1a. Label the axes with $x$, $y$, $z$ correctly.

Left-hand coordinate system   Right-hand coordinate system

1b. Plot the points $(3, 0, 0)$ and $(2, 3, 1)$, and find the distance between the two points. (Your answer may be expressed using square roots.)

1c. Sketch the plane $5y + 4z = 20$. 
2. Name the surface given by the equation; match the graph to the equation; match the level curves to the equation. (To match, write (a), (b), (c), or (d) next to the graph.)

<table>
<thead>
<tr>
<th>Equation</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ( \frac{x^2}{4} + \frac{y^2}{4} - \frac{z^2}{4} = 1 )</td>
<td>__________________</td>
</tr>
<tr>
<td>b. ( \frac{x^2}{4} - \frac{y^2}{4} + \frac{z^2}{4} = 1 )</td>
<td>__________________</td>
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<tr>
<td>c. ( \frac{x^2}{4} - \frac{y^2}{4} - \frac{z^2}{4} = 1 )</td>
<td>__________________</td>
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<tr>
<td>d. ( x^2 + \frac{y^2}{4} + \frac{z^2}{4} = 1 )</td>
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</table>
3. Find the radius and center of the sphere $x^2 + y^2 + z^2 - 2x + 4y + 1 = 0$. 
4. Find all the first- and second partial derivatives of the function

\[ f(x, y) = e^{x+2y} + x \sin y + y \sin y + 3x - 5y + 10. \]

Do not simplify.

5. Find all critical points only of the function \( z = \frac{1}{2} x^2 - \frac{1}{2} x^2 y + y^2 - y \). Do not find any extrema.
6. Let \( z = \frac{\cos(x + y)}{1 + y^2} \).

a. Given that

i. \( z \) has only one critical point, namely, \((0, 0)\),

ii. the first- and second partial derivatives of \( z \) are

\[
\begin{align*}
z_x &= -\frac{\sin(x + y)}{1 + y^2}, \\
z_y &= -\frac{\sin(x + y)}{1 + y^2} - 2y \frac{\cos(x + y)}{(1 + y^2)^2}, \\
z_{xx} &= -\frac{\cos(x + y)}{1 + y^2}, \\
z_{xy} &= -\frac{\cos(x + y)}{1 + y^2} + 2y \frac{\sin(x + y)}{(1 + y^2)^2}, \\
z_{yy} &= -\frac{\cos(x + y)}{1 + y^2} + 4y \frac{\sin(x + y)}{(1 + y^2)^2} + 8y^2 \frac{\cos(x + y)}{(1 + y^2)^3} - 2 \frac{\cos(x + y)}{(1 + y^2)^2},
\end{align*}
\]

classify the relative extremum of the function \( z \) at \((0, 0)\).

b. To find the extrema of \( z \) subject to the constraint \( x + y = 1 \) by the method of Lagrange multipliers, we need to solve a particular system of equations. Write down that system of equations. Do not solve the system.
c. From 6(a), above, we know that the only extremum of $z$, without any constraints, occurs at $(0, 0)$. It turns out that the only extremum of $z$ subject to the constraint $x + y = 1$ occurs at $(1, 0)$. Is this inconsistent? Explain.

7. Evaluate $\int_1^2 \int_0^{\ln x} \int_0^x 2e^{x^2} \, dy \, dx \, dz$. (Follow your nose; your answer should be an integer.)

8. Let $R$ be the region in the $xy$-plane bounded by $x = 1$, $y = 2x$, and $y = x/2$. Set up iterated integrals in two ways, $dx \, dy$ and $dy \, dx$, to find the area of $R$. Do not evaluate the integrals.
9. Set up an iterated integral to find the volume of the solid in the first octant and bounded by the graphs of the equations $z = x, \; x = 1, \; y = 1$. Do not evaluate the integral.

10. A rectangular plate in the $xy$-plane has vertices at the origin, $(2, 0)$, $(2, 1)$, and $(0, 1)$. Find the average temperature of the plate if its temperature $T$ at the point $(x, y)$ is given by the function $T(x, y) = 2x + 2y + 1$. 