Please indicate your intentions below.

I wish the MTE598 RUME II final examination to be considered as my Mathematics Education Qualifying Examination, Part II. **Give a brief rationale why you have made this decision.**   Name: Date:

I DO NOT wish the MTE598 RUME II final examination to be considered as my Mathematics Education Qualifying Examination, Part II. Name: Date:

Mathematics Education Qualifying Exam: Part II Spring, 2013
Name:

Instructions:

The use of a cell phone is prohibited during this exam period. Please check at this time that your cell phone is turned off or set to silent mode.

Save this file on your computer, with your initials added to the beginning of the current file name. For example, if your name were Ima Reasoning Fan, then you would save this document as IRF_MathEdQual2_2013.doc(x). After you've completed the exam, delete the questions that you did NOT choose from the document, but keep the original numbering of the questions.

You <u>must</u> respond to Questions 1 and 2. In addition, respond to 2 (two) other questions of your choosing from the remaining list. Provide responses to entire questions, not parts of multiple ones.

All responses should be in essay form; aim for clarity and explicitness, as well as thoroughness, concision, and coherence in your writing. Your responses must be original; you may not insert text that you have prepared prior to this exam. Nor may you consult abstracts or articles that you might have on your computer or in paper form.

You may use diagrams in your responses; label each with a title (e.g., "Figure x"), and insert a clear reference to each figure in the appropriate place in your narrative. Turn in any diagrams with your responses.

Your responses may cite literature that is not explicitly mentioned in a question. You may use Endnote to insert references. Good luck and good writing!

Name:

<u>Question 1 (Mandatory)</u>

Cobb (2007) compares and contrasts four theoretical perspectives that have made a considerable mark on mathematics education: *experimental psychology, cognitive psychology, sociocultural theory*, and *distributed cognition*.

a) Discuss the relationship between theory and research, more explicitly how a researcher's theoretical perspective impacts the types of research questions asked, the methods employed, and the contributions that are made to the field of mathematics education research.

b) Describe the notion of *bricologe* that Cobb urges researchers to embrace with respect to doing the work of mathematics education research. Provide an illustrative example of such bricologe that can account for students' mathematical development as it occurs in the social context of the classroom.

<u>Question 2 (Mandatory)</u>

Clinical interviews (Clement, 2000) and teaching experiments (Steffe & Thompson, 2000) are often employed in mathematics education research.

a) Compare and contrast these two research methods focusing on the purposes, underlying principles, and essential elements.

b) Explain how these research methods can be viewed as a scientific method. Address the nature of a scientific method and the ways that proper use of each method fits within the nature of scientific method.

<u>FOR YOUR REMAINING ESSAYS, ANSWER TWO OF THE FOLLOWING:</u>

<u>Question 3</u>

Researchers have formulated and adopted different definitions of advanced mathematical thinking (AMT). Select <u>two</u> of the following articles:

a) Summarize, compare, and contrast the authors' definitions of AMT.

b) Discuss how the definition impacts the types of research questions asked, the methods employed, and the contributions that are made to the field of mathematics education research.

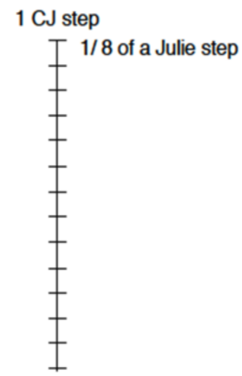
- Edwards, B., Dubinsky, E., & McDonald, M. (2005). Advanced mathematical thinking. *Mathematical Thinking and Learning, 7,* 15-25.
- Harel, G., & Sowder, L. (2005). Advanced mathematical-thinking at any age: Its nature and its development. *Mathematical Thinking and Learning, 7,* 27-50.
- Rasmussen, C., Zandieh, M., King, K., & Teppo, A. (2005). Advancing mathematical activity: A practice-oriented view of advanced mathematical thinking. *Mathematical Thinking and Learning, 7*, 51-73.

Name:

Question 4

Your recent work in RUME II involved designing and conducting an interview with an individual learner around the set of tasks motivated by the step task below:

> The figure to the right shows the relationship between the size of CJ's step and the size of Julie's step. Suppose CJ and Julie walk the same distance. How many steps did CJ take in relation to the number of steps Julie took?



Summarize your method of creating the interview protocol and analyzing the data generated in the interview that you conducted. Your summary must include a description of:

a) The mathematical task(s) employed, and the underlying mathematical concepts that those tasks were designed to address.

b) The theoretical perspective(s) that you employed in the design and analysis of the interview, or that you *would* employ were you to do it again.

c) The role that conceptual analysis of the mathematical learning objectives (Saldanha & Thompson, 2003) played in your actual design and analysis of the interview, and in any envisioned future revisions of your interview protocol.

Question 5

Gravemeijer (1999) introduces developmental research as an integration of design and research whose central goal is to explicate the *local instructional theory* (LIT) of Realistic Mathematics Education (RME).

a) Describe instructional design heuristics in RME and a reflexive relation between RME and developmental research.

b) Discuss a role of models in LIT, and provide an example of research that illustrates an emergent model and its development.

Name:

Question 6

Roh (2008, 2010) conducted a study that explored calculus students' mathematics in relation to the (rigorous) ε-N definition of the limit of a sequence:

a) Describe Roh's ε-strip activity and discuss its role as an instructional intervention and as a research tool in her study.

b) Explain how von Glasersfeld's (1995) explication of the construction of *self* and *others*, and Steffe and Thompson's (2000) distinction between *students' mathematics* and *mathematics of students* can inform the analysis of students' understanding of a definition of limit that appeared in Roh's study.

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