$\boxed{1}$

(a) $|\bar{u} \times \bar{v}| = |u|\,|v| \sin\theta$

$= 3 \times 5 \times \sin 90°$

$= 15$

$\theta = 90°$ as u and v are orthogonal

(b) $\bar{u} \times \bar{v}$ is orthogonal to $\bar{u}$

$\bar{u} \times \bar{v}$ is orthogonal to $\bar{v}$

x-coordinate > 0

(c) y-coordinate $= 0$

(d) z-coordinate > 0

$\boxed{2}$ Given

$|\bar{u}| = 2\sqrt{2}$, $|\bar{v}| = 2\sqrt{2}$

$|u-v| = 2\sqrt{2}$

$|u+v| = ?$, $(\bar{u},\bar{v}) = ?$

(a) $|u-v| = \sqrt{u^2+v^2-2uv\cos\theta}$

$\Rightarrow 2\sqrt{2} = \sqrt{(2\sqrt{2})^2+(2\sqrt{2})^2-2(2\sqrt{2})(2\sqrt{2})\cos\theta}$

$\Rightarrow 2\sqrt{2} = \sqrt{8+8-16\cos\theta}$

$= \sqrt{16-16\cos\theta}$

$\Rightarrow 2\sqrt{2} = 4\sqrt{1-\cos\theta}$

$\Rightarrow 8 = 16(1-\cos\theta)$

$\Rightarrow \frac{1}{2} = 1-\cos\theta$

$\Rightarrow \cos\theta = 1-1/2 = 1/2$

$\Rightarrow \theta = 60^\circ$

$|u+v| = \sqrt{u^2+v^2+2uv\cos\theta}$

$= \sqrt{(2\sqrt{2})^2+(2\sqrt{2})^2+2(2\sqrt{2})(2\sqrt{2})\cos 60^\circ}$

$= \sqrt{8+8+\cancel{2}(8)\times\frac{1}{\cancel{2}}}$

$= \sqrt{24} = \sqrt{4\times 6} = 2\sqrt{6}$

(b) $\theta = \pi/3$

$\boxed{3}$

(a) $a = 0$

Leading entry of first row is 1
Row echelon form has multiple properties.

(P1) All the leading entries in each of the rows of the matrix are 1

$$\begin{bmatrix} 1 & 3 & 2 \\ a & 6 & 2 \\ 0 & 9 & 5 \end{bmatrix}$$

(P2) If a column contains a leading entry then all entries below the leading entry are zero.

$\therefore$ $a = 0$

(b) For what values of a is the matrix singular?

- A square matrix is singular if and only if its determinant is zero.

$\Rightarrow 1(30-18) - 3(5a-0) + 2(9a-0) = 0$

$\Rightarrow 12 - 15a + 18a = 0$

$\Rightarrow 12 + 3a = 0$

$\Rightarrow a = -4$