Function Homework – Homework: Horizontal and Vertical Permutations II*

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Abstract

This module provides practice problems designed to develop some concepts related to horizontal and vertical permutations of functions by graphing.

1. In a certain magical bank, your money doubles every year. So if you start with \$1, your money is represented by the function $M = 2^t$, where t is the time (in years) your money has been in the bank, and M is the amount of money (in dollars) you have.
   Don puts \$1 into the bank at the very beginning ($t = 0$).
   Susan *also* puts \$1 into the bank when $t = 0$. However, she also has a secret stash of \$2 under her mattress at home. Of course, her \$2 stash doesn't grow: so at any given time t, she has the same amount of money that Don has, plus \$2 more.
   Cheryl, like Don, starts with \$1. But during the first year, she hides it under *her* mattress. After a year ($t = 1$) she puts it into the bank, where it starts to accrue interest.

   a. Fill in the following table to show how much money each person has.

	t=0	t=1	t=2	t=3
Don	1			
Susan	3			
Cheryl	1	1		

Table 1

   b. Graph each person's money as a function of time.

*Version 1.1: Sep 15, 2009 3:33 pm -0500
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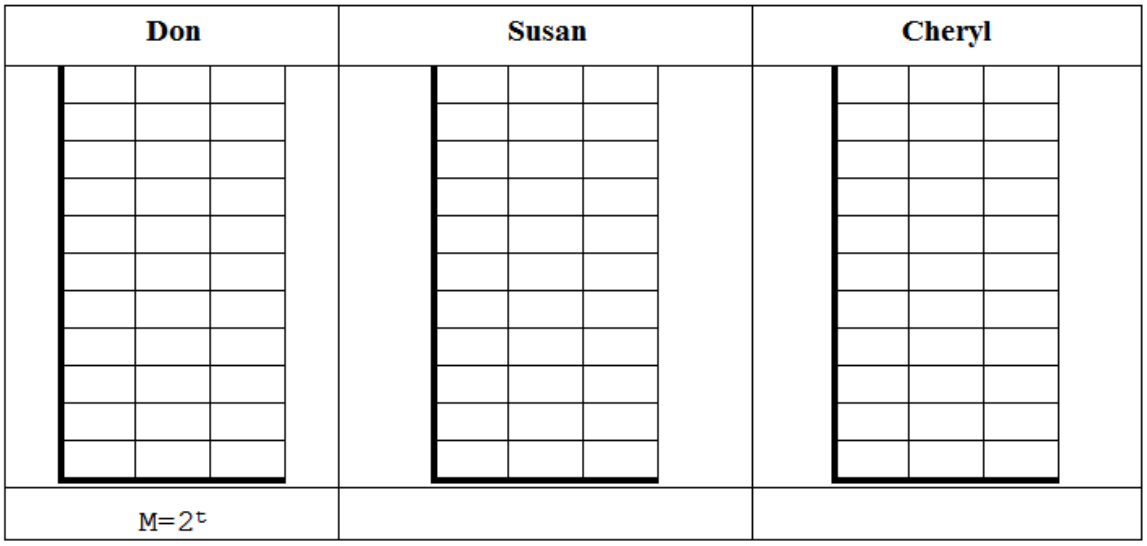

Figure 1

c. Below each graph, write the function that gives this person's money as a function of time. Be sure your function correctly generates the points you gave above! (*For Cheryl, your function will not accurately represent her money between $t = 0$ and $t = 1$, but it should accurately represent it thereafter.)

2. The function $y = f(x)$ is defined on the domain [–4,4] as shown below.

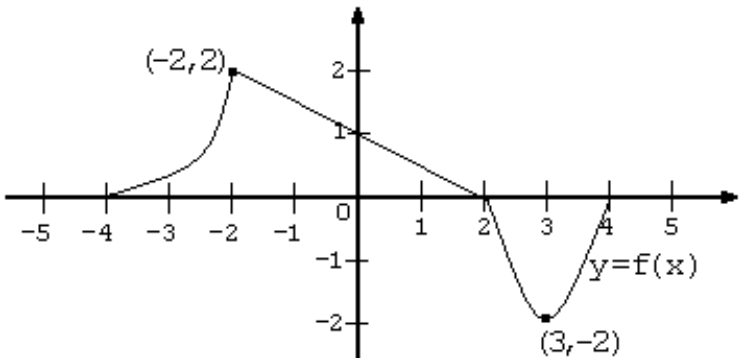

Figure 2

a. What is $f(--2)$? (That is, what does this function give you if you give it a -2?)
b. What is $f(0)$?
c. What is $f(3)$?
d. The function has three zeros. What are they?

The function $g(x)$ is defined by the equation: $g(x) = f(x) - -1$. That is to say, for any x*-value you put into $g(x)$, it first puts that value into $f(x)$, and then it subtracts 1 from the answer.*

e. What is $g(--2)$?
f. What is $g(0)$?
g. What is $g(3)$?
h. Draw $y = g(x)$ next to the $f(x)$ drawing above.

The function $h(x)$ is defined by the equation: $h(x) = f(x+1)$. That is to say, for any x*-value you put into $h(x)$, it first adds 1 to that value, and then it puts the new* x*-value into $f(x)$.*

i. What is $h(--3)$?
j. What is $h(--1)$?
k. What is $h(2)$?
l. Draw $y = h(x)$ next to the $f(x)$ drawing to the right.

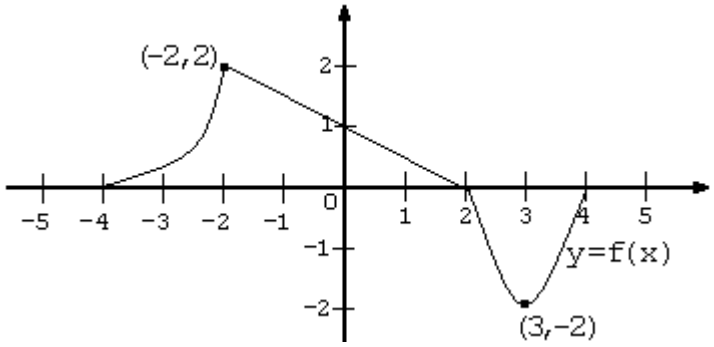

Figure 3

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m. Which of the two permutations above *changed the domain* of the function?

3. On your calculator, graph the function $Y1 = x^3 - -13x - -12$. Graph it in a window with x going from –5 to 5, and y going from –30 to 30.

a. Copy the graph below. Note the three zeros at $x = --3$, $x = --1$, and $x = 4$.

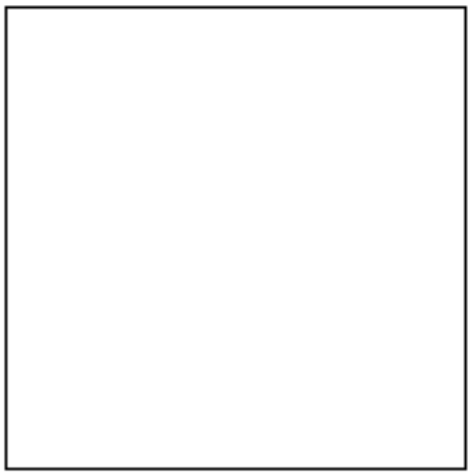

Figure 4: $y = x^3 - -13x - -12$

b. For what x-values is the function *less than zero?* (Or, to put it another way: solve the inequality $x^3 - -13x - -12 < 0$.)
c. Construct a function that looks exactly like this function, but moved *up 10.* Graph your new function on the calculator (as Y2, so you can see the two functions together). When you have a function that works, write your new function below.
d. Construct a function that looks exactly like the original function, but moved *2 units to the left.* When you have a function that works, write your new function below.
e. Construct a function that looks exactly like the original function, but moved *down 3* and *1 unit to the right.* When you have a function that works, write your new function below.