

PROBLEM SET 1

Name: _____

Date: _____

Section: _____

PROBLEM 1

Consider the function $f(x) = x^2 + 3x - 4$. Find the derivative of $f(x)$ using the power rule.

Solution: The derivative of $f(x)$ is $f'(x) = 2x + 3$.

Verify this result using the definition of the derivative.

Solution: Using the definition of the derivative, we have:

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

Substituting $f(x) = x^2 + 3x - 4$, we get:

$$f'(x) = \lim_{h \rightarrow 0} \frac{(x+h)^2 + 3(x+h) - 4 - (x^2 + 3x - 4)}{h}$$

Simplifying the numerator, we have:

$$f'(x) = \lim_{h \rightarrow 0} \frac{x^2 + 2xh + h^2 + 3x + 3h - 4 - x^2 - 3x + 4}{h}$$

This simplifies to:

$$f'(x) = \lim_{h \rightarrow 0} \frac{2xh + h^2 + 3h}{h}$$

Factoring out h from the numerator, we get:

$$f'(x) = \lim_{h \rightarrow 0} \frac{h(2x + h + 3)}{h}$$

Canceling h from the numerator and denominator, we have:

$$f'(x) = \lim_{h \rightarrow 0} (2x + h + 3)$$

As $h \rightarrow 0$, the term h goes to 0, so we have:

$$f'(x) = 2x + 3$$

This matches the result obtained using the power rule.

Therefore, the derivative of $f(x)$ is $f'(x) = 2x + 3$.

Q.E.D.

End of problem set.

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