1.2.14

In the notation of Theorem 2, show that if $\vec{n}$ has length 1, then $|d|$ is the distance of the plane from the origin.

If $\vec{r}$ represents a displacement vector from the origin to any point in the plane,

$$\frac{\vec{r}\cdot\vec{n}}{|\vec{n}|}$$

is the scalar projection of $\vec{r}$ onto $\vec{n}$, the magnitude of which represents the distance of the plane from the origin.

Since $\vec{n}$ has length 1, $|\vec{n}|=1$, therefore

$$\frac{\vec{r}\cdot\vec{n}}{|\vec{n}|}=\frac{\vec{r}\cdot\vec{n}}{1}=\vec{r}\cdot\vec{n}$$

Thus, the distance from the origin to the plane is simply $|\vec{r}\cdot\vec{n}|$

And from Theorem 2:

$$\vec{n}\cdot\vec{r}=d$$

Consequently,

$$|\vec{r}\cdot\vec{n}|=|d|$$

Thus, $|d|$ represents the distance of the plane from the origin.