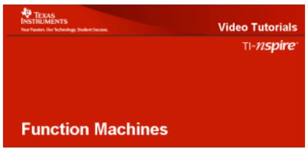
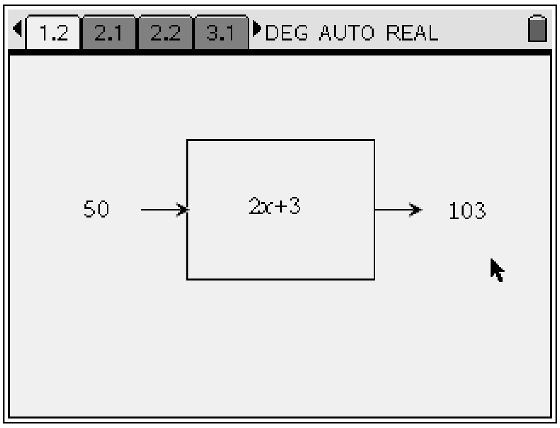
Function Machines
Teacher Notes



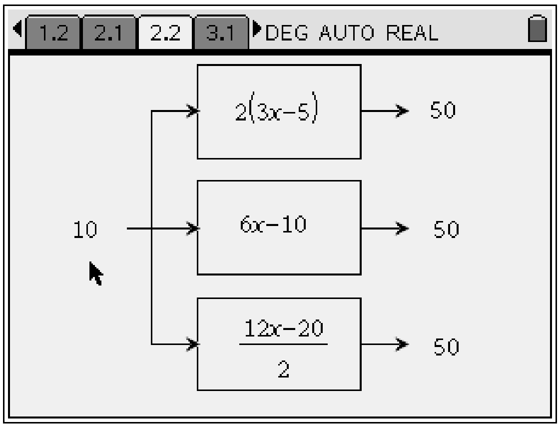
See accompanying video tutorial!

Overview

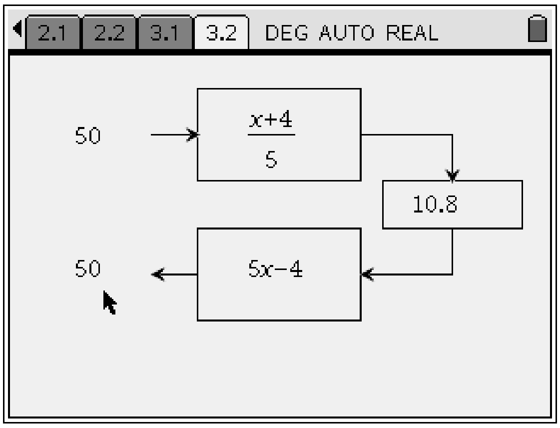
The Function Machines document offers three ways to work with functions.



Students can explore functions by choosing different input values and trying to predict the output values. (Document pages 1.1 and 1.2)



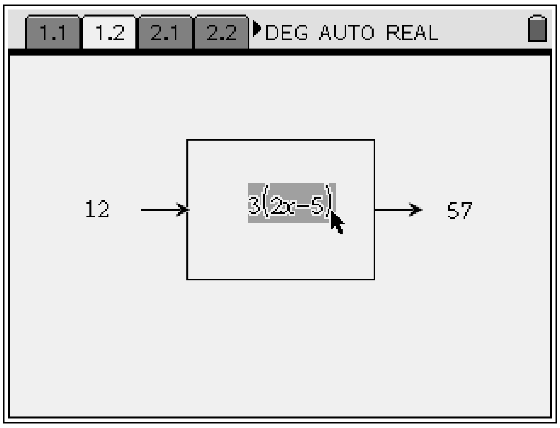
Students can try to make functions that are equivalent to each other. (Document pages 2.1 and 2.2)



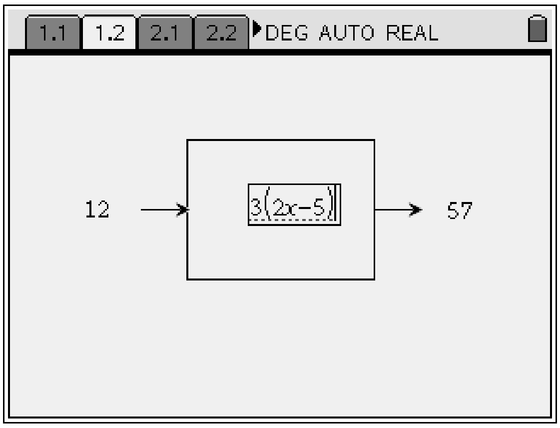
Students can try to make functions that are inverses of each other. (Document pages 3.1 and 3.2)

Any function of the variable x can be used and inputs can have any value. The outputs are calculated automatically.

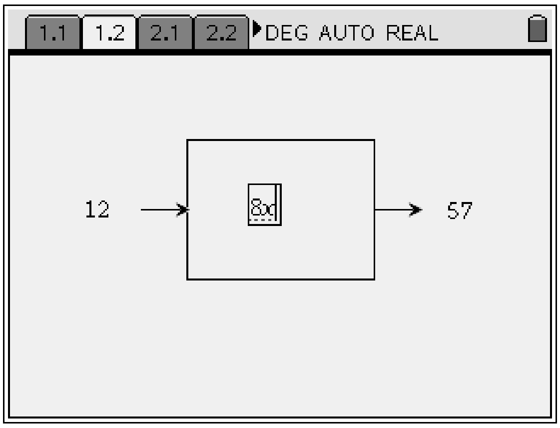
How to change an expression or input value



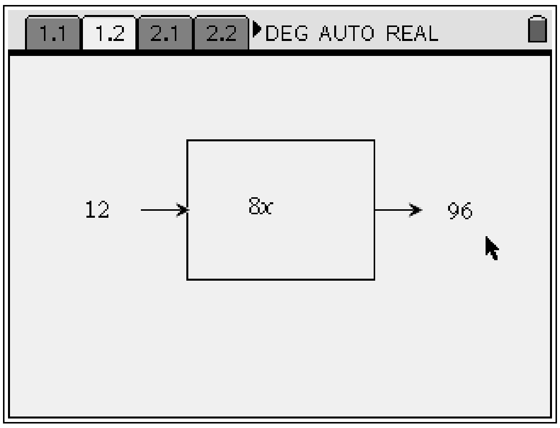
Navigate to the function or number to be changed. Press [enter] once and the text box will change to grey…



…press [enter] again and a flashing cursor bar will appear. The function can now be changed. Press the [clear] key to delete any unwanted letters or numbers.



When the new function or number has been keyed in…



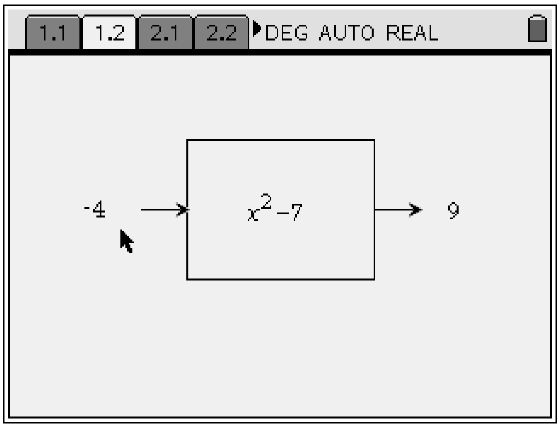
…press [enter] to see the output change!

If the function or input value disappears altogether, use the undo feature to bring it back.
Press [ctrl][esc] or [ctrl][Z].

Ideas for using Function Machine (pages 1.1 and 1.2)

The function is… The input is… Try and predict the output!

The activity would be suitable for whole class teaching using the Viewscreen or the TI-*n*spire computer software projected onto a screen or interactive whiteboard.
Choose a function and ask students to predict the output values.

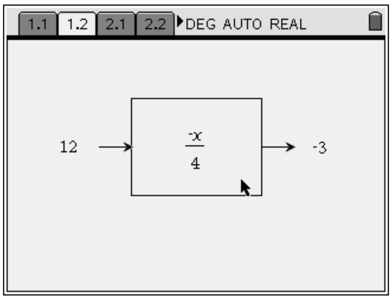


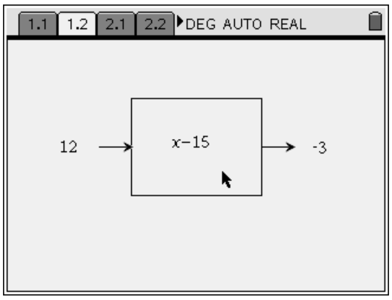
This could be particularly useful when working on specific areas of difficulty, such as use of decimals or negatives in the algebraic evaluation of functions.

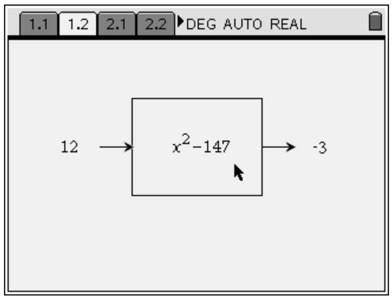
In this example the whole class could be asked to look at the function and write down or share their predictions before the teacher pressed enter. Asking students to record or share predictions enables them to be active participants and encourages them to take notice of the actual output, comparing it with their own prediction.

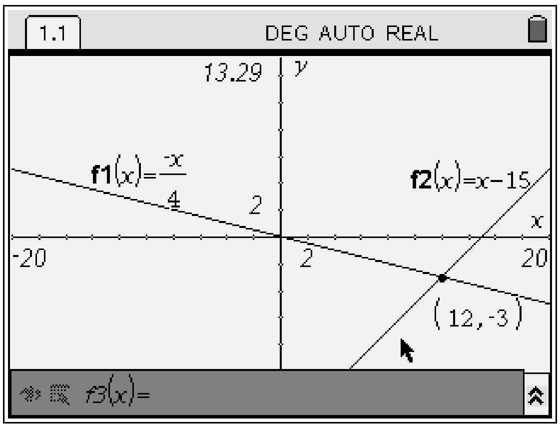
Find as many functions as you can so that when the input is… the output is…

Students can practise their understanding of functions by trying to find as many functions as possible so that, for example, when the input value is 12 the output value is -4.









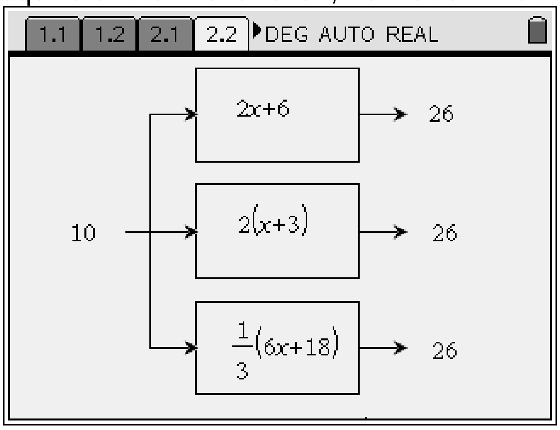
As an extension activity, students could plot their functions on a Graphs and Geometry page as shown here. This is a good opportunity to point out that although both functions map 12 onto -3 (in this example) they are not equivalent functions: they only give the same output value for one input value as their graphs make clear. To emphasise this further they could construct an intersection point as shown (menu 6 3) or trace the graphs (menu 5 1).

Ideas for Using Equivalent Functions (pages 2.1 and 2.2)

This page displays three function machines with a common input value. The output values are calculated automatically and are displayed to the right of the function machines.

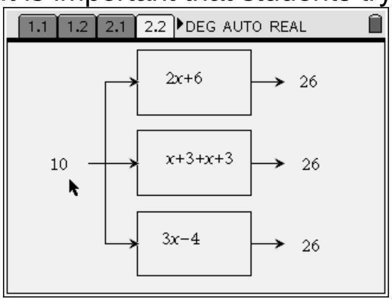
Find as many functions as you can that are equivalent to…

In this activity, students are given a starter function. This could be written on the board, or set as the first function on page 2.2. Students must find as many other functions as they can that are equivalent to this function, no matter what the input values.

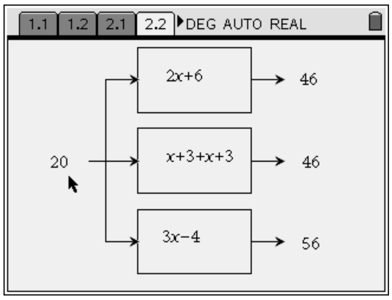


For example, if the starter function was 2x+6, a student might produce this screen, and then go on to try to find more equivalent functions.

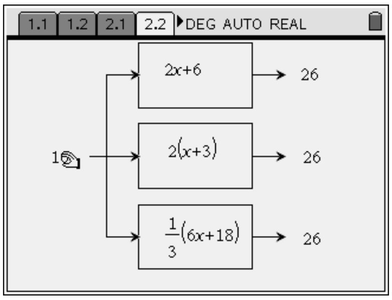
It is important that students try different input values…



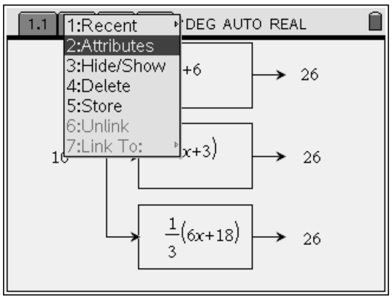
In this example, the third function, f(x)=3x-4 has the same output as the other functions when the input is 10, but not when the input is changed to 20.



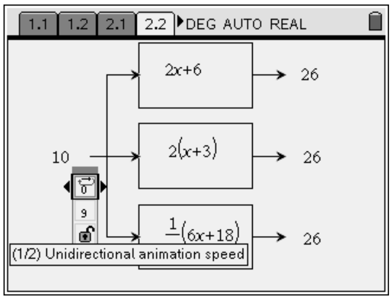
Animate the page and try lots of input values!



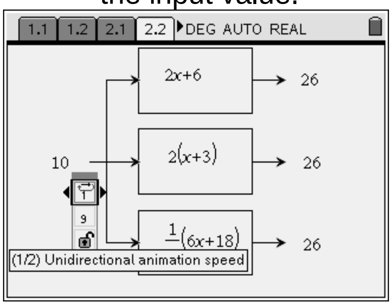
Move the pointer until it is over the input value.



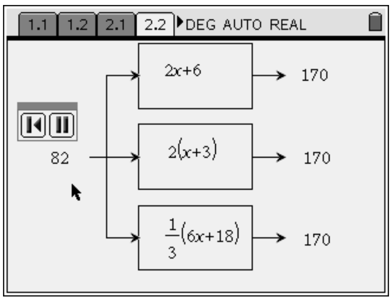
Press ctrl menu followed by 2 to see the Attributes menu.



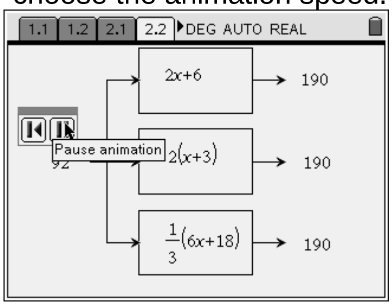
This menu is asking you to choose the animation speed.



Pressing 1 enter sets the input value to increase in steps of 1.



Here the input value is still increasing and is now 82.

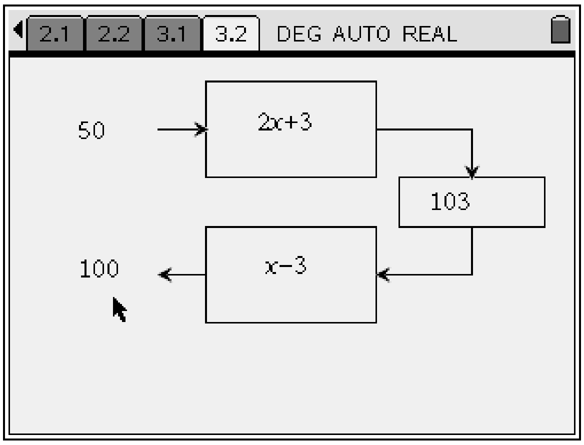


Click on the Pause or Reset icons to stop the animation.

Ideas for Using Inverse Functions (pages 3.1 and 3.2)

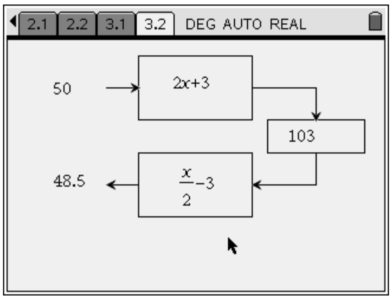
The inverse functions activity gives you the opportunity to enable students to work on finding inverse functions at any level.

Try to make the second function the inverse of the first function…

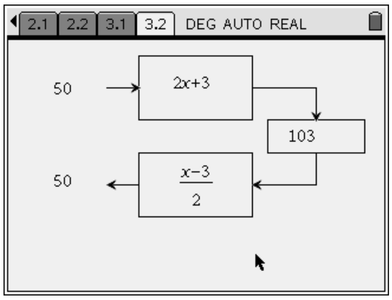


The input value is fed into the first function and the output from the first function is fed into the second function.

The aim is to *change the second function* so that *the input value always equals the final output value,* no matter what input value is chosen.



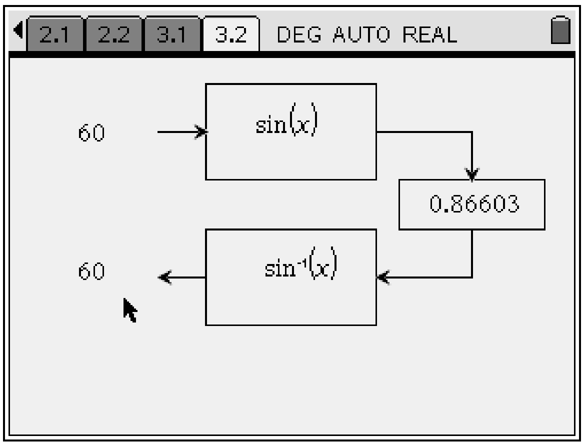
In this example the student tries $\frac{x}{2}-3$ as the inverse function. This produces an output of 48.5. The student then tries $\frac{x-3}{2}$ which gives the desired output of 50, the same value as the input.



It is important to emphasise to students that they must try several different input values before asserting that they have found the correct inverse function. They also need to understand how to show that they have found the correct inverse function algebraically.

Trigonometric Functions

Students often struggle with the trigonometric functions when they meet them for the first time. Using this page to 'play' with the trigonometric functions and their inverses may give students an insight into them. There are many questions you could ask students to work on.



Try setting questions that will force students to think about the non-linearity of the trigonometric functions.
For example, you could ask students to try and find a value for the input for sin(x) so that the output is greater than 1. Students will soon find that this is not possible! What can they work out from this about the sine function?
What are the greatest and least values possible for sin(x)?
Can they make the output of sin(x) exactly 0.5? What about 0.3?