2.1

29. $f(x)=\sqrt{x}$, $(1,1)$

$m = f'(1)$

$f(x) = x^{1/2}$

$f'(x) = \frac{1}{2}x^{-1/2} = \frac{1}{2\sqrt{x}}$

$f'(1) = \frac{1}{2}$

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

$y - 1 = \frac{1}{2}(x-1)$

$y = \frac{1}{2}x + \frac{1}{2}$

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$\frac{d}{dx}[a^u] = a^u u' \ln a \qquad u = f(x)$

$\frac{d}{dx}[2^x] = 2^x \cdot \ln 2$

$\frac{d}{dx}[3^{x^2}] = 3^{x^2} \cdot 2x \cdot \ln 3$

$\frac{d}{dx}[e^x] = e^x \cdot \ln e = e^x$

$\frac{d}{dx}[e^{5x^2-4x}] = e^{5x^2-4x} \cdot (10x-4)$

$\frac{d}{dx}[5^{\cos x}] = 5^{\cos x} \cdot (-\sin x) \cdot \ln 5$

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$\frac{d}{dx}[\log_a u] = \frac{u'}{u \ln a}$

$\frac{d}{dx}[\log_3 x] = \frac{1}{x \ln 3}$

$\frac{d}{dx}[\log_2(5x^3)] = \frac{1}{5x^3 \ln 2} \cdot 15x^2$ ($u'' = 5x^3$, $u' = 15x^2$)

$\frac{d}{dx}[\ln x] = \frac{1}{x \ln e} \cdot x' = \frac{1}{x}$ ($u = x$)

$\frac{d}{dx}[\ln(5\sin(2x))] =$

$\frac{1}{5\sin(2x)} \cdot 5\cos(2x) \cdot 2$

$= 2\cot 2x$

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$f(x) = 3^{\cos(4\ln(x^2))}$

$f(x) = 3^u$, $u = \cos v$, $v = 4\ln w$, $w = x^2$

$f'(x) = 3^u \ln 3 \cdot u'$

$= 3^u \ln 3 \cdot (-\sin v) \cdot v'$

$= 3^u \ln 3 (-\sin v) \cdot \frac{4}{w} \cdot w'$

$= 3^u \ln 3 (-\sin v) \cdot \frac{4}{w} \cdot 2x$

$f(x) = 3^{\cos(4\ln(x^2))}$

$f(x) = 3^{\cos(4\ln(x^2))} \ln 3 (-\sin(4\ln(x^2))) \cdot \frac{4}{x^2} \cdot 2x$

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$f(x) = \csc\left[e^{\tan(5\ln x)}\right]$

csc u
e^v
tan w
5 ln x

$f'(x) = -\csc\left(e^{\tan(5\ln x)}\right)\cot\left(e^{\tan(5\ln x)}\right) \cdot e^{\tan(5\ln x)} \cdot \sec^2(5\ln x) \cdot \frac{5}{x}$

5.1 #58

$f(x) = \ln\sqrt[3]{\frac{x-1}{x+1}} = \ln\left(\frac{x-1}{x+1}\right)^{1/3}$

$= \frac{1}{3}\ln\left(\frac{x-1}{x+1}\right) = \frac{1}{3}\ln(x-1) - \frac{1}{3}\ln(x+1)$

$f'(x) = \frac{1}{3(x-1)} - \frac{1}{3(x+1)}$

AW: memorize derivative rules!

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