Warm-up: Find t_{125} for each of the following...

linear patterns

$\boxed{t_n = a + (n-1)d}$

a) $t_1 = 5$
$d = -6$

b) $t_1 = 10$
$t_{20} = 67$

$t_{125} = 5 + (125-1)(-6)$

$t_{125} = 5 + (-744)$

$t_{125} = \underline{-739}$

b) $t_{125} = 10 + (124)d$

??

$67 = 10 + (20-1)d$

$67 = 10 + 19d$

$\frac{57}{19} = \frac{19d}{19}$

$3 = d$

$t_{125} = 10 + (124)(3)$

$= \underline{382}$

c) $t_{10} = 16$
$d = 3$

d) $t_{11} = -48$
$t_{27} = -128$

?

$t_n = t_1 + d(n-1)$

$16 = t_1 + (3)(10-1)$

$16 = t_1 + 27$

$-11 = t_1$

$t_{125} = -11 + (3)(125-1)$

$= -11 + 372$

$= 361$

$t_{11} \Rightarrow -48 = a + (11-1)d$

$\boxed{-48 = a + 10d}$

$t_{27} \Rightarrow -128 = a + (27-1)d$

$\boxed{-128 = a + 26d}$

Subtract

$-128 = a + 26d$

$-48 = a + 10d$

$\dfrac{-80}{16} = \dfrac{16d}{16}$

$-5 = d$

Sub.

$-48 = a + 10(-5)$

$-48 + 50 = a$

$2 = a$

$t_{125} = 2 + (124)(-5)$

$= -618$

WARM - UP

1, 1, 2, 3, 5, 8, 13, 21, 34, 55, . . .

Finish the above number sequence!!!

1202

Leonardo Pisano Fibonacci
Born 1170 in (probably) Pisa
Died 1250 in (possibly) Pisa

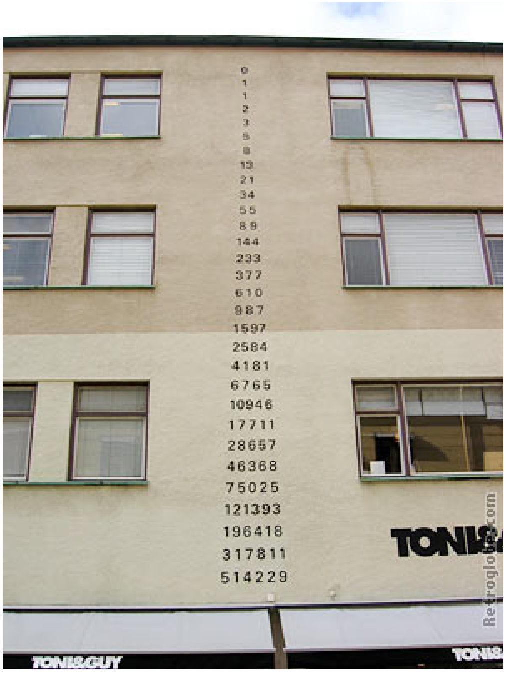
His Book:
Liber abaci
The Book of the Abacus
His work introduces the arithmetic and algebra he learned in the Middle East.

Fibonacci introduces the Fibonacci Sequence

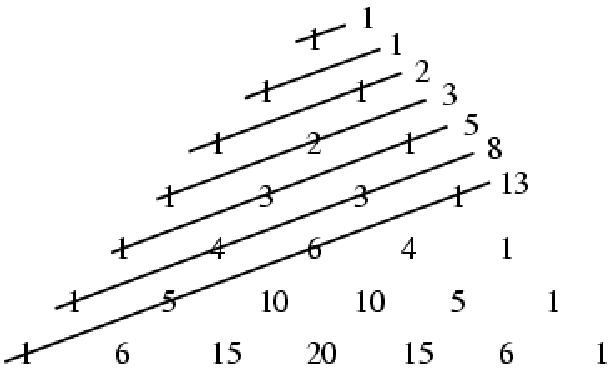
The Fibonacci Sequence

- Important numerical sequence over 800 years old that was originally developed to predict how many pairs of rabbits there will be if one assumes that each month, each pair produces a new pair of baby rabbits, that then bear again two months later…
- The sequence begins with 1, and each successive number is the sum of the previous two numbers.
- 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144 …

  0+1 1+1 1+2 2+3 3+5 5+8 …



Building in Goteborg, Sweden



Diagonals in Pascal's Triangle

Levels of Differences

The results of subtracting consecutive terms in a sequence are referred to as Levels of Difference.

- **If the First-level Differences (D_1) result in a common number, the relation is LINEAR**

  ex: -25, -20, -15, -10, -5, ...

  $t_n = a + (n-1)d$

  D_1: 5, 5, 5, 5, ...

  → constants at first level

- **If the Second-Level Differences (D_2) result in a common number, the relation is QUADRATIC**

  ex: 2, 9, 22, 41, 66, ...

  QuadReg
  $y = ax^2 + bx + c$
  $a = 3$
  $b = -2$
  $c = 1$
  $R^2 = 1$

  D_1: 7, 13, 19, 25, ...

  $t_n = 3n^2 - 2n + 1$

  → D_2: 6, 6, 6, ...

- **If the Third-Level Differences (D_3) result in a common number, the relation is CUBIC**

  ex: -4, 7, 40, 107, 220, ...

  D_1: 11, 33, 67, 113

  D_2: 22, 34, 46

  D_3: 12, 12, ...

  $t_n = 2^3 + \ldots$

- **If the Forth-Level Differences (D_4) result in a common number, the relation is QUARTIC**

  ex: 1, 16, 81, 256, 625, 1296, ...

  D_1: 15, 65, 175, 369, 671

  D_2: 50, 110, 194, 302

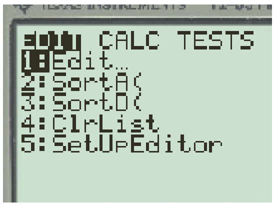
  D_3: 60, 84, 108

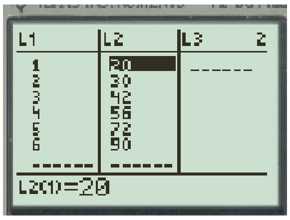
  D_4: 24, 24

Creating Equations with the TI-83

1. Determine if the sequence is linear, quadratic, cubic or quartic.
   (Using Levels of Difference-on your own paper)

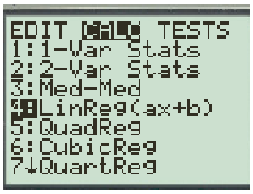
2. Enter the data into Lists: $n \Rightarrow L_1$ $t_n \Rightarrow L_2$



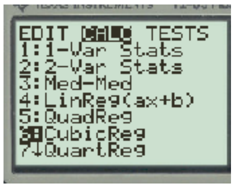


3. Then "Calculate" the regression for the type of function determined by the level of diffences.

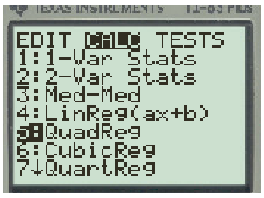
Linear $y = ax + b$



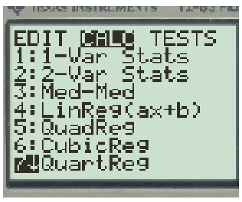
Cubic $y = ax^3 + bx^2 + cx + d$



Quadratic $y = ax^2 + bx + c$



Quartic $y = ax^4 + bx^3 + cx^2 + dx + e$



Can you come up with the general term for each of these??

X	Y1
1	1
2	-5
3	-11
4	-17
5	-23
6	-29
7	-35

X=1

X	Y1
1	3
2	11
3	33
4	75
5	143
6	243
7	381

X=1