1) Given the line \( r : 2x_1 - 3x_2 = 1 \) on an affine plane, find the equations of the projection onto \( r \) in the direction \( \vec{w}(1,1) \) and the equations of the reflection with respect to \( r \) in the direction \( \vec{w} \).

2) Find the equations of the reflection with respect to the plane \( \pi : 2x - y + z = 1 \) in the direction \( \vec{w}(0,1,2) \).

3) Let \( f \) be an affinity with equations
\[
\begin{align*}
  x'_1 &= 2x_1 + 3x_2 - 2 \\
  x'_2 &= 2x_1 + 7x_2 - 3
\end{align*}
\]
find, if possible, the fixed points and the invariant lines under \( f \).

4) Let \( f \) be an affinity with equations
\[
\begin{align*}
  x'_1 &= -2x_1 + x_2 - 1 \\
  x'_2 &= 4x_1 + x_2 - 2
\end{align*}
\]
find, if possible, the fixed points and the invariant lines under \( f \).

5) Let \( A \) be an affine plane and let \( R = (O, B) \) be a reference frame in \( A \). Let \( f \) be an affinity such that \((f(P))_R = (-1,1)\) with \((P)_R = (1,1)\); \((f(Q))_R = (-1,2)\) with \((Q)_R = (2,-1)\) and \((f(T))_R = (0,1)\) with \((T)_R = (1,0)\). Find, if possible, the fixed points and the invariant lines under \( f \).

6) Is it the affinity with equations
\[
\begin{align*}
  x' &= 2x + 2y + 1 \\
  y' &= 3x + y + 3
\end{align*}
\]
a homology? Find, if possible, the invariant lines under \( f \).

7) Let \( f \) be an affinity with \( P(1,2) \) and \( Q(-1,-2) \) as fixed points and taking \( M(-1,0) \) to \( M'(2,0) \).

   a) Is \( f \) a homology? If so, find its axis and its direction
   b) If there existed invariant lines under \( f \), which would they be?.

8) If \( g \) is a homology with axis the line \( m \) and it takes the point \( P \) to the point \( P' \), sketch the image under \( g \) of the line passing through \( N \) and \( T \).
13) If $h_1$ is a homothety with centre $Q$ that takes $M$ to $M'$ and $h_2$ is the homology that takes $Q$ to $Q'$ and has the line $r$ as axis, sketch the image under $h_2 \circ h_1$ of $X$, $X'$. Explain carefully the steps you take in order to get $X'$.