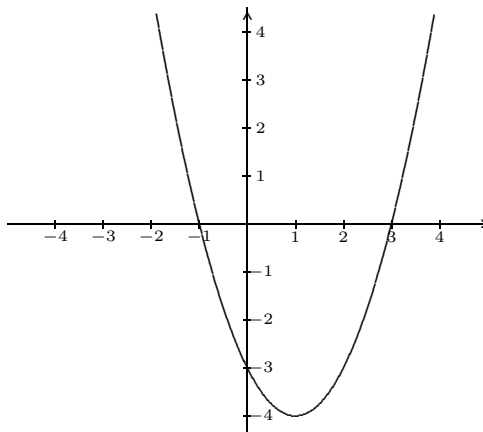


March 26, 1999

Your name \_\_\_\_\_

The first 15 problems count 6 points each and the final one counts 20 points. Problems 1 through 12 are multiple choice and 13 through 15 are fill-in-the-blank. In the multiple choice section, circle the correct choice(s). You do not need to show your work on problems 1 through 15.

- Which of the following numbers belong to the *domain* of the function  $h(x) = \sqrt{6 + x - x^2}$ ? Circle all those that apply.  
 (A)  $-2$     (B)  $0$     (C)  $2$     (D)  $3$     (E)  $5$
- The circle whose equation is  $4x^2 + 4y^2 - 4x + 9y + 1 = 0$  has a radius of  
 (A)  $9/8$     (B)  $9/4$     (C)  $81/16$     (D)  $81/64$     (E)  $9/2$
- The graph of  $f(x) = ax^2 + bx + c$  is shown for certain values of  $a, b$ , and  $c$ . Which of the following quantities are positive? Hint:  $f(1) = a \cdot 1^2 + b \cdot 1 + c$ . Circle all that apply.



- (A)  $a$     (B)  $c$     (C)  $b^2 - 4ac$     (D)  $a + b + c$     (E)  $9a + 3b + c$
- Suppose  $g$  is defined by  $g(x) = \frac{4-x}{3}$ . Let  $f$  be the inverse of the function  $g$ . Then  $f(2) =$   
 (A)  $-16$     (B)  $-2$     (C)  $1/3$     (D)  $2$     (E)  $8$

5. If the domain of the function  $f(x) = 2x^2 + 5$  is the interval  $[-2, 1]$ , which of the following numbers belongs to the range? Circle all those that apply.

(A)  $-2$    (B)  $0$    (C)  $5$    (D)  $12$    (E)  $15$

The next four questions refer to the functions  $f$  and  $g$ . Let

$$f(x) = 2x - 3 \quad \text{and} \quad g(x) = \begin{cases} |x| & \text{if } x < 3 \\ x^2 - 1 & \text{if } x \geq 3 \end{cases}$$

6. What is  $g \circ f(-2)$ ?

(A)  $1$    (B)  $4$    (C)  $7$    (D)  $15$    (E)  $48$

7. Compute  $(f/g)(-1) + (f \cdot g)(3)$ .

(A)  $-4\frac{5}{8}$    (B)  $-3$    (C)  $8$    (D)  $5\frac{3}{8}$    (E)  $19$

8. Find a value of  $x$  for which  $g \circ f(x) = 0$ .

(A)  $-6$    (B)  $-5$    (C)  $0$    (D)  $3/2$    (E)  $6$

9. Suppose  $3 < x < 4$ . Which of the expressions describes the value of  $f(g(x))$ ?

(A)  $2|x| - 3$    (B)  $|2x - 3|$    (C)  $|x^2 - 1|$    (D)  $(2x - 3)^2 - 1$    (E)  $2x^2 - 5$

The next three questions apply to the table given below: Suppose the functions  $f$  and  $g$  are given completely by the table of values shown.

$x$	$f(x)$	$g(x)$
0	2	5
1	0	7
2	6	4
3	1	2
4	3	4
5	5	3
6	6	1
7	4	0

10. What is the value of  $f(g(f(2)))$ ?  
(A) 0    (B) 1    (C) 2    (D) 6    (E) 7
11. Solve the equation  $g(f(x)) = 7$  for  $x$   
(A) 1    (B) 3    (C) 4    (D) 6    (E) 7
12. What is  $f(g(1+2) + f(6 - f(4)))$ ?  
(A) 1    (B) 3    (C) 4    (D) 5    (E) 7

The next few questions are short answer questions. Write your answer in the blank provided.

13. Solve for  $x$ :  $\sqrt{3+x} = 3\sqrt{x}$ .  
\_\_\_\_\_
14. A  $4 \times 4 \times 4$  cube is built from unit cubes. The entire outside surface is painted. How many of the 64 unit cubes receive some paint?  
\_\_\_\_\_
15. Suppose the curve  $y = 3x^2 + bx + 3$  has exactly one  $x$  intercept. Find a value of  $b$ ?  
\_\_\_\_\_

Work only one of the following two problems. If you show work on both, scratch out the work on the one you don't want counted. **Show your work.**

16. Use the 'completing the square' technique to find the standard form of the quadratic function  $y = x^2 + bx + c$  in terms of  $b$  and  $c$ . Then find the vertex of the parabola.

17. Find all  $x$  satisfying the inequality  $\frac{(x-1)(x+3)(x+6)}{(x+2)} \geq 0$ .