

4. Let  $u = g(x) = \sin x$  and  $y = f(u) = \tan u$ . Then  $\frac{dy}{dx} = \frac{dy}{du} \frac{du}{dx} = (\sec^2 u)(\cos x) = \sec^2(\sin x) \cdot \cos x$ ,  
or equivalently,  $[\sec(\sin x)]^2 \cos x$ .

10.  $f(t) = \sqrt[3]{1 + \tan t} = (1 + \tan t)^{1/3} \Rightarrow f'(t) = \frac{1}{3}(1 + \tan t)^{-2/3} \sec^2 t = \frac{\sec^2 t}{3 \sqrt[3]{(1 + \tan t)^2}}$

14.  $y = 4 \sec 5x \Rightarrow y' = 4 \sec 5x \tan 5x(5) = 20 \sec 5x \tan 5x$

26.  $y = \frac{\sin^2 x}{\cos x} \Rightarrow$

$$y' = \frac{\cos x (2 \sin x \cos x) - \sin^2 x (-\sin x)}{\cos^2 x} = \frac{\sin x (2 \cos^2 x + \sin^2 x)}{\cos^2 x} = \frac{\sin x (1 + \cos^2 x)}{\cos^2 x}$$

$$= \sin x (1 + \sec^2 x)$$

*Another method:*  $y = \tan x \sin x \Rightarrow y' = \sec^2 x \sin x + \tan x \cos x = \sec^2 x \sin x + \sin x$

30.  $y = x \sin \frac{1}{x} \Rightarrow y' = \sin \frac{1}{x} + x \cos \frac{1}{x} \left(-\frac{1}{x^2}\right) = \sin \frac{1}{x} - \frac{1}{x} \cos \frac{1}{x}$

36.  $y = \sqrt{x + \sqrt{x + \sqrt{x}}} \Rightarrow y' = \frac{1}{2} \left(x + \sqrt{x + \sqrt{x}}\right)^{-1/2} \left[1 + \frac{1}{2}(x + \sqrt{x})^{-1/2} \left(1 + \frac{1}{2}x^{-1/2}\right)\right]$

58. The use of  $D, D^2, \dots, D^n$  is just a derivative notation (see text page 86). In general,  $Df(2x) = 2f'(2x)$ ,

$D^2 f(2x) = 4f''(2x), \dots, D^n f(2x) = 2^n f^{(n)}(2x)$ . Since  $f(x) = \cos x$  and  $50 = 4(12) + 2$ , we have

$f^{(50)}(x) = f^{(2)}(x) = -\cos x$ , so  $D^{50} \cos 2x = -2^{50} \cos 2x$ .

60. (a)  $s = A \cos(\omega t + \delta) \Rightarrow \text{velocity} = s' = -\omega A \sin(\omega t + \delta)$ .

(b) If  $A \neq 0$  and  $\omega \neq 0$ , then  $s' = 0 \Leftrightarrow \sin(\omega t + \delta) = 0 \Leftrightarrow \omega t + \delta = n\pi \Leftrightarrow t = \frac{n\pi - \delta}{\omega}$ ,  $n$  an integer.