# CF - Vectors

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| **What are the 2 equations for the scalar product?** | *Where θ is the acute angle between the 2 vectors.* |
| **When are two vectors perpendicular?** | When **a**.**b** = 0 |
| **What is the vector/cross product?** | * **a** x **b** = **n** where **n** is a vector normal to both **a** and **b**.      * From the textbook:     *In 2D, the cross product gives the area of a parallelogram made of the 2 vectors. This is since you can express the 2 vectors as a matrix and the determinant (change in area from a unit square) is its area. Whereas in 3D, the cross product of 2 vectors is another vector whose length is the area of the parallelogram.*  *You can ensure you get the right direction by this:* <https://www.youtube.com/watch?v=zGyfiOqiR4s>*.* |
| **When are 2 vectors parallel?** | When **a** x **b** = **0** |
| **How can you work out the area of a triangle using cross product?** | Since…    and    so… |
| **What is the vector equation of a plane?** | *Where* ***a*** *is some point on the plane and where* ***s*** *and* ***t*** *are 2 non-parallel vectors used to define the plane.* |
| **What is the vector product form of a line?** | Since… |
| **What is the dot/scalar product equation of a plane?** | Since… |
| **What is the Cartesian equation of a plane and how does it relate to another form?** |  |
| **How do you show 2 planes are the same?** | 1. Show they have the normals which are parallel (so planes are parallel). 2. Check if the point of one lies on the other. |
| **How can you work out the shortest distance from a point to a plane?** | 1. Form a line from that point (P) perpendicular to the plane. 2. Find where it intersects the plane (Q). 3. Calculate the distance PQ.   From the textbook: |
| **How can you work out the angle between a line and plane?** | 1. Find the angle between the direction vector of the line and the normal of the plane using the dot product. 2. Do 90 - (angle above) (aka finding the complement). |
| **How can you find the angle between 2 planes?** | Find the angle between their normals. |
| **How can you find the distance between 2 skew lines using 2 different methods?** | **First Method:**   1. Consider a general point on both lines. 2. Find a vector joining these 2 general point. 3. Dot this vector with the direction vector of both lines. 4. Use the newly found vector and calculate its magnitude.       **Second Method:**   1. Consider the component of the general vector perpendicular to the lines. 2. Multiply by the magnitude of that unit vector. 3. Use the dot product in reverse. 4. Use the scalar product. |
| **How do you work out the distance between a point and line (or 2 parallel lines) using 2 different methods?** | **First Method:**   1. Calculate the vector between a general point on the line and the point in question (P). 2. Dot this vector with the direction vector of the line. 3. Calculate its magnitude.   **Second Method:** |
| **How can you find the line of intersection of 2 planes?** | 1. Eliminate one of the variables. 2. Let another variable equal λ. 3. Find the remaining variables that define the line.   **Example:**  (A), x + y + z = -1  (B), x + 2y + 3z = -4  (B) - (A) gives (C), y + 2z = -3 which is true for all points on the line.  Let z = λ so y = -2λ - 3 from (C) and x = 2 + λ from (A). These all define the line of intersection. |