Name: Summer Help Wanted
Course: Geometry
Time: One 80 minute class period
Pre-Req.   The students must have knowledge of:
Knowledge:
- trigonometric ratios: sine, cosine and tangent functions
- solving multi-step problems
- calculating surface area of cylinder

Objectives: Students will be able to use indirect measurement as an application of trigonometric functions and will be able to apply this knowledge to a real-world application. Students will be able to use scientific calculator to determine sine, cosine or tangent given side measurements.

Materials   Blackline master for clinometer construction, transparent tape, kite string,
Needed: 5"x7" index card, straw, nut, 100 foot measuring tape, scientific calculator and bid proposal for each pair of students
Worksheet: Angles of Elevation and Depression

Important   Angle of Elevation: an angle formed by a horizontal line and the line of
Vocabulary   sight to an object above the level of the horizontal

Angle of Depression: an angle formed by a horizontal line and the line of sight to an object below the level of the horizontal

Clinometer: an instrument used to measure the angle of elevation or depression

Procedure:
- 5-min Check of previously taught trigonometric functions
- **Ask:** What assumptions do we make in these problems? (triangles formed are right triangles)
- Tell students that today we are going to apply our knowledge of trigonometric functions to solve a real-life problem.
- Introduce new vocabulary using 5-min check problems as examples.
- Partner students in groups of 2. Describe the problem "Summer Help Wanted"
- **Ask**: What information will you need to solve this problem? (height of flagpole, diameter or circumference of flagpole)
- Tell students that today we are going to construct a clinometer to help us measure the angle of elevation of the flagpole.
- Handout directions for construction and have students assemble clinometer according to instructions (provide model and tell students to make sure that string hangs freely to create a plumb line)
- Have students practice finding a horizontal line of sight and reading the clinometer angle of elevation
- Have students use the following equation to solve for the height of an object:
    tan (angle sighted) =height of object –x/distance to object

where x represents the distance from the ground to eye level.
- Remind students to have calculator in degree mode
- Have students complete exercise 1 and 2 on worksheet Activity A
- Go outdoors and have students gather data to calculate surface area of flagpole, height of tree and height of building. Discuss units of measurement with students, reminding them that 6'5" is not the same as 6.5 ft.
- Have student pairs calculate amount of paint needed to paint flagpole with stated assumptions. Have student pairs submit bids to paint flagpole.

Follow-up This activity can followed by Law of Sines and Law of Cosines to solve problems that involve triangles that are not right triangles. This activity can be extended by challenging students to find a more accurate calculation for the amount of paint necessary to paint this particular flagpole, by using area of frustum. Discussion can include approximating diameter of top of pole from photograph by comparing known measurements with scaled measures in photo.

Assessment: Student Practice Sheet: Angles of Elevation and Depression

Resources: Glencoe Geometry Integrations, Applications and Connections, 2001.

Bid Proposal:

Proposal Submitted By: _____

Draw an appropriately labeled diagram for determining height of flagpole using clinometer in space below:

Please round answers to nearest tenth of foot and show all work for calculations:

Height of flagpole:
Height of tree by office:
Height of front of building:

Surface Area of Flagpole:

Amount of Paint Needed (round to nearest quart)**:**

Item	cost	total
Paint	x 72.50/qt	
Brushes	x 6.50/brush	
Labor	x 2.50/ft^2	
	Total	

Cost of Labor:

Incidentals: Please include description and estimated cost of all incidentals along with explanation of use on back of page.

Total Bid: