Chain Rule

GROUP MEMBERS:
1. ______________ (Reader)
2. ______________ (Manager)
3. ______________ (Presenter)
4. ______________ (Questioner)

Goal: Gain practice in using the Chain Rule:
\[
\frac{dy}{dx} = \frac{dy}{du} \frac{du}{dx}
\]
which is used to take the derivative of a composition of functions.

Instructions: There are two problems. Person 1 and 3 will do problem 1 together (from page 2) and person 2 and 4 will do problem 2 together (from page 3). Show all your work on your pages. If you get stuck, ask a neighboring group for help. When both teams are done, present your work to the other group and write your final answers on the summary sheet at the end.
Question 1: For Persons 1 and 3.

Consider: \( F(x) = (2x^3 - 4x + 1)^6 \)

This function is a composition of two functions: an ‘inner function’ \( g(x) \) and an ‘outer function’ \( f(x) \) such that \( F(x) = f( g(x) ) \).

a. \( g(x) = \)

b. \( f(x) = \)

c. Test whether you have correctly gotten \( g(x) \) and \( f(x) \) by evaluating:

\[ f( g(x) ) = \]

d. Now use the notation of the change rule where we introduce the variable \( u \).

\[ u = g(x) = \]

\[ y = f(u) = \]

e. The Chain Rule says that

\[ F'(x) = \frac{dy}{du} \cdot \frac{du}{dx} \]

Calculate:

\[ \frac{dy}{du} = \]

\[ \frac{du}{dx} = \]

\[ F'(x) = \frac{dy}{du} \cdot \frac{du}{dx} = \]
Question 2: For Persons 2 and 4.

Consider: \( F(x) = \sin(4x^2) \)

This function is a composition of two functions:
an ‘inner function’ \( g(x) \) and an ‘outer function’ \( f(x) \) such that \( F(x) = f(g(x)) \).

f. \( g(x) = \)

g. \( f(x) = \)

h. Test whether you have correctly gotten \( g(x) \) and \( f(x) \) by evaluating:

\[
f( g(x) ) =
\]

i. Now use the notation of the change rule where we introduce the variable \( u \).

\[
u = g(x) =
\]

\[
y = f(u) =
\]

j. The Chain Rule says that

\[
F'(x) = \frac{dy}{du} \frac{du}{dx}
\]

Calculate:

\[
\frac{dy}{du} =
\]

\[
\frac{du}{dx} =
\]

\[
F'(x) = \frac{dy}{du} \frac{du}{dx} =
\]
Summary:

Question 1: Persons 1 and 3.
For \( F(x) = (2x^3 - 4x + 1)^6 \),

\[
F'(x) = \frac{dy}{du} \frac{du}{dx} =
\]

Question 2: Persons 2 and 4.
For \( F(x) = \sin(4x^2) \)

\[
F'(x) = \frac{dy}{du} \frac{du}{dx} =
\]