52. (a) We write $\vec{b} = b\,\hat{\jmath}$ where $b > 0$. We are asked to consider

$$\frac{\vec{b}}{d} = \left(\frac{b}{d}\right)\hat{\jmath}$$

in the case $d > 0$. Since the coefficient of $\hat{\jmath}$ is positive, then the vector points in the $+y$ direction.

(b) If, however, $d < 0$, then the coefficient is negative and the vector points in the $-y$ direction.

(c) Since $\cos 90° = 0$, then $\vec{a} \cdot \vec{b} = 0$, using Eq. 3-20.

(d) Since $\vec{b}/d$ is along the y axis, then (by the same reasoning as in the previous part) $\vec{a} \cdot (\vec{b}/d) = 0$.

(e) By the right-hand rule, $\vec{a} \times \vec{b}$ points in the $+z$ direction.

(f) By the same rule, $\vec{b} \times \vec{a}$ points in the $-z$ direction. We note that $\vec{b} \times \vec{a} = -\vec{a} \times \vec{b}$ is true in this case and quite generally.

(g) Since $\sin 90° = 1$, Eq. 3-27 gives $|\vec{a} \times \vec{b}| = ab$ where a is the magnitude of $\vec{a}$. Also, $|\vec{a} \times \vec{b}| = |\vec{b} \times \vec{a}|$ so both results have the same magnitude.

(h) and (i) With $d > 0$, we find that $\vec{a} \times (\vec{b}/d)$ has magnitude ab/d and is pointed in the $+z$ direction.