The Chain Rule

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1. $\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{(du)}{dx}$

2. $\frac{d}{dx}\left[stuff^{power}\right] = (power)\cdot(stuff)^{(power\ -\ 1)}\cdot\frac{d}{dx}[stuff]$

3. $\frac{d}{dx}\left([f(g(x))\right] = f'(g(x))\cdot g'(x)$

4. $\frac{d}{dx}\left[u^n\right] = nu^{(n-1)}u'$

Differentiate problems 1 - 4.

1. $f(x) = (x^3 + 7)^3$

$f'(x) = 3(x^3+7)^2(3x^2)$

$= 9x^2(x^3+7)^2$

2. $f(x) = \frac{\csc(3x)}{5}$

$f'(x) = \frac{1}{5}(-\csc 3x \cot 3x)\,3$

$= \frac{-3}{5}\csc(3x)\cot(3x)$

**3. $g(x) = x\sqrt{2x-3}$

$1 \quad \frac{1}{2}(2x-3)^{-1/2}(2)$

$g'(x) = \frac{x}{\sqrt{2x-3}} + \sqrt{2x-3}$ or

$= \frac{x + 2x - 3}{\sqrt{2x-3}} = \frac{3x-3}{\sqrt{2x-3}}$

**4. $y = (x^2\sin 2x)$

$2x \quad \cos 2x\,2$

$y' = 2x^2\cos(2x) + 2x\sin(2x)$

**5. Find the equation of the line tangent to the graph of $f(x) = (x(1 - 2x))^3$ at the point (1, -1).

$f'(x) = 3(x(1-2x))^2(x(-2) + (1-2x))$

$= 3[1(1-2)]^2(-2 + 1 - 2(1))$

$= 3(1)(-3)$

$m = -9$

$y + 1 = -9(x - 1)$