p.547: 7-25 odd

9.1 HW Selected Answers

7. $x = 4\sin(t) \quad y = 2\cos(t)$

$\frac{dx}{dt} = 4\cos(t) \quad \frac{dy}{dt} = -2\sin(t)$

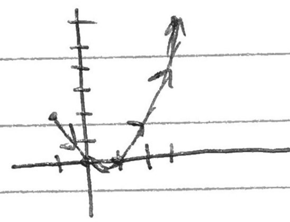
$$\boxed{\frac{dy}{dx} = \frac{-2\sin(t)}{4\cos(t)} = \frac{-\sin(t)}{2\cos(t)}} \boxed{= -\frac{1}{2}\tan(t)}$$

$$\frac{d^2y}{dx^2} = \frac{\left[\frac{2\cos(t)(-\cos(t)) - (-\sin(t))(2(-\sin(t)))}{4\cos^2(t)}\right]}{4\cos(t)} = \frac{-2\cos^2(t) - 2\sin^2(t)}{16\cos^3(t)}$$

$$= \frac{-2[\cos^2(t) + \sin^2(t)]}{16\cos^3(t)} = \frac{-2(1)}{16\cos^3(t)} = \frac{-2}{16\cos^3(t)} = \frac{-1}{8\cos^3(t)} = \boxed{-\frac{1}{8}\sec^3(t)}$$

17. a)

t	x	y
-2	-1	2
-1	0	0
0	1	0
1	2	2
2	3	6



b) lowest point: y at a min: $\frac{dy}{dt} = 2t+1$ $\quad \frac{dy}{dt}$ changes $- \to +$ is lowest point.

At $t = -\frac{1}{2}$, t changes from $- \to +$

$t = -\frac{1}{2} \quad x = \frac{1}{2} \quad y = -\frac{1}{4} \quad \boxed{\left(\frac{1}{2}, -\frac{1}{4}\right)}$

c) At $t = -\frac{1}{2}$, the curve hits its lowest point b/c $\frac{dy}{dt}$ changes from neg to pos.

The point is $\left(\frac{1}{2}, -\frac{1}{4}\right)$

23. $x = 2 + \cos(t) \quad y = -1 + \sin(t)$

$\frac{dx}{dt} = -\sin(t) \quad \frac{dy}{dt} = \cos(t) \qquad \frac{dy}{dx} = \frac{\cos(t)}{-\sin(t)}$

a) horizontal tangent when $\frac{dy}{dx} = 0$, so $\cos(t) = 0$. That's at $t = \frac{\pi}{2} + \pi n$ where n is an integer

let's use $t = \frac{\pi}{2}$ and $\frac{3\pi}{2}$ as our times: $\underbrace{x = 2, y = 0}_{t = \frac{\pi}{2}}$ and $\underbrace{x = 2, y = -2}_{t = \frac{3\pi}{2}}$

b) vertical tangents when $\frac{dy}{dx}$ DNE, so $\sin(t) = 0$. $t = 0, \pi$

$\underbrace{x = 3, y = -1}_{t = 0}$ and $\underbrace{x = 1, y = -1}_{t = \pi}$