1 (a) The slope in the x-direction is: $\dfrac{-4-(-6)}{2-1} = 2 = m$,

while the slope in the y-direction is:

$\dfrac{0-(-6)}{-2-(-4)} = \dfrac{6}{2} = 3 = n$. Since neither of these slopes depends on which x and y we choose, the table can represent a linear function. The function would have to be

$$f(x,y) = -6 + 2(x-1) + 3(y+4) = 2x+3y+4$$

(b) Although, for fixed x, the slope with respect to y is constant and, for fixed y, the slope with respect to x is constant, the slope with respect to x varies across the different columns. For example, the slope for $y=-4$ is $m = \dfrac{-10-(-7)}{2-1} = \dfrac{-3}{1} = -3$ while the slope for $y=-2$ is

$$m = \frac{-4-(-3)}{2-1} = -1 \neq -3.$$

Therefore, the table cannot represent a linear function.

2. The contours are parallel and equally spaced, so they can represent a linear function. Examining the -4 contour and 2 contour at $y=2$, we see that the slope in the y-~~x~~-direction must be: $n = \frac{2-(-4)}{1-(-1)} = \frac{6}{2} = \boxed{3}$

Examining the 4 contour and 2 contour at $y=-1$ gives that the slope in the x-direction must be $m = \frac{2-4}{-1-(-2)} = \frac{-2}{1} = \boxed{-2}$.

Since $f(0,-1)=0$, we obtain:

$$f(x,y) = 0 - 2x + 3(y-(-1))$$
$$= -2x + 3(y+1)$$
$$= -2x + 3y + 3$$

3 (a) The distance of (x,y,z) from the xy-plane is $|z|$, while the distance of (x,y,z) from the z-axis is $\sqrt{x^2+y^2}$.

We thus have

$$|z| = \left(\sqrt{x^2+y^2}\right)^2 = x^2+y^2.$$

That is, $z = \pm(x^2+y^2)$

(b) The graph is two paraboloids, one opening down and one opening up.

(c)