1.1

Yes. It is . No, just this.

1.2

No. cannot be orthogonal to both vectors in a 2D plane.

1.3

Both will have an infinite amount of possible vectors.

2.

The value would be 0. Yes. Because the 0 is unique.

3. Plug in the two points on the matrix including a,b,c and set the determinant to 0. Solve.

4.

As we can see, if i and j in matches the order of subscripts and , then it will hold its respective vector.

5.

The determinant is 0 when all points lie on a plane as they would not form a tetrahedron.

6. Plug in the 4 points on the matrix and set the determinant to 0. Solve.

7. It is a vector orthogonal between the cross product two vector. It is also the area. The relationship of n and in terms of the dot product is the volume. As seen in questions 5 and 6, if the dot product of the cross product vector of the 3 points is 0, then the volume is 0 and thus, it must be on the plane.

8.

A sphere.

9.

Solve the system of linear equations to find abcd. Then apply to .

10.

For (a), all points include .

For (b),

11.

The matrix is an ellipsoid, thus it can be anywhere in the range between 0 and the max eigenvalue, which is the longest length.

The matrix is a hyperboloid, so there exists a vector that is the center.

The both eigenvalues must both be positive.

12.