**MATH235 Calculus 1**
**Problems on Finding Derivatives.**
**09/23/2010**

Find the derivative of the given function.

1. $y = 9\tan\frac{x}{3}$

$$\begin{aligned}\frac{dy}{dx} &= 9\sec^2(\frac{x}{3})\frac{1}{3} && \text{by the Chain Rule,}\\ &= 3\sec^2(\frac{x}{3})\end{aligned}$$

2. $s = \sin^2(\theta^2 e^\theta) = (\sin(\theta^2 e^\theta))^2$

$$\begin{aligned}\frac{ds}{d\theta} &= 2\sin(\theta^2 e^\theta)\frac{d}{d\theta}(\sin(\theta^2 e^\theta)) && \text{by the Power Rule and the Chain Rule,}\\ &= 2\sin(\theta^2 e^\theta)\cos(\theta^2 e^\theta)\frac{d}{d\theta}(\theta^2 e^\theta) && \text{by the Chain Rule,}\\ &= 2\sin(\theta^2 e^\theta)\cos(\theta^2 e^\theta)(2\theta e^\theta + \theta^2 e^\theta) && \text{by the Product Rule,}\\ &= 2\theta e^\theta \sin(\theta^2 e^\theta)\cos(\theta^2 e^\theta)(2+\theta)\end{aligned}$$

3. $y = (9x^2 - 6x + 2)e^{x^3}$

$$\begin{aligned}\frac{dy}{dx} &= (18x-6)e^{x^3} + (9x^2-6x+2)\frac{d}{dx}e^{x^3} && \text{by the Product Rule,}\\ &= (18x-6)e^{x^3} + (9x^2-6x+2)e^{x^3}3x^2 && \text{by the Chain Rule,}\\ &= e^{x^3}(27x^4 - 18x^3 + 6x^2 + 18x - 6)\end{aligned}$$

4. $r = sec\sqrt{\theta}\tan\frac{1}{\theta}$

$$\begin{aligned}\frac{dr}{d\theta} &= \frac{d}{d\theta}(\sec\sqrt{\theta})\tan\frac{1}{\theta} + \sec\sqrt{\theta}\frac{d}{d\theta}(\tan\frac{1}{\theta}) && \text{by the Product Rule,}\\ &= \sec\sqrt{\theta}\tan\sqrt{\theta}(\frac{d}{d\theta}\sqrt{\theta})\tan\frac{1}{\theta} + \sec\sqrt{\theta}\sec^2\frac{1}{\theta}(\frac{d}{d\theta}\frac{1}{\theta}) && \text{by the Chain Rule,}\\ &= \sec\sqrt{\theta}\tan\sqrt{\theta}(\frac{1}{2\sqrt{\theta}})\tan\frac{1}{\theta} + \sec\sqrt{\theta}\sec^2\frac{1}{\theta}(\frac{-1}{\theta^2})\\ &= \sec\sqrt{\theta}(\frac{1}{2\sqrt{\theta}}\tan\sqrt{\theta}\tan\frac{1}{\theta} - \frac{1}{\theta^2}\sec^2\frac{1}{\theta})\end{aligned}$$

5. $y = e^{\sqrt{3x+1}}$

$$\begin{aligned}
\frac{dy}{dx} &= e^{\sqrt{3x+1}} \frac{d}{dx}\sqrt{3x+1} && \text{by the Chain Rule,} \\
&= e^{\sqrt{3x+1}} \frac{1}{2}(3x+1)^{-\frac{1}{2}} \frac{d}{dx}(3x+1) && \text{by the Power Rule and the Chain Rule,} \\
&= \frac{3e^{\sqrt{3x+1}}}{2\sqrt{3x+1}}
\end{aligned}$$

6. $y = \sin^5 x = (\sin x)^5$

$$\begin{aligned}
\frac{dy}{dx} &= 5\sin^4 x \frac{d}{dx}\sin x && \text{by the Chain Rule,} \\
&= 5\sin^4 x \cos x
\end{aligned}$$

7. $y = \dfrac{2}{3x-2} = 2(3x-2)^{-1}$

$$\begin{aligned}
\frac{dy}{dx} &= -2(3x-2)^{-2} \frac{d}{dx}(3x-2) && \text{by the Power Rule and the Chain Rule,} \\
&= \frac{-6}{(3x-2)^2}
\end{aligned}$$

8. $y = 3x(x^2+2x)^{\frac{2}{3}}$

$$\begin{aligned}
\frac{dy}{dx} &= 3(x^2+2x)^{\frac{2}{3}} + 3x\frac{d}{dx}((x^2+2x)^{\frac{2}{3}}) && \text{by the Product Rule,} \\
&= 3(x^2+2x)^{\frac{2}{3}} + 3x(\frac{2}{3}(x^2+2x)^{-\frac{1}{3}} \frac{d}{dx}(x^2+2x)) && \text{by the Power Rule and the Chain Rule,} \\
&= 3(x^2+2x)^{\frac{2}{3}} + \frac{4x^2+4x}{(x^2+2x)^{\frac{1}{3}}} \\
&= \frac{3(x^2+2x)+4x^2+4x}{(x^2+2x)^{\frac{1}{3}}} \\
&= \frac{7x^2+10x}{(x^2+2x)^{\frac{1}{3}}}
\end{aligned}$$