1. At what point on the surface \( x = \frac{y^4}{4} + 3z^2 \) is its tangent plane parallel to the plane \(-2x + 2y + 12z = 3\).

**Solution:** The direction of the normal line to the tangent plane of a surface is given by the gradient. Planes are parallel when their normal lines are parallel. Therefore, we must set the gradient of the surface equal to a scalar multiple of the normal line to the given plane and solve for \( x, y, \) and \( z \). Moving \( x \) to the other side of the equation, we get \(-x + \frac{y^4}{4} + 3z^2 = 0\), which is of the form \( F(x, y, z) = k \). Then we find \( \nabla(F) = \langle -1, y^3, 6z \rangle \). The normal vector to the plane \(-2x + 2y + 12z = 3\) is simply \( \langle -2, 2, 12 \rangle \). Therefore, we set:

\[
\langle -1, y^3, 6z \rangle = a \langle -2, 2, 12 \rangle \tag{1}
\]

Equating the first components, we find that \( a = \frac{1}{2} \). Then we have \( y^3 = 1 \), so \( y = 1 \). We also have \( 6z = 6 \), so \( z = 1 \). Therefore, the tangent plane of the surface is parallel to the given plane when \( y = 1 \) and \( z = 1 \). Plugging into the equation of the surface we see that \( x = \frac{1^4}{4} + 3 \times 1^2 = \frac{13}{4} \). Our final solution is the point \( \left( \frac{13}{4}, 1, 1 \right) \).