Name: _____ ID: _____

1. Consider the surface defined by the equation

$$x^2 + y^2 - 2x - 6y - z + 10 = 0.$$

(a) Find the center or vertex of the surface by completing the square to identify it as a translated version of a surface with center/vertex at the origin.

(b) Identify the horizontal traces of the surface in the planes $z = k$. If the answer depends on the value of k, be sure to specify which values of k give which answer.

(c) Identify the vertical traces of the surface in the planes $x = k$. If the answer depends on the value of k, be sure to specify which values of k give which answer.

(d) Identify the vertical traces of the surface in the planes $y = k$. If the answer depends on the value of k, be sure to specify which values of k give which answer.

(e) Identify the surface.

(f) Sketch the surface. Your sketch does not need to be quantitatively correct, but it should show the correct type of surface in the correct location with the correct orientation. If you feel like you need to, feel free to write a sentence to clarify the location and orientation.

2. Consider the curve defined by the equation

$$\mathbf{r}(t) = \left\langle \sqrt{2}t, e^t, e^{-t} \right\rangle.$$

Find the unit tangent vector $\mathbf{T}(t)$. Be sure to simplify.