

78. We choose a coordinate system with origin at the clock center and  $+x$  rightward (towards the “3:00” position) and  $+y$  upward (towards “12:00”).

(a) In unit-vector notation, we have (in centimeters)  $\vec{r}_1 = 10\hat{i}$  and  $\vec{r}_2 = -10\hat{j}$ . Thus, Eq. 4-2 gives

$$\Delta\vec{r} = \vec{r}_2 - \vec{r}_1 = -10\hat{i} - 10\hat{j} \longrightarrow (14 \angle -135^\circ)$$

where we have switched to magnitude-angle notation in the last step.

(b) In this case,  $\vec{r}_1 = -10\hat{j}$  and  $\vec{r}_2 = 10\hat{j}$ , and  $\Delta\vec{r} = 20\hat{j}$  cm.

(c) In a full-hour sweep, the hand returns to its starting position, and the displacement is zero.