Derivative of a Polynomial

Goal: • Can determine the derivative of a sum and difference of functions • Can derive power rule using limits • Can use power rule to take the derivative of a polynomial • Can find higher order derivatives
Terminology: • Power Rule • Second/Third Derivative

Using the definition of the derivative, prove the following statements:

$$\frac{d}{dx}(f+g)=\frac{df}{dx}+\frac{dg}{dx}$$

$$\frac{d}{dx}\big(c\cdot f(x)\big)=c\cdot\frac{df}{dx}$$

$$\frac{d}{dx}x^n=nx^{n-1}, n\in\mathbb{N}$$

Example: If $x = \frac{t^6}{3} + 5t^3 - 9t + 1$ then find $\frac{dx}{dt}$

We are also going to introduce notation for taking the derivative repeatidly for the function $y = f(x)$

1. First Derivative:

$$y' = \frac{dy}{dx} = \frac{d}{dx} f(x)$$

2. Second Derivative:

$$(y')' = y'' = \frac{d^2y}{dx^2} = \frac{d^2}{dx^2} f(x) = \frac{d}{dx}\left(\frac{d}{dx} f(x)\right)$$

3. Third Derivative

4. Higher Order Derivatives

Practice Problems: 3.3: # 1-8, 27-29, 34

35-38

In Class Evidence

27. Find an equation of the line perpendicular to the tangent to the curve $y = x^3 - 3x + 1$ at the point $(2, 3)$.

28. Find the tangent lines to the curve $y = x^3 + x$ where the slope is 4. What is the smallest slope of the curve and at what value of x does the curve have that slope?

36. The area of a circle is $A = \pi r^2$. Explain in terms of geometry why $\frac{dA}{dr} = C$ where C is the circumference.

38. An apple farmer currently has 156 trees yielding an average of 12 bushels of apples per tree. He is expanding his farm at a rate of 13 trees per year, while improved husbandry is improving his average annual yield by 1.5 bushels per tree. What is the current (instantaneous) rate of increase of his total annual productions of apples?