9. Differentiate $y = \sec(\theta)\tan(\theta)$. One way:

10 pts

$$y = \frac{\sin\theta}{(\cos\theta)^2}$$

$$\frac{dy}{d\theta} = \frac{(\cos\theta)^2\cos\theta - \sin\theta \cdot 2\cos\theta(-\sin\theta)}{\cos^4\theta} \quad //$$

Note $= \dfrac{\cos\theta\,[\cos^2\theta + 2\sin^2\theta]}{\cos^4\theta} = \dfrac{\cos^2\theta + \sin^2\theta + \sin^2\theta}{\cos^3\theta}$

$$= \frac{1 + \sin^2\theta}{\cos^3\theta}.$$

10. Calculate $\lim_{t\to 0} \frac{\sin^2(3t)}{t^2}$. Keep in mind that $\lim_{\theta\to 0} \frac{\sin(\theta)}{\theta} = 1$.

10 pts

$$\lim_{t\to 0} 3\left(\frac{\sin 3t}{3\cdot t}\right)\cdot\left(\frac{\sin 3t}{t}\cdot 3\right)$$

(note $3t \to 0$ as $t \to 0$)

$= 9.$

11. Differentiate $y = \sin(\cos(\sqrt{x}))$.

10 pts

$$y' = \cos(\cos\sqrt{x})\cdot\frac{d}{dx}(\cos\sqrt{x})$$

$$= \cos(\cos\sqrt{x})\cdot(-\sin\sqrt{x})\frac{d}{dx}\sqrt{x}$$

$$= -\cos(\cos\sqrt{x})\sin\sqrt{x}\ \frac{1}{2}x^{-1/2}.$$