1. (12 points) Find the area of the region enclosed by the line $y = x$ and the parabola $x = y^2 - 2$. Simplify your answer.
2. (10 points) Find the average value of the function \( f(x) = x\sqrt{x^2 - 1} \) on \([1, 3]\).

3. (6 points) Find the average value of \( g(x) \) on \([0, 8]\) where the graph of \( y = g(x) \) is shown below.
4. (12 points) The base of a solid \( S \) is the region enclosed by the parabola \( y = 9 - x^2 \) and the \( x \)-axis. Cross sections perpendicular to the \( y \)-axis are rectangles with height equal to one-half of the width. Calculate the volume of the solid \( S \).

5. (10 points) Consider the solid generated by rotating the region bounded by \( x = 0 \) and \( x = -y^2 + 4y - 3 \) (see the diagram) about the \( y \)-axis. Set up an integral, in terms of a single variable, that gives the volume of the solid. DO NOT EVALUATE THE INTEGRAL.
6. (10 points) Consider the solid generated by rotating the region bounded by the curves $y = x^4$ and $y = x$ about the line $x = 3$. Set up an integral, in terms of a single variable, that gives the volume of the solid. DO NOT EVALUATE THE INTEGRAL.

7. (10 points) A force of 10lb is required to hold a spring stretched to 4in beyond its natural length. How much work is done in stretching the spring from its natural length to 6in beyond its natural length?
8. (10 points) A spherical tank of radius 10 ft is buried underground. The highest point on the surface of the tank is 4 ft below ground level. If the tank is half full with a fluid that has a density of 50 lbs/ft³, write an integral that describes the work required to pump all of the fluid to ground level. Be sure to include a clear diagram which specifically indicates your choice of variable. DO NOT EVALUATE THE INTEGRAL.
9. (8 points) Evaluate \( \int_1^3 y \ln y \, dy \).

10. (12 points) Evaluate \( \int x^2 e^x \, dx \).

For Instructor Use Only:

<table>
<thead>
<tr>
<th>Question</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Points:</td>
<td>12</td>
<td>10</td>
<td>6</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>8</td>
<td>12</td>
<td>100</td>
</tr>
</tbody>
</table>

Score: