March 31, 1997
Your TA’s name is Brett and your lab section is ________________

Your name
The first 12 problems count 6 points each and the final 4 count 12 points each.

1. How many of the last 10 lectures did you attend? There have been ten lectures since the last test. Please answer truthfully. Every answer will be counted as correct.
   
   (A) fewer than 3  (B) 3 or 4  (C) 5 or 6  (D) 7 or 8  (E) 9 or 10

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

<table>
<thead>
<tr>
<th>$x$</th>
<th>$f(x)$</th>
<th>$g(x)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
<td>0</td>
</tr>
</tbody>
</table>

2. Given that $f(x - 3) = 7$, what is $f(x)$?
   
   (A) 1   (B) 3   (C) 4   (D) 6   (E) 7

3. Given that $g(f(x + 2)) = 4$, what is $g(f(x))$?
   
   (A) 2 only   (B) 3 only   (C) 4 only   (D) 5 only
   
   (E) $g(f(x))$ could have any of several values

4. The equation $x^2 - 2x + y^2 - 6y = 6$ describes a circle with center at $(h, k)$ and radius $r$. Find $h + k + r$.
   
   (A) 2   (B) 8   (C) 9   (D) 14   (E) 20

5. Let $A$ be the point $(1, 2)$. Let $B$ be the result of reflecting $A$ through the $y$-axis. Let $C$ be the reflection of $B$ through the line $y = x$, and let $D$ be the result of reflecting $C$ through the $x$-axis. Find the distance between $A$ and $D$.
   
   (A) 0   (B) 1   (C) $\sqrt{2}$   (D) 2   (E) $3\sqrt{2}$

The answer is C.
6. The sum of the roots of \(|x| = x^2 + x - 3\) is

(A) 0  (B) \(3 - \sqrt{3}\)  (C) \(\sqrt{3}\)  (D) 3  (E) \(\sqrt{3} - 3\)

The answer is E.

7. One billion seconds is about

(A) 10 years  (B) 12 years  (C) 20 years  (D) 32 years  (E) 320 years

8. The four numbers \(\frac{1}{3}, x, y,\) and \(\frac{2}{3}\) are in order from smallest to largest and are equally spaced. What is \(x\)?

(A) \(\frac{13}{23}\)  (B) \(\frac{7}{18}\)  (C) \(\frac{29}{36}\)  (D) \(\frac{5}{12}\)  (E) \(\frac{1}{3}\)

The answer is B.

9. If \(P \uparrow\) means \(P + 1\) and \(P \downarrow\) means \(P - 1\), then \((4 \uparrow)(3 \downarrow) =\)

(A) 9 \(\downarrow\)  (B) 10 \(\uparrow\)  (C) 11 \(\downarrow\)  (D) 12 \(\uparrow\)  (E) 13 \(\downarrow\)

The answer is C.

10. What is the value of \(2 - (1 - (2 - (1 - (2 - (1 - (2)))))))\)?

(A) \(-3\)  (B) \(-6\)  (C) 3  (D) 4  (E) 5

11. Chris and Sarah left for a week’s vacation together. Chris took $380 and spent $32 per day and Sarah took $300 and spent $29 per day. Which of the following expressions describes how much more money Chris has than Sarah, \(x\) days into their vacation, where \(0 \leq x \leq 7\).

(A) \(42 - 3x\)  (B) \([80-3x]\)  (C) \(158 - 3x\)  (D) \(80 + 3x\)  (E) \(80 + 61x\)

12. If \(||x - 2| - 4\| = a\) where \(a\) is a constant, has exactly three distinct roots, what is \(a\)? Hint: look at the graph of \(y = ||x - 2| - 4|\), and see if you can picture a horizontal line which touches it in three places.

(A) 0  (B) 1  (C) 2  (D) 3  (E) \(4\)
On all the following questions, show your work.

13. Sketch the graph of the relation \((x - 1)(y - 2) = 0\), and describe, by means of an equation, the reflection of the set across the origin \((0, 0)\).

14. Write an equation of the reflection of the line \(y = 3x + 1\) about the line or point indicated:
   
   (a) the \(x\)-axis

   \___________________\n
   (b) the origin

   \___________________\n
15. Find an equation for the line which is the perpendicular bisector of the segment with endpoints \((6, 0)\) and \((0, -2)\). Two lines are perpendicular if the product of their slopes is \(-1\).
16. Match each of the function equations with the appropriate graph.

_____ \( y = x^2 - 1 \)

_____ \( y = -3x^4 + 6x^2 - 1 \)

_____ \( y = x\sqrt{x + 3} - 1 \)

_____ \( y = x^3 - 1 \)

_____ \( y = -\frac{1}{3}(x-1)(x+1)(x-3) \)