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Jessica M Mikhaylov*, jessica.mikhaylov@usma.edu. *Cookies, Sidewalk-chalk, and Office Chairs: Hands-on Activities from Calculus to Comets.*

In every course I have taught, from pre-calculus to astrodynamics, I have found that manipulative materials allow the students to internalize the concepts more concretely. I will present a short sampling of activities and pictures of actual students participating in these activities. The first activity is applicable to any course that introduces multivariable functions: using cookies to build functions of two variables. The second and third activities are used in my advanced undergraduate astrodynamics course; however the ideas are fundamental enough to be presented in a seminar course for non-mathematicians. We explore the definition of an ellipse and use sidewalk chalk, string, meter sticks, and some quick calculations to draw a partial model of the solar system. Lastly, we explore how conservation of momentum relates to Kepler's second law using a spinning office chair and a quick "run around the sun" for a highly eccentric comet orbit. (Received September 22, 2011)