Trig Derivatives Quiz Review WS #1

$\frac{d}{dx}\sin u = \cos u * u'$	$\frac{d}{dx}\cos u = -\sin u * u'$
$\frac{d}{dx}\tan u = \sec^2 u * u'$	$\frac{d}{dx}\cot u = -csc^2 u * u'$
$\frac{d}{dx}\sec u = \sec u \tan u * u'$	$\frac{d}{dx}\csc u = -\csc u \cot u * u'$

Power Rule: $\frac{d}{dx}[x^n] = n * x^{n-1}$

Product Rule: $\frac{d}{dx}[f(x)g(x)] = f'g + fg'$

Quotient Rule: $\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{f'g - fg'}{g^2}$

Chain Rule: $\frac{d}{dx} f[g(x)] = f'[g(x)] \times g'(x)$

Find the derivative of the following equations

1) $y = x^3 \sec(7x - 2)$

2) $g(x) = \frac{\sin(3x)}{\cot(5x-1)}$

3) $f(x) = 4csc^5(4x^3 - 2x)$

4) $\sec y = 2x + y - 12$

5) $x sin y - 5y + 2x^3 = 10$

6) $g(x) = \sqrt[4]{cos(3x^3 - 6x + 9)}$

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Key

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Power Rule: $\frac{d}{dx}[x^n] = n * x^{n-1}$

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Chain Rule: $\frac{d}{dx} f[g(x)] = f'[g(x)] \times g'(x)$

Find the derivative of the following equations

1) $y = x^3 \sec(7x - 2)$

*product rule

$y = \underbrace{x^3}_{f} \cdot \underbrace{\sec(7x-2)}_{g}$

$y' = \underbrace{3x^2}_{f'} \cdot \underbrace{\sec(7x-2)}_{g} + \underbrace{x^3}_{f} \cdot \underbrace{\sec(7x-2)\tan(7x-2) \cdot 7}_{g'}$

$y' = 3x^2\sec(7x-2) + 7x^3\sec(7x-2)\tan(7x-2)$

2) $g(x) = \frac{\sin(3x)}{\cot(5x-1)}$

*quotient rule

$g'(x) = \frac{\underbrace{\cos 3x \cdot 3}_{f'} \cdot \underbrace{\cot(5x-1)}_{g} - \underbrace{\sin(3x)}_{f} \cdot \underbrace{-\csc^2(5x-1) \cdot 5}_{g'}}{\underbrace{\cot^2(5x-1)}_{g^2}}$

$g'(x) = \frac{3\cos 3x \cot(5x-1) + 5\sin(3x)\csc^2(5x-1)}{\cot^2(5x-1)}$

3) $f(x) = 4csc^5(4x^3 - 2x)$

*chain rule:

$f(x) = 4[\csc(4x^3-2x)]^5$

outside: $4(\ )^5$

inside: $\csc u$

inner: $4x^3 - 2x$

$f'(x) = 20(\csc(4x^3-2x))^4 \cdot -\csc(4x^3-2x)\cot(4x^3-2x) \cdot (12x^2-2)$

$f'(x) = -20(12x^2-2)\csc^5(4x^3-2x)\cot(4x^3-2x)$

4) $\sec y = 2x + y - 12$

*implicit differentiation

$\sec y \tan y\left(\frac{dy}{dx}\right) = 2 + 1\left(\frac{dy}{dx}\right) - 0$

$\sec y \tan y\left(\frac{dy}{dx}\right) - 1\left(\frac{dy}{dx}\right) = 2$

$\frac{dy}{dx}(\sec y \tan y - 1) = 2$

$$\frac{dy}{dx} = \frac{2}{\sec y \tan y - 1}$$

5) $x \sin y - 5y + 2x^3 = 10$

*implicit
*product rule

$\underbrace{(1)}_{f'}\underbrace{\sin y}_{g} + \underbrace{x}_{f} \cdot \underbrace{\cos y\left(\frac{dy}{dx}\right)}_{g'} - 5\left(\frac{dy}{dx}\right) + 6x^2 = 0$

$x\cos y\left(\frac{dy}{dx}\right) - 5\left(\frac{dy}{dx}\right) = -6x^2 - \sin y$

$\frac{dy}{dx}(x\cos y - 5) = -6x^2 - \sin y$

$$\frac{dy}{dx} = \frac{-6x^2 - \sin y}{x\cos y - 5}$$

6) $g(x) = \sqrt[4]{\cos(3x^3 - 6x + 9)}$

*chain rule

$g(x) = [\cos(3x^3 - 6x + 9)]^{1/4}$

outside: $[\ \ ]^{1/4}$

in: $\cos u$

inner: $3x^3 - 6x + 9$

$g'(x) = \frac{1}{4}[\cos(3x^3 - 6x + 9)]^{-3/4} \cdot -\sin(3x^3 - 6x + 9) \cdot (9x^2 - 6)$

$$g'(x) = \frac{-(9x^2 - 6)\sin(3x^3 - 6x + 9)}{4[\cos(3x^3 - 6x + 9)]^{3/4}}$$