

## Indeterminate Forms and L'Hôpital's Rule(4.5)

### Expected Skills.

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

- explain in words what an indeterminate form is,
- explain what L'Hôpital's rule is, when we can use it, and what kinds of limits we can compute with it,
- correctly use L'Hôpital's rule to compute limits.

**Pre-Class Activity** (ch4-applications-1-lhospital-1-pc). In the pre-class activity we have the students look at limits that give the expressions " $0/0$ ", " $\infty/\infty$ ", " $0 \cdot \infty$ ", and " $\infty^0$ ". We then ask them if we can factor out and simplify these expression as we did at the beginning of the course (which we cannot do for these limits). We thus want them to realize that one needs another technique to compute these limits.

**Worksheet** (ch4-applications-1-lhospital-2-ws). The worksheet starts by stating L'Hôpital's rule and its hypotheses. We first have the students use it on three slightly different cases. On the second page, we then look at limits that first need to be re-written to apply L'Hôpital's rule. This activity is well suited for a jigsaw (see more detail on the worksheet). We then have the students "test" the hypotheses of L'Hôpital's rule by giving to them a misuse of the rule (the key message of this part is: "verify the hypotheses when using the rule"). Finally, we ask the students to describe in words what L'Hôpital's rule means in geometrical terms (in other words, to make sense of the equation given by the rule).

**Supplemental Activity** (ch4-applications-1-lhospital-3-sup-indeterminate forms). This activity has students engage in a jigsaw discussion where half the class determines cases where an indeterminate form approaches a particular limit. The students then present their findings to the other half of the class.