CURVATURE

For each of the following curves, find the curvature at the indicated value for *t*. Also, state the radius of the best fitting circle at this point $\left(\text{circle radius } = r = \frac{1}{\kappa}\right)$. If $\kappa = 0$, then state that $\text{circle radius } = \infty$.

1. $\vec{r}(t) = \cos(t)\hat{i} + \sin(t)\hat{j},\ 0 \le t \le 2\pi,\ t = \frac{\pi}{4}$

2. $\vec{r}(t) = 2\cos(t)\hat{i} - 2\sin(t)\hat{j},\ 0 \le t \le 2\pi,\ t = \frac{5\pi}{4}$

3. $\vec{r}(t) = (2+3t)\hat{i} + (1+4t)\hat{j},\ 0 \le t \le 2,\ t = 1$

4. $\vec{r}(t) = t\hat{i} + t^2\hat{j},\ -2 \le t \le 2,\ t = 1$

5. $\vec{r}(t) = \sin t\hat{i} + t\hat{j},\ 0 \le t \le 2\pi,\ t = \pi$