Double Tree

ID: 9772

Activity Overview

Students visually model the sequence 2^n for n = 1…8 by drawing line segments that represent a tree that doubles its height every year. They then extend the sequence "backward though time" over negative values for n.

Topic: Exponential & Radical Functions

- *Display the terms of a geometric sequence on a spreadsheet using the formula for the nth term.*

- *Graph the terms of a geometric sequence as a scatter plot.*

- *Calculate the doubling time or half-life in a problem involving exponential growth or decay.*

Teacher Preparation

- *Students should have experience with sequences of positive exponents.*

- *This activity relies on the technology's Graphs & Geometry tools, including drawing and measuring line segments, finding midpoints, transferring measurements, and manipulating the viewing window both by dragging and adjusting the window settings. If students are not familiar with these features of the handheld, extra time should be taken to explain them.*

- *This activity is more efficient on the computer software, but the handheld can still be used.*

- ***To download the student and solution TI-Nspire documents (.tns files) and student worksheet, go to education.ti.com/exchange and enter "9772" in the quick search box.***

Associated Materials

- *DoubleTree_Student.doc*
- *DoubleTree.tns*
- *DoubleTree_Soln.tns*

Suggested Related Activities

To download any activity listed, go to education.ti.com/exchange and enter the number in the quick search box.

- *Arithmetic Sequences & Series (TI-Nspire technology) — 8638*
- *Geometric Sequences & Series (TI-Nspire technology) — 8674*
- *What's The Equation? – Various Functions (TI-Nspire technology) — 9841*

Problem – Modeling tree growth

The activity begins with a review of the sequence 2^n. Students should draw line segments with lengths 8, 16, 32, … units without much trouble.

Use this step to review the different methods for adjusting the viewing window: 1) change the **Window Settings**, 2) grab and drag the coordinate plane to shift the view, 3) grab and drag the tick marks on the axis to zoom in and out, 4) using the **Zoom-Box** and other zoom commands.

The majority of the work students perform in this activity will be adjusting the window to bring the part of the sequence they are working with into view.

When finished creating all of the segments, students should zoom out so that they can see the overall pattern of the segments.
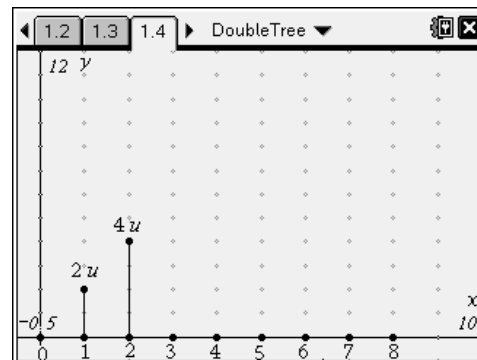
After building the sequence by hand, students are ready to write it with sequence notation and create it numerically on a *Lists & Spreadsheet* page. At this point, students should list the values 1 though 8 for *n* in Column A, then enter a formula to calculate 2^n in Column B. They then graph the sequence as a scatter plot on top of their "trees" on page 1.4 to confirm that this sequence does model the heights.

Take some time to discuss the mapping between years and *x*-values. Ask, *What formula can I use to find the x-value from the year?* This will help students understand why the years prior to 2000 are represented by negative values.

Guide the class through the process of cutting the trees in half, following the steps given on the worksheet. Again, the challenge for the students will be finding an appropriate viewing window. All of the adjustments reinforce how small the heights become as the students step backwards through time.

When viewing all of the segments together, it is helpful to hide the measurements above the segments on the left side of the *y*-axis, so that you can see the points. The window settings for the graph at left are $-9 \leq x \leq 9$ and $-30 \leq y \leq 260$.
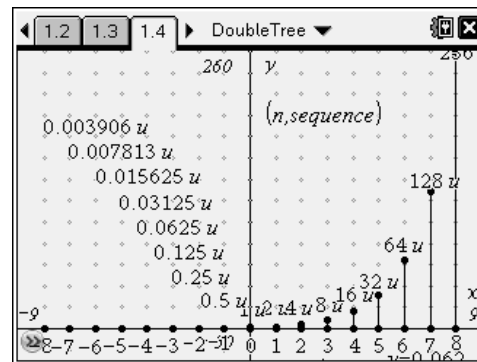
Now students return to the *Lists & Spreadsheet* page and extend their sequence into the negative values. For most classes, it will be easiest for the students to simply type the values of *n* into Column A, but they can also type the command **=seq(x,x-8,-8)** in the formula bar. The sequence in Column B and scatter plot on page 1.4 will update automatically. This helps students see that the negative and positive powers of 2 are parts of the same sequence.

If there is time, discuss how the tree's rate of growth. Originally it seemed like a tree that doubled its height every year must grow very fast. But from 1997 to 1998, it grew only 0.25 foot, or 4 inches.