Mathematics-Science 381H – Ancient and classical mathematics
Trent University, Fall 2007

Take-home Final Examination
Due on Thursday, 20 December, 2007.

Instructions: Give complete answers to receive full credit, including references to any and all sources you used. You may use your texts from this and any other courses, as well as any handouts, class notes, and the like; you may also ask the instructor to clarify the instructions or any of the questions; and you may use a calculator or computer to perform any necessary calculations. *You may not consult any other sources, nor give or receive any other aid on this exam, except with the intructor's explicit permission or as otherwise indicated on a given problem.*

Part I – This and that. Do all three of **1** – **3**.

1. Answer all of **a** – **i**. *[10 = 10×1 each]*

- **a.** Is Euclid's Fifth Postulate true or not?
- **b.** Express 1/11 as a repeating sexagesimal.
- **c.** Can some irrational numbers be constructed using a ruler and compass?
- **d.** Is there any evidence that the ancient Egyptians ever did mathematics for its own sake? If so, what is it?
- **e.** What are the three major interpretations of *Plimpton 322*?
- **f.** When was Archimedes' work *Method* rediscovered?
- **g.** How did the ancient Egyptians write fractions?
- **h.** Who developed the theory of proportion used in Euclidean geometry?
- **i.** Who first systematically used a symbolic notation for algebraic expressions?
- **j.** What is the only known problem where the Egyptians used the method of single false position to solve a non-linear equation?

2. Compare and contrast the extent to which progress in mathematics was driven by the needs of science and technology in ancient Egypt and in classical Greek and Hellenistic culture. [*You may consult additional sources for this problem.*] *[15]*

3. Read Example 3 in §2-7 of the text and solve the given system of equations. Having done so, try to solve the problem as the Babylonians might have done it. *[10]*

[Parts **II** – **IV** on page 2.]

Part II – History. Do *one* of **4** or **5**.

4. The desire or need to solve practical problems and the pursuit of mathematics for its own sake have both played a big role in the history of mathematics. How did they interact in the development and evolution of trigonometry in ancient and classical times? [*You may consult additional sources for this problem.*] *[15]*

5. Compare and contrast – and try to explain! – the relative strngths and weaknesses of the number systems and geometry in ancient Mesopotamia and in classical Greek and Hellenistic culture. [*You may consult additional sources for this problem.*] *[15]*

Part III – Mathematics. Do any *two* of **6** – **8**.

6. Describe how to use the *quadratrix* to trisect an angle and explain in detail why the method works. [*You may consult additional sources for this problem.*] *[10]*

7. Show that the converse of the Pythagorean Theorem is true. *[10]*

If a triangle has sides of length a, b, and c, where $a^2 + b^2 = c^2$,
then it has a right angle.

8. If u and v are two numbers and $u \geq v$, their *average* is $(u+v)/2$ and their *semidifference* is $(u - v)/2$.

a. Express uv in terms of the average and semidifference of u and v. *[1]*

b. Given that $a = u + v$ and $b = uv$, solve for u and v in terms of a and b. *[2]*

c. Use your solution to **b** to help solve the quadratic equation $x^2 + ax + b = 0$. *[4]*

d. In which ancient or classical culture were such techniques used to solve problems? Give an example! [*You may consult additional sources for this part of the problem.*] *[3]*

[Total = 70]

Part IV - Fun. Bonus!

$\circ^{\circ^{\circ}}$**.** Write a little poem touching on mathematics or its history. *[1]*

I HOPE THAT YOU ENJOYED THE COURSE. ENJOY THE BREAKL!