Function Transformations

by Jeff Van Arnhem

Activity overview

Students will analyze the resulting change in the graph of a function in the form $y = af(b(x+c)) + d$ as the constants a, b, c, and d are altered. They should be able to compare the transformed graph to the parent graph $y = f(x)$ using proper vocabulary, i.e. vertical stretch, horizontal shift, etc.

Concepts

- Parent graphs
- Vertical stretch/compression (amplitude if trigonometric function is used)
- Horizontal stretch/compression (period if trigonometric function is used)
- Vertical shifts
- Horizontal shifts (phase shift if trigonometric function used)

Teacher preparation

Transfer the transformation.tns file to student calculators. Make copies of the accompanying handout.
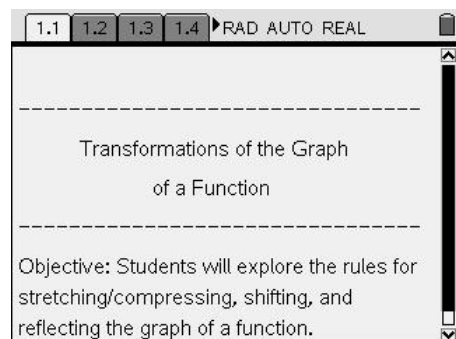
Classroom management tips

Activity may work best if students can work in pairs to discuss their conjectures.
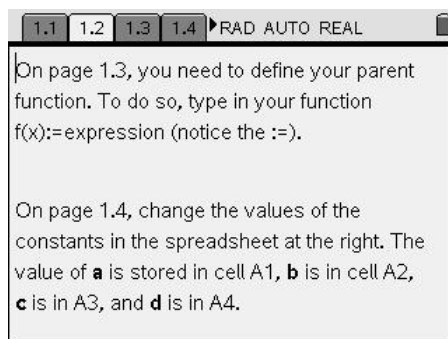
TI-Nspire Applications

- Notes pages (default and Q&A format)
- Lists and Spreadsheet for storing values of a, b, c, and d
- Calculator Page for assignment of function
- Graphs & Geometry Page
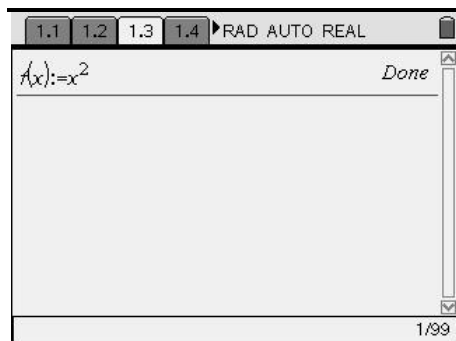
Step-by-step directions

Step-by-step instructions are provided on the pages of the document. That way students can walk through the activity right on the TI-Nspire.
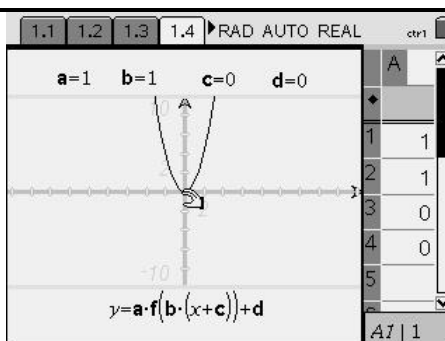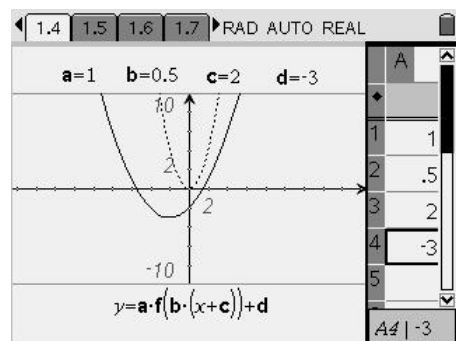

Title page with objective

Instructions for students are on page 2

Function Transformations
by: Jeff VanArnheme
Grade level: secondary
Subject: mathematics
Time required: 60 minutes
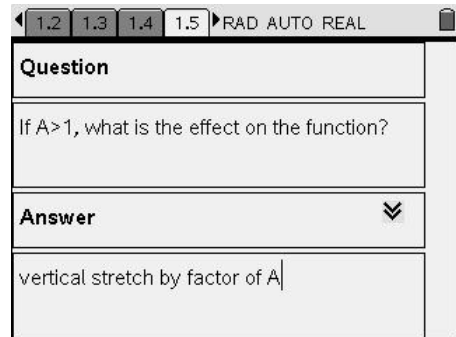
Students will assign the parent function on this page.

Students see only the graph of the parent function initially (constants are set such that y = f(x)).

Upon changing the values in the spreadsheet at the right, the transformed graph will appear (a dotted version of the parent function remains). This is the page the students will spend the majority of their time experimenting with to determine the effects of the constants.
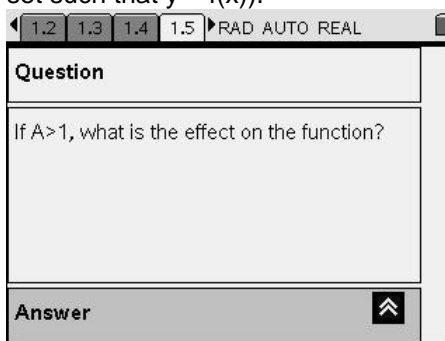
Students will then proceed to the question-answer pages to check themselves for conceptual understanding.

Students will then complete the "Transformation of a Graph" worksheet provided. They may refer back to the TI-Nspire at any point to test/check their conjectures.

Answers are provided for this self-assessment.

Assessment and evaluation

- Students will receive a brief self-assessment in the Q&A Notes pages that are part of the document.
- Teachers can assess verbally by asking students their conjectures during the activity.

TEXAS INSTRUMENTS

• The accompanying worksheet is also a more formal means of assessment for the teacher.

Student TI-Nspire Document
Transformation.tns

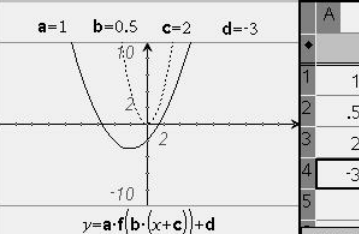|		
1.1 1.2 1.3 1.4 ▶RAD AUTO REAL –––––––––––––––––––––– Transformations of the Graph of a Function –––––––––––––––––––––– Objective: Students will explore the rules for stretching/compressing, shifting, and reflecting the graph of a function.	1.1 1.2 1.3 1.4 ▶RAD AUTO REAL On page 1.3, you need to define your parent function. To do so, type in your function f(x):=expression (notice the :=). On page 1.4, change the values of the constants in the spreadsheet at the right. The value of **a** is stored in cell A1, **b** is in cell A2, **c** is in A3, and **d** is in A4.	1.1 1.2 1.3 1.4 ▶RAD AUTO REAL $f(x):=x^2$ *Done* 1/99
1.4 1.5 1.6 1.7 ▶RAD AUTO REAL a=1 b=0.5 c=2 d=-3 $y=a \cdot f(b \cdot (x+c)) + d$	1.2 1.3 1.4 1.5 ▶RAD AUTO REAL **Question** If A>1, what is the effect on the function? **Answer** ⤫	1.3 1.4 1.5 1.6 ▶RAD AUTO REAL **Question** If A=-1, what is the effect on the function? **Answer** ⤓ reflection over the x–axis
1.4 1.5 1.6 1.7 ▶RAD AUTO REAL **Question** If C>0, what is the effect on the function? **Answer** ⤓ shift left C units|	1.5 1.6 1.7 1.8 RAD AUTO REAL **Question** If 0<B<1, what is the effect on the function? **Answer** ⤓ horizontal stretch by a factor of 1/B.	