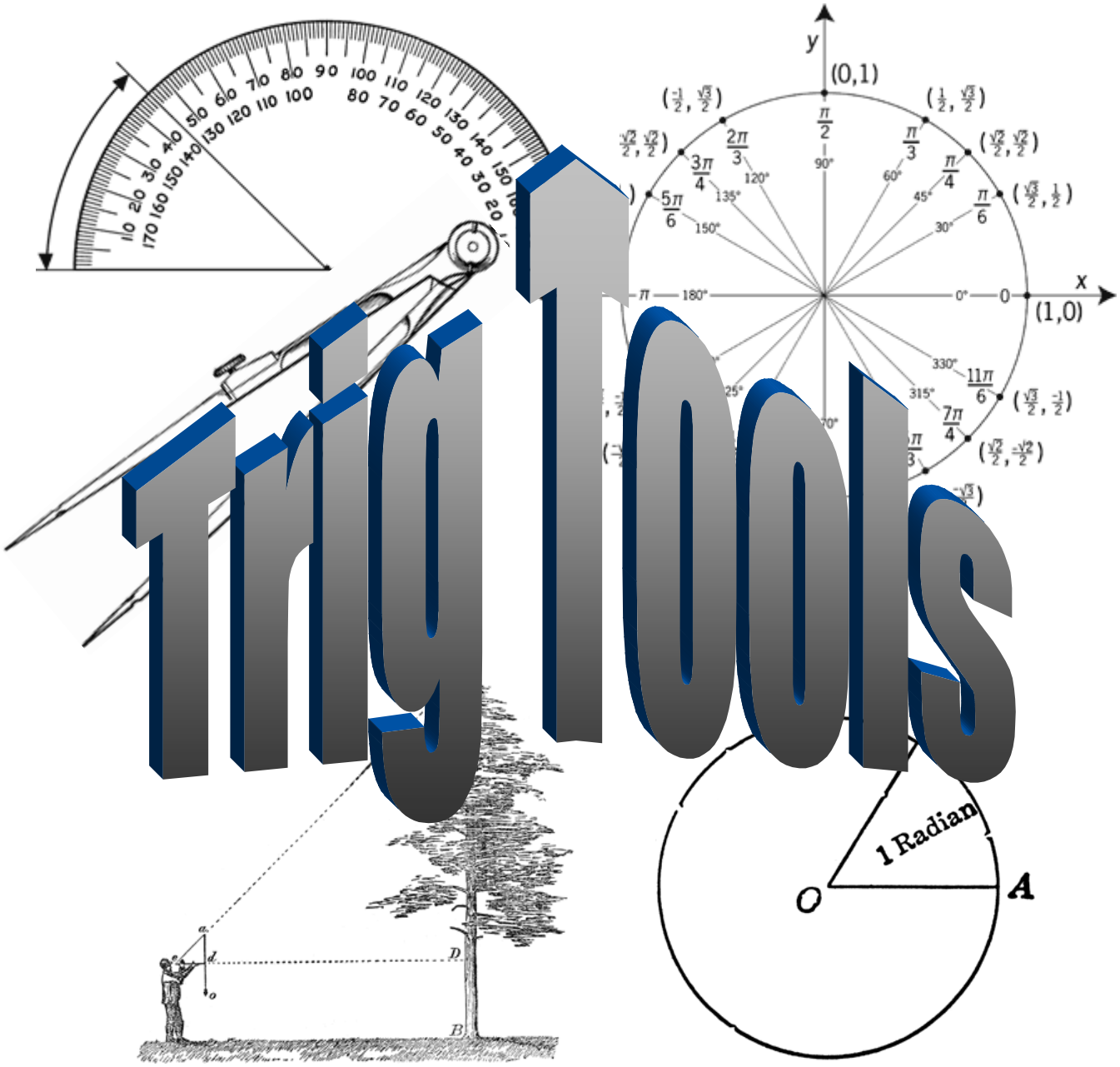


T^3 Regional – MEGSL Conference
Parkway West High School
Ballwin, Missouri

November 15, 2008

Pam Burke
Potosi High School
Potosi, Missouri

pamburke74@gmail.com
pburke@potosir3.org

Name _____

Partners' names _____

_____

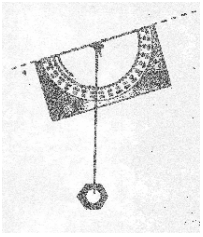
_____

Finding Measurements Indirectly Using Trigonometry
Trig Project

Scheduled date for taking measurements: _____
Due date for project: _____

Your task is to find the height of one corner of a building or other structure at your school using an angle measuring device and trigonometry.

Building the Hypsometer



The first part of your task is to build the hypsometer you will use for measuring angles.

You will need the following materials:

paper protractor,
rectangular-shaped piece of cardboard
small straw or coffee stirrer
tape
light-weight string or thread
a weight (such as a metal washer or nut)

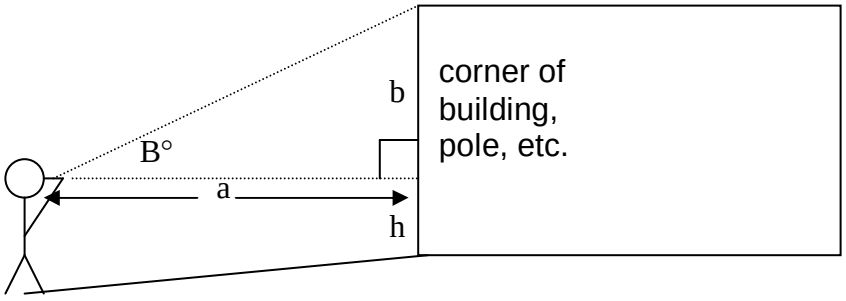
- Glue or tape the paper protractor to the piece of cardboard so that the zero line of the protractor is on the edge of the cardboard.
- Tape the straw on the edge of the cardboard along the zero line of the protractor.
- Attach the string to the center vertex of the protractor.
- Attach the weight to the bottom of the string.

Collecting the Data

You and your classmates will go outside during class time with your hypsometers (or clinometers), pencils, and paper, and gather data. Give all measurements in reasonable units.

You will work in a group of three to five students. Partners are very important in this project. Each person will make his own sightings, while the partners help take measurements. Within a group, the measurements should all be different. To ensure this, all group members should stand at different distances from the structure. But it is important that each person stand in the same spot to make all of his/her measurements. In your summary you will mention specifically how each person in your group helped you.

You will be using right triangular trig, so you must have a right triangle to work with. It would be nice if the buildings on our campus formed right angles with the ground, but you are not that lucky. You will need to "make" a right triangle. Study the diagram below.



- To find "h" you will need to use a measuring tape that you and your partners will have prepared before going outside. This will be made from a piece of adding machine paper on which you have marked increments of one inch. Someone in your group should tape the piece of paper on the corner of the structure. You are to look through your hypsometer/clinometer at a 0° angle. One of your partners will look at the hypsometer/clinometer to make sure that your angle is exactly 0°. Another partner should be standing at the corner of the building. You are to direct that partner to make a mark on the measuring tape at the height you see when looking at a 0° angle.

  h = _____

- To find "a" you will need to carefully stretch a measuring tape so that it does not sag and read the distance. You will need the help of your partners to do this.

  a =_____

- To find the measure of the angle of elevation to the top of the building, use your hypsometer/clinometer.

  B = _____°

- Now calculate b by using the correct trig function. Show work below.

  b = _____

- For the total height of the corner of the building/pole, add "h" and "b."

  The total height of the building/pole is _____.

What did your group measure? _____

Preparing the Report

On graph paper make an accurate scale drawing, including all the measurements and the scale you used to make the drawing.

Write a brief summary answering the following questions. This summary should be typed.

- What is your calculated height of the building? Do you think this is a reasonable estimate? Why or why not?
- How long did it take you to complete the task?
- What difficulties did you encounter in completing the task?
- What did each of your partners do in helping you take measurements?
- What suggestions do you have for improving this project?
- Would you recommend this project for future trig classes? Why or why not?

Review your work for errors in spelling and grammar.

Turn in this entire handout, along with your scale drawing and summary.

☺☺☺

To make 100% on the project, all criteria in the following scoring rubric must be met:

- All required papers are turned in: complete handout, scale drawing, report, and any other work done on the project.
- The scale drawings accurately depict the problem and show all measurements, including the scale used.
- All questions are answered completely and accurately, with work shown where needed.
- The computed height of the building is reasonable.
- There are no mathematical errors.
- Report was well written, with spelling and grammatical errors not significantly affecting the communication of ideas.

If you turn your project in by the due date, your teacher will evaluate it. Then, if your project does not meet all the criteria, you will be given the opportunity to work more on it to bring it up to that standard.

You may earn bonus points on your project by including the following: Interview an engineer or someone else who may use trig to take measurements in his/her work. Or using the Internet or other resource, research some use of trig in a comparable setting. Prepare a brief report (at least ½ page typed). Include information about your source(s).

Name _____

Project Checklist

____ All papers turned in

____ Value of "h"

____ Value of "a"

____ Measurement of angle

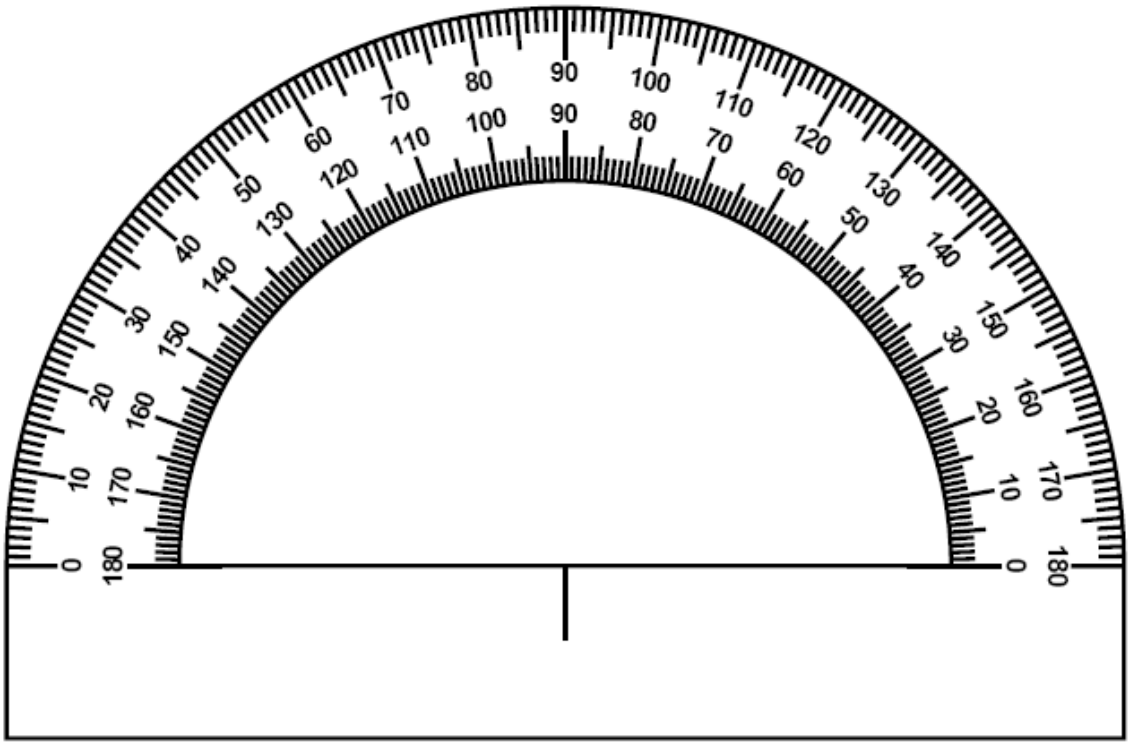
____ Value of "b" (with work shown)

____ Total height of the building

____ Accurate scale drawing (including all measurements and scale used)

____ Report answers all questions and is well written

- What is your calculated height of the building? Do you think this is a reasonable estimate? Why or why not?
- How long did it take you to complete the task?
- What difficulties did you encounter in completing the task?
- What did each of your partners do in helping you take measurements?
- What suggestions do you have for improving this project?
- Would you recommend this project for future trig classes? Why or why not?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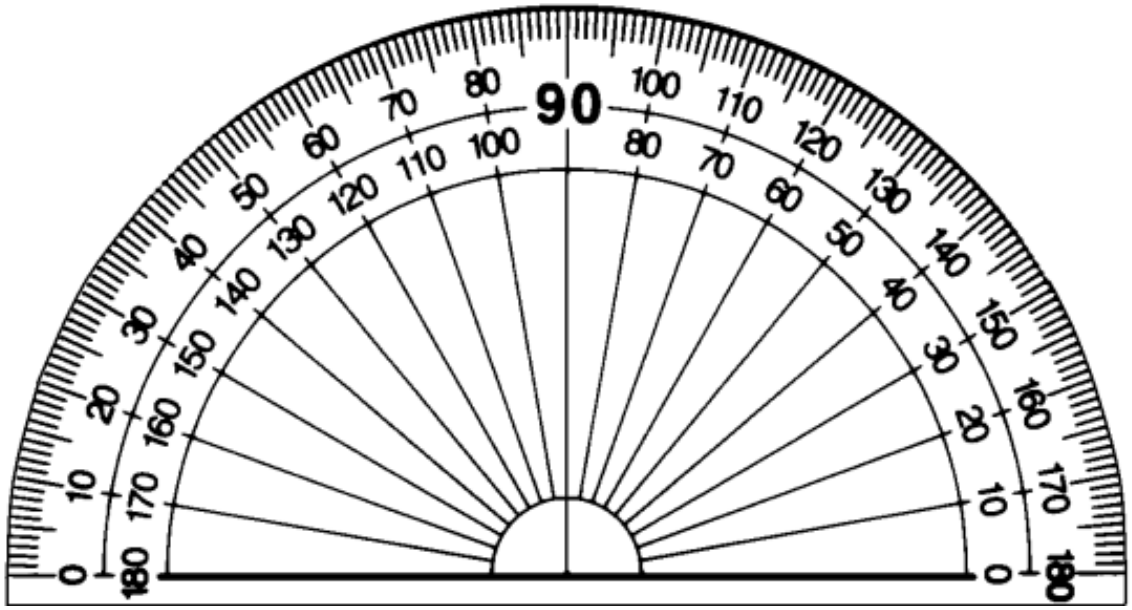

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180

COLLECTING SINUSOIDAL DATA

- Collect data from each of the following websites.
- Make a scatter plot and find a sinusoidal curve which best fits the data.

Tides

http://www.maineharbors.com/

on left, select an area; then select a port
look at either high or low tide, either AM or PM, and record height for each day of the month; ignore any place where data is missing

Temperatures

http://www.met.utah.edu/

click on "Weather"
scroll down, under "Climate and Other Info" click on "Utah and National Climate Data"
scroll down, under "National Climate" click on "Normal Daily Maximum Temperatures" or "Normal Daily Minimum Temperatures"
choose a city and record monthly temperatures

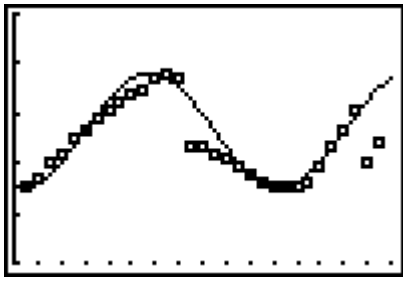
Hours of Sunlight

http://www.srh.noaa.gov/meg/sun.php

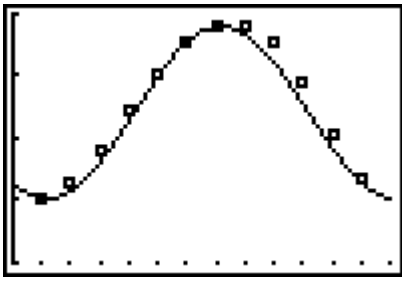
under "Tables for Entire Year 2008, click on "Sunrise/Sunset" for a city of your choice
record sunrise and sunset times for a selected day of each month; subtract to find number of sunlight hours

Samples of Student Graphs:

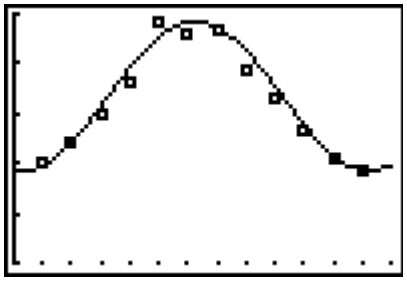
Tides



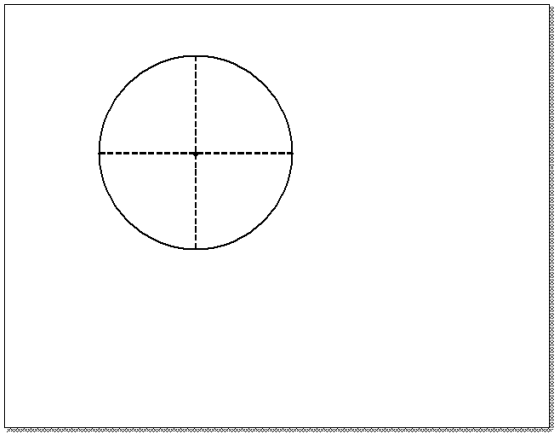
Temperature

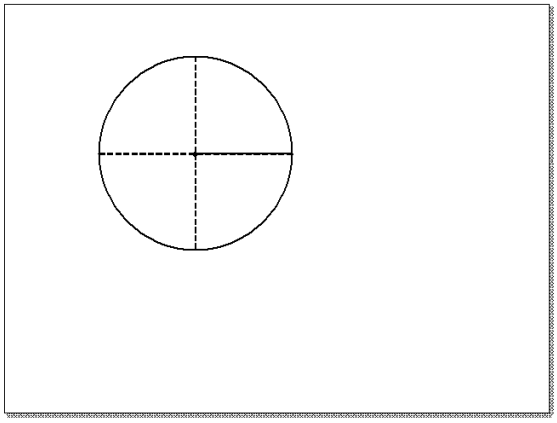


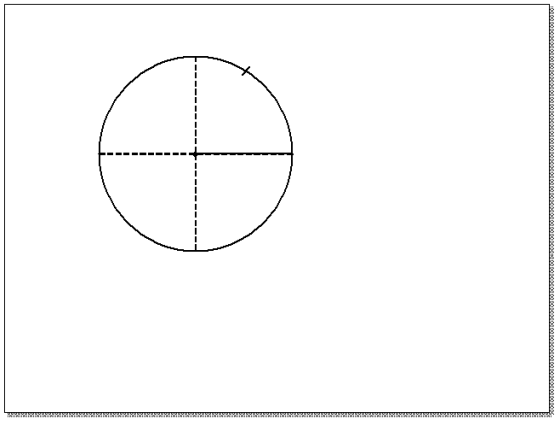
Hours of Sunlight

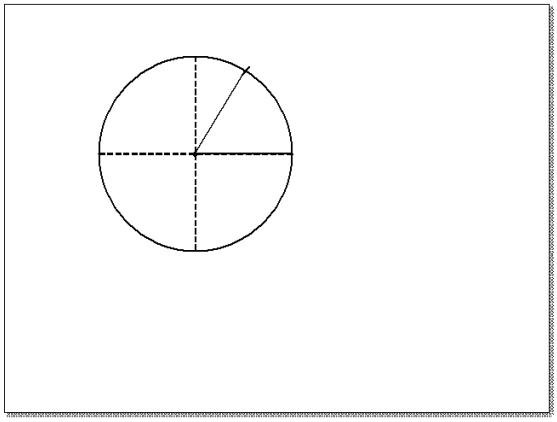


Unit Circle

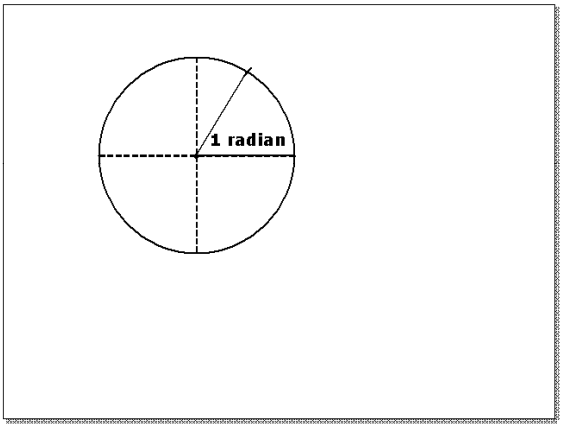


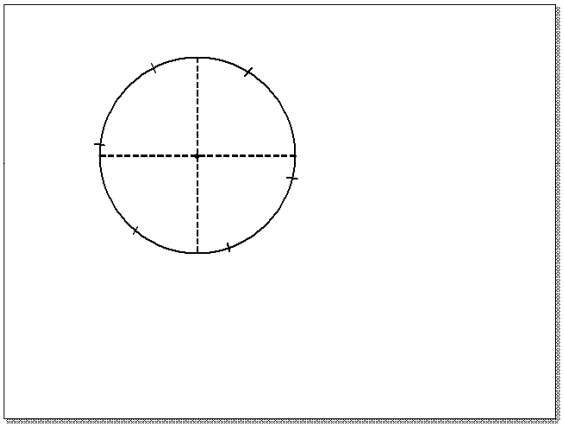


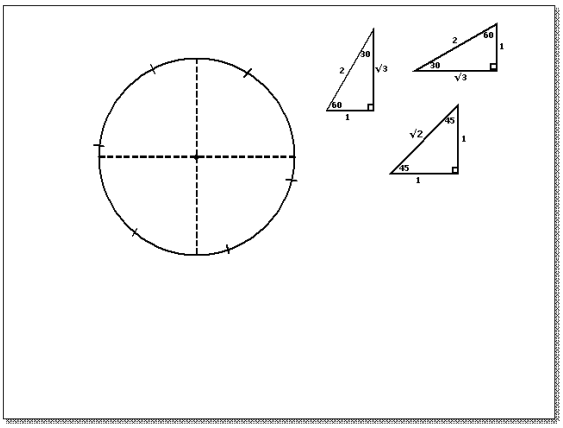


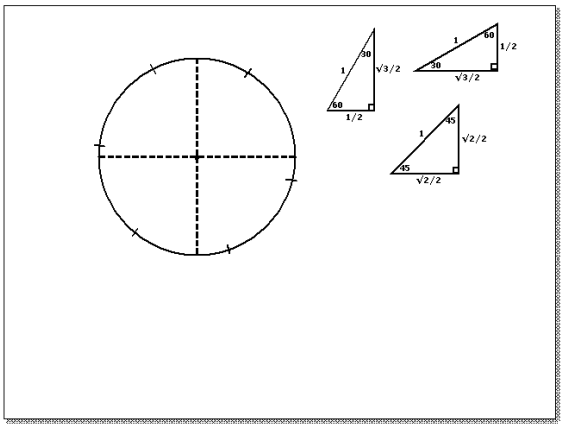


Unit Circle


1 radian



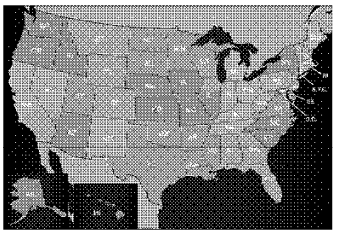

2
30
√3
60
1
2
60
1
30
√3
√2
45
1
45
1


1
30
√3/2
60
1/2
1
60
1/2
30
√3/2
1
45
√2/2
45
√2/2

Potosi Latitude Longitude

POTOSI , MO
Latitude: N 37° 56'
Longitude: W 90 ° 47'

http://www.bcca.org/misc/qiblih/latlong.html



POTOSI , MO
Latitude: N 37° 56'
Longitude: W 90 ° 47'

http://www.bcca.org/misc/qiblih/latlong.html

Concord 37° 58' N 121° 59' W -- CA
Carbondale 37° 47' N 89° 15' W -- IL
Cedar City 37° 42' N 113° 6' W -- UT
Garden City 37° 56' N 100° 44' W -- KA
Owensboro 37° 45' N 87° 10' W -- KY
Houma 29° 31' N 90° 40' W -- LA
Jonesboro 35° 50' N 90° 42' W -- AR
Dubuque 42° 24' N 90° 42' W -- IA

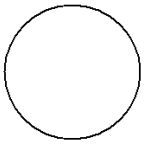
Earth's diameter is approximately 7926 miles

Potosi Latitude Longitude

POTOSI , MO
Latitude: N 37° 56′
Longitude: W 90 ° 47′

Concord, CA
37° 58′ N 121° 59′ W

$s = r\theta$



Trigonometry Properties Square

NAME _____

$\cos^2 A$ Sin A $\quad \frac{\cos A}{\cot A}$ $\frac{1}{\sec A}$	sec A Sin A $\quad \sec^2 A - 1$ $\frac{\sin A}{\tan A}$	cot A $\tan^2 A \quad \cos^2 A \tan^2 A$ sin A cot A	$\frac{\tan A}{\sec A}$ $\sin^2 A \quad \sin^2 A$ 1-sin A
cos A 1 $\quad$ sin A $\sin^2 A \cot^2 A$	cos A tan A cos A $\quad \sec^2 A$ cos A sec A	$\frac{\sec A}{1}$ $1 + \tan^2 A \quad \frac{1}{\cot A}$ $\frac{1}{\cos A}$	$\frac{\cos^2 A}{1+\sin A}$ tan A $\quad$ cot A cos A
$\cos^2 A$ $\cot^2 A + 1 \quad 1-\cos^2 A$ $\frac{1}{\csc A}$	1 $\sin^2 A \quad \tan A \cos A$ $\csc^2 A$	sec A $\frac{1}{\csc A} \quad \frac{\sin^2 A}{1+\cos A}$ $\frac{\sin A}{\cos A}$	cot A sin A 1-cos A $\quad$ cos A 1
sin A 1 $\quad \frac{1}{\cot A}$ $\cos^2 A$	$\cot^2 A + 1$ $\frac{\sin A}{\cos A} \quad \frac{1}{\sin A}$ csc A	tan A csc A $\quad$ 1 $\frac{1}{\sec^2 A}$	$\sin^2 A + \cos^2 A$ $\sec^2 A - \tan^2 A \quad \cot^2 A - \csc^2 A$ tan A

Trigonometry Square

$\frac{\sqrt{2}}{2}$ $\tan 60°$ $\frac{\sqrt{3}}{2}$ sec 45°	0 $\cos 30°$ $\sqrt{3}$ sin 60°	$\frac{1}{2}$ 1 $\frac{\sqrt{3}}{2}$ 1	1 $\cos 0°$ 2 csc 30°
$\sqrt{2}$ $\frac{1}{2}$ 1 sin 45°	$\cos \frac{\pi}{6}$ undefined $\cos 60°$ sin 0°	$\tan 45°$ $\cot 0°$ 2 sec 60°	2 $\sin 30°$ $\frac{\sqrt{3}}{2}$ $\sqrt{2}$
$\frac{\sqrt{2}}{2}$ $\cot 30°$ 1 sin 90°	0 $\sin \frac{\pi}{2}$ $\sqrt{3}$ $\frac{\sqrt{3}}{2}$	$\sec 60°$ 0 1 $\frac{\sqrt{3}}{3}$	$\csc 45°$ $\tan \pi$ 0 0
1 $\cot \frac{\pi}{4}$ $\frac{\sqrt{2}}{2}$ 0	$\sin 60°$ 1 $\frac{\sqrt{2}}{2}$ $\frac{\sqrt{3}}{2}$	$\tan 30°$ $\cot 45°$ $\cos 45°$ $\frac{\sqrt{3}}{2}$	$\cos 90°$ 1 1 $\frac{\sqrt{2}}{2}$