

Name: \_\_\_\_\_

PID: \_\_\_\_\_

1. Please justify all answers and show your work.
2. You may work with classmates, but all answers must be your own.

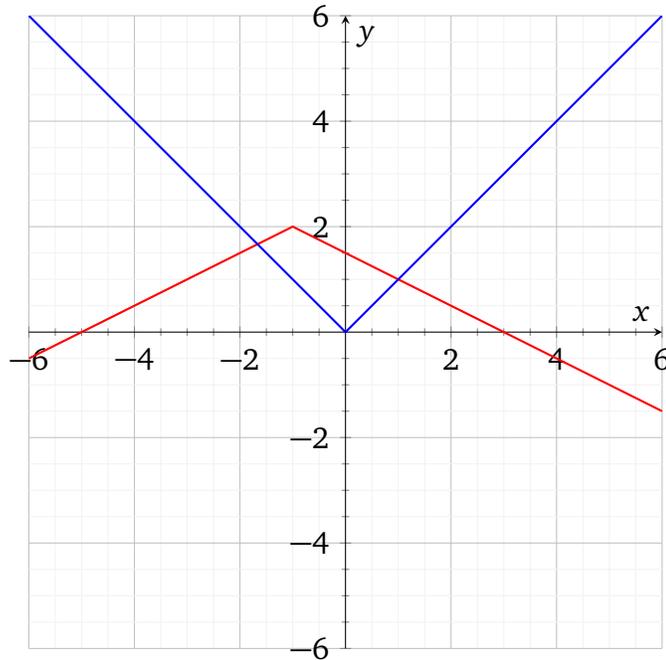
1. (a) Let  $f(x) = \frac{x}{x+1}$  and  $g(x) = \frac{4}{x}$ . Compute  $f(g(x))$ . Show your work.

(b) What is the domain of  $f(g(x))$ ? How do you know?

2. Suppose  $h(x) = (x - 5)^3$ . Find functions  $f(x)$  and  $g(x)$  such that  $h(x) = f(g(x))$ . Compute  $f(g(x))$  to show that your answer works.

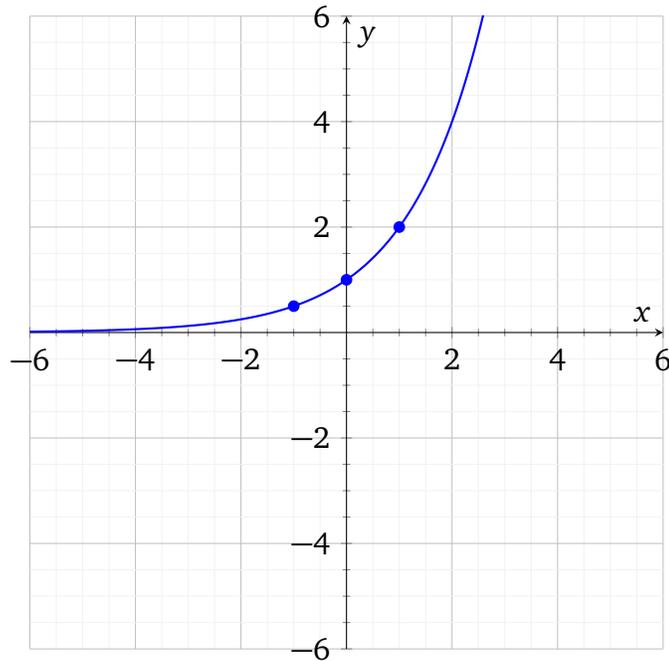
3. Suppose you use  $x$  amount of kWh (kilowatt hours) of electricity each day in your apartment. Each month, your power company charges you \$0.20 per kWh for the first 500 kWh you use and \$0.40 per kWh after that. ‘
- (a) Write a formula for a function  $f(x)$  such that  $f(x)$  = the total number of kWh you use in a 30 day month using  $x$  kWh per day.
- (b) Write a formula for a function  $g(x)$  such that  $g(x)$  = the amount of money you are charged for using  $x$  kWh in a month.
- (c) Suppose you want a function which computes how much your electricity bill will be if you use  $x$  many kWh per day for a 30 day month. Would you use  $f(g(x))$  or  $g(f(x))$ ? Why? Compute the composition that you choose.
- (d) Suppose you realize you only have \$150 to spend on your electricity bill this month. What is the maximum number of kWh you can use per day while still affording your electricity bill?

4. Write the equation of the function graphed below in red which is a transformation of the function  $f(x) = |x|$  (graphed in blue).



5. Write the formula for the function which results when the function  $f(x) = \frac{1}{x}$  is horizontally reflected, then vertically stretched by a factor of 8, then shifted to the right 4 units and up 2 units. Point out which parts of your formula correspond to each transformation.

6. Below is the graph of the function  $f(x) = 2^x$ . Graph (on the same axes) the function  $g(x) = f(-\frac{1}{2}(x - 3)) - 1$ . For each of the shaded points on the graph below  $(-1, 0.5)$ ,  $(0, 1)$ , and  $(1, 2)$ , shade the corresponding point on your graph (i.e. where these three points are moved to after the transformations you apply). Write down a list of the transformations you applied.



7. Suppose  $f(x) = 9 + 10x$ . Find a formula for  $f^{-1}(x)$ .

8. Suppose  $f(x)$  is defined according to the following table:

$x$	3	5	7	13	15
$f(x)$	2	6	9	11	16

Create a table for  $f^{-1}(x)$ .

9. Suppose  $f(x) = (x-6)^2$ . Find a domain on which  $f(x)$  is one-to-one and non-decreasing (for example,  $g(x) = x^2$  is non-decreasing on  $[0, \infty)$ ), then find the inverse of  $f(x)$  restricted to that domain.