MthT 411 Sample Questions
The exam will contain 5 questions of roughly this level of difficulty; it will apply to the entire course.

1. Consider the geometry illustrated here.

   The halfplanes of the ten lines in this geometry are given by the following table:

l	Ψ_l^1	Ψ_l^2
$\{C, D, E, F, G\}$	$\{A\}$	$\{B\}$
$\{A, E, B\}$	$\{C, D\}$	$\{F, G\}$
$\{A, C\}$	$\{E\}$	$\{B, D, F, G\}$
$\{B, C\}$	$\{E\}$	$\{A, D, F, G\}$
$\{A, D\}$	$\{E\}$	$\{B, C, F, G\}$
$\{B, D\}$	$\{E\}$	$\{A, C, F, G\}$
$\{A, F\}$	$\{E\}$	$\{B, C, D, G\}$
$\{B, F\}$	$\{E\}$	$\{A, C, D, G\}$
$\{A, G\}$	$\{E\}$	$\{B, C, D, F\}$
$\{B, G\}$	$\{E\}$	$\{A, C, D, F\}$

   - Does AXIOM III hold for this geometry? Prove or disprove.
   - Does AXIOM IV hold for this geometry? Prove or disprove.
   - Find $\overline{AB}$. Does E lie between A and B? Does E separate A and B?

2. Recall the definition of the kernel of a set in Exercise 8.52. Let $ABCD$ be a quadrilateral. Let $S = \overline{AB} \cup \overline{BC} \cup \overline{CD} \cup \overline{DA}$. Prove $K(S) = \emptyset$. What is $K(S \cup \text{int}ABCD)$? What is $K(AB \cup BC)$?

3. Let a, b, c be three lines that meet at one point V. Prove that c meets one or two but not more of the four quadrants $\Psi_a^1 \cap \Psi_b^1$, $\Psi_a^1 \cap \Psi_b^2$, $\Psi_a^2 \cap \Psi_b^1$, $\Psi_a^2 \cap \Psi_b^2$.

4. Let a and b be two lines and $O = a \cdot b$. The point O divides a into opposite rays a^1, a^2 and divides b into opposite rays b^1, b^2. Let u be a bisector of the angle $a^1 \cup b^1$ and let v be a bisector of the angle $a^1 \cup b^2$. Prove that $u \perp v$.
   Suggestion: consider the effect of $\Gamma_u \Gamma_v \Gamma_u \Gamma_v$ on the rays.

5. Let A, B, C be three collinear points and $C \in \overrightarrow{AB}$. Prove that C lies between A and B, or else B lies between A and C, but not both.

6. Essay question: General principle? Why did we think about these strange axioms for geometry. Here are two ways I might address that question.

   (a) Distinguish between a geometry where the notion of length is fundamental as in your high school geometry and the approach of this text. First, what is the formal difference? Second, what effects does this have organization of the subject?

(b) What are several ways that one can treat straight angles? First, what is the formal difference? Second, what effects does this have organization of the subject?