Worksheet

#4/(f) $t_5 = -20 \Rightarrow t_1 + (5-1)d$

$t_{18} = -53 \Rightarrow t_1 + (18-1)d$

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

$-20 = t_1 + 4d$

$-53 = t_1 + 17d$

$33 = -13d$

$d = \frac{33}{-13}$

Sub.

$-20 = t_1 + 4\left(-\frac{33}{13}\right)$

$-20 = t_1 + -\frac{132}{13}$

$t_1 = \frac{-20}{1} + \frac{132}{13}$

$t_1 = \frac{-260}{13} + \frac{132}{13}$

$t_1 = \frac{-128}{13}$

$t_n = \frac{-128}{13} + (n-1)\left(-\frac{33}{13}\right)$

$t_n = -\frac{128}{13} - \frac{33n}{13} + \frac{33}{13}$

$\boxed{t_n = -\frac{33n}{13} - \frac{95}{13}}$

Fibonacci Numbers

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

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 …

Pascal's Triangle

1

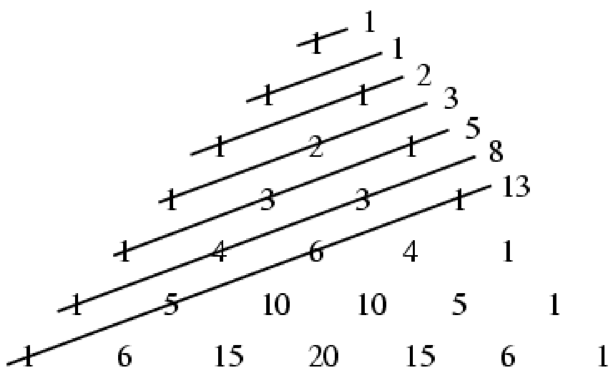
1 1

1 2 1

1 3 3 1

1 4 6 4 1

1 5 10 10 5 1



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, ...

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

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

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

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

D_2: 6, 6, 6, . . ← 2nd level constant

- **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,

- **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 . . .

Functions

- a ***function*** is a special relationship where each value of x has "one and only one" y value.
- we can quickly tell from a graph when a relation is a function by doing a...

VERTICAL LINE TEST

- the **degree** of a function is the value of the *highest exponent* in the equation or the *sum of the exponents* in a term containing more than one variable . For example, a quadratic function is of degree 2.

Examples:

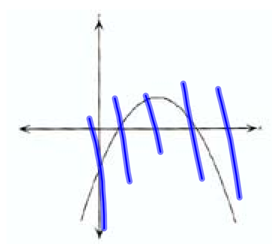
$y = x^3 + 7x^2 - x^7$

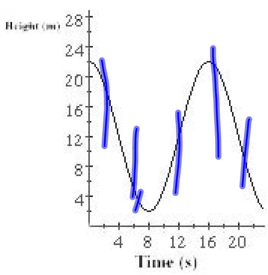
Degree: 7

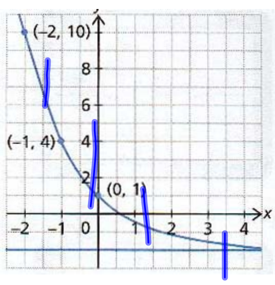
$y = 3x^{2}y^{4} - 2x^{6} - 3xy^{6}$ (6, 6, 7)

degree 7

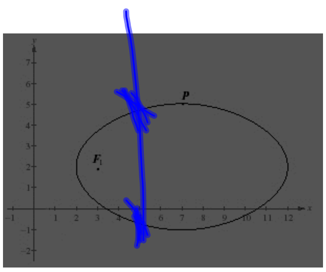
EXAMPLES of Functions...

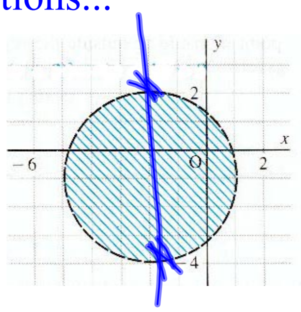


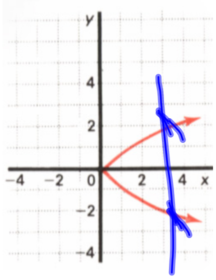




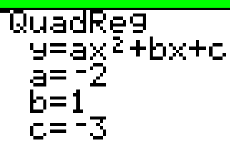
EXAMPLES of Non-Functions...







Determining General Term with the TI-83



Example:

-4, -9, -18, -31, -48, -69, ...

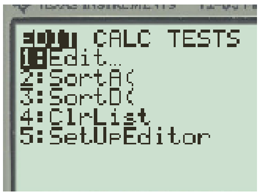
Determine the general term, t_n, of the above sequence.

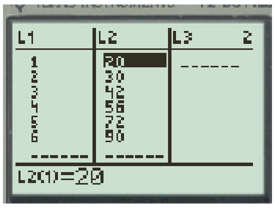
D_1: -5, -9, -13

Quadratic → D_2: -4, -4 . . . . .

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

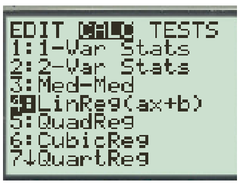
2. Enter the data into Lists: $n \Rightarrow L_1$ $t_n \Rightarrow L_2$



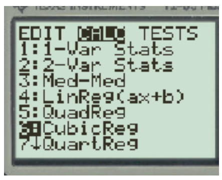


3. Then "Calculate" the regression for the type of function determined by the level of diffences.

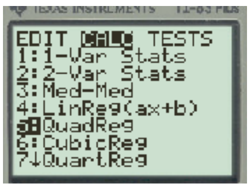
Linear $y = ax + b$



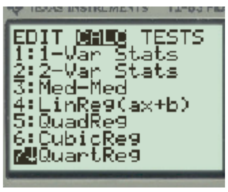
Cubic $y = ax^3 + bx^2 + cx + d$



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



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



QuadReg
y=ax²+bx+c
a=-2
b=1
c=-3

$$\boxed{t_n = -2n^2 + n - 3}$$

$$t_{15} = -2(15)^2 + (15) - 3$$

$$= -450 + 15 - 3$$

$$= -438$$