Chapter 3

Determining Change: Derivatives

Simple Rate of Change Formulas

The Formulas

Instead of calculating derivatives by hand every time, we can develop sets of rules which will help us more easily calculate them. These are given below; let c be a constant, and $f(x), g(x)$ be functions:

Name	Function	Derivative
Constant Rule	$f(x) = b$	$f'(x) =$
Power Rule	$f(x) = x^n$	$f'(x) =$
Constant Multiplier Rule	$c \cdot f(x)$	$f'(x) =$
Sum Rule	$f(x) + g(x)$	
Difference Rule	$f(x) - g(x)$	

Examples

Example 3.1.1. Write the formula for the derivative of the function.

(a) $f(x) = x^2$

(b) $g(x) = 3x^4$

(c) $h(t) = 0.2t^{50} - 10t + 1$

(d) $x(t) = t^{2\pi}$

(e) $f(x) = 3x^3$

(f) $q(x) = zx^{n+2}$

(g) $f(x) = 12x^{0.4} + 2x^{56} + 5$

(h) $g(x) = -3.2x^{-3.5} + 6.1x^{5/2} - 5.3$

(i) $f(x) = 7x^{-3}$

(j) $g(x) = -\dfrac{9}{x^2}$

(k) $f(x) = 4\sqrt{x} + 3.3x^5$

(l) $k(x) = \dfrac{4x^2 + 19x + 6}{x}$

(m) $g(t) = 5.8t^3 + 2t^{-1.2} - 5$

Example 3.1.2. Find the derivative of $h(x) = x^2(x^3 + 1)$

Example 3.1.3. The temperature (in $^\circ F$) of Norman on Wednesday can be modeled by $t(x) = -0.8x^2 + 11.6x + 38.2$ degrees Fahrenheit, x hours after 6 A.M.

(a) Write the **complete** rate of change model for the temperature.

(b) By how much is the temperature changing at 10 A.M.? Round your answer to the nearest hundredth.

(c) Compute and interpret $\left.\frac{dt}{dx}\right|_{x=10}$. Round your answer to the nearest tenth.

(d) Compute the percent rate of change of temperature at 4:00pm. Round your answer to the nearest hundredth.

Example 3.1.4. The table shows the metabolic rate of a typical 18- to 30-year-old male according to his weight:

Weight (lbs)	88	110	125	140	155	170	185	200
Metabolic Rate (kCal/day)	1291	1444	1551	1658	1750	1857	1964	2071

(a) Find a **complete** linear model for the metabolic rate of a typical 18- to 30-year-old male.

(b) Write the derivative model for the formula in part (a).

(c) Write a sentence which interprets the derivative of the metabolic rate model of a 26-year-old male. Round your answer to the nearest whole number.