdot u_4$

$u_6 = 2 \cdot u_5$

$\begin{cases} u_1 = 1 \\ u_n = 2 \cdot u_{n-1} \end{cases}$

any term

$u_{12} = 2048 \text{ sec}$

$u_{24} = 2 \cdot u_{23}$

$u_{24} = 8,388,608$

$u_{36} = 3.4 \times 10^{10} \text{ sec}$

# Arithmetic Sequence
## add the same number each time

$$\begin{cases} u_0 = a \\ u_n = u_{n-1} + d, \ n \geq 1 \end{cases}$$

$d$ = common difference

$d$ = now − previous

$d = u_n - u_{n-1}$

$a$ = starting value

# Geometric Sequence
## multiply by the same number each time

$$\begin{cases} u_0 = a \\ u_n = r \cdot u_{n-1}, \ n \geq 1 \end{cases}$$

$r$ = common ratio

$r = \dfrac{\text{now}}{\text{previous}}$

$r = \dfrac{u_n}{u_{n-1}}$

$a$ = starting value

ex. write recursio formula

1   2   3   4

4, 12, 36, 108, 324, ...

$r = \frac{12}{4} = 3$    $a = 4$        $U_1 = 4$

$\frac{36}{12} = 3$                $U_n = 3 \cdot U_{n-1}$, $n \geq 2$

$\frac{324}{108} = 3$              $U_n = (U_{n-1}) 3$

7, 9.3, 11.6, 13.9, 16.2, ...

$d = 2.3$
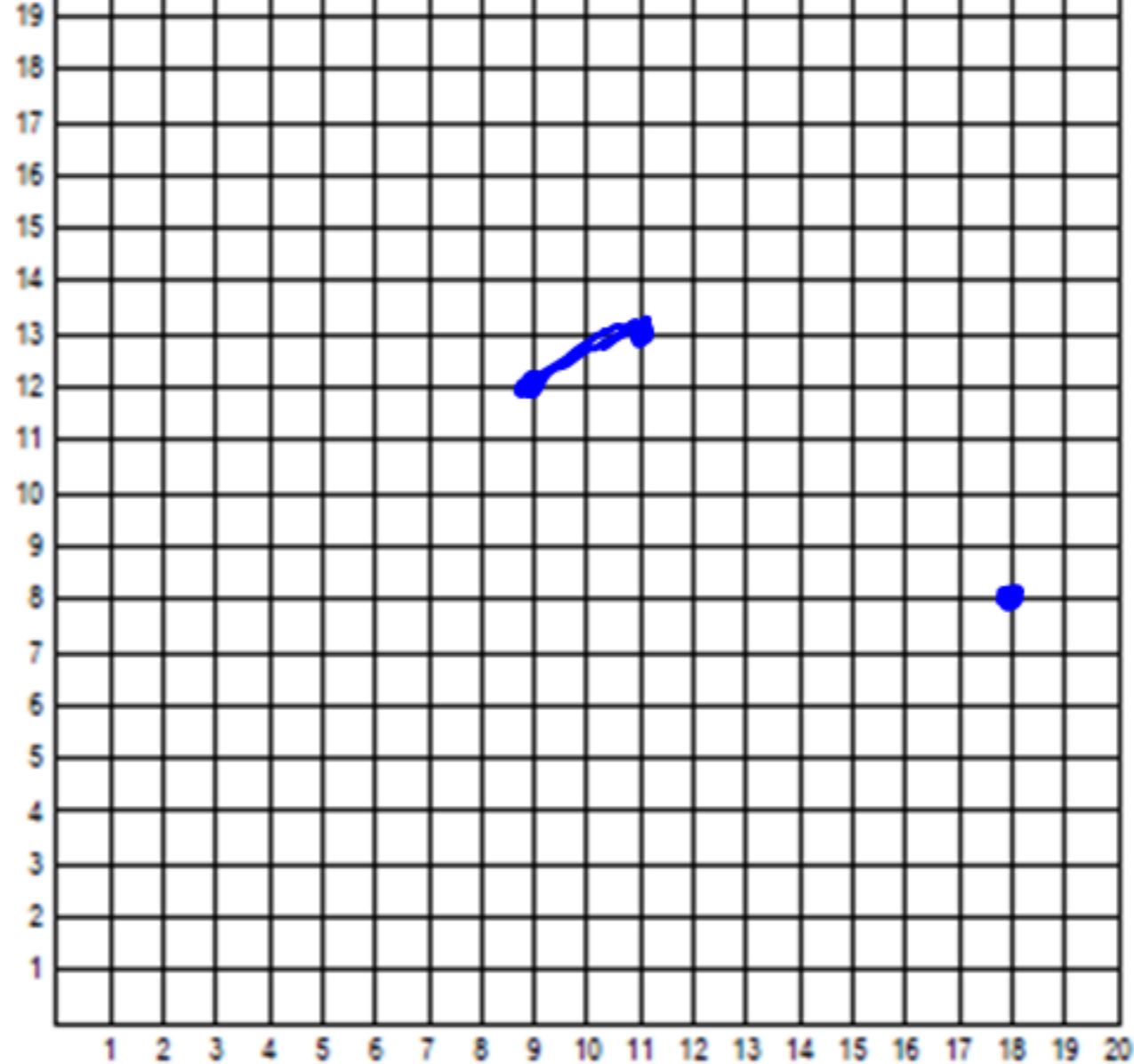
$a = 7$              $U_1 = 7$

$U_n = U_{n-1} + 2.3$, $n \geq 2$

or

$U_n = 2.3 + U_{n-1}$, $n \geq 2$

**Line 1:** (2,10), (0,13), (0,16), (1,18), (2,14), (4,12), (9,12), (11,13)
**Line 2:** (18,9), (16,7), (14,5), (12,5), (11,3), (12,0), (10,0), (9,4), (9,7), (10,8)   **Line 3:** (12,5), (13,1), (15,1), (14,4), (15,6)   **Line 4:** (8,5), (7,4), (8,1), (6,1), (5,4), (6,6), (6,9)   **Line 5:** (10,10), (15,8), (20,10), (18,16), (20,18), (17,19), (17,16), (13,16), (13,19), (10,18), (12,16), (10,10)   **Line 6:** (14,9), (16,11), (14,11), (16,9)   **Line 7:** (13,10), (15,8), (17,10)   **Line 8:** (13,12), (14,12), (14,13), (13,12)
**Line 9:** (3,12), (1,8), (2,5), (2,3), (3,0), (5,0), (4,3), (6,6), (9,5)
**Line 10:** (16,12), (16,13), (17,12), (16,12)