Problem 2. If $y = 9x^4 + 6x^2 - 7x + 11$, then $\dfrac{dy}{dx} =$

Answer: $\dfrac{dy}{dx} = 9\left(4x^3\right) + 6\left(2x\right) - 7\left(1\right) + 0 = 36x^3 + 12x - 7$

Problem 3. If $f(x) = 6x^{\frac{3}{2}} - 12\sqrt{x} - \dfrac{8}{\sqrt{x}} + 24x^{-\frac{3}{2}}$, then $f'(x) =$

Answer: $f'(x) = 6\left(\dfrac{3}{2}x^{\frac{1}{2}}\right) - \left(\dfrac{12}{2\sqrt{x}}\right) - 8\left(-\dfrac{1}{2}x^{-\frac{3}{2}}\right) + 24\left(-\dfrac{3}{2}x^{-\frac{5}{2}}\right) = 9\sqrt{x} - \dfrac{6}{\sqrt{x}} + 4x^{-\frac{3}{2}} - 36x^{-\frac{5}{2}}$

How'd you do? Did you notice the changes in notation? How about the fractional powers, ra cal signs, and x's in denominators? You should be able to switch back and forth between notatio between fractional powers and radical signs, and between negative powers in a numerator and po tive powers in a denominator.

PRACTICE PROBLEM SET 4

Find the derivative of each expression and simplify. The answers are in Chapter 21.

1. $(4x^2 + 1)^2$

2. $(x^5 + 3x)^2$

3. $11x^7$

4. $8x^{10}$

5. $18x^3 + 12x + 11$

6. $\dfrac{1}{2}(x^{12} + 17)$

7. $-\dfrac{1}{3}(x^9 + 2x^3 - 9)$

8. π^5

9. $\dfrac{1}{a}\left(\dfrac{1}{b}x^2 - \dfrac{2}{a}x - \dfrac{d}{x}\right)$

10. $-8x^{-8} + 12\sqrt{x}$

11. $6x^{-7} - 4\sqrt{x}$

12. $x^{-5} + \dfrac{1}{x^8}$

13. $\sqrt{x} + \dfrac{1}{x^3}$

14. $(6x^2 + 3)(12x - 4)$

15. $(3 - x - 2x^3)(6 + x^4)$

16. $e^{10} + \pi^3 - 7$

17. $\left(\dfrac{1}{x} + \dfrac{1}{x^2}\right)\left(\dfrac{4}{x^3} - \dfrac{6}{x^4}\right)$

18. $\sqrt{x} + \dfrac{1}{\sqrt{3}}$

19. $(x^2 + 8x - 4)(2x^{-2} + x^{-4})$

20. 0

21. $(x + 1)^3$

22. $\sqrt{x} + \sqrt[3]{x} + \sqrt[3]{x^2}$

23. $x(2x + 7)(x - 2)$

24. $\sqrt{x}\left(\sqrt[3]{x} + \sqrt[5]{x}\right)$

25. $ax^5 + bx^4 + cx^3 + dx^2 + ex + f$

THE PRODUCT RULE

Now that you know how to find derivatives of simple polynomials, it's time to get more complicated. What if you had to find the derivative of this?

$$f(x) = (x^3 + 5x^2 - 4x + 1)(x^5 - 7x^4 + x)$$

You could multiply out the expression and take the derivative of each term, like this:

$$f(x) = x^8 - 2x^7 - 39x^6 + 29x^5 - 6x^4 + 5x^3 - 4x^2 + x$$

And the derivative is:

$$f'(x) = 8x^7 - 14x^6 - 234x^5 + 145x^4 - 24x^3 + 15x^2 - 8x + 1$$

Differentiation - Quotient Rule

Date________________ Period

Differentiate each function with respect to *x*.

1) $y = \frac{2}{2x^4 - 5}$

2) $f(x) = \frac{2}{x^5 - 5}$

3) $f(x) = \frac{5}{4x^3 + 4}$

4) $y = \frac{4x^3 - 3x^2}{4x^5 - 4}$

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

6) $y = \frac{4x^5 + 2x^2}{3x^4 + 5}$

7) $y = \frac{4x^5 + x^2 + 4}{5x^2 - 2}$

8) $y = \frac{3x^4 + 5x^3 - 5}{2x^4 - 4}$

9) $y = \dfrac{x^3 - x^2 - 3}{x^5 + 3}$

10) $y = \dfrac{x^4 + 6}{3 - 4x^{-4}}$

11) $y = \dfrac{4x^4 - 4x^2 + 5}{2x^{\frac{5}{3}} + 3}$

Critical thinking question:

12) A classmate claims that $\left(\dfrac{f}{g}\right)' = \dfrac{f'}{g'}$ for any functions f and g. Show an example that proves your classmate wrong.