

## The Chain Rule (3.6)

### Expected Skills.

At the end of this section, students will be able to:

- recognize when the chain rule is needed,
- appropriately apply the chain rule to compute derivatives of functions.

**Pre-Class Activity** (ch3-derivatives-4-chain-1-pc). The goal here is twofold. First, to connect to the previous differentiation rules we have seen and point out that they are not sufficient for composed functions. Second, to have the students work on composing functions as preparation for the chain rule.

**Worksheet** (ch3-derivatives-4-chain-2-ws). In this activity we have the students use the chain rule on cases with increasing difficulty. We also use some contrasting cases to help the students identify when the chain rule is used from when it is not.

The goal of the second part is to have the students focus on the chain rule itself and not so much on formulas. The goal is also to have students be able to *read* information on a graph.

The last exercise to have the students think about we implicitly use the chain rule “all the time” but we don’t see it because we don’t write the “ $x' = 1$ ” part.

The challenge exercise is only for students who have finished everything else and are bored.

If there is enough time, one could add an exercise on the composition of functions (e.g. ask the student to compose the functions of the first exercise. In this part, one could also add the students to compose functions (e.g. compose the functions of this exercise).

One could also add an exercise where the values of the functions and derivatives are given at certain points and then we ask the students to compute the derivative of composition of functions (cf. GranValley: [p. 132][gv17])?