Calculus 1 Unit 3 worksheet: The power rule and basic differentiation rules

Name _____ Date _____ Period _____

1. Find each derivative with the power, constant multiple, sum and constant rules. For a function written $y = \ldots$, give $\dfrac{dy}{dx}$.

(a) $y = x^{15}$

(b) $y = -\dfrac{2}{3}x^{9}$

(c) $\dfrac{d}{dt}\left[4t^5 - t^2\right]$

(d) $y = \dfrac{x^6}{3} - 5x^2 + 8$

(e) $y = 3x^4 - 7x^3 + \dfrac{1}{2}x^2 - x + 12$

(f) $y = \sqrt{2}\,x^3 + \pi^2$

(g) $\dfrac{d}{du}\left[0.6u^5 - 1.5u^2\right]$

(h) $y = (2x^2 - 3)(x + 4)$

2. Rewrite each function as a sum of constant multiples of powers of x, then find $\dfrac{dy}{dx}$. Say for which x your answer holds.

(a) $y = \dfrac{7}{x^3}$

(b) $y = \sqrt[5]{x^2}$

(c) $y = \dfrac{1}{4x^2}$

(d) $y = x^2\sqrt{x}$

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

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3. The curve $y = ax^3 + bx^2$, where a and b are constants, has slope -17 at $x = 1$ and slope -52 at $x = 2$. Find a and b.

4. Lucas rewrites each function as a power of x and then uses the power rule, but each line has one mistake. Find the mistake, and give the correct derivative and the x for which it holds.

(a) $\dfrac{d}{dx}\left[\dfrac{5}{x^2}\right] = \dfrac{5}{2x}$

(b) $\sqrt{x^3} = x^{2/3}$, so $\dfrac{d}{dx}\left[\sqrt{x^3}\right] = \dfrac{2}{3}x^{-1/3}$

(c) $\dfrac{6}{\sqrt{x}} = 6x^{-1/2}$, so $\dfrac{d}{dx}\left[\dfrac{6}{\sqrt{x}}\right] = -3x^{1/2}$

(d) $\dfrac{1}{2x^3} = 2x^{-3}$, so $\dfrac{d}{dx}\left[\dfrac{1}{2x^3}\right] = -6x^{-4}$

5. Let $f(x) = x^{5/3} - 5x^{2/3}$, which is defined for every real x because cube roots of negative numbers exist.

(a) Find $f'(x)$ for $x \neq 0$, and write it as a single fraction.

(b) Find $f'(8)$ and $f'(-1)$.

(c) Find every x at which $f'(x) = 0$.

(d) Use the difference quotient at 0 to decide whether $f'(0)$ exists.

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