p. 888 (11.4)

Find an arc length parameterization of the given two-dimensional curve.

5. The circle of radius 2 centered at the origin.
6. The circle of radius 5 centered at the origin.
7. The line segment from the origin to the point (3, 4)
8. The line segment from (1, 2) to the point (5, -2)

Find the unit tangent vector to the curve at the indicated points.

9. $\vec{r}(t) = \langle 3t, t^2 \rangle,\ t = 0,\ t = -1,\ t = 1$

11. $\vec{r}(t) = \langle 3\cos t, 2\sin t \rangle,\ t = 0,\ t = -\frac{\pi}{2},\ t = \frac{\pi}{2}$

13. $\vec{r}(t) = \langle 3t, \cos 2t, \sin 2t \rangle,\ t = 0,\ t = -\pi,\ t = \pi$

15. Sketch the curve in exercise 11 along with the vectors $\vec{r}(0),\ \vec{T}(0),\ \vec{r}(\frac{\pi}{2})$ and $\vec{T}(\frac{\pi}{2})$.

17. Sketch the curve in exercise 13 along with the vectors $\vec{r}(0),\ \vec{T}(0),\ \vec{r}(\pi)$ and $\vec{T}(\pi)$.

Find the curvature at the given point.

19. $\vec{r}(t) = \langle e^{-2t}, 2t, 4 \rangle,\ t = 0$

21. $\vec{r}(t) = \langle t, \sin 2t, 3t \rangle,\ t = 0$

25. $f(x) = \sin x,\ x = \frac{\pi}{2}$

26. $f(x) = e^{-3x},\ t = 0$

27. For $f(x) = \sin x$, show that the curvature is the same at $x = \frac{\pi}{2}$ and $x = \frac{3\pi}{2}$. Use the graph of $y = \sin x$ to predict whether the curvature would be larger or smaller at $x = \pi$.

28. For $f(x) = e^{-3x}$, show that the curvature is larger at $x = 0$ than at $x = 2$. Use the graph of $y = e^{-3x}$ to predict whether the curvature would be larger or smaller at $x = 4$.

Sketch the curve and compute the curvature at the indicated points.

29. $\vec{r}(t) = \langle 2\cos 2t, 2\sin 2t, 3t \rangle,\ t = 0,\ t = \frac{\pi}{2}$

31. $\vec{r}(t) = \langle t, t, t^2 - 1 \rangle,\ t = 0,\ t = 2$

Sketch the curve and find any points of maximum or minimum curvature.

33. $\vec{r}(t) = \langle 2\cos t, 3\sin t \rangle$

34. $\vec{r}(t) = \langle 4\cos t, 3\sin t \rangle$

Graph the curvature function $\kappa(x)$ and find the limit of the curvature as $x \to \infty$.

37. $y = e^{2x}$

38. $y = e^{-2x}$

43. Label as True or False and explain: at a relative extremum of $y = f(x)$, the curvature is either a minimum or maximum.

44. Label as True or False and explain: at an inflection point of $y = f(x)$, the curvature is zero.