**Student handout** Calculate the total differential of a function $f = f(x, y)$, where $x = x(u, v)$ and $y = y(u, v)$.

How would your answer change if $x = u$?

### Prerequisite Knowledge

- Familiarity with derivatives.
- Familiarity with the general form of the total differential
- Basic understanding of the state-specific form of the total differential

**Activity: Introduction** Before letting the small groups begin to solve the differential, an unrelated example in computing a total differential with multivariable dependence would help convince students to utilize a chain rule diagram. Also, emphasis should be placed on writing down what variables are being held constant when computing the partial differential of a function; this kind of book-keeping is very important and will be necessary to keep from getting lost when computing partial differentials involves more complex equations.

**Activity: Wrap-up** In the wrap-up, students will find it helpful if the solution to the problem is written on the board. Students that have little experience with multivariable calculus can become lost quickly in this activity, so presenting the solution to the total differential using the chain rule diagram as a tool and visual aid will assist these students greatly. By replacing $x$ with $u$ in the chain rule diagram, the answer to *"How would the total differential change if $x = u$?"* can also be easily shown. A short lecture on how chain rule diagrams can take different shapes depending on the problem is beneficial for students still practicing performing differentials and using chain rule diagrams.