2.1

32. $f(x)=\frac{1}{x+1}$; $(0,1)=(x_1,y_1)$

$$f'(x)=\frac{(x+1)(0)-1(1)}{(x+1)^2}=\frac{-1}{(x+1)^2}$$

$$m=f'(0)=\frac{-1}{(0+1)^2}=-1=m$$

$y-y_1=m(x-x_1)$

$y-1=-1(x-0)$

$y-1=-x$

$\boxed{y=-x+1}$

2.2

43. $f(x)=\frac{x^3-3x^2+4}{x^2}$

$$=\frac{x^3}{x^2}-\frac{3x^2}{x^2}+\frac{4}{x^2}$$

$f(x)=x-3+4x^{-2}$

$f'(x)=\boxed{1-8x^{-3}}$

2.2

94. $s(t) = -4.9t^2 + V_0 t + S_0$

$s(6.8) = 0$; $S_0 = ?$; $V_0 = 0$

$$0 = -4.9(6.8)^2 + S_0$$

$$S_0 = 4.9(6.8)^2$$

2.3 Product & Quotient

$$f(x) = \tan x = \frac{\sin x}{\cos x}$$

$$f'(x) = \frac{(\cos x)(\sin x)' - (\sin x)(\cos x)'}{(\cos x)^2}$$

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

$$= \frac{1}{\cos^2 x}$$

$$(\tan x)' = \sec^2 x$$

$(\cot x)' = -\csc^2 x$

$(\sec x)' = \sec x \tan x$

$(\csc x)' = -\csc x \cot x$

2.4 - The Chain Rule

$$[f(g(x))]' = f'(g(x)) \cdot g'(x)$$

$$[h(g(f(x)))]' = h'(g(f(x)) \cdot g'(f(x)) \cdot f'(x)$$

$$f(x) = \sin(x^5 - 3x^2)$$

$$f'(x) = [\cos(x^5 - 3x^2)](x^5 - 3x^2)'$$

$$= (5x^4 - 6x)\cos(x^5 - 3x^2)$$

$$f(x) = \cos[5\sin(7x)]$$

$f(u) = \cos u$

$u = 5\sin 7x$

$= 5v$

$v = \sin 7x$

$= \sin w$

$w = 7x$

$$f'(x) = [-\sin[5\sin(7x)]] \cdot (5 \cdot \cos(7x)) \cdot 7$$

$$= -35 \sin(5\sin 7x) \cos 7x$$

$$f(x) = 5x \cdot \sin(x^2)$$

$$f'(x) = (5x)'(\sin(x^2)) + (5x)(\sin(x^2))'$$

$$= 5\sin(x^2) + 5x(\cos(x^2)) \cdot (2x)$$

$$= 5\sin(x^2) + 10x^2 \cos(x^2)$$

$$f(x) = 5\sin\left(3\cos\left(2x^5\right)\right)$$

$$f'(x) = 5\cos\left(3\cos(2x^5)\right)\cdot\left(-3\sin(2x^5)\right)\cdot(10x^4)$$

$$f(x) = (x\sin x)\sqrt{x-1}$$

$$f'(x) = (x\sin x)\left(\sqrt{x-1}\right)' + (x\sin x)'\left(\sqrt{x-1}\right)$$

$$\left(\sqrt{x-1}\right)' = (x-1)^{1/2}$$

$$= (x\sin x)\left(\tfrac{1}{2}(x-1)^{-1/2}(1)\right) + \left[x(\sin x)' + x'\sin x\right]\left(\sqrt{x-1}\right)$$

$$(x-1)' = 1$$

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

$$f(x) = \sec^2(\sin(3x))$$

$$= \left[\sec(\sin(3x))\right]^2$$

$$f'(x) = 2\sec(\sin(3x))\cdot\left[\sec(\sin 3x)\tan(\sin 3x)\right]\cdot$$

$$\cdot(\cos 3x)\cdot 3$$

$$f(x) = \cos\left(\sqrt{\tan^2 x - 2x}\right)$$

$$= \cos\left(\left[(\tan x)^2 - 2x\right]^{1/2}\right)$$

$$f'(x) = -\sin\left(\sqrt{\tan^2 x - 2x}\right) \cdot \frac{1}{2\sqrt{\tan^2 x - 2x}} \cdot \left[2\tan x \cdot \sec^2 x - 2\right]$$

1. $f(x) = \cot(5x^2 - 3x)$

$$f'(x) = \left[-\csc^2(5x^2 - 3x)\right](10x - 3)$$

2. $f(x) = \sqrt[3]{\csc(4x)} = [\csc(4x)]^{1/3}$

$$f'(x) = \frac{1}{3}[\csc 4x]^{-2/3} \cdot (-\csc 4x \cot 4x) \cdot 4$$

3. $f(x) = \dfrac{\sin 2x}{x^3}$

$$f'(x) = \frac{x^3(\cos 2x)\,2 - (\sin 2x)(3x^2)}{(x^3)^2}$$

$$= \frac{2x^3 \cos 2x - 3x^2 \sin 2x}{x^6}$$

$$= 2x^{-3}\cos 2x - 3x^{-4}\sin 2x$$

2.3 # 1-53 odd
63-69 odd
75-81 all
83-91 odd
109-115 all

2.4 # 7-33 odd
47-81 odd