Composition of Functions – ID: 10219

By Pat Flynn and Brock Wenciker

Time required
20 minutes

Activity Overview

Students will determine the resulting functions produced from the composition of two functions. They will explore the graphical representation of the resulting function and support the algebraic solution by determining if the graphs coincide. Additionally, students will evaluate two points using both forms of the functions.

Concepts

- *Determine the result of multiplication and division of functions.*

Teacher Preparation

This activity allows students to compose the functions f(x) and g(x).

- *This activity could be used in Algebra 2 or Precalculus following operations on functions.*
- *The screenshots on pages 2 and 3 (top) demonstrate expected student results. Refer to the screenshots on pages 3 (bottom) and 4 for a preview of the student TI-Nspire document (.tns file).*
- ***To download the student .tns file and student worksheet, go to education.ti.com/exchange and enter "10219" in the quick search box.***

Classroom Management

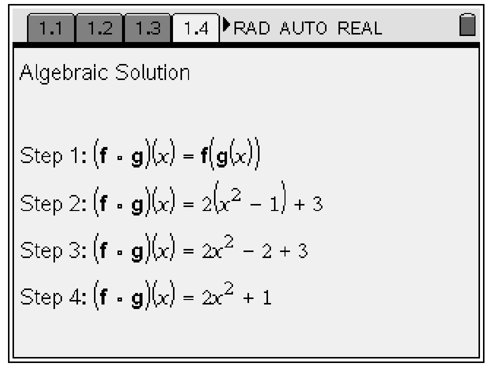
- *This activity is intended to be* ***teacher-led****. You may use the following pages to present the material to the class and encourage discussion. Students will follow along using their handhelds, although the majority of the ideas and concepts are only presented in this document; be sure to cover all the material necessary for students' total comprehension.*
- *Students may record their answers within the TI-Nspire document or on separate sheets of paper. Alternatively, you may wish to use the questions posed to engage a class discussion.*

TI-Nspire™ Applications

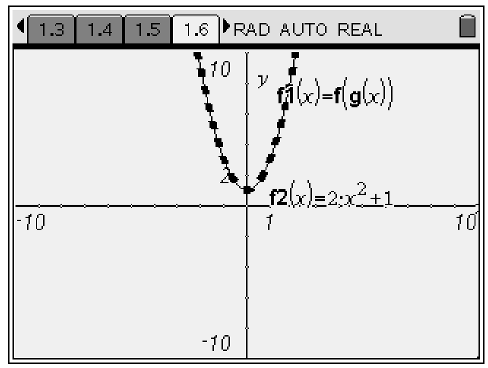
Calculator, Graphs & Geometry, Notes

Composition of Functions

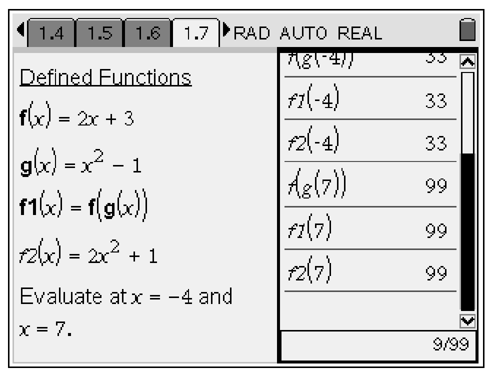
Students will find the composite function of *f*(*x*) and *g*(*x*). Students are given a rule to follow and asked to apply the rule. On page 1.3, students will find $(f \circ g)(x)$. Students can verify their answers on page 1.4.



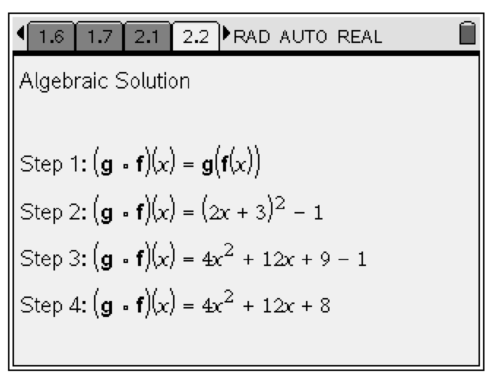
Students will learn how to support their solutions graphically. If the graph of *f*(*g*(*x*)) coincides with the graph of the composite function students found, then their composition is supported.



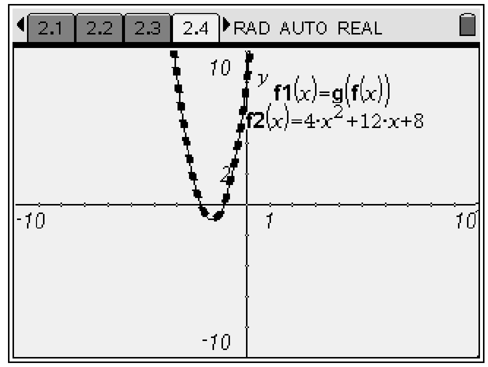
Students are asked to evaluate *f*(*x*), *g*(*x*), and their composite function at a few *x*-values to show one more way that the compositions are equivalent.



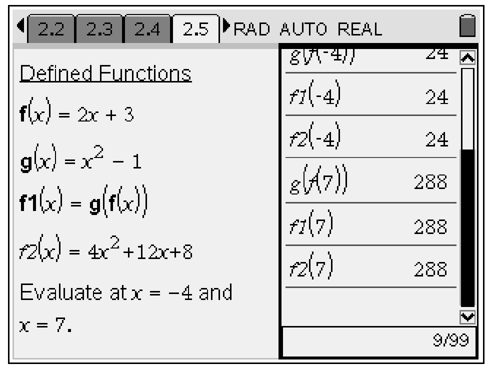
Students are then asked to find $(g \circ f)(x)$ using the same functions *f*(*x*) and *g*(*x*). At this time, you should point out that in general, the compositions $(f \circ g)(x)$ and $(g \circ f)(x)$ will not be the same. (These compositions will be the same if *f*(*x*) and *g*(*x*) are inverses.) Students can verify their answers on page 2.2.



Students will once again support their answers graphically.



Students evaluate the functions for a few *x*-values.



Students will later complete a few practice problems on their own.

Student Exercise Solutions

1. $(g \circ f)(x) = x^2 - 8x + 17$ **2.** $(f \circ g)(x) = x^2 - 30$, when $x \neq 5$

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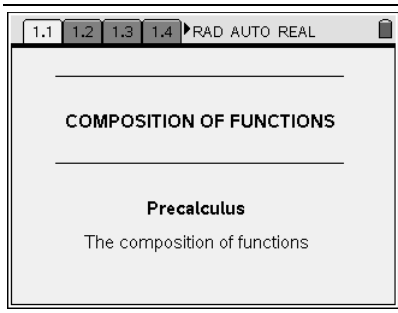
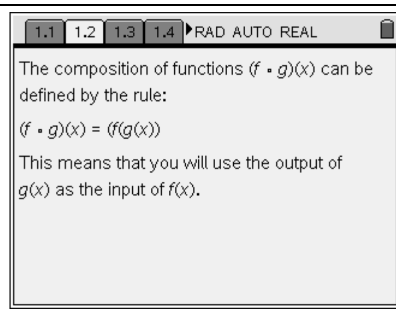
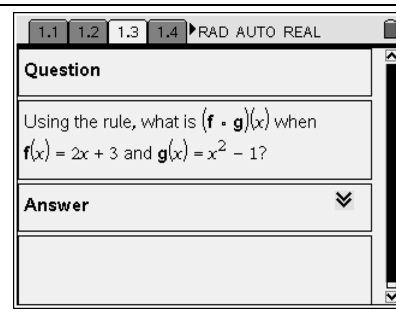
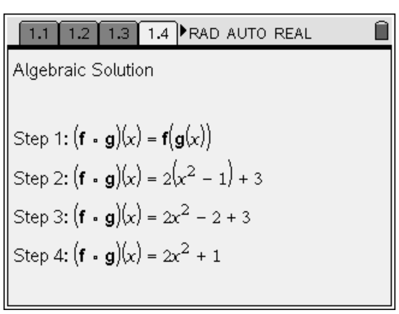
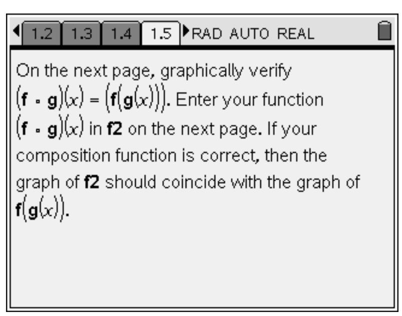
(Student)TI-Nspire File: *PreCalcAct30_CompOfFxns_EN.tns*

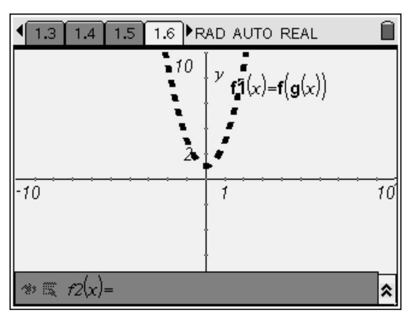


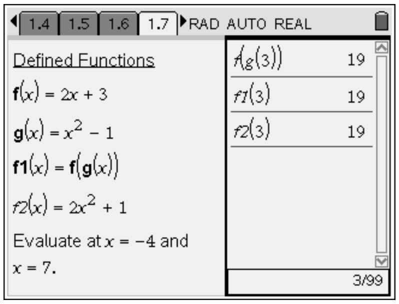


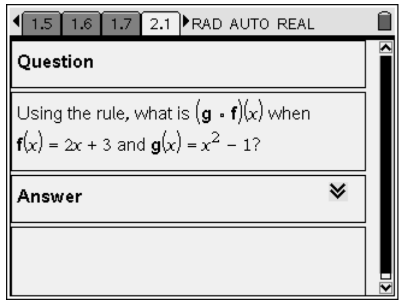


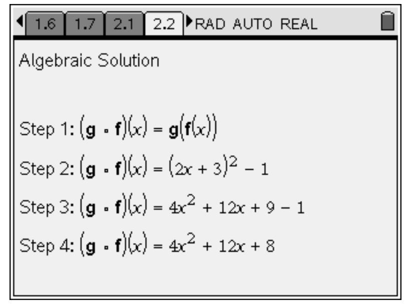


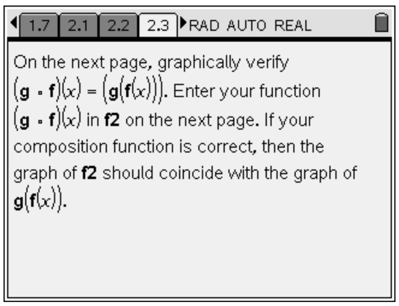


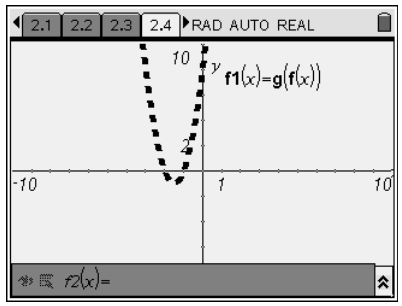


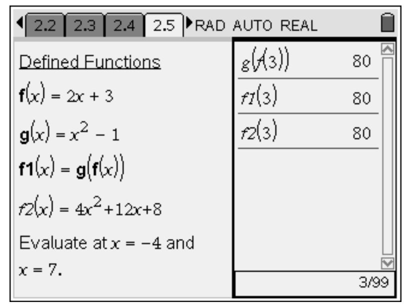

1.4 1.5 1.6 1.7 RAD AUTO REAL
Defined Functions
f(x) = 2x + 3
g(x) = x² − 1
f1(x) = f(g(x))
f2(x) = 2x² + 1
Evaluate at x = −4 and x = 7.
f(g(3)) 19
f1(3) 19
f2(3) 19
3/99

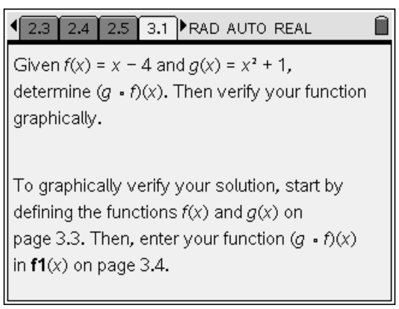

1.5 1.6 1.7 2.1 RAD AUTO REAL
Question
Using the rule, what is (g • f)(x) when f(x) = 2x + 3 and g(x) = x² − 1?
Answer

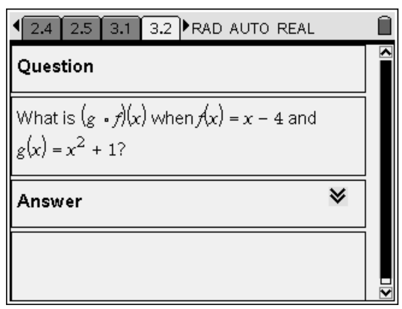

1.6 1.7 2.1 2.2 RAD AUTO REAL
Algebraic Solution
Step 1: (g • f)(x) = g(f(x))
Step 2: (g • f)(x) = (2x + 3)² − 1
Step 3: (g • f)(x) = 4x² + 12x + 9 − 1
Step 4: (g • f)(x) = 4x² + 12x + 8

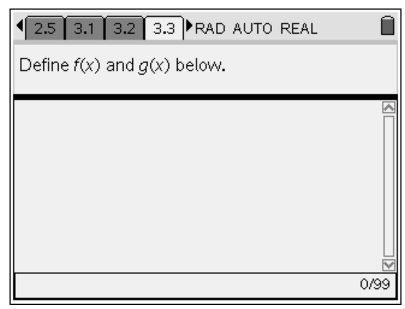

1.7 2.1 2.2 2.3 RAD AUTO REAL
On the next page, graphically verify (g • f)(x) = (g(f(x))). Enter your function (g • f)(x) in f2 on the next page. If your composition function is correct, then the graph of f2 should coincide with the graph of g(f(x)).

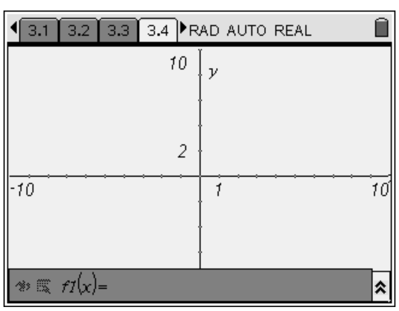

2.1 2.2 2.3 2.4 RAD AUTO REAL
10
y
f1(x)=g(f(x))
2
-10
1
10
f2(x)=

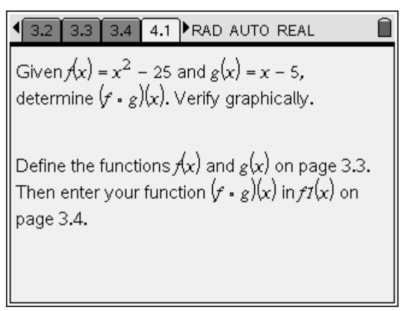

2.2 2.3 2.4 2.5 RAD AUTO REAL
Defined Functions
f(x) = 2x + 3
g(x) = x² − 1
f1(x) = g(f(x))
f2(x) = 4x²+12x+8
Evaluate at x = −4 and x = 7.
g(f(3)) 80
f1(3) 80
f2(3) 80
3/99

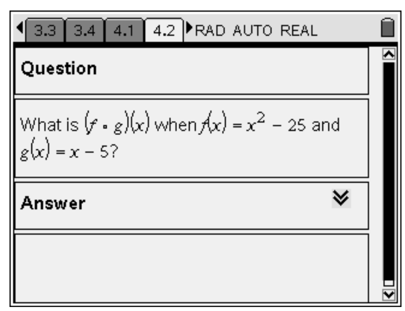

2.3 2.4 2.5 3.1 RAD AUTO REAL
Given f(x) = x − 4 and g(x) = x² + 1, determine (g • f)(x). Then verify your function graphically.
To graphically verify your solution, start by defining the functions f(x) and g(x) on page 3.3. Then, enter your function (g • f)(x) in f1(x) on page 3.4.

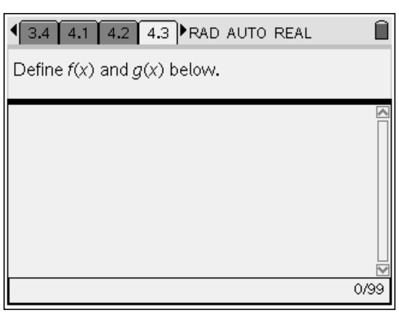

2.4 2.5 3.1 3.2 RAD AUTO REAL
Question
What is (g • f)(x) when f(x) = x − 4 and g(x) = x² + 1?
Answer

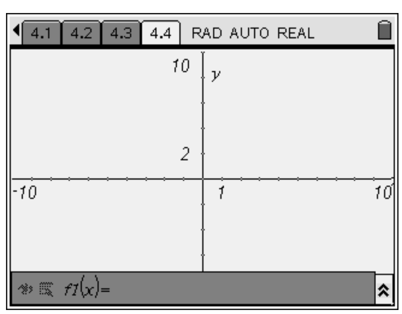

2.5 3.1 3.2 3.3 RAD AUTO REAL
Define f(x) and g(x) below.
0/99


3.1 3.2 3.3 3.4 RAD AUTO REAL
10
y
2
-10
1
10
f1(x)=


3.2 3.3 3.4 4.1 RAD AUTO REAL
Given f(x) = x² − 25 and g(x) = x − 5, determine (f • g)(x). Verify graphically.
Define the functions f(x) and g(x) on page 3.3. Then enter your function (f • g)(x) in f1(x) on page 3.4.


3.3 3.4 4.1 4.2 RAD AUTO REAL
Question
What is (f • g)(x) when f(x) = x² − 25 and g(x) = x − 5?
Answer


3.4 4.1 4.2 4.3 RAD AUTO REAL
Define f(x) and g(x) below.
0/99


4.1 4.2 4.3 4.4 RAD AUTO REAL
10
y
2
-10
1
10
f1(x)=

