Warm Up

Differentiate the following:

$$f(x) = \left(8\sqrt{x} - 5x\right)^{7}\left(x^2 + 4x - 1\right)^{4}\left(6x^{-2} + 5x\right)^{5}$$

$$f'(x) = 7\left(8\sqrt{x} - 5x\right)^{6}\left(4x^{-1/2} - 5\right)\left[\left(x^2 + 4x - 1\right)^{4}\left(6x^{-2} + 5x\right)^{5}\right] +$$

$$4\left(x^2 + 4x - 1\right)^{3}\left(2x + 4\right)\left(8\sqrt{x} - 5x\right)^{7}\left(6x^{-2} + 5x\right)^{5} +$$

$$5\left(6x^{-2} + 5x\right)^{4}\left(-12x^{-3} + 5\right)\left(8\sqrt{x} - 5x\right)^{7}\left(x^2 + 4x - 1\right)^{4}$$

Now let's make things a bit more complicated...

Remember ALL of the rules!

$$f(x) = \sqrt{x^2 - \sqrt{3x + \sqrt{x^4 + 9}}}$$

$$f(x) = \left[x^2 - \left(3x + (x^4 + 9)^{\frac{1}{2}} \right)^{\frac{1}{2}} \right]^{\frac{1}{2}}$$

$$f'(x) = \frac{1}{2}\left[x^2 - \left(3x + (x^4+9)^{\frac{1}{2}}\right)^{\frac{1}{2}} \right]^{-\frac{1}{2}} \left[2x - \frac{1}{2}\left(3x + (x^4+9)^{\frac{1}{2}}\right)^{-\frac{1}{2}} \cdot \right.$$

$$\left. \left(3 + \frac{1}{2}(x^4+9)^{-\frac{1}{2}}(4x^3) \right) \right]$$

$$f(x) = \frac{(x^3 - 5)^4 \sqrt{9 - x^2}}{\dfrac{9}{x^3}(5x^7 + x^{-3})^{-2}} \qquad \boxed{9x^{-3}}$$

$$f'(x) = \frac{\left[4(x^3-5)^3(3x^2)\sqrt{9-x^2} + (x^3-5)^4 \frac{1}{2}(9-x^2)^{-\frac{1}{2}}(-2x) \right] \frac{9}{x^3}(5x^7+x^{-3})^{-2}}{\left(\frac{9}{x^3}(5x^7 + x^{-3})^{-2} \right)^2}$$

$$\frac{- \left[-27x^{-4}(5x^7+x^{-3})^{-2} + 9x^{-3}\left(-2(5x^7+x^{-3})^{-3}(35x^6 - 3x^{-4})\right) \right](x^3-5)^4\sqrt{9-x^2}}{\left(\frac{9}{x^3}(5x^7 + x^{-3})^{-2} \right)^2}$$

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$$f(x) = \frac{\left(x^3 - 5\right)^4 \sqrt{9 - x^2}}{\left(9x^{-3}\right)\dfrac{9}{x^3}\left(5x^7 + x^{-3}\right)^{-2}}$$

$$f(x) = \left(x^3 - 5\right)^4 \sqrt{9 - x^2} \left(9x^{-3}\right)^{-1} \left(5x^7 + x^{-3}\right)^2$$