

## **Mathematics Education Qualifying Exam May 2009**

The following six questions constitute the Mathematics Education Qualifying Exam for May of 2009. The questions are separated into two sections. You must answer two of the three questions in each section. Make sure it is clear which questions you are answering. You have four hours to complete this exam. Remember to save your work frequently.

### Section I:

1. Four of the main learning theories applied to mathematics education are: cognitive science, constructivism, sociocultural theory, and the emergent perspective (also referred to as social constructivism). Discuss the main perspectives in each of these learning theories, making sure to explain how they relate to and differentiate from each other.
2. Cobb and Yackel (1996) have defined the terms: 1) Classroom social norms, 2) Sociomathematical norms, and 3) Classroom mathematical practices. Explain what each of these terms mean and relate them to the emergent perspective. Then make connections between these terms and the learning and teaching of mathematical proof.
3. The mathematics education literature on proof discusses many different purposes of proof, both relevant to mathematics research and to the teaching of mathematics. Explain the different purposes of proof and the role each purpose plays in the teaching and learning of proof.

### Section II:

1. Discuss mental model theory. Include in your discussion the impact of working memory capacity on the development of these models.
2. What are the consequences of increasing working memory capacity (include a discussion of math anxiety; discuss formation of mental models)? What effect does practice with math problems have on working memory capacity?
3. How can we help students increase working memory capacity and what would be the effect of such an increase on math performance (include a discussion of mental models)?