1. (i) is the only one which can happen.

2. (a) $\mathbf{x} \cdot \mathbf{y} = 0$

   (b) $\|\mathbf{x}\| = \sqrt{91}$; $\|\mathbf{y}\| = \sqrt{91}$

   (c) $\text{dist}(\mathbf{x}, \mathbf{y}) = \|\mathbf{x} - \mathbf{y}\| = \|\langle -3, 5, 1, 5, 11, 1 \rangle\| = \sqrt{182}$

   (d) angle $= \cos^{-1}(0) = \pi/2$

   (e) Because $\mathbf{x}$ and $\mathbf{y}$ are linearly independent, W has dimension 2.

   (f) Both $\mathbf{x}$ and $\mathbf{y}$ live in $\mathbb{R}^6$, so the dimension of $W^\perp$ is $6 - 2 = 4$.

   (g) Write out the equations for $\mathbf{u} \cdot \mathbf{x} = 0$, $\mathbf{u} \cdot \mathbf{y} = 0$, $\mathbf{v} \cdot \mathbf{x} = 0$, and $\mathbf{v} \cdot \mathbf{y} = 0$ and plug in accordingly to get the right answer.

   For example: $\mathbf{u} \cdot \mathbf{x} = 0 \Leftrightarrow u_1 + 2u_2 + 3u_3 + 4u_4 + 5u_5 + 6u_6 = 0$. That's one of the equations; there should be three others.

3. (a) This depends on how creative you decided to be, but make sure it's non-diagonal, is 5×5, has real entries, and is symmetric.

   (b) Regardless of what you picked for (a), all of the eigenvalues should be real. That's a property of symmetric matrices.

   (c) Regardless of what you picked for (a), all of the eigenspaces should be orthogonal (i.e. have angle $\pi/2$ between them). That's *also* a property of symmetric matrices.

4. (a) True

   (b) True

   (c) False

   (d) False

   (e) False

   (f) True

   (g) True

   (h) True

   (i) True

   (j) True

   (k) False

   (l) True

(m) True

(n) False

(o) True

(p) True

(q) True

(r) True

(s) False

(t) True

(u) True

(v) True

(w) False

(x) True

(y) False