1. (a) $|PQ| = 6$
   $|QR| = 2\sqrt{10}$
   $|RP| = 6$
   PQR is not a right triangle.
   PQR is isosceles.

   (b) $|PQ| = 3$
   $|QR| = 3\sqrt{5}$
   $|RP| = 6$
   PQR is a right triangle.
   PQR is not isosceles.

2. $$\mathbf{c} = \frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b}$$
   $$\mathbf{d} = -\frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b}$$

3. (a) $|\langle 4, 1, 8\rangle| = 9$, we have $\cos\alpha = \frac{4}{9}, \cos\beta = \frac{1}{9}, \cos\gamma = \frac{8}{9}$. The direction angles are given by $\alpha = \arccos\frac{4}{9}, \beta = \arccos\frac{1}{9}, \gamma = \arccos\frac{8}{9}$

   (b) $|3\mathbf{i} - \mathbf{j} - 2\mathbf{k}| = \sqrt{14}$, we have $\cos\alpha = \frac{3}{\sqrt{14}}, \cos\beta = -\frac{1}{\sqrt{14}}, \cos\gamma = -\frac{2}{\sqrt{14}}$. The direction angles are given by $\alpha = \arccos\frac{3}{\sqrt{14}}, \beta = \arccos\left(-\frac{1}{\sqrt{14}}\right), \gamma = \arccos\left(-\frac{2}{\sqrt{14}}\right)$

   (c) $|\langle c, c, c\rangle| = \sqrt{3}c$, we have $\cos\alpha = \cos\beta = \cos\gamma = \frac{1}{\sqrt{3}}$. The direction angles are given by $\alpha = \beta = \gamma = \arccos\frac{1}{\sqrt{3}}$