OUTDOOR MATH ACTIVITIES

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This fall when the days are cool and clear and you feel a need for a break from the classroom, why not take your class outside and let them do some measuring? Many mathematical ideas can be demonstrated, and besides, it is fun.

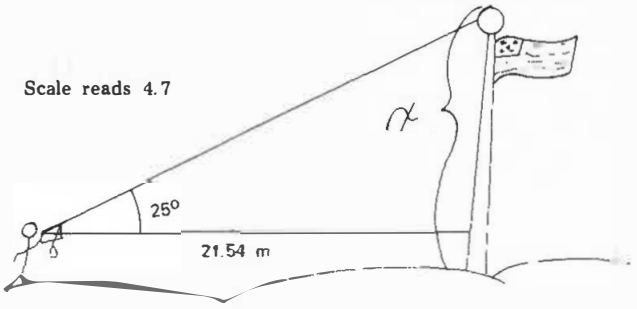
In the next few issues of this Newsletter, you will find plans for making, and ideas for using, several outdoor measuring devices.

This article will feature a clypsometer (clip-som-e-ter), so named by the author because it is a combination of two devices, the clinometer and hypsometer. The device could be used to measure verticle angles (angles in the air or up and down angles) and the height of objects. A detailed drawing for construction purposes and an explanation of how to use it will follow, but first, some possible activities.

The simplest activity we can do with the clypsometer is to measure angles. One might like to do this and make scale drawings of objects in the school yard. Remember, that by making scale drawings, one can determine measurement not directly obtainable.

A second activity which would be good for upper middle school and junior high students is to use the measured angle and trigonometric tables to obtain the height of objects. To do this, students would have to be provided with the tangents for the angles from 0^{o} to 45^{o}. You may want to provide more but these would be adequate for most purposes. To obtain the height of an object the student will measure (in metres) the distance from himself to the bottom of the object. Then the height of the object is obtained by multiplying the tangent of the angle by the distance to the base and adding the students' height (in metres). The answer will be in metres if the student measured in metres.

The third type of activity is using the clypsometer to measure heights of objects. To do this the student will read the number on the scale on the saw blade and multiply that number by the distance from the student to the object and divide by 10. The number thus found plus the students' height is the height of the object.



$\tan 25^{o} = .466$

$x = (.466)\ (21.54) = 10.04$

Scale reading = 4.7

$$x = \frac{(4.7)\ (21.54)}{10} = 10.12$$

The height of the flagpole is 10.04 metres plus the students' height.

This is a good way to bring in the multiplication of decimals for students in a meaningful way. One can also talk about accuracy and relative error to a meaningful way.

Clypsometer

To make it and use it:

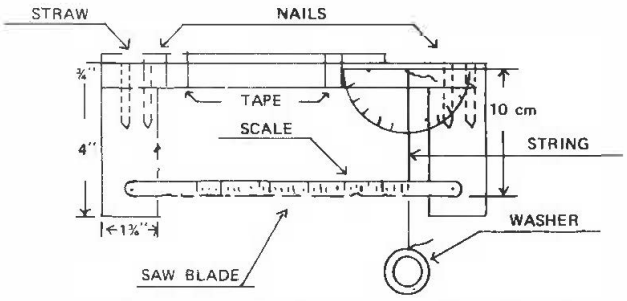
Material needed. (all wood thicknesses and widths are given as you would purchase it and is not the actual measurement.)*

2 blocks of wood, one inch by two inches and 4 inches long.
1 block of wood, one inch by one inch and 12 inches long.
1 drinking straw.
1 hacksaw blade - used.
1 protractor.
1 washer for string weight.
1 piece of string 50 cm long.
4 # 4 common nails.
1 # 4 finishing nail.
2 carpet tacks to attach the saw blade.
Masking tape, glue and a hammer.

*Standard American Measurements are given here and on the drawing because it is not possible at this time to purchase materials in metric measure.

Construction:

First nail the pieces together as illustrated. Next attach the protractor and the hacksaw blade. Do not drive in the nail in the center of the protractor until the string has been attached. Be certain that the distance from the top of the string to the bottom of the blade is exactly 10 cm. Affix masking tape to the saw blade taking care not to cover the teeth. Mark a linear scale on the tape by making the zero point of the scale directly under the 90° point on the protractor. Mark the scale in centimetres and half centimetres. Finally attach the string and washer to the center of the protractor.



Use the above drawing to construct the clypsometer.

To use the clypsometer to measure angles a student simply looks at the top of an object through the straw and making sure the string is free (not caught on the sawblade) and is not swinging, he then twists the clypsometer so the string catches on the sawblade and then reads the angle on the protractor. Notice that if a commercial protractor is used, the student must subtract the 90° from the reading. (You may wish to suggest that the students construct a protractor which would eliminate the subtraction.)

To measure heights of objects with the clypsometer a student will go through the same sighting process as to find angles but instead of reading the protractor, the student will read the scale on the sawblade. The height of the object then is the number on the scale times the distance to the object divided by 10. The height of the object will be in the same unit as the distance to the object as long as the metric system is used as the system of measurement.

Further information on this device and activities and a copy of the tangent table may be obtained by writing

Del Mod Resource Center
Delaware Technical Community College
Southern Branch
Georgetown, Delaware 19947

and asking for them. Good Luck!

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Change of Address

Please note that the address of Western Educational Activities has been changed and should now read:

Western Educational Activities Limited
10324 - 103 Street
Edmonton, Alberta
T5J 0Y9