WORKSHEET: DERIVATIVES FROM LINEARITY FORMULAS

Names and student IDs: ____

Recall:

(1) If c is a constant, and f is the function $f(x) = c$ for all real x, then $f'(x) = 0$ for all real x.
(2) If g is the function $g(x) = x$ for all real x, then $g'(x) = 1$ for all real x. (This is a special case of rule (5) below.)
(3) If f and ~~f~~ g are differentiable at a, then $f + g$ and $f - g$ are differentiable at a, with $(f + g)'(a) = f'(a) + g'(a)$ and $(f - g)'(a) = f'(a) - g'(a)$.
(4) If f is differentiable at a, c is a constant, and k is the function $k(x) = cf(x)$, then k is differentiable at a, with $k'(a) = cf'(a)$. For short, $(cf)'(a) = cf'(a)$.
(5) If n is any positive integer, then the function $f(x) = x^n$ for all real x is differentiable everywhere, and $f'(x) = nx^{n-1}$.

In fact, the rule (5) is still correct for $x > 0$ when n is any real number, and also for $x < 0$ if $n = p/q$ for integers p and q with q odd, so that $f(x)$ is defined when $x < 0$.

1. Let f be the function $f(x) = -43$ for or all real x. Find $f'(x)$ and $f'(9)$.

2. Let g be the function $g(x) = x^5$ for or all real x. Find $g'(x)$ and ~~$f'(-2)$~~$g'(-2)$.

3. Let f be the function $f(x) = x^7 - x^3$ for or all real x. Find $f'(x)$ and $f'(1)$.

(Continued on back or next page.)

Date: 14 January 2024.

4. Let q be the function $q(x) = -3x^6 - 5x^4 + \sqrt{2}$ for or all real x. Find ~~$f'(x)$ and $f'(a)$~~ $q'(x)$ and $q'(a)$.

5. Let f be the function $f(x) = x^2 + 4$ for or all real x, and let g be the function $g(x) = x^3 - 1$ for or all real x~~. Find $f'(x)$ and $f'(9)$~~.

Does any rule above directly apply to finding $(fg)'(x)$?

Expand $(fg)(x)$.

Find $(fg)'(x)$.

What is $f'(x)g'(x)$? Is it the same as $(fg)'(x)$?

The product rule, which we have not seen yet, says that $(fg)'(x) = f'(x)g(x) + f(x)g'(x)$. Check that it give the right answer in this case.