

Model Lesson

Unit Name: Indirect measure		Unit Length: 45	
Overview: Ratios provide a method for indirect measure			
DESIRED RESULTS			
TEKS and Student Expectations (See Appendix A for detailed description.)			
(G.11) Similarity and the geometry of shape. (B)			
Enduring Understandings (Big Ideas) With great accuracy, measures can be determined without access to rulers or other measuring instruments.		Essential Questions How can one determine the height of a tree when no measuring instrument is available.	Critical Vocabulary Triangles Base Altitude Perpendicular Ratio Cross products Parallel
Learning Goals Content objective: To use similar triangles to solve proportions. Language objective: The student will use the appropriate vocabulary for discussing triangles, ratios, proportions, and measures.		Materials Needed Tape measure or a carpenter's rule. Mirror	
ASSESSMENT PLAN			
Performance Tasks Quiz Given sketches and data, students will solve problems involving similar triangles using ratios. For examples, see Figure 1		Other Evidence The teacher will observe the students as they work to determine participation in the tasks and understanding of the concept of indirect measure. Students will write reports of the task in their journals, explaining exactly how they determined the height of the flag pole.	

Submitted by:	MaryE Wilkinson	Date:	February 22, 2008
Edited by:	Pat Curtin & John Beck, MELL Staff	Date:	March, 2008

LEARNING PLAN

The teacher may need to review the concepts of ratios, proportions, and similar triangles.

The teacher will lead a class discussion of similar triangles and how they can help in solving measurement problems when direct measurement is not possible. This discussion will include information about the sun's rays (which are essentially parallel by the time the light reaches the earth), and the concept of incoming angles and outgoing angles. (MC-12), (MC-16)

The teacher will pick a reference high on the wall of the classroom and place the mirror on the floor. A student will be positioned so that he or she can see the reference in the mirror, then the distances from the mirror to the student and from the mirror to the wall will be measured. The height from the floor to the student's eye will be measured. The class will determine a ratio of the student's eye height to the distance from the student to the mirror. A second ration will be set up (using a variable for the height of the reference

MELL Connections

(MC-07) - New concepts should first be presented to ELLs in a concrete manner, followed by a semi-concrete manner, and finally an abstract manner.

(MC-08) - Hands-on activities involving math manipulatives are typically helpful to ELLs because the lesson involves multiple learning modalities and does not require the student to rely solely upon his/her ability to understand verbal instruction.

(MC-09) - To assist the ELLs, the teacher should model the expected task and use visual representations to reinforce concepts and/or steps in the problem-solving process. Critical concepts should be clearly emphasized and repeated.

(MC-12) - ELLs should be given numerous opportunities to write about the mathematics concepts they are learning. Journal entries, for example, provide opportunities for the students to crystallize their thinking about concepts and for the teacher to check for understanding. Students who have limited English language skills should be allowed to write in their first language initially

point) of the height of the reference to the distance from the mirror to the wall. The two ratios will be set equal to determine the height of the reference using cross products. (MC-07), (MC-09), (MC-12), (MC-16)

In groups of three, the students will repeat the investigation with a reference of their choice. (MC-12), (MC-16)

If the day is sunny, the teacher will take the class outside to investigate the height of a tree, flagpole, etc. Using shadows to determine the similar triangles created by the sun's rays. (MC-08), (MC-12), (MC-16)

In groups of three, the students will repeat the investigation with a reference of their choice. (MC-12), (MC-14), (MC-15), (MC-16), (MC-17)

The teacher will close the lesson with a class discussion about real world applications of the two problem solving methods and the students will write reports in their journals. (MC-12), (MC-16)

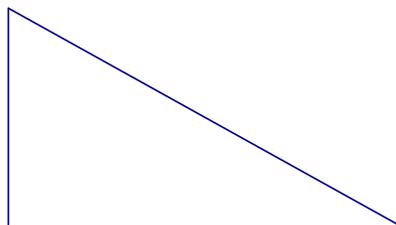
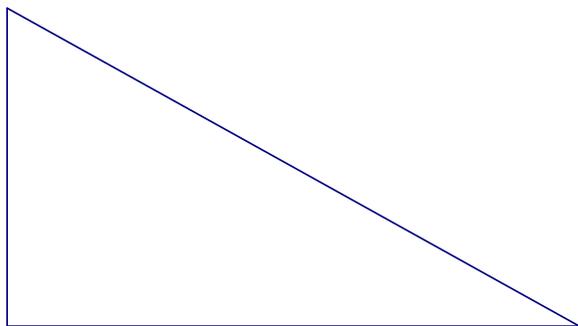
and should not be penalized for spelling or grammar errors.

(MC-14) - Teachers should support ELLs who need extra time for dialogue by providing opportunities to work in groups. When possible, pair each ELL with another student who has some fluency in the ELL's dominant language and who can function as a "peer tutor."

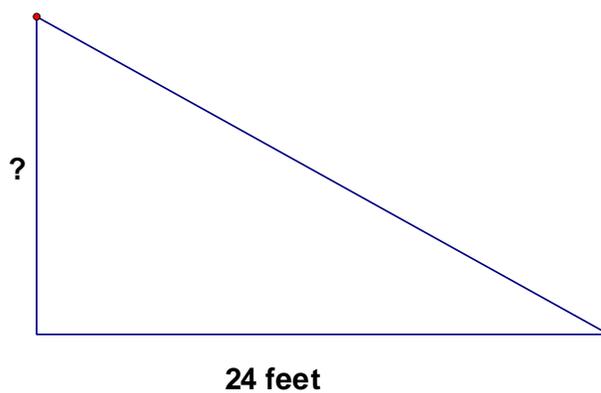
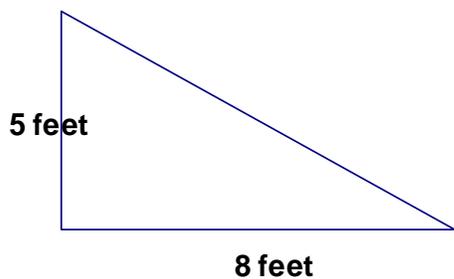
(MC-15) - In forming groups, the teacher should make sure that ELLs are assigned with a peer tutor, that ELLs are distributed among groups, and that no group is predominantly comprised of ELLs.

(MC-16) - When monitoring ELLs during instruction, the teacher should make a special effort to assist, re-explain and demonstrate again, if necessary. Encouragement and reinforcement should be used frequently.

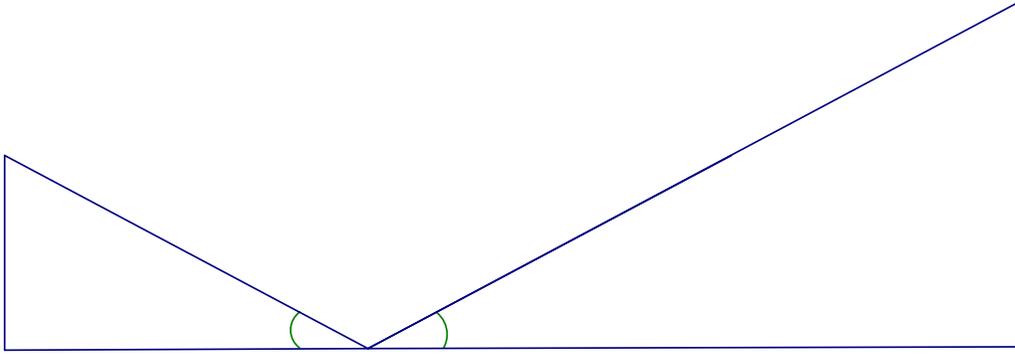
(MC-17) - Examples that are relevant to the lives of ELLs are helpful in motivating students and in promoting their engagement with the content.



Use your protractor to measure the angles to confirm that these two triangles are similar.



Standing beside the flagpole, Carol is 5 feet tall and casts a shadow that is 8 feet long. The flagpole casts a shadow that is 24 feet long. How tall is the flagpole?



Use the following information to mark the sketch and then solve the problem.

Paul is 6 feet tall. When the mirror is placed on the ground 9 feet away from Paul and 27 feet away from the telephone pole, Paul can see the top of the pole in the mirror. How tall is the pole?

English Language Proficiency Standards Quick Reference. (Chapter 74. Curriculum Requirements Subchapter A. Required Curriculum, §74.4. English Language Proficiency Standards). The standards checked here are merely examples for the teacher's consideration for inclusion in this lesson.

Cross-curricular second language acquisition/listening.

The ELL listens to a variety of speakers including teachers, peers, and electronic media to gain an increasing level of comprehension of newly acquired language in all content areas. ELLs may be at the beginning, intermediate, advanced, or advanced high stage of English language acquisition in listening. In order for the ELL to meet grade-level learning expectations across the foundation and enrichment curriculum, all instruction delivered in English must be linguistically accommodated (communicated, sequenced, and scaffolded) commensurate with the student's level of English language proficiency. The student is expected to:

- [X] (c)(2)(A) - distinguish sounds and intonation patterns of English with increasing ease;
- (c)(2)(B) - recognize elements of the English sound system in newly acquired vocabulary such as long and short vowels, silent letters, and consonant clusters;
- (c)(2)(C) - learn new language structures, expressions, and basic and academic vocabulary heard during classroom instruction and interactions;
- (c)(2)(D) - monitor understanding of spoken language during classroom instruction and interactions and seek clarification as needed;
- (c)(2)(AE) - use visual, contextual, and linguistic support to enhance and confirm understanding of increasingly complex and elaborated spoken language;
- (c)(2)(F) - listen to and derive meaning from a variety of media such as audio tape, video, DVD, and CD ROM to build and reinforce concept and language attainment;
- (c)(2)(G) - understand the general meaning, main points, and important details of spoken language ranging from situations in which topics, language, and contexts are familiar to unfamiliar;
- (c)(2)(H) - understand implicit ideas and information

	<p>in increasingly complex spoken language commensurate with grade-level learning expectations; and</p> <p>(c)(2)(I) - demonstrate listening comprehension of increasingly complex spoken English by following directions, retelling or summarizing spoken messages, responding to questions and requests, collaborating with peers, and taking notes commensurate with content and grade-level needs.</p>
<p><i>Cross-curricular second language acquisition/speaking.</i></p> <p>The ELL speaks in a variety of modes for a variety of purposes with an awareness of different language registers (formal/informal) using vocabulary with increasing fluency and accuracy in language arts and all content areas. ELLs may be at the beginning, intermediate, advanced, or advanced high stage of English language acquisition in speaking. In order for the ELL to meet grade-level learning expectations across the foundation and enrichment curriculum, all instruction delivered in English must be linguistically accommodated (communicated, sequenced, and scaffolded) commensurate with the student's level of English language proficiency. The student is expected to:</p>	<p>[X] (c)(3)(A) - practice producing sounds of newly acquired vocabulary such as long and short vowels, silent letters, and consonant clusters to pronounce English words in a manner that is increasingly comprehensible;</p> <p>(c)(3)(B) - expand and internalize initial English vocabulary by learning and using high-frequency English words necessary for identifying and describing people, places, and objects, by retelling simple stories and basic information represented or supported by pictures, and by learning and using routine language needed for classroom communication;</p> <p>(c)(3)(C) - speak using a variety of grammatical structures, sentence lengths, sentence types, and connecting words with increasing accuracy and ease as more English is acquired;</p> <p>(c)(3)(D) - speak using grade-level content area vocabulary in context to internalize new English words and build academic language proficiency;</p>

	<p>(c)(3)(E) - share information in cooperative learning interactions;</p> <p>(c)(3)(F) - ask and give information ranging from using a very limited bank of high-frequency, high-need, concrete vocabulary, including key words and expressions needed for basic communication in academic and social contexts, to using abstract and content-based vocabulary during extended speaking assignments;</p> <p>(c)(3)(G) - express opinions, ideas, and feelings ranging from communicating single words and short phrases to participating in extended discussions on a variety of social and grade-appropriate academic topics;</p> <p>(c)(3)(H) - narrate, describe, and explain with increasing specificity and detail as more English is acquired;</p> <p>(c)(3)(I) - adapt spoken language appropriately for formal and informal purposes; and</p> <p>(c)(3)(J) - respond orally to information presented in a wide variety of print, electronic, audio, and visual media to build and reinforce concept and language attainment.</p>
<p><i>Cross-curricular second language acquisition/reading.</i> The ELL reads a variety of texts for a variety of purposes with an increasing level of comprehension in all content areas. ELLs may be at the beginning, intermediate, advanced, or advanced high stage of English language</p>	<p>(c)(4)(A) - learn relationships between sounds and letters of the English language and decode (sound out) words using a combination of skills such as recognizing sound-letter relationships and identifying cognates, affixes, roots, and base words;</p> <p>(c)(4)(B) - recognize</p>

acquisition in reading. In order for the ELL to meet grade-level learning expectations across the foundation and enrichment curriculum, all instruction delivered in English must be linguistically accommodated (communicated, sequenced, and scaffolded) commensurate with the student's level of English language proficiency. For Kindergarten and Grade 1, certain of these student expectations apply to text read aloud for students not yet at the stage of decoding written text. The student is expected to:

directionality of English reading such as left to right and top to bottom;
(c)(4)(C) - develop basic sight vocabulary, derive meaning of environmental print, and comprehend English vocabulary and language structures used routinely in written classroom materials;
(c)(4)(D) - use prereading supports such as graphic organizers, illustrations, and pretaught topic-related vocabulary and other prereading activities to enhance comprehension of written text;
(c)(4)(E) - read linguistically accommodated content area material with a decreasing need for linguistic accommodations as more English is learned;
(c)(4)(F) - use visual and contextual support and support from peers and teachers to read grade-appropriate content area text, enhance and confirm understanding, and develop vocabulary, grasp of language structures, and background knowledge needed to comprehend increasingly challenging language;
(c)(4)(G) - demonstrate comprehension of increasingly complex English by participating in shared reading, retelling or summarizing material, responding to questions, and taking notes commensurate with content area and grade level needs;
(c)(4)(H) - read silently with increasing ease and comprehension for longer

	<p>periods;</p> <p>(c)(4)(I) - demonstrate English comprehension and expand reading skills by employing basic reading skills such as demonstrating understanding of supporting ideas and details in text and graphic sources, summarizing text, and distinguishing main ideas from details commensurate with content area needs;</p> <p>(c)(4)(J) - demonstrate English comprehension and expand reading skills by employing inferential skills such as predicting, making connections between ideas, drawing inferences and conclusions from text and graphic sources, and finding supporting text evidence commensurate with content area needs; and</p> <p>(c)(4)(K) - demonstrate English comprehension and expand reading skills by employing analytical skills such as evaluating written information and performing critical analyses commensurate with content area and grade-level needs.</p>
<p><i>Cross-curricular second language acquisition/writing.</i> The ELL writes in a variety of forms with increasing accuracy to effectively address a specific purpose and audience in all content areas. ELLs may be at the beginning, intermediate, advanced, or advanced high stage of English language acquisition in writing. In order for the ELL to meet grade-level learning expectations across foundation</p>	<p>(c)(5)(A) - learn relationships between sounds and letters of the English language to represent sounds when writing in English;</p> <p>[x] (c)(5)(B) - write using newly acquired basic vocabulary and content-based grade-level vocabulary;</p> <p>(c)(5)(C) - spell familiar English words with increasing accuracy, and employ English spelling patterns and rules with increasing accuracy as</p>

and enrichment curriculum, all instruction delivered in English must be linguistically accommodated (communicated, sequenced, and scaffolded) commensurate with the student's level of English language proficiency. For Kindergarten and Grade 1, certain of these student expectations do not apply until the student has reached the stage of generating original written text using a standard writing system. The student is expected to:

more English is acquired;
 (c)(5)(D) - edit writing for standard grammar and usage, including subject-verb agreement, pronoun agreement, and appropriate verb tenses commensurate with grade-level expectations as more English is acquired;

e(c)(5)(E) - employ increasingly complex grammatical structures in content area writing commensurate with grade-level expectations, such as:

- (i) using correct verbs, tenses, and pronouns/antecedents;
- (ii) using possessive case (apostrophe *s*) correctly; and
- (iii) using negatives and contractions correctly;

(c)(5)(F) - write using a variety of grade-appropriate sentence lengths, patterns, and connecting words to combine phrases, clauses, and sentences in increasingly accurate ways as more English is acquired; and

- [x] (c)(5)(G) - narrate, describe, and explain with increasing specificity and detail to fulfill content area writing needs as more English is acquired.

Appendix 1
TEKS and Student Expectations

(G.11) **Similarity and the geometry of shape.** The student applies the concepts of similarity to justify properties of figures and solve problems.

The student is expected to:

(B) use ratios to solve problems involving similar figures