L1 – Derivative of a Polynomial Functions Unit 1
MCV4U
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In advanced functions, you should have been introduced to the idea that the instantaneous rate of change is represented by the slope of the ________________ at a point on the curve. You also learned that you can determine this value by taking the derivative of the function using the Newton Quotient.

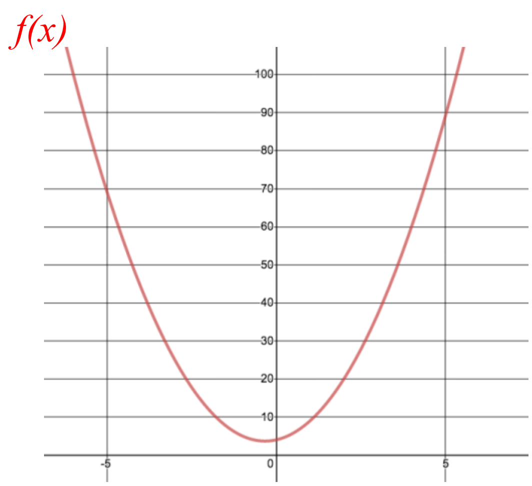
Newton Quotient Example:

Newton's Quotient:

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

a) Find the equation of the derivative of $f(x) = 3x^2 + 2x + 4$

b) Calculate $f'(5)$. What does it represent?



Mathematicians have derived a set of rules for calculating derivatives that make this process more efficient.

Rule	Derivative	Example
Constant Rule If $f(x) = c$ where c is a constant	$f'(x) = 0$	
Power Rule If $f(x) = x^n$	$f'(x) = nx^{n-1}$	
Constant Multiple Rule If $f(x) = c \cdot g(x)$ where c is a constant	$f'(x) = c \cdot g'(x)$	
Sum Rule If $h(x) = f(x) + g(x)$	$h'(x) = f'(x) + g'(x)$	
Difference Rule If $h(x) = f(x) - g(x)$	$h'(x) = f'(x) - g'(x)$	

Proof of Power Rule:

Use Binomial Theorem:

$$t_{r+1} = \binom{n}{r} a^{n-r} b^r$$

Example 1: Determine the equation of the derivative of each of the following functions:

a) $f(x) = 3x^5$

b) $f(x) = 71$

c) $f(x) = \sqrt{x}$

d) $y = \sqrt[3]{x}$

e) $y = \frac{1}{x}$

f) $y = -\frac{1}{x^5}$

Example 2: Differentiate each function

a) $y = 5x^6 - 4x^3 + 6$

b) $f(x) = -3x^5 + 8\sqrt{x} - 9.3$

c) $g(x) = (2x - 3)(x + 1)$

d) $h(x) = \frac{-8x^6 + 8x^2}{4x^5}$

Example 3: Determine an equation for the tangent to the curve $f(x) = 4x^3 + 3x^2 - 5$ at $x = -1$.

Point on the tangent line:

Slope of tangent line:

Remember: *The equation of the derivative tells you the slope of the tangent to the original function.*

Equation of tangent line:

Example 4: Determine the point(s) on the graph of $y = x^2(x+3)$ where the slope of the tangent is 24.