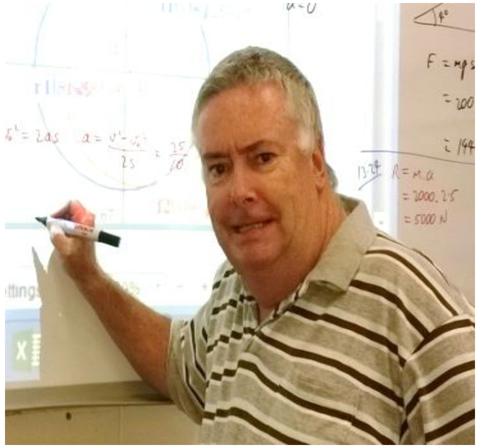
TI-30X Plus Mathprint

2D: Growth & Decay in sequences

Brian Lannen

Texas Instruments



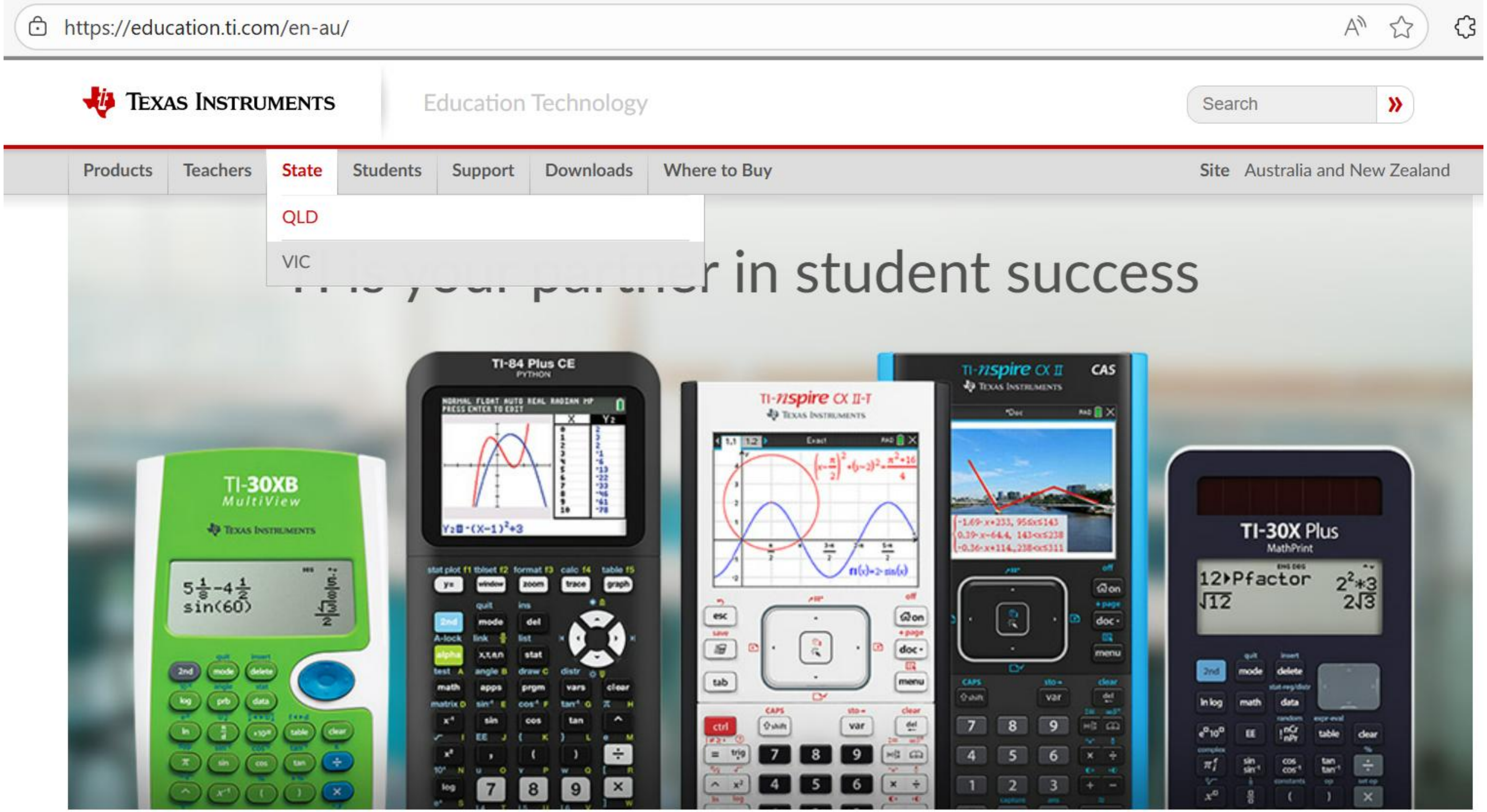
Brian Lannen

Murray Mathematics Curriculum Services

T³ National Instructor

2D: Growth & Decay in sequences(TI-30X Plus Mathprint)

Recursion will be used to generate both arithmetic and geometric sequences with terms displayed in both tabular and graphical form. Rules for the n^{th} term will also be developed and models used to analyse practical situations of growth & decay.



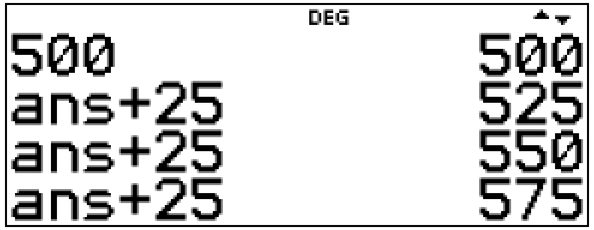
TI calculators and resources are built with the classroom in mind —

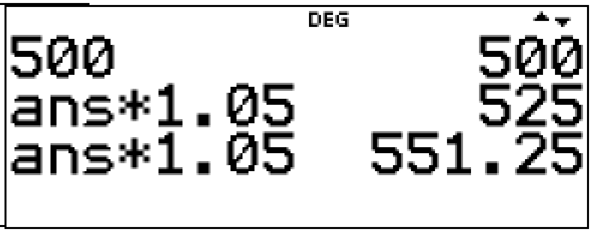
At what point do we commence counting the terms of a sequence?

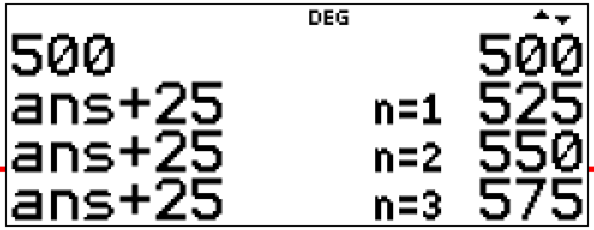
Sequences			
arithmetic sequence	$t_n = t_1 + (n-1)d$	geometric sequence	$t_n = t_1 r^{(n-1)}$
		compound interest	$A = P(1+i)^n$

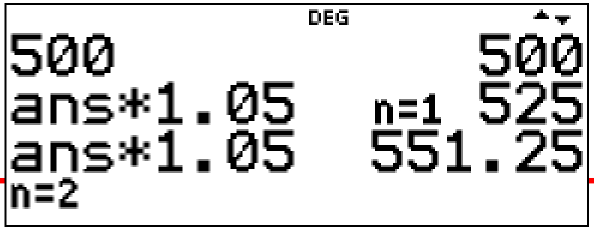
Compare the growth of a $500 initial investment at 5% p.a.

Simple interest (arithmetic sequence) and Compound interest (geometric sequence)

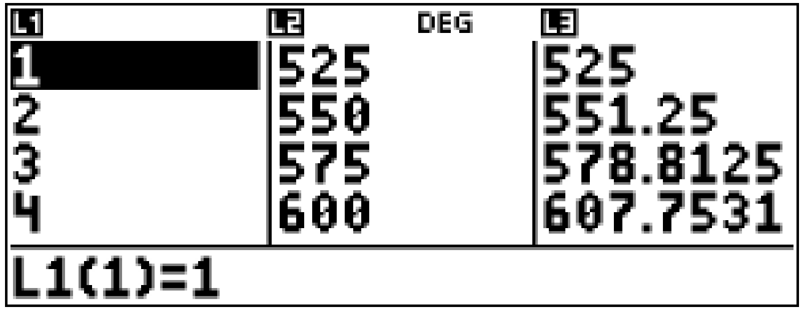


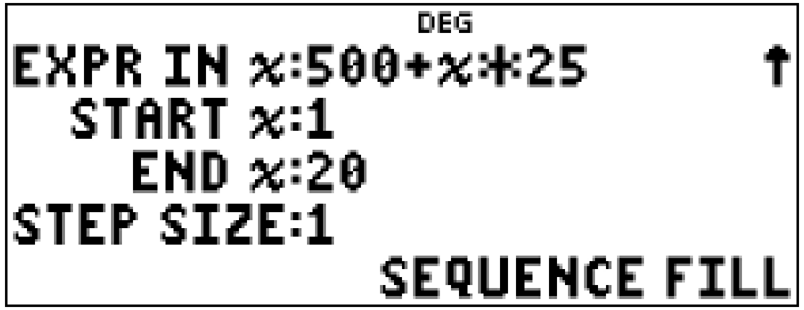


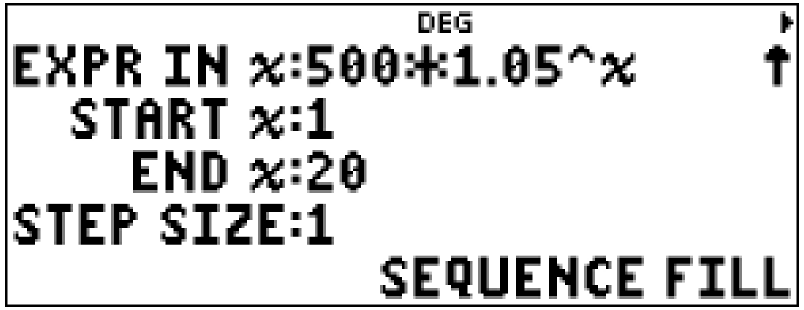


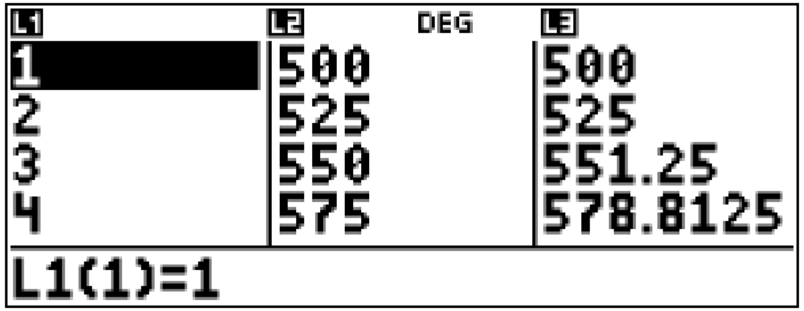


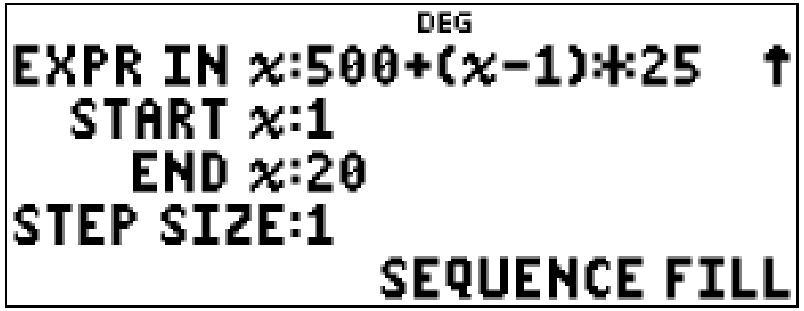
Display in tabular form

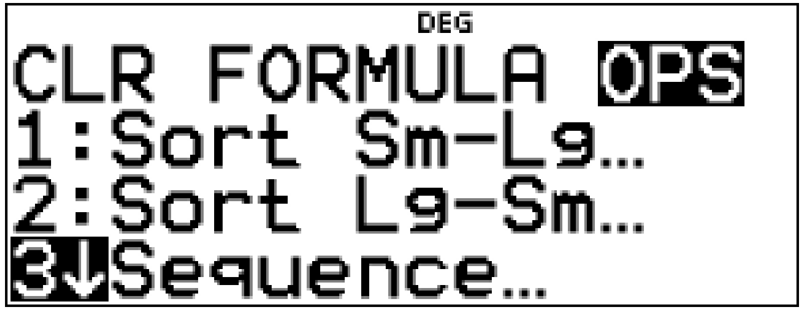






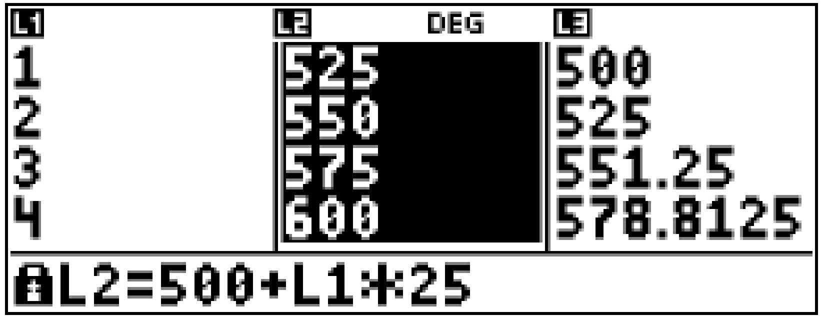


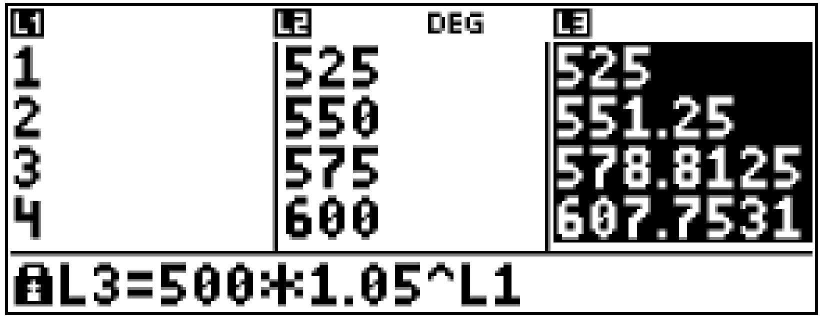


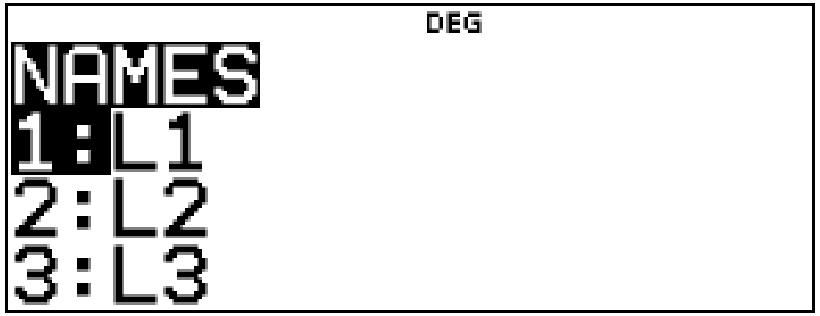


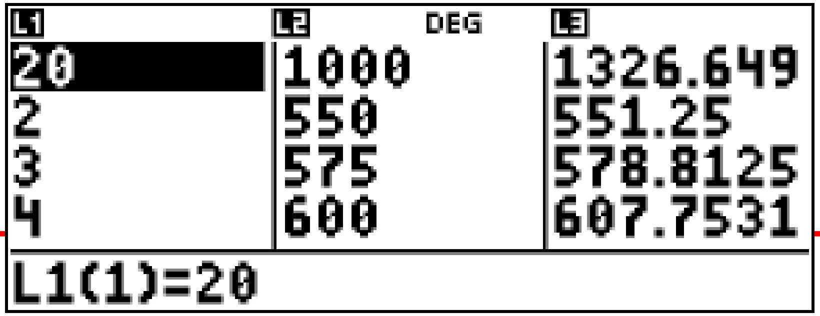
Display in tabular form

Can you achieve the same result using formulas and list reference?



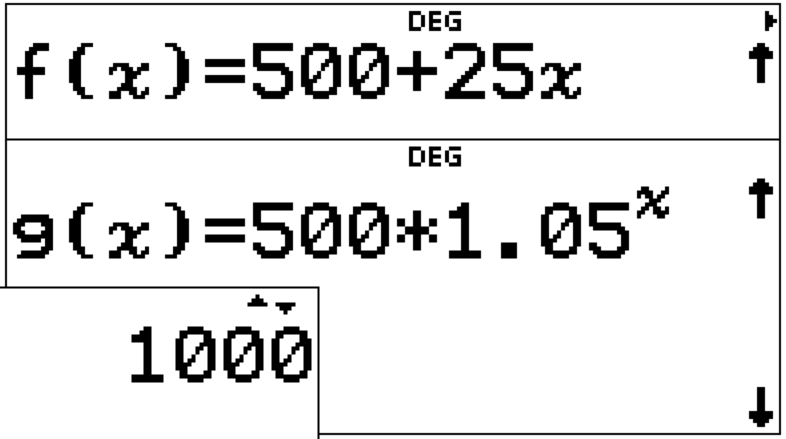


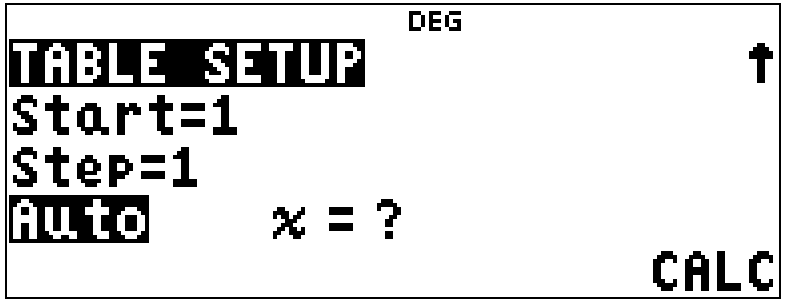


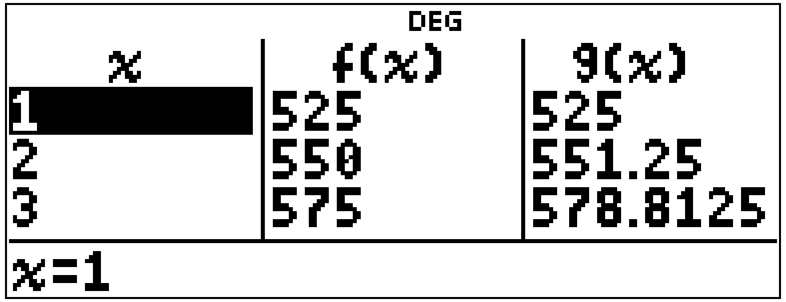


Display in tabular form

Can you achieve the same result using a function table?







QUESTION 8

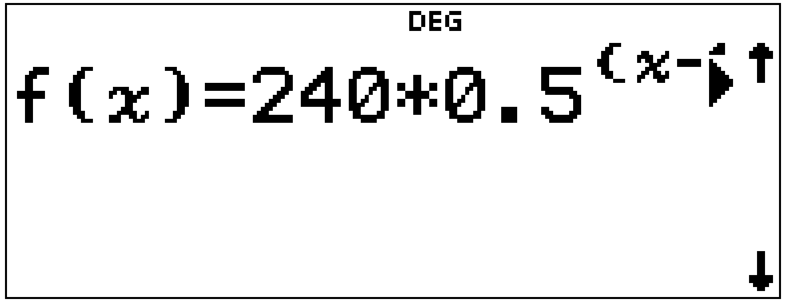
After n bounces, the rebound height (cm) of a ball, t_n, is modelled by the rule $t_n = 240 \times 0.5^{(n-1)}$. Calculate the difference in rebound height (cm) between the first bounce and the third bounce.

(A) 90

(B) 120

(C) 180

(D) 210



Display in graphical form

Scientific calculator list

General senior syllabus external assessment: updated 2025

Texas Instruments (TI)	TI-30XB MultiView TI-30X Plus MathPrint

Other calculators

Any calculator not listed above may be used as long as it meets the requirements listed below. This includes calculators with more limited features such as basic (pocket and desktop) calculators.

Features that are permitted

Calculators should be able to perform addition, subtraction, multiplication, division, square roots and powers. Scientific calculators also typically have access to the following features:

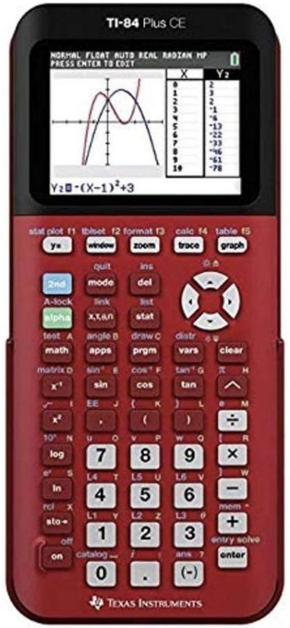
- trigonometric functions and inverse
- fractions and percentages
- statistical operations, such as standard deviation, mean and linear regression.

Features that are NOT permitted

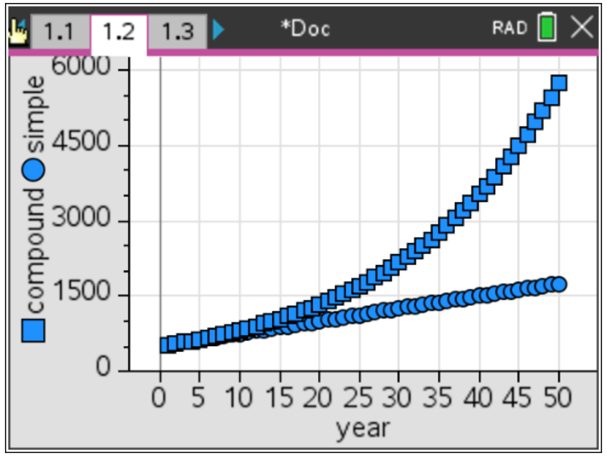
Calculators must not allow access to the following features:

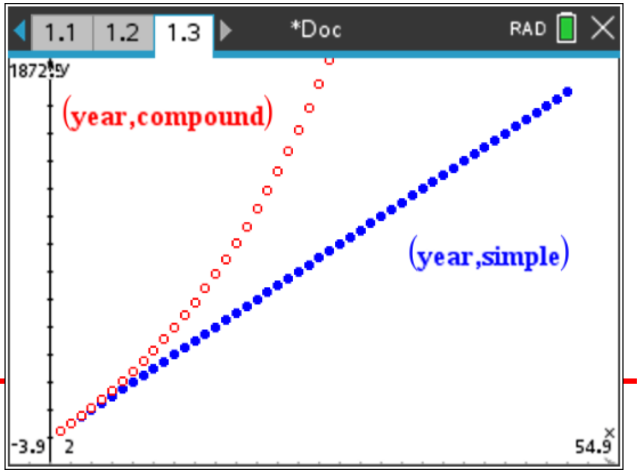
- retrievable information, including databanks, dictionaries, mathematical formulas and text
- displaying a graph
- matrix operations
- symbolic algebra manipulation
- programmability
- communication with other machines, students or the internet
- language translation.

Calculator emulation software or equivalent applications running on computers, laptops, tablets, iPads or mobile phones are not permitted.



	A year	B simple	C compound
=		=500+25*	=500*(1.05)^(
1	1	525	525.
2	2	550	551.25
3	3	575	578.813
4	4	600	607.753
5	5	625	638.141





Texas Instruments

Can we talk about arithmetic & geometric series (i.e. sum of the sequence)?

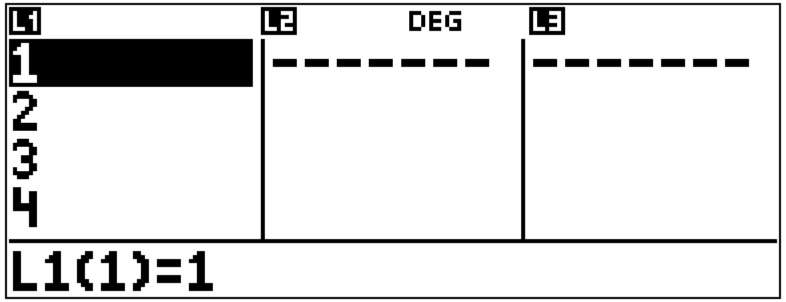
$$S_n = \frac{n}{2}[2a + (n-1)d]$$

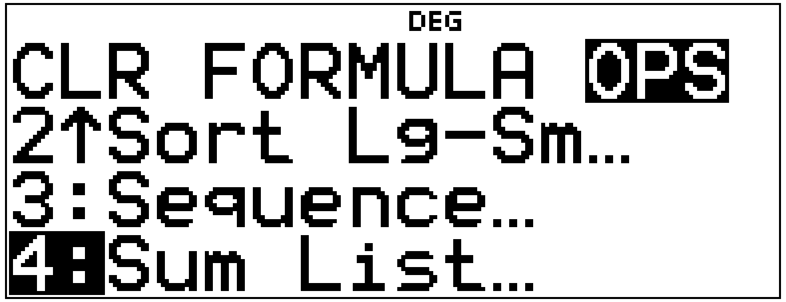
- Use the rule for the n^{th} term of an arithmetic sequence.
  - $t_n = t_1 + (n-1)d$ where t_n is n^{th} term, t_1 is first term, n is term number and d is common difference
- Use arithmetic sequences to model and analyse practical situations involving linear growth or decay, e.g. analysing a simple interest loan or investment, calculating a taxi fare based on the flag fall and the charge per kilometre, calculating the value of an item using the straight-line method of depreciation.

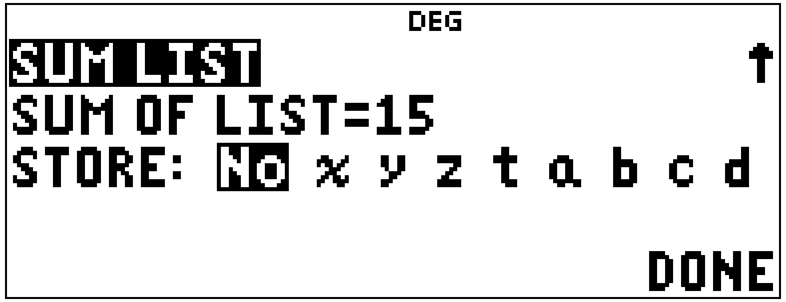
$$S_n = a_1\left(\frac{1-r^n}{1-r}\right)$$

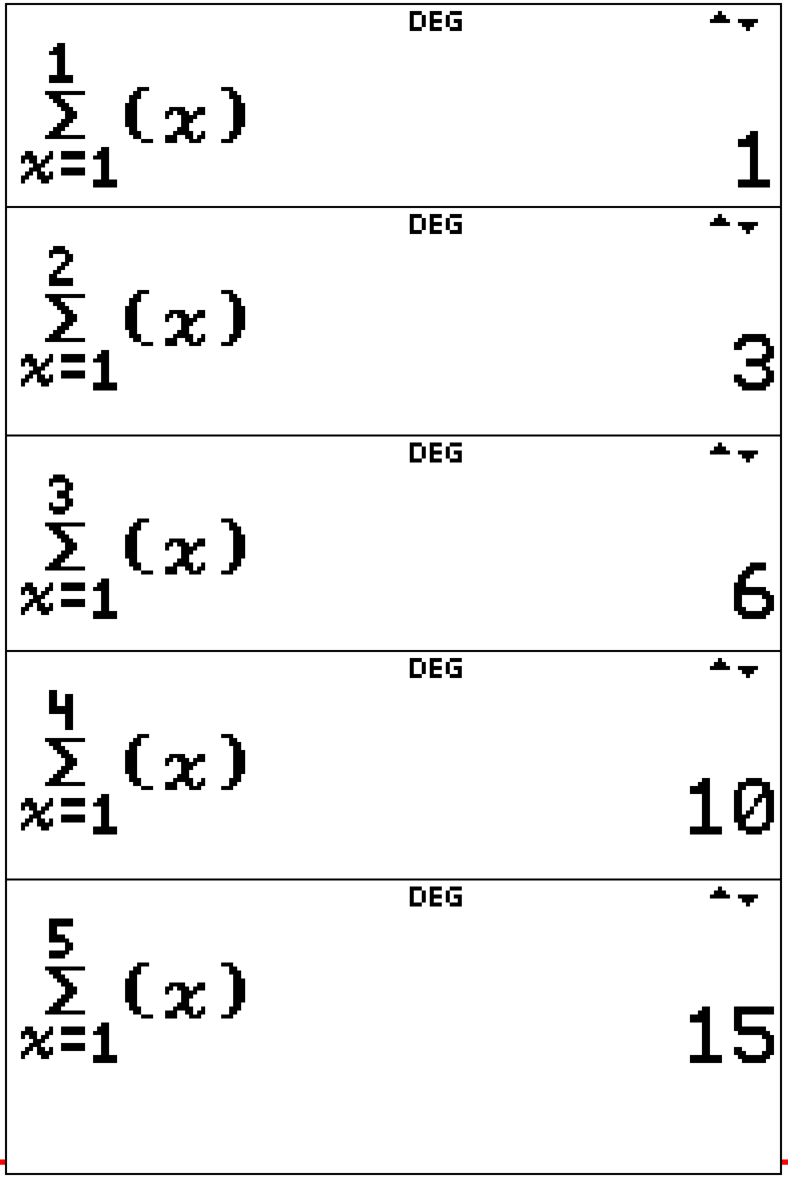
- Use the rule for the n^{th} term of a geometric sequence.
  - $t_n = t_1 r^{(n-1)}$ where t_n is n^{th} term, t_1 is first term, n is term number and r is common ratio
- Use geometric sequences to model and analyse practical situations involving geometric growth and decay (use of logarithms not required), e.g. modelling the growth of a bacterial population that doubles in size each hour, calculating the value of an item using the diminishing-value method of depreciation.

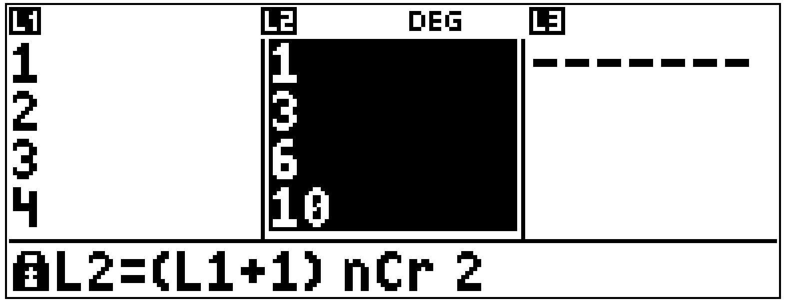
Consider the sum of first 5 terms in the A.P. where a=1 d=1

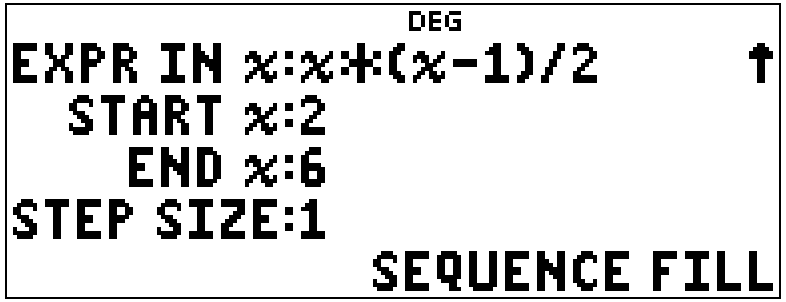




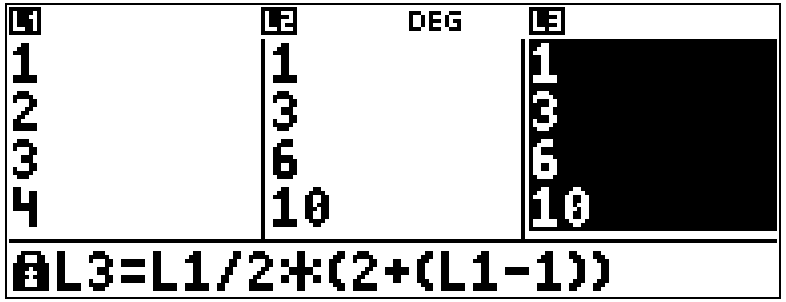








$$S_n = \frac{n}{2}[2a + (n-1)d]$$



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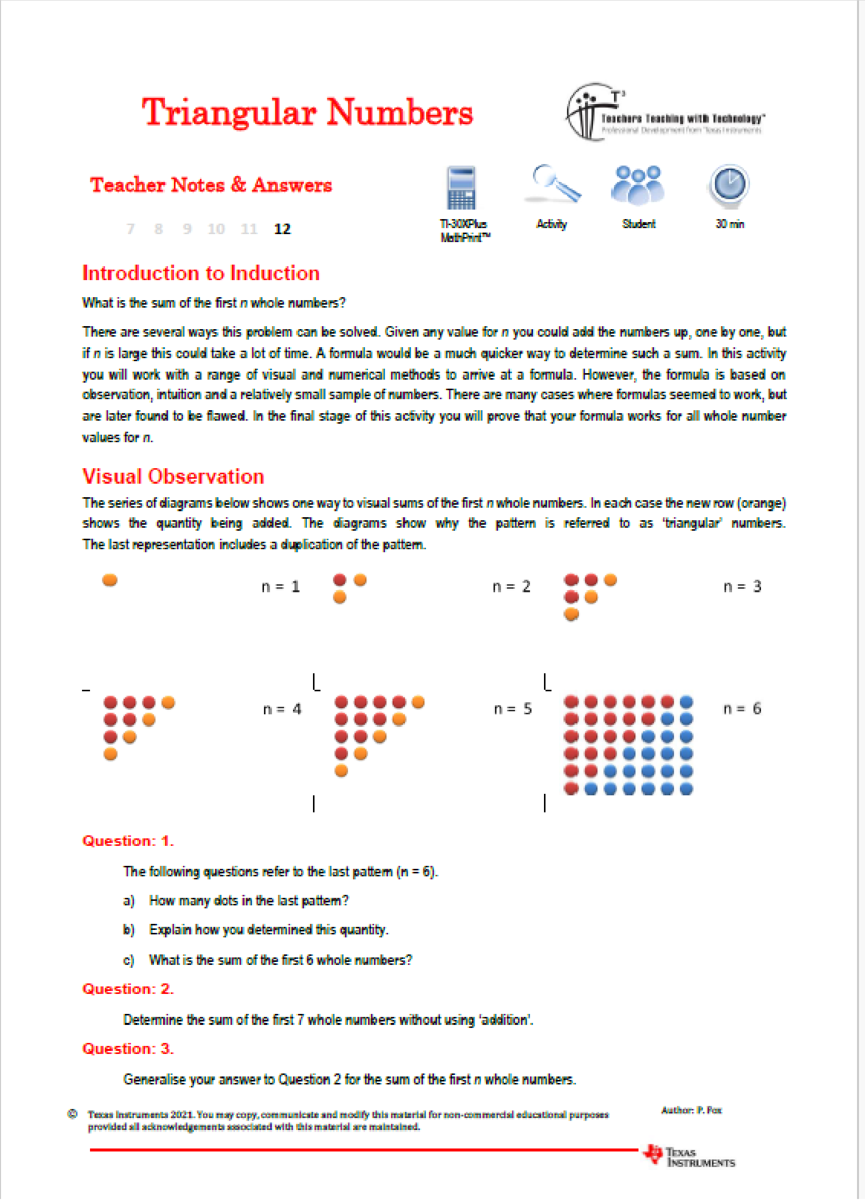
Resources for more activities



Triangular Numbers

Teachers Teaching with Technology™
Professional Development from Texas Instruments

Teacher Notes & Answers

7 8 9 10 11 **12**

TI-30XPlus MathPrint™ | Activity | Student | 30 min

Introduction to Induction

What is the sum of the first *n* whole numbers?

There are several ways this problem can be solved. Given any value for *n* you could add the numbers up, one by one, but if *n* is large this could take a lot of time. A formula would be a much quicker way to determine such a sum. In this activity you will work with a range of visual and numerical methods to arrive at a formula. However, the formula is based on observation, intuition and a relatively small sample of numbers. There are many cases where formulas seemed to work, but are later found to be flawed. In the final stage of this activity you will prove that your formula works for all whole number values for *n*.

Visual Observation

The series of diagrams below shows one way to visual sums of the first *n* whole numbers. In each case the new row (orange) shows the quantity being added. The diagrams show why the pattern is referred to as 'triangular' numbers. The last representation includes a duplication of the pattern.

n = 1 n = 2 n = 3

n = 4 n = 5 n = 6

Question: 1.

The following questions refer to the last pattern (n = 6).

a) How many dots in the last pattern?

b) Explain how you determined this quantity.

c) What is the sum of the first 6 whole numbers?

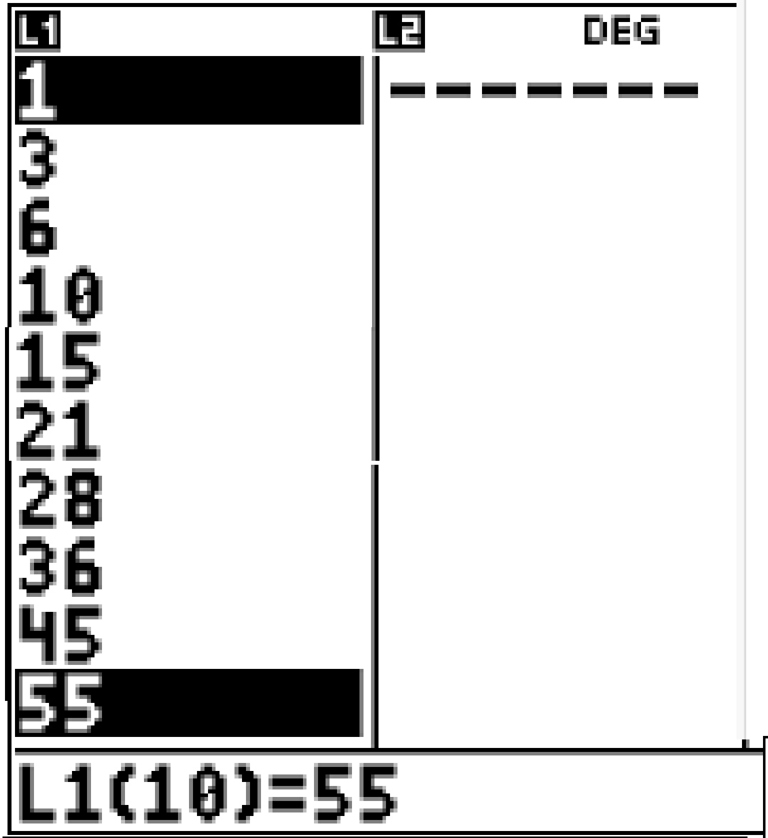
Question: 2.

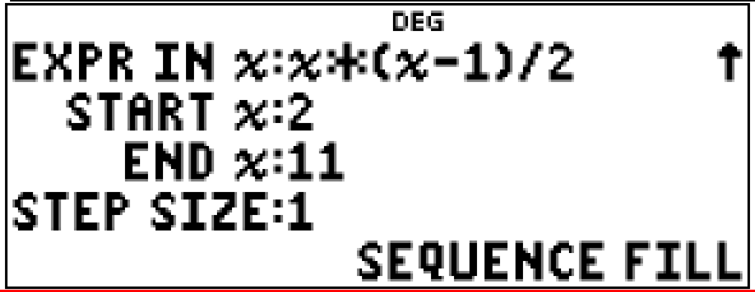
Determine the sum of the first 7 whole numbers without using 'addition'.

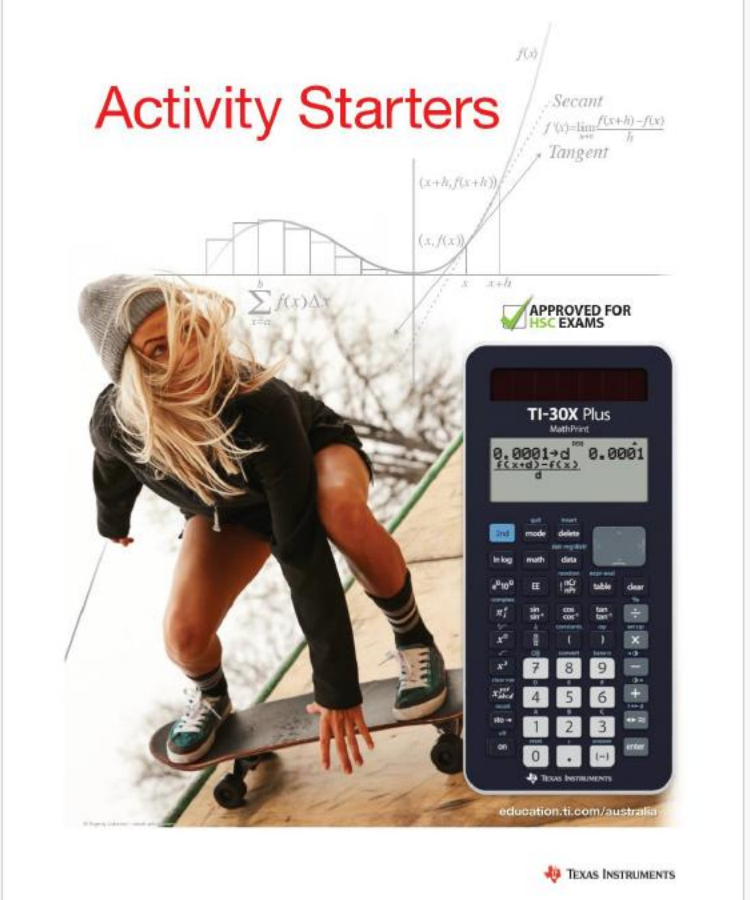
Question: 3.

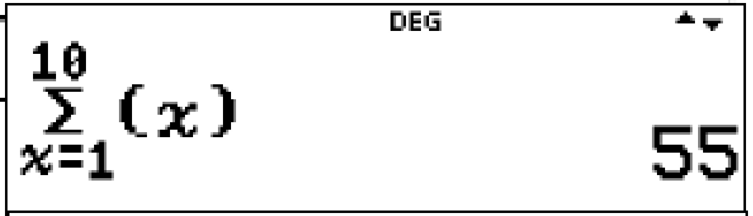
Generalise your answer to Question 2 for the sum of the first *n* whole numbers.

Author: P. Fox









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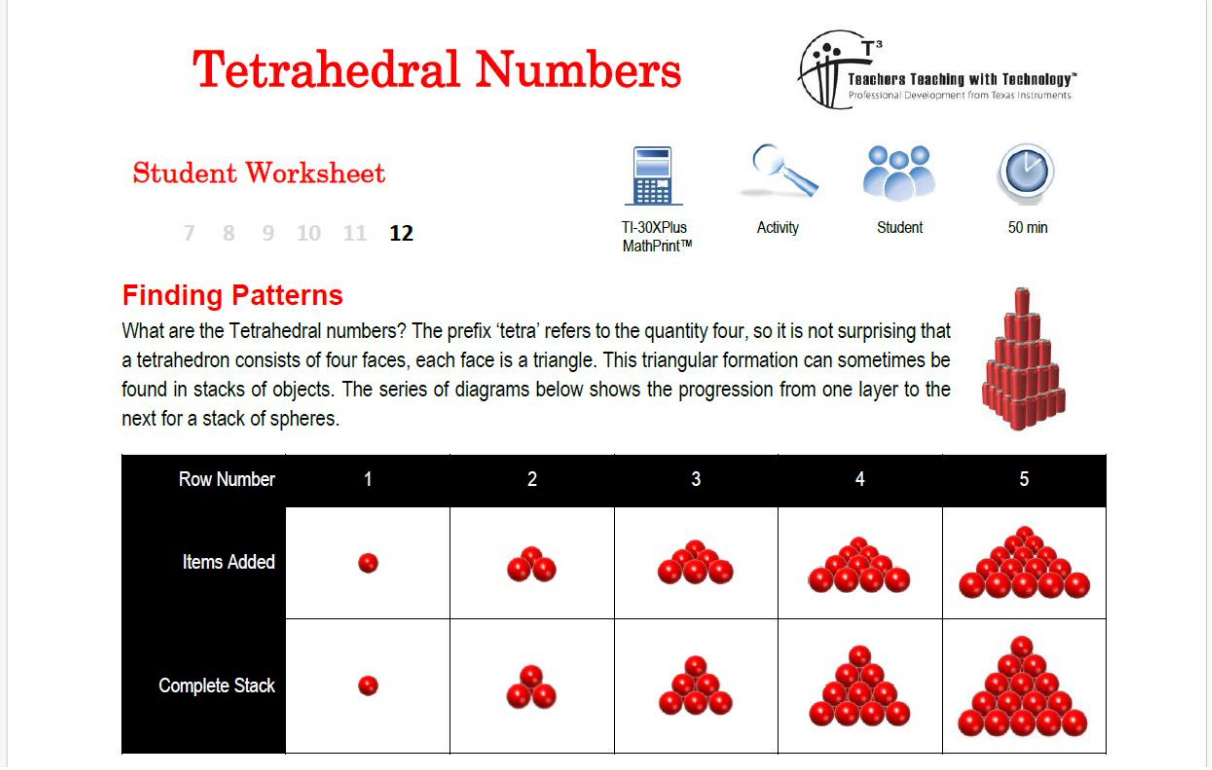

Tetrahedral Numbers

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Student Worksheet

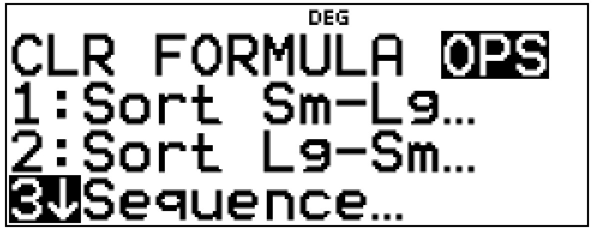
7 8 9 10 11 **12**

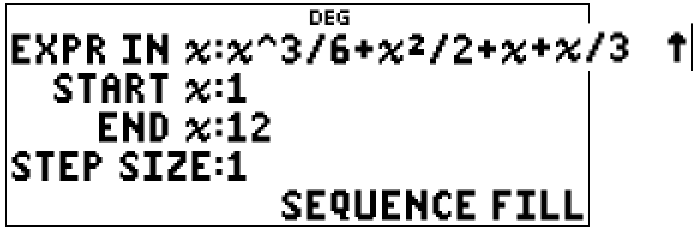
TI-30XPlus MathPrint™ | Activity | Student | 50 min

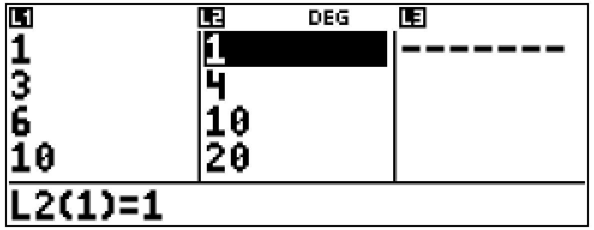
Finding Patterns

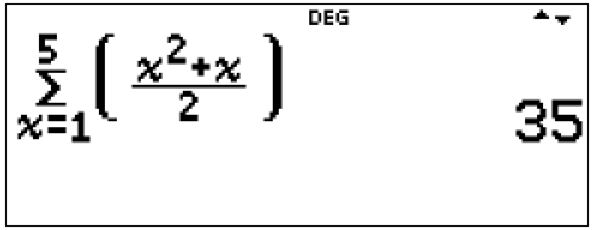
What are the Tetrahedral numbers? The prefix 'tetra' refers to the quantity four, so it is not surprising that a tetrahedron consists of four faces, each face is a triangle. This triangular formation can sometimes be found in stacks of objects. The series of diagrams below shows the progression from one layer to the next for a stack of spheres.

Row Number	1	2	3	4	5
Items Added					
Complete Stack					









Question: 1.

Create a table of values for the row number and the corresponding quantity of items that are added to the stack.

Answer:

Row	1	2	3	4	5
Items:	1	3	6	10	15

Question: 2.

Create a table of values for the row number and the corresponding quantity of items in a complete stack.

Answer:

Row	1	2	3	4	5
Items:	1	4	10	20	35

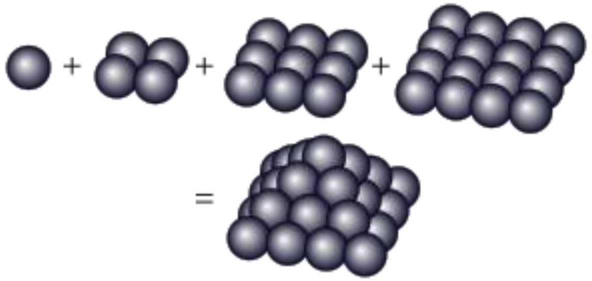
Take your sequence for the next dance..

```
DEG
EXPR IN x:x^3/3+x²/2+x/6
  START x:1
    END x:10
STEP SIZE:1
            SEQUENCE FILL
```

```
DEG
EXPR IN x:2x^3/3+x/3
  START x:1
    END x:10
STEP SIZE:1
            SEQUENCE FILL
```

```
DEG
EXPR IN x:3x²/2-x/2
  START x:1
    END x:10
STEP SIZE:1
            SEQUENCE FILL
```

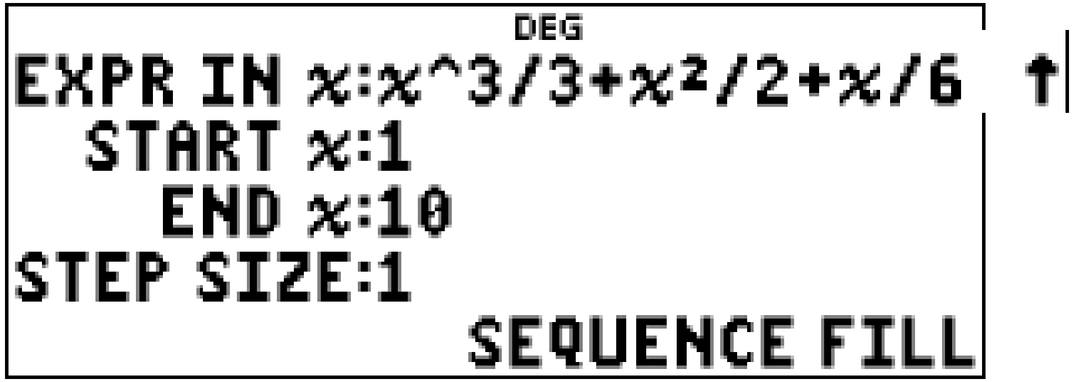
Square pyramidal numbers

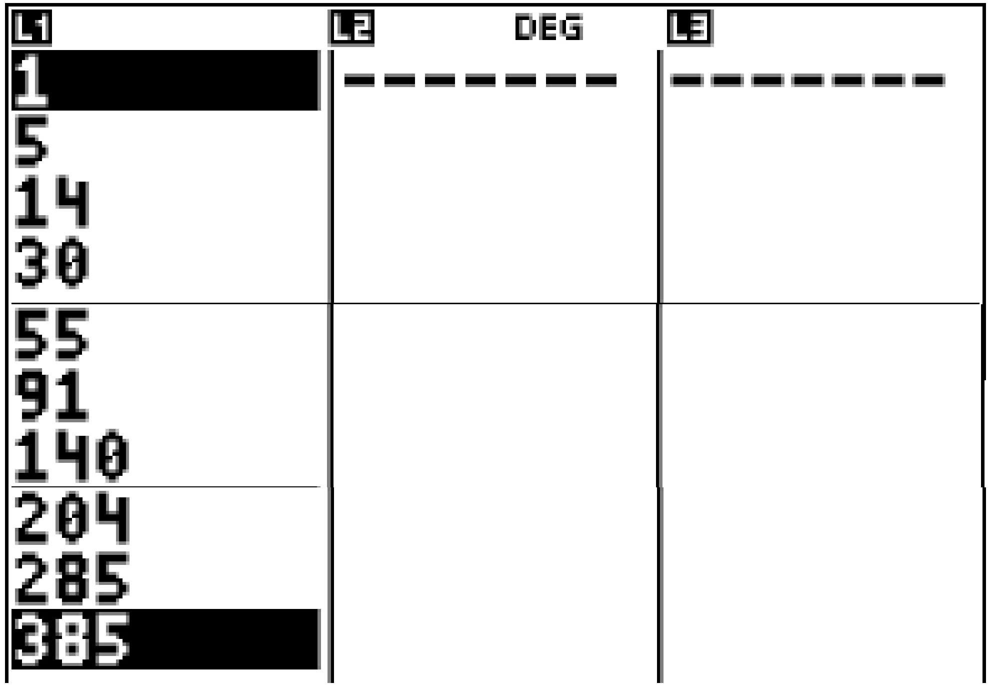


Octahedral numbers

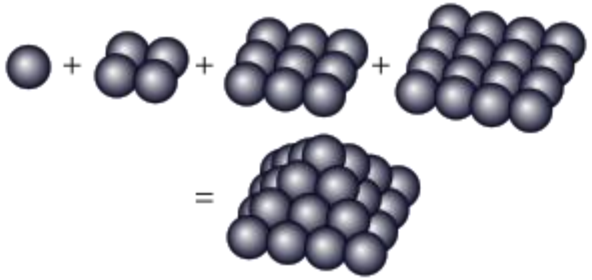
Pentagonal numbers

Take your sequence for the next dance..

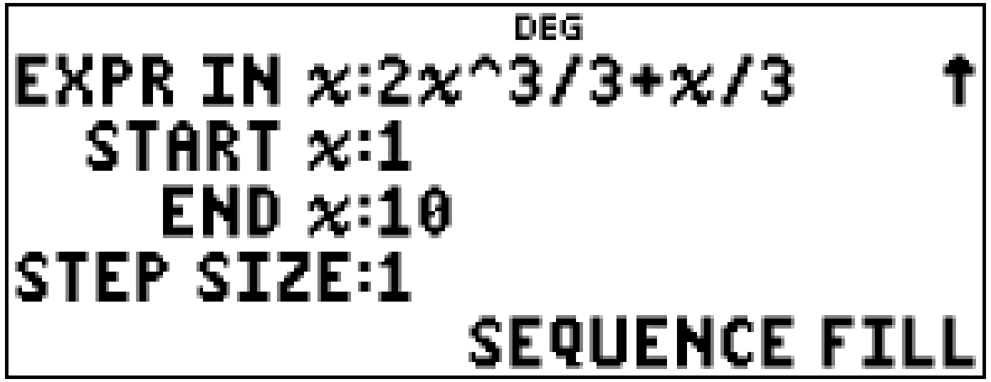


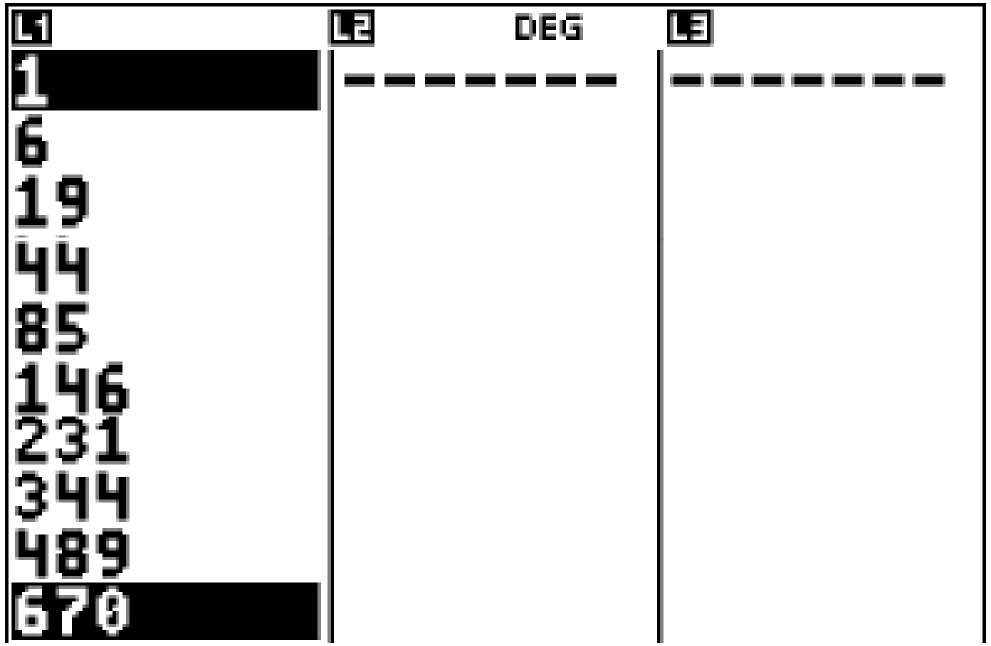


Square pyramidal numbers



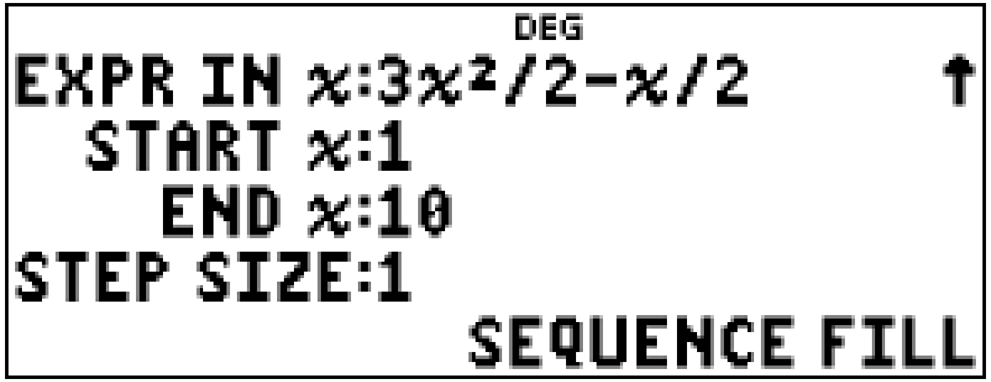
Take your sequence for the next dance..



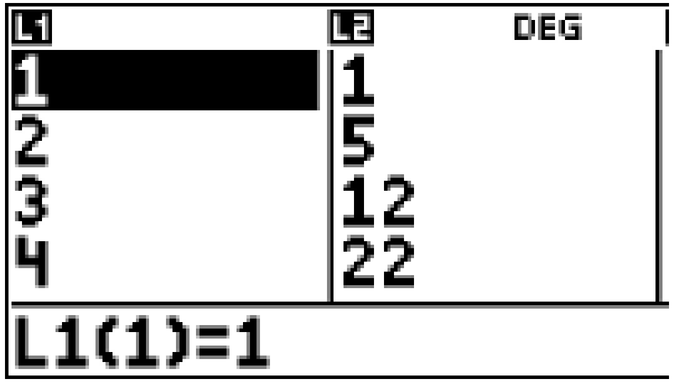


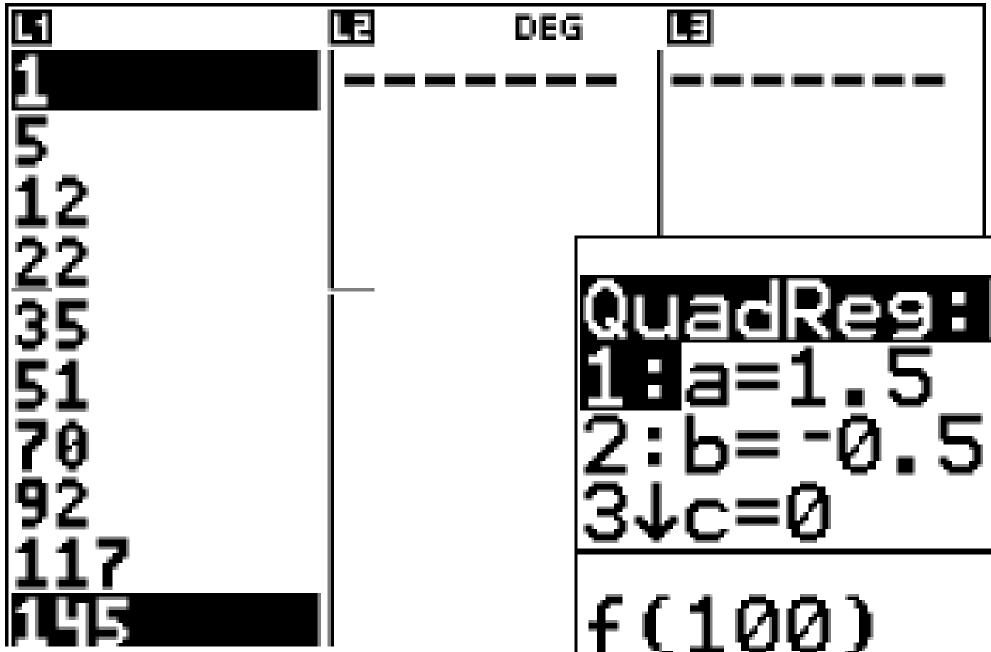
Octahedral numbers

Take your sequence for the next dance..



Pentagonal numbers





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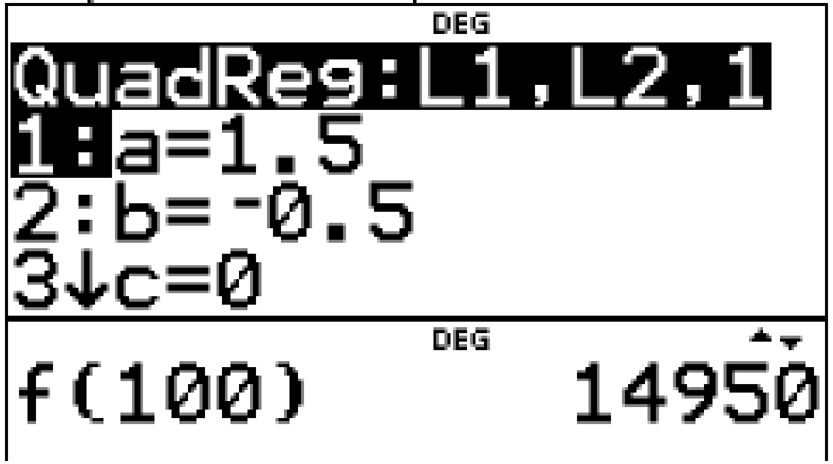

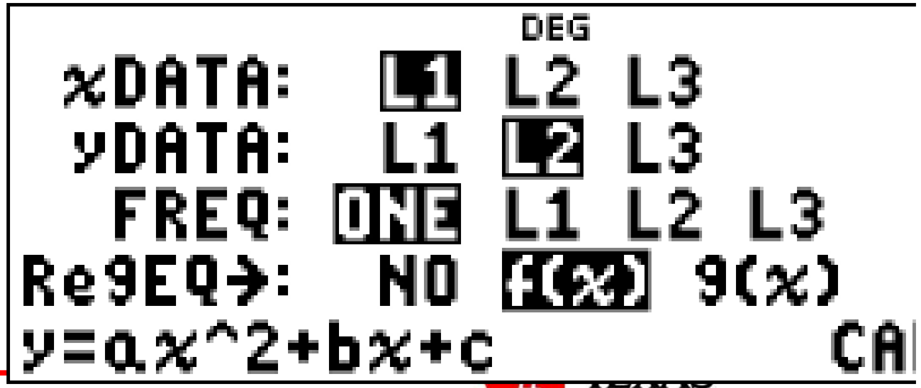

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2D: Growth & Decay in sequences

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