Group Assignment #17

**DERIVATIVES: THE CHAIN RULE**

For the following questions, let \( k(x) = (2x + 1)^2 \).

1) As it is written above, \( k(x) \) is in factored form. Expand \( k(x) \).

2) Compute \( k'(x) \) using the power rule.

3) Perform the power rule on the factored form of \( k(x) \).

4) How does your answer in (3) compare to your answer in (2)?

5) This difference can be attributed to the fact that \( k \) is a composite function: \( k(x) = f(g(x)) \), where \( f(z) = z^2 \) and \( g(x) = 2x + 1 \). Compute \( g'(x) \).

6) How can we use the derivatives \( f'(z) \) (or, more accurately, your answer from (3)) and \( g'(x) \) to compute \( k'(x) \)?

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**Suggested Homework Problems**

*Section 3.4: 1-15 odd, 16-30 even, 34, 39*
The Chain Rule

If \( y = f(z) \) and \( z = g(t) \) are differentiable, then the derivative of \( y = f(g(t)) \) is given by

\[
\frac{dy}{dt} = \frac{dy}{dz} \cdot \frac{dz}{dt}
\]

In words, the derivative of a composite function is the derivative of the outside function times the derivative of the inside function:

\[
\frac{d}{dt}(f(g(t))) = f'(g(t)) \cdot g'(t)
\]

Using the ideas from the previous page and the chain rule compute the derivatives for the following functions:

1) \( f(x) = (x^2 + 1)^3 \)

2) \( g(x) = a(x^2 + 1)^3 \)

3) \( h(x) = 100(x^3 - x)^{1.08} \)

4) \( b(t) = e^{kt} \)

Suggested Homework Problems
Section 3.4: 1-15 odd, 16-30 even, 34, 39
5) \[ k(x) = \frac{b}{(e^x - \ln x)^3} \]

6) \[ V(r) = \frac{4}{3} \pi r^3 \]

7) \[ z(x) = \ln(e^x - m) \]

8) \[ m(t) = ke^{kt} - \ln(t^2 - z) \]

9) \[ y = 3\sqrt{x} + 3 \]

**Suggested Homework Problems**
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