2.5. Basic Differentiation Properties

For the following c and n represents constant real numbers.

(1) $\dfrac{d}{dx}(c) =$

(2) $\dfrac{d}{dx}(x) =$

(3) $\dfrac{d}{dx}(x^n) =$

(4) $\dfrac{d}{dx}(cf(x)) =$

(5) $\dfrac{d}{dx}(f(x) + g(x)) =$

(6) $\dfrac{d}{dx}(f(x) - g(x)) =$

Examples

Example 2.5.1. *Find $\frac{dy}{dx}$ if $y = \sqrt{31}$*

Example 2.5.2. *Find $\frac{d}{dx}(x^{31})$*

Example 2.5.3. *Find $\frac{d}{dx}(4x^{31})$*

Example 2.5.4. *Find $f'(x)$ if $f(x) = \dfrac{1}{4x^{31}}$*

Example 2.5.5. *Find $f'(x)$ if $f(x) = \dfrac{4}{x^{31}}$*

Example 2.5.6. *Find $f'(x)$ if $f(x) = x^\pi$*

Example 2.5.7. *Find $\frac{dy}{dx}$ if $f(x) = x^4 x^5$*

Example 2.5.8. *Find $f'(x)$ if $f(x) = \sqrt{31}x$*

Example 2.5.9. *Find $f'(x)$ if $f(x) = \sqrt{31x}$*

Example 2.5.10. *Find $\frac{dy}{dx}$ if $y = 5x^3 - 2x^2 + 7x - 4$*

Example 2.5.11. *Find the equation of the line tangent to the graph of $f(x) = (x^3 + 4x)^2$ at $x = 1$.*

Example 2.5.12. *Find $\frac{d}{dx}\left(3x^{14} - \frac{1}{14}x^{-12} - 8\right)$*

Example 2.5.13. *Find $f'(x)$ if $f(x) = \dfrac{5x^3 - 2x^2 + 7x - 4}{\sqrt[3]{x}}$*

Example 2.5.14. *Find $h'(3)$ if $h(x) = 3f(x) - 4g(x) - 9$ and $f(3) = 4$, $f'(3) = -2$, $g(3) = 1$, $g'(3) = 5$.*

Example 2.5.15. *Find the equation of the line tangent to the graph of $f(x) = x^4 - x^3$ at $(1, 0)$.*

Example 2.5.16. *Find all value(s) of x for which the graph of $f(x) = -2x^3 + 3x^2 + 36x$ has a horizontal tangent line.*

Example 2.5.17. *An object moves along the y-axis (marked in feet) according to the formula $y = 2x^2 - 7x - 6$ where x is the time in seconds. Find the velocity of the object in feet per second when $x = 0$.*

Example 2.5.18. *Suppose that in a given gourmet food store, people are willing to buy x pounds of chocolate candy per day at $\$p$ per quarter pound, as given by the price-demand equation*

$$x = 10 + \frac{180}{p} \qquad 2 \le p \le 10$$

Find the demand and instantaneous rate of change of demand with respect to price when the price is $\$5$. Interpret.