You must show all your work. Partial credit will be given.

1. Find the equation of the line which contains the two points (3, 1) and (-1, 5). Is this line parallel to the line $3x + 3y = 4$? Why or why not. (8 pts)

2. Determine whether or not the table below could be a table of values for a function. (5 pts)

<table>
<thead>
<tr>
<th>Input</th>
<th>-5</th>
<th>1</th>
<th>3</th>
<th>-5</th>
<th>7</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>36</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

3. Consider the two functions $f(x) = \frac{1}{2x + 1}$ and $g(x) = x^2 - 1$. Find

(a) (2 pts) $f(0)$

(b) (2 pts) $g(-4)$

(c) (3 pts) $g(-2) + g(0)$

(d) (4 pts) $g(r + s)$

(e) (4 pts) $g \circ f(x)$

(f) (4 pts) $f \circ g(x)$
4. Find the average rate of change for the function \( f(x) = 3x^2 - 1 \) on the closed interval \([x, x+h]\). (8 pts)

5. Does the equation \( xy - 4x^3 + 14y = 0 \) define \( y \) as a function in \( x \)? Why or why not. (5 pts)

6. The number of cubic yards of dirt, \( D \), needed to cover a garden with area \( a \) square feet is given by \( D = g(a) \). A garden with area 5000 square feet requires 50 cubic yards of dirt. Express this information in terms of the function \( g \). (2 pts)

7. The data in the table below is approximately linear. Find the best fitting linear model for that data. The table shows the projected number of new cases of Alzheimer’s disease (in thousands) in the United States in selected years. (Make sure to write your model down on the test.) (4 pts)

<table>
<thead>
<tr>
<th>Year</th>
<th>2000</th>
<th>2010</th>
<th>2020</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Cases</td>
<td>400</td>
<td>467</td>
<td>489</td>
<td>600</td>
<td>800</td>
<td>956</td>
</tr>
</tbody>
</table>

According to your model when will the number of new cases be 750,000? (2 pts)
8. For the function \( f(x) = \frac{1}{9}x^3 + \frac{1}{6}x^2 - 2x + \frac{1}{2} \) find the domain. Now sketch a graph of the function on the axes below, find the range, and label any maximum or minimum points and inflection points that exist. Also state the intervals on which the function is increasing, where it decreasing, where it is concave down and where it is concave up. (15 pts)

9. Use algebra to find the inverse of the function \( f(x) = 5 + \sqrt{3x - 2} \). (9 pts)
10. Using the graph shown find \( g(1) \), \( g(5) \), \( g^{-1}(2.5) \), \( g^{-1}(3) \), and \( g^{-1}(-1) \). (10 pts)

11. Two cars leave a gas station at the same time, one traveling north and the other south. The northbound car travels at 50 mph while the eastbound car travels at 60 mph. How long will it take for the diagonal distance between the two cars to be 250 miles? (7 pts)

12. Find the slope, horizontal intercept and vertical intercept for the function \( k(x) = -5x + 1 \). (6 pts)