4.1 day 1

Saturday, September 16, 2017 8:14 PM

pg. 160 # 1-7, 12, 13, 53, 55

1. $y = \sin(3x+1)$

$u = 3x+1$

$du = 3$

$\frac{dy}{dx} = \cos u \cdot du$

$= \cos(3x+1) \cdot 3$

$= 3\cos(3x+1)$

2. $y = \sin(7-5x)$

$u = 7-5x$

$du = -5$

$\frac{dy}{dx} = \cos u \cdot du$

$= \cos(7-5x) \cdot -5$

$= -5\cos(7-5x)$

3. $y = \cos(\sqrt{3}x)$

$u = \sqrt{3}x$

$du = \sqrt{3}$

$\frac{dy}{dx} = -\sin u \cdot du$

$= -\sin\sqrt{3}x \cdot \sqrt{3}$

$= -\sqrt{3}\sin\sqrt{3}x$

4. $y = \tan(2x-x^3)$

$u = 2x-x^3$

$du = 2-3x^2$

$\frac{dy}{dx} = \sec^2 u \cdot du$

$= \sec^2(2x-x^3) \cdot (2-3x^2)$

$= (2-3x^2)\sec^2(2x-x^3)$

5. $y = \left(\frac{\sin x}{1+\cos x}\right)^2$

$u = \frac{\sin x}{1+\cos x}$

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

$= \frac{\cos x + \overbrace{\cos^2 x + \sin^2 x}^{1}}{(1+\cos x)^2}$ Pythagorean Identity!

$= \frac{1+\cos x}{(1+\cos x)^2}$

$= \frac{1}{1+\cos x}$

$\frac{dy}{dx} = 2u \cdot du$

$= \frac{2\sin x}{1+\cos x} \cdot \frac{1}{1+\cos x}$

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

$1+\cos x$

6. $y = 5\cot\left(\frac{2}{x}\right)$

$u = \frac{2}{x} = 2x^{-1}$

$du = -2x^{-2}$

$\frac{dy}{dx} = -5\csc^2 u \cdot du$

$= -5\csc^2\left(\frac{2}{x}\right) \cdot -2x^{-2}$

$= \frac{10\csc^2\left(\frac{2}{x}\right)}{x^2}$

7. $y = \cos(\sin x)$

$u = \sin x$

$du = \cos x$

$\frac{dy}{dx} = -\sin u \cdot du$

$= -\sin(\sin x) \cdot \cos x$

12. $s = \sin\left(\frac{3\pi}{2}t\right) + \cos\left(\frac{7\pi}{4}t\right)$

$v(t) = s'(t) = \cos\left(\frac{3\pi}{2}t\right) \cdot \frac{3\pi}{2} + -\sin\left(\frac{7\pi}{4}t\right) \cdot \frac{7\pi}{4}$

$= \frac{3\pi}{2}\cos\left(\frac{3\pi}{2}t\right) - \frac{7\pi}{4}\sin\left(\frac{7\pi}{4}t\right)$

13. $y = (x+\sqrt{x})^{-2}$

$u = x + \sqrt{x}$

$du = 1 + 1/2x^{-1/2}$

$\frac{dy}{dx} = -2u^{-3} \cdot du$

$= -2(x+\sqrt{x})^{-3} \cdot (1 + \frac{1}{2}x^{-1/2})$

$= \frac{-2 - x^{-1/2}}{(x+\sqrt{x})^3}$

53. $y = \sin\left(\frac{x}{2}\right)$

$\frac{dy}{dx} = \cos\left(\frac{x}{2}\right) \cdot \frac{1}{2}$

$= \frac{1}{2}\cos\left(\frac{x}{2}\right)$

The max parent cosine value is 1. Therefore, $\frac{1}{2}\cos$ has a max of $\frac{1}{2}$.

55. $y = 2\tan\left(\frac{\pi x}{4}\right)$

$\frac{dy}{dx} = 2\sec^2\left(\frac{\pi x}{4}\right) \cdot \frac{\pi}{4}$

$y_{|x=1} = 2$

$$\frac{dy}{dx} = 2\sec^2\left(\frac{\pi x}{4}\right) \cdot \frac{\pi}{4}$$

$$\frac{dy}{dx}\Big|_{x=1} = 2\sec^2\left(\frac{\pi}{4}\right) \cdot \frac{\pi}{4}$$

$$= 2\left(\frac{2}{\sqrt{2}}\right)^2 \cdot \frac{\pi}{4}$$

$$= 2 \cdot \frac{4}{2} \cdot \frac{\pi}{4}$$

$$= \pi$$

Tangent line: $y - 2 = \pi(x-1)$

Normal line: $y - 2 = -\frac{1}{\pi}(x-1)$