TEST I

Math 231
September 21, 2004

Name: _____
By writing my name I swear by the honor code.

Read all of the following information before starting the exam:

- Show all work, clearly and in order. You will not get full credit if I cannot see how you arrived at your answer (even if your final answer is correct).
- Make sure that you follow the directions in each problem and that your answer matches what is asked for.
- Justify your answers algebraically whenever possible. For most problems, work done by calculator will not receive any points (although you may use your calculator to check your answers).
- Please keep your written answers brief; be clear and to the point. I will take points off for rambling and for incorrect or irrelevant statements.
- By writing your name above, you agree to the JMU honor code. In particular, this means that you may not use any notes or crib sheets during this exam, that all work must be your own, and that you may not obtain advance information revealing the problems on this exam.
- This test has 7 problems and is worth 100 points, plus some extra credit at the end. Make sure that you have all of the pages!
- Good luck!

1. (*16 pts*) Determine whether each of the following statements is true (T) or false (F).

(**a**) **T** **F** If $a \neq 0$ and $b \neq 0$, then $\dfrac{12}{(\frac{a}{b})} = \dfrac{12b}{a}$.

(**b**) **T** **F** If $x^2 > 4$ then $x > \pm 2$.

(**c**) **T** **F** If $a < 0$ then $|a| = -a$.

(**d**) **T** **F** If $\frac{3}{x-1} \leq 4$ then $3 \leq 4(x-1)$.

(**e**) **T** **F** $|x-2| < 0.1$ means that $x \in (1.9, 2.1)$.

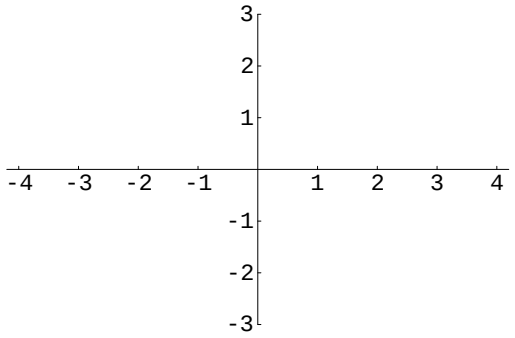
(**f**) **T** **F** For all real numbers x, there is some real number y such that $x = y^2$.

(**g**) **T** **F** For all real numbers x, there is some real number y such that $y = x^2$.

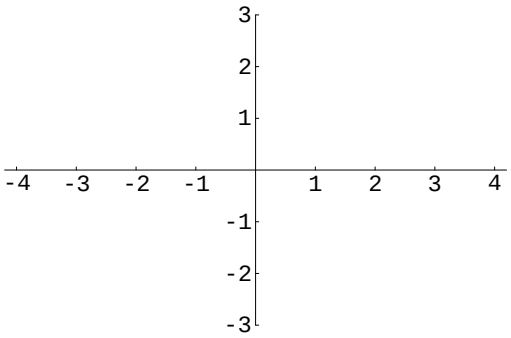
(**h**) **T** **F** If x is in the domain of $f(x)$ and also in the domain of $g(x)$, then x is in the domain of $f(g(x))$.

2. (*8 pts*) On each set of axes, sketch the graph of a function that has the indicated limits and values. (Note: There may be more than one possible answer for each graph.)

(**a**) On the axes below, sketch a graph with $\lim_{x\to\infty} f(x) = -1$ and $\lim_{x\to -2} f(x) = \infty$.



(**b**) On the axes below, sketch a graph with $\lim_{x\to 2^-} f(x) = 1$, $\lim_{x\to 2^+} f(x) = -2$, and $f(2) = -1$.



3. **(*8 pts*)** Find the inverse of the function $f(x) = \dfrac{x+2}{x-3}$. Show your work clearly so I can see how you arrived at your answer.

4. **(*20 pts*)** Give precice mathematical definitions of the following.

(**a**) A function $f(x)$ is *increasing* on an interval I if:

(**b**) A function $f(x)$ is an *even function* if:

(**c**) A function $f(x)$ is *one-to-one* if:

(**d**) Suppose f is a one-to-one function. A function f^{-1} is the *inverse* of f if:

5. (*26 pts*) Fill in each blank with an example of what is described. If such an example does not exist, write "not possible." (Note: For each part that asks for a function, give an actual equation $f(x) =$ _____ , not just a picture of the function.)

(**a**) _____ A solution to the equation $y = 2 - x + 3x^5$.

(**b**) _____ A quadratic function whose discriminant is negative.

(**c**) _____ Two numbers a and b for which $|a + b|$ is greater than $|a| + |b|$.

(**d**) _____ A function with domain $[1, \infty)$.

(**e**) _____ A function that is always nonpositive and always concave down.

(**f**) _____ A linear function that is not a proportional function.

(**g**) _____ A power function that is not a polynomial function.

(**h**) _____ A polynomial function that is not a rational function.

(**i**) _____ A function $f(x)$ for which the graphs of $f(x)$ and $f(x - 2)$ are the same.

(**j**) _____ A function that is neither an odd function nor an even function.

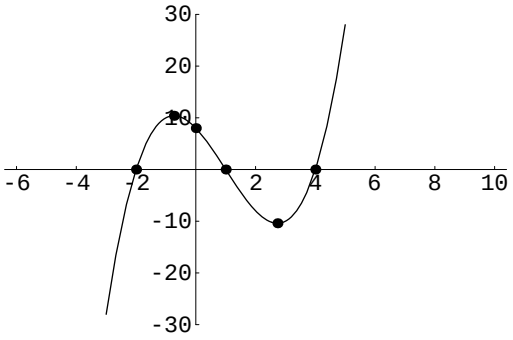
(**k**) _____ A function that is both an odd function and an even function.

(**l**) _____ A restricted domain on which $f(x) = x^2 - 5$ is invertible.

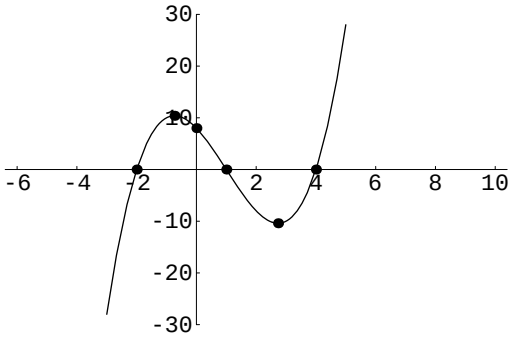
(**m**) _____ A function that is monotonic.

6. (*10 pts*) In each graph below a function $f(x)$ is shown. On the same set of axes, graph the given transformation of $f(x)$. Clearly mark the five dots on the graph of your transformation that come from the five dots marked on the graph of $f(x)$.

(**a**) Graph $-2f(x)$ on the axes below.



(**b**) Graph $f(x-3)+5$ on the axes below.



7. (*12 pts*) Complete the tables with numerical values.

(**a**) Assuming that f is a linear function, use the values given in the table to fill in the remaining values.

x	1	3		7	
$f(x)$	1	-5	-8		-23

(**b**) Complete the entries in the table below so that the functon f described by the table is an odd function.

x	-3	-2	-1	0	1	2	3
$f(x)$	4		2		-2	1	

(**c**) Complete the table using only the given entries. Some values may need to be filled in before others.

x	0	1	2	3
$f(x)$	3	0	1	2
$g(x)$		2	0	
$(f+g)(x)$	5		1	
$(f \circ g)(x)$			3	1

Survey Questions: *(2 extra credit points)*

Name a question or topic that could have been on this test, but wasn't.

How do you think you did?

SPACE FOR SCRAP WORK