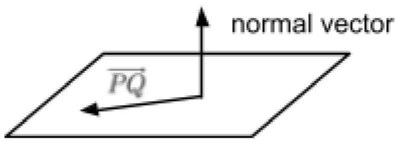
2.4 Cartesian Equation of a Plane

Another way to describe a plane is to describe the set of vectors perpendicular to a normal vector.



If $\vec{n} = (A, B, C)$ and $\overrightarrow{PQ} = (x - x_0, y - y_0, z - z_0)$ where $\overrightarrow{PQ}$ is some vector on the plane.

For any $\overrightarrow{PQ}$, $\vec{n} \cdot \overrightarrow{PQ} = 0$ and it can be shown that Ax + By + Cz + D = 0.

The good news is that this equation is unique. There is only one normal to a plane, and all other normal vectors will be collinear to it. If a point (x,y,z) satisfies the equation, then it is a point on the plane.

Ex Determine the equation of the plane:

(a) that contains A(1,2,2) and has a normal $\vec{n} = (-1, 2, 6)$.

-x+2y+6z-15=0

(b) that contains the points A(-1,2,5), B(3,2,4) and C(-2,-3,6).

5x+3y+20z-101=0

(c) whose vector equation is (x,y,z) = (1,2,−1) + s(1,0,2) + t(−1,3,4)

2x+2y-z-7=0

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