$A = \frac{\partial^2 H}{\partial x^2} = 1 + 2e^{2x} > 0$ ∴ The fixed point is a minimum.

$\frac{7}{7}$

b) $\dot{x} = x^2 - 4$, $\dot{y} = y^2 + xy - 3$
fixed points are at $\dot{x} = \dot{y} = 0$
ie $0 = x^2 - 4 = (x+2)(x-2) \Rightarrow x = -2, 2$
$0 = y^2 + xy - 3$
Put $x = -2$
$0 = y^2 - 2y - 3 = (y+1)(y-3) \Rightarrow y = -1, 3$
∴ $(-2,-1), (-2,3)$ are fixed points
Put $x = 2$
$0 = y^2 + 2y - 3 = (y+3)(y-1) \Rightarrow y = -3, 1$
∴ $(2,-3), (2,1)$ are fixed points.
Nature of the fixed points is given by the eigenvalues of the Jacobian matrix.

Notation again!

$\frac{\partial \dot{x}}{\partial x} = \frac{\partial}{\partial x}(x^2 - 4) = 2x$

$\frac{\partial \dot{x}}{\partial y} = \frac{\partial}{\partial y}(x^2 - 4) = 0$

$\frac{\partial \dot{y}}{\partial x} = \frac{\partial}{\partial x}(y^2 + xy - 3) = y$

$\frac{\partial \dot{y}}{\partial y} = \frac{\partial}{\partial y}(y^2 + xy - 3) = 2y + x$

ie Jacobian matrix is
$\begin{pmatrix} 2x & 0 \\ y & 2y+x \end{pmatrix}$, and its eigenvalues are found from
$\det\begin{pmatrix} 2x-\lambda & 0 \\ y & 2y+x-\lambda \end{pmatrix} = 0$ for each fixed point (x_f, y_f).
$(-2,-1)$