



**TRIG-STAR**

**National Society of Professional Surveyors**  
5119 Pegasus Court, Suite Q, Frederick, MD 21704  
Phone: 240-439-4615 | Fax: 240-439-4952 | [trig-star.com](http://trig-star.com)

Trig-Star is an annual High School Mathematics Competition sponsored by the National Society of Professional Surveyors and you, the local sponsor. The goal is to recognize and challenge the best students of mathematics from among school districts across the United States utilizing a competition with awards. The purpose of the Trig-Star program is:

- To build an awareness of surveying and mapping as a profession among math high school students, career guidance counselors, and high school math teachers;
- To acquaint high school students with the use and practical applications of mathematics in the surveying professions;
- To promote real world applications of mathematics in high school;
- To honor high school students who have demonstrated their superior skill among classmates at the local, state and national levels.

Your assistance is critical to ensuring the success of the Trig-Star program. Trig-Star can be a tremendous public relations event for the surveying and mapping profession. High school students, their parents, teachers, and the public see first-hand some of the work undertaken by surveying and mapping professionals, and the concern of the profession for rewarding academic achievement and teaching excellence. Thank you for taking the time to become a Trig-Star sponsor.

The Trig-Star Competition can be a good way to introduce high school students to available surveying and mapping college degree programs. Please encourage those students who may have any interest in information on careers and scholarships to check the box on the cover of the contest form for more information. Checked Cover Sheets can be sent to [info@nsps.us.com](mailto:info@nsps.us.com), and information will be sent to the student.

**Trig-Star local contest results must be submitted through the online form  
[trig-star.com](http://trig-star.com) – Submit Results**

Please review the enclosed material carefully. Each state is responsible for running its own state Trig-Star contest in order to choose a state Trig-Star champion who will compete in the National Trig-Star competition. Please contact the state Trig-Star coordinator about the program in your state. A list of State Coordinators is available on the Trig-Star web site. In addition to any awards at the local and state level, the State Trig-Star will be eligible to compete for \$2,000, \$1000, and \$500 national prizes. In addition the Teaching Excellence Awards provide cash awards for the teachers of the national winners.

With your assistance we can maximize the exposure of the surveying and mapping profession to the next generation and create a strong positive image of our profession. The Trig-Star endowment fund was created to ensure the future of our scholarship program and provide increased benefits. Please consider a donation to the endowment fund with a tax-deductible gift. More information about the fund and Trig-Star can be found at [trig-star.com](http://trig-star.com). Thank you for your assistance and support of Trig-Star.

Gerald Juarez, NSPS Trig-Star Chair



## PREPARATION FOR THE LOCAL CONTEST

### Contacting Your Local High School

Making first contact with the High School is often the hardest thing to do when trying to get a Trig-Star Program going. Here are some tips:

- Do you know any teacher, guidance counselor or administrator at your local high school that could introduce you to a math teacher?
- Do any of your children, grandchildren, nieces, nephews, etc., attend a nearby high school where you would be willing to visit to present the Trig-Star program/test?
- Are there any of your neighbors or friends at church or social groups, teachers or school employees, or your fellow employees who may be able to steer you in the right direction to contact the trigonometry teacher or math department head?
- Find out when a teacher is available and make your contact at that time, don't wait for them to call you.

### Presentation Suggestions

One of the most important parts of the Trig Star Program is your initial presentation. The objective is to discuss careers in Surveying and Mapping with the students. Tell them briefly, what it is, why it's a good career, why we like it and how trigonometry is used in our business as a practical application of math.

There are many Trig-Star presentation formats that can be followed. The variations depend not only on your personal speaking style, but also other factors, such as the size of the group you will be talking to, the amount of time allowed for your presentation and the room configuration that you will be presenting in. For example, small groups allow for more hands-on demonstration of equipment and explanation of Survey Plats or Maps. Questions are more common in small groups and personal connections are easier to make

On the other hand, larger groups will allow you to reach more students and you may feel that you have made more efficient use of your time. Visual aids and demonstrations make for better presentations. If you are going to do the contest online with remote students, try to work with the teacher to present your information to the group in the online setting.

Examples of Visual Aids and Demonstrations:

- Plats and Maps are always interesting to students, especially if it shows an area they are familiar with.
- Setting up a total station, using a drone, or demonstrating other survey technologies can encourage questions.
- Showing the types of data that is being captured and how it's being used can create discussions.
- Use of 3D/4D imagery from scans can also be a crowd pleaser.

If you can engage the students in doing some sample calculations they feel more involved. For example, set up the total station in the classroom, a prism in the back of the room and another prism out the door in the hallway, if possible. Then measure the two distances and the interior angle between the lines. Sketch the measurements on the board and ask the students to solve for the unknown distance through the wall. If they seem unsure on how to approach the problem help them determine that they must use the law of cosines and fill out the equation on the board, then all students can perform the calculations on their calculators and come up with an answer.

It is also important to discuss what they should know to prepare for the Trig-Star Competition, such as:

- Use of basic trigonometric functions (sine, cosine, tangent).
- Use of basic trigonometric formulas (law of sine, law of cosine, Pythagorean theorem) and their applications.
- Understanding and importance of rounding.
  - Distances are rounded to the hundredth for the final answer only. Intermediate solutions for additional calculations should not be rounded, only the final answer. This may cause rounding errors.
  - Angles are rounded to the second and shown as degrees, minutes and seconds, (DMS) for the final answers.
  - Areas are rounded to the nearest whole unit.
- Use of notes and/or reference books are allowed. A basic formula sheet will be provided.
- Calculators are permitted. However, programmable calculators are banned from being used, and graphing calculators are considered to be programmable calculators. Programmable calculators are only allowed if they are administered

by the school and the teacher has verified that the programs have been cleared prior to testing. Please review current [Trig-Star Calculator Policy](#).

## **Resources**

[NCEES Speaker's Kit](#): Includes speakers guide, PowerPoint presentation, script, and videos

[BEaSURVEYOR.com](#)

[GetKidsIntoSurvey.com](#) (free posters available)

[Additional resources and support items available through NSPS – Trig-Star](#)



## ADMINISTRATION OF THE LOCAL CONTEST IN PERSON TESTING

The following instructions are to be used for the traditional in-person testing, utilizing a “paper” test. Prior to testing, the school sponsor should:

- Verify with NSPS, State Sponsor, or Local Sponsor that Trig-Star test license has been obtained. If the school is working under a State license, you should work with the State Coordinator to ensure that test is available for the current year.
- Choose a test date that is convenient for the school and any additional volunteers/proctors that may be assisting on site.
- Work with the school to establish a timeline for results, acknowledgment, and awards. It is the responsibility of the local and State sponsors to provide results, acknowledgment, and awards for their level of the contest. For test security, the actual test should not be returned to the teacher or the students.

### ***ADMINISTRATION OF TEST***

1. Work with school to secure a room for testing and provide an initial count of contestants.
2. Have enough copies of test available for distribution and secure a timer (stop watch, phone, etc.) for timing the contestants.
3. Obtain the help of additional proctors as needed to assist you with monitoring the contestants as they complete the exam. (Larger groups of contestants may require 2 to 3 proctors.) Teachers usually can fill this role.
4. Calculators are permitted for testing. However, programmable calculators are banned from being used, and Graphing calculators are considered to be programmable calculators. Programmable calculators are only allowed if they are administered by the school and the teacher has verified that the programs have been cleared prior to testing. Please review current [Trig-Star Calculator Policy](#).
5. Notes and reference books are allowed. A basic formula sheet is provided at the back of test.
6. Contestants should be seated far enough apart to maintain test security.
7. Proctors may distribute tests while initial instructions are being read from the test cover sheet. Contestants may fill in the questions on the test cover sheet at this time but should be instructed NOT to open the test materials until told to do so.
  - a. The maximum time allowed to complete the test is 60 minutes.
  - b. Place answers in the spaces provided – answers shown elsewhere will not count. Be sure to give answers in the format requested.
  - c. All competition materials will be collected when you are finished.
  - d. Raise both hands when you finish – your time will be noted to the nearest second. (Disability accommodations should be made, if needed)
  - e. After your test is collected, you may leave the room, unless instructed otherwise. (Check with school for appropriate instructions)

- f. First place is awarded to the competitor with the highest score in the shortest amount of time.
8. Instruct the contestants to open the test materials, print their name in the space provided on the first page and begin.
9. Start the timer.
10. As the contestants finish, record their time to the nearest second on the test cover sheet and collect the test and any other test materials (scratch paper, etc.).
11. After 60 minutes, collect all tests that have not been turned in and record a time of 60 minutes

### ***GRADING AND SCORING OF TEST***

If you are giving the exam by yourself, you may find it easier to take all the exams home and score them at a later time. If there are two or more of you giving the exam, while one person is keeping the official time (collecting completed exams and marking the times on them); the other person could be scoring the exams.

The highest score determines the Trig-Star winner. If there are two or more students with the same score, the shortest time of the group determines the winner.

Students naturally want to know how they did on the exam, even if they didn't come out on top. Obviously, for the security of the exam, you cannot give copies of the exams back to the students or. If you give a score sheet to the teacher, let them know about your scoring policy.

### ***REPORTING***

It is important to report test results of each participating high school to both the State Trig-Star Coordinator and NSPS to ensure that participants have the opportunity for future scholarships. The following information should be provided to the State Coordinator, which may be used to determine the overall State Winner:

- Local Contest Report Form
- Copy of first place winner test (paper)
- List of student participants (name and current grade)

Similarly, the above information should be provided to NSPS through the "Submit Results" portal on the Trig-Star website: <https://trig-star.com/>

**The following order forms can be found under Resources at trig-star.com**

- Trig-Star plaques are available, but the sponsor will have to have it engraved with the winning student's name, high school name and year of the award. You can include the sponsors name on the plaque.
- 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> Place Participation Medals may be purchased.
- A certificate of participation form is downloadable.
- Sample Press Release is available on the website: trig-star.com



## ADMINISTRATION OF THE LOCAL CONTEST ON-LINE CONTEST

The following instructions are to be used for online testing, when the students are gathered in-person at one location. If, due to restrictions, this is not possible or the only way to administer the test if all of the students are participating remotely, then special arrangements with the State Trig-Star Coordinator (in consultation with NSPS) will need to be made. Prior to testing, the school sponsor should:

- Verify with NSPS, State Sponsor, or Local Sponsor that Trig-Star test license has been obtained. If the school is working under a State license, you should work with the State Coordinator to ensure that test is available for the current year.
- Choose a test date and time that is convenient for the school.
- Reach out to State Coordinator and/or NSPS to obtain a unique link to access the online test. Information required to receive a link includes:
  - School Name (City and State)
  - Sponsor (contact info)
  - Date of test
  - Time of test. Due to the nature of the online testing platform, the link will be available 30 minutes prior to start and 30 minutes after assumed end to account for connectivity issues that may arise. The contestants will be allowed 60 minutes to complete the test.
- Work with the school to establish a timeline for results, acknowledgment, and awards. It is the responsibility of the local sponsor and State Coordinator to provide results, acknowledgment, and awards for their level of the contest. Please review current [Trig-Star Calculator Policy](#).

### ***ADMINISTRATION OF TEST***

- 1) Work with the school to ensure that all computers used for testing have access to the internet. Additional proctors may be needed to assist you with monitoring the competition if the online testing is held in an in-person setting with multiple locations such as additional classrooms or computer labs. Teachers usually can fill this role.
- 2) The Sponsor will receive a school specific link that will be activated for the date and time previously requested. This information should be shared with the teacher who will pass it on to the students.
- 3) The following rules and instructions should be read to students prior to accessing the link:
  - a) You will be given 60 minutes to complete the test.
  - b) Calculators are permitted for testing. However, programmable calculators are banned from being used, and Graphing calculators are considered to be programmable calculators. Programmable calculators are

only allowed if they are administered by the school and the teacher has verified that the programs have been cleared prior to testing.

- c) No software programs other than those required for the online testing may be used while taking the test.
  - d) Notes and reference books are not allowed. A basic formula sheet will be provided electronically with test link.
  - e) Answers must be in the format requested.
  - f) You can click on image to increase its size.
  - g) The online platform will allow you to skip questions; and then go back. Be sure to review your test prior to submitting.
  - h) A countdown clock will be shown during the test to assist you with time management.
  - i) Any technological issues should be reported immediately to your instructor. Reporting should include the date, time, and specifics of the occurrence.
  - j) After finishing the test, follow the instructions provided by the school / teacher.
  - k) First place is awarded to the competitor with the highest score. In the event of a tie score, the student that completed fastest wins.
- 4) Instruct the students to log onto the online testing platform using the link provided.
- a) Complete the student information and start your test. The timer will automatically start when the student starts the test.

### ***GRADING AND SCORING OF TEST***

Once testing is complete, the sponsor should request the online test results from their Local Sponsor, State Coordinator and/or NSPS, whoever is their main contact. The results will be sent in a spreadsheet format and should be reviewed and certified by the local sponsor prior to announcement of winners.

Certification of results include verification of test takers and review of answer formats. In some cases, students may have included additional carriage spaces or words that may not have been accepted by the online test platform. For example: *135-22- 06*, instead of *135-22-06* for an angular answer OR *321 square units*, instead of *321*. If you give a score sheet to the teacher, let them know about the scoring policy.

The highest score determines the Trig-Star winner. If there are two or more students with the same score, the shortest time of the group determines the winner.

Students naturally want to know how they did on the exam, even if they didn't come out on top. Obviously, for the security of the exam, you cannot give copies of the exams back to the students.



## ***REPORTING***

It is important to report test results of each participating high school to both the State Trig-Star Coordinator and NSPS to ensure that participants have the opportunity for future scholarships. The following information should be provided to the State Coordinator, which may be used to determine the overall State Winner:

- Local Contest Report Form
- Copy of first place winner test (online results that have been certified)
- List of student participants (name and current grade)

Similarly, the above information should be provided to NSPS through the "Submit Results" portal on the Trig-Star website: <https://trig-star.com/>

### **The following order forms can be found under Resources at trig-star.com**

- Trig-Star plaques are available, but the sponsor will have to have it engraved with the winning student's name, high school name and year of the award. You can include the sponsors name on the plaque.
- 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> Place Participation Medals may be purchased.
- A certificate of participation form is downloadable.
- Sample Press Release is available on the website: trig-star.com



# TRIG-STAR

## TRIG-STAR CONTEST AWARDS & TESTING DATES

### *LOCAL CONTEST – LEVEL 1*

Local sponsors should work with the State Trig-Star Coordinator to ensure local testing is complete prior to the deadline to announce the State Trig-Star. The following information should be provided to the State Trig-Star Coordinator, which may be used to determine the overall State winner:

- Local Contest Report Form
- Copy of first place winners test (paper), or online testing results
- List of student participants (name and current grade) – excel spreadsheet preferred

Similarly, the above information should be provided to NSPS through the “Submit Results” portal on the Trig-Star website: <https://trig-star.com/>

### *STATE WINNER NOTIFICATION*

State Trig-Star Coordinators shall choose and submit the State Trig-Star winners to NSPS between **May 1 and June 1**. The following information should be provided to NSPS when submitting the State winner:

- State Report Form
- List of participating high schools
- Total number of Trig-Star Contest participants within the State
- Value and nature of any awards given at the local level and by the State Society / Association

### *NATIONAL CONTEST – LEVEL 2*

State Trig-Star winners are offered the opportunity to take part in the National Contest. The test administrators will receive the National Trig-Star test after submission of the State winner’s name and test administrators contact information to NSPS. Test should be administered in accordance with the instructions and returned to NSPS with a postmark no later than July 1.

### *NATIONAL CONTEST AWARDS*

The National Trig-Star winners will receive \$2,000 for first place, \$1,000 for second place, and \$500 for third place, in addition to any awards at the state and local level. The winner’ trigonometry teachers will receive a Teacher Excellence Award in the amount of \$1,000 for first place, \$500 for second place, and \$250 for third place.



## LOCAL CONTEST RULES

1. Only one TRIG-STAR is allowed per high school per year. The winner will be designated the TRIG-STAR for that particular school year.
2. All contestants in a particular high school must begin the TRIG-STAR test at the same time.
3. The winner is the student with the highest score in the fastest time to solve the problems provided. The contest incorporates the use of complex trigonometric functions including right triangle formulas, circle formulas, the law of sines, and the law of cosines to solve real problems typically encountered in the surveying and mapping professions.
4. The competition is sanctioned nationally by the National Society of Professional Surveyors and state surveying Societies, Affiliates and Associations. The local sponsor is responsible for all contest fees, local promotion, news coverage, and presentation of local awards.
5. There shall be no cost to the contestant for the privilege of competing for the award designation Trig-Star. All Trig-Star contestants are eligible to apply to NSPS for the Trig-Star Scholarship.
6. Calculators are permitted for testing. However, programmable calculators are banned from being used, and graphing calculators are considered to be programmable calculators. Programmable calculators are only allowed if they are administered by the school and the teacher has verified that the programs have been cleared prior to testing. Please review current [Trig-Star Calculator Policy](#).
7. Notes and reference books are not allowed. A basic formula sheet is provided at the back of test, or included with the online test package.
8. The maximum amount of time to complete the test is 60 minutes.

Proper reporting of test results must be provided to the State Trig-Star Coordinator for the contest winner to be eligible for the State Contest. Similar reporting should be provided to NSPS through the "Submit Results" portal on the Trig-Star website: <https://trig-star.com/>

**Sample Certificate of Participation**

MS Word document is attached to Trig-Star packet as an attachment.

# *National Society of Professional Surveyors*

## CERTIFICATE OF PARTICIPATION

*Is hereby presented to*

*In recognition of your participation in the*

## TRIG-STAR COMPETITION



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Trigonometry Teacher

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Local Sponsor





**TRIG-STAR**

**2021-2022**  
**Sample Problems**

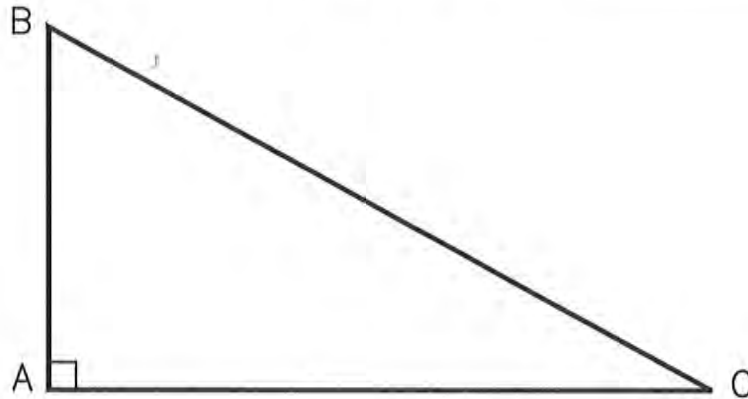


***NSPS***

Sponsored by  
National Society of Professional Surveyors

# TRIG-STAR PROBLEM LOCAL CONTEST

PRINT NAME: \_\_\_\_\_



KNOWN: DISTANCE AB = 260.19      DISTANCE BC = 490.49

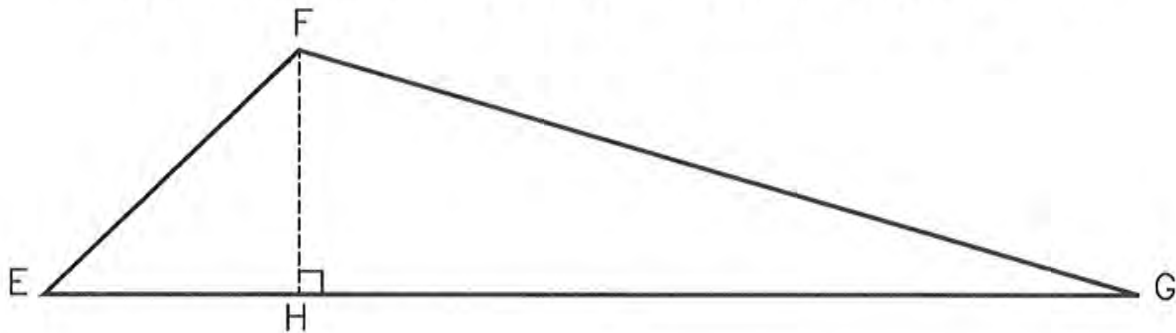
FIND:  $\angle CBA =$  \_\_\_\_\_ (5 POINTS)

DISTANCE AC = \_\_\_\_\_ (5 POINTS)

REQUIRED ANSWER FORMAT

DISTANCES: NEAREST HUNDREDTH  
ANGLES: DEGREES-MINUTES-SECONDS  
TO THE NEAREST SECOND

# TRIG-STAR PROBLEM LOCAL CONTEST



KNOWN: DISTANCE EF = 319.89     $\angle EFG = 121^{\circ}19'12''$      $\angle FEG = 41^{\circ}45'36''$

FIND:  $\angle EGF =$  \_\_\_\_\_ (6 POINTS)

DISTANCE EH = \_\_\_\_\_ (6 POINTS)

DISTANCE FH = \_\_\_\_\_ (6 POINTS)

DISTANCE FG = \_\_\_\_\_ (6 POINTS)

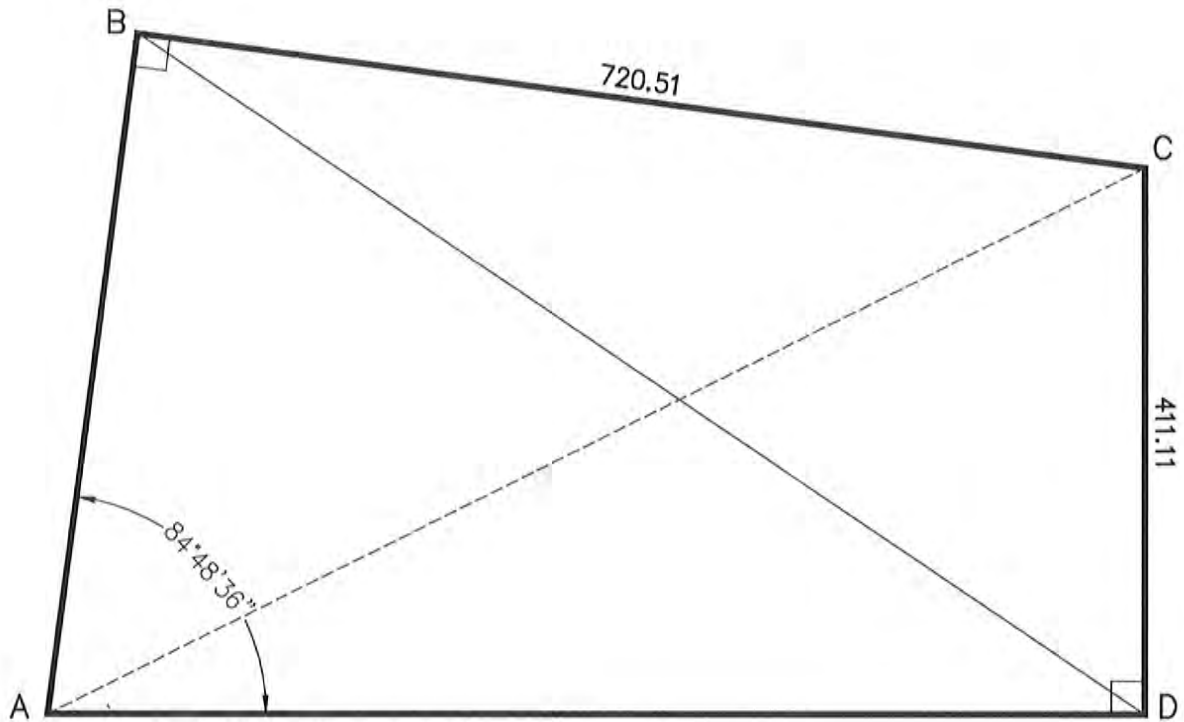
DISTANCE GH = \_\_\_\_\_ (6 POINTS)

REQUIRED ANSWER FORMAT

DISTANCES: NEAREST HUNDREDTH  
ANGLES: DEGREES-MINUTES-SECONDS  
TO THE NEAREST SECOND

PAGE TOTAL: \_\_\_\_\_ POINTS

# TRIG-STAR PROBLEM LOCAL CONTEST



KNOWN: DISTANCE BC = 720.51    DISTANCE CD = 411.11  
 $\angle$  BAD = 84°48'36"

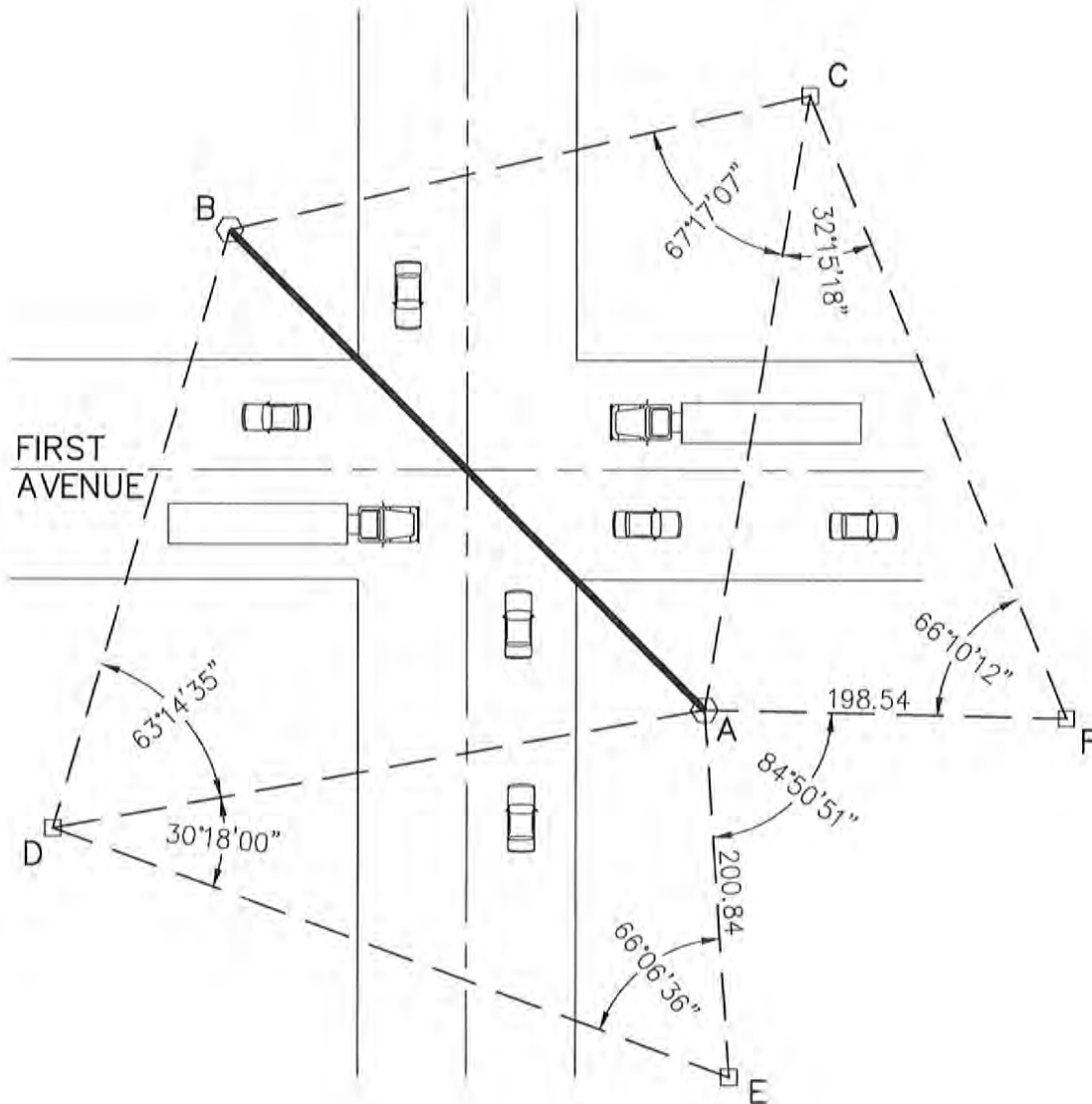
- FIND: DISTANCE AB = \_\_\_\_\_ (10 POINTS)  
DISTANCE AD = \_\_\_\_\_ (10 POINTS)  
DISTANCE AC = \_\_\_\_\_ (10 POINTS)

**REQUIRED ANSWER FORMAT**  
DISTANCES: NEAREST HUNDREDTH

PAGE TOTAL: \_\_\_\_\_ POINTS

# TRIG-STAR PROBLEM LOCAL CONTEST

A LOCAL TRAFFIC ENGINEERING DEPARTMENT HAS DETERMINED THE NEED FOR AN OVERHEAD SIGNAL LIGHT SYSTEM AT A VERY BUSY INTERSECTION. THE SUPPORT POLES NEED TO BE PLACED AT POINTS A AND B. DUE TO HEAVY TRAFFIC VOLUME, THE FIELD MEASUREMENTS BY THE SURVEY CREW WERE LIMITED TO THE FOLLOWING SKETCH:



- FIND:
- DISTANCE AC = \_\_\_\_\_ (6 POINTS)
  - DISTANCE AD = \_\_\_\_\_ (6 POINTS)
  - DISTANCE DC = \_\_\_\_\_ (6 POINTS)
  - DISTANCE BC = \_\_\_\_\_ (6 POINTS)
  - DISTANCE AB = \_\_\_\_\_ (6 POINTS)

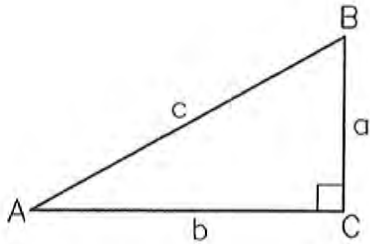
**REQUIRED ANSWER FORMAT**  
DISTANCES: NEAREST HUNDREDTH

PAGE TOTAL: \_\_\_\_\_ POINTS



## TRIG-STAR MISCELLANEOUS DATA

### RIGHT TRIANGLE FORMULAS



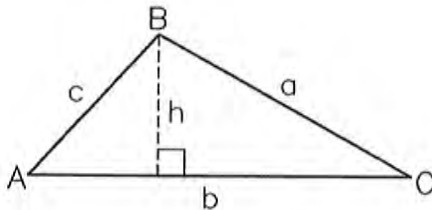
PYTHAGOREAN THEOREM:  $a^2 + b^2 = c^2$

AREA:  $\frac{1}{2}ab$

TRIGONOMETRIC FUNCTIONS:  $\sin A = \frac{a}{c}$ ,  $\cos A = \frac{b}{c}$ ,

$\tan A = \frac{a}{b}$

### OBLIQUE TRIANGLE FORMULAS

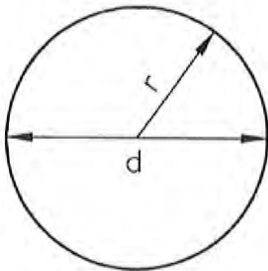


LAW OF SINES:  $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

LAW OF COSINES:  $a^2 = b^2 + c^2 - 2bc \cos A$

AREA:  $\frac{1}{2}bh$

### CIRCLE FORMULAS



DIAMETER =  $d$       RADIUS =  $r$

CIRCUMFERENCE:  $2\pi r$  or  $\pi d$

AREA:  $\pi r^2$

ONE DEGREE ( $1^\circ$ ) OF ARC = 60 MINUTES ( $60'$ ) OF ARC

ONE MINUTE ( $1'$ ) OF ARC = 60 SECONDS ( $60''$ ) OF ARC

THEREFORE ONE DEGREE OF ARC ( $1^\circ$ ) = 3600 SECONDS OF ARC.

# TRIG-STAR ANSWER KEY LOCAL CONTEST

PAGE 1

$$\sphericalangle CBA = 57^{\circ}57'46''$$

$$\text{DISTANCE AC} = 415.79$$

PAGE 1

$$\sphericalangle EGF = 16^{\circ}55'12''$$

$$\text{DISTANCE EH} = 238.62$$

$$\text{DISTANCE FH} = 213.05$$

$$\text{DISTANCE FG} = 732.04$$

$$\text{DISTANCE GH} = 700.35$$

PAGE 2

$$\text{DISTANCE AB} = 478.25$$

$$\text{DISTANCE AD} = 760.82$$

$$\text{DISTANCE AC} = 864.79$$

PAGE 3

$$\text{DISTANCE AC} = 340.30$$

$$\text{DISTANCE AD} = 363.97$$

$$\text{DISTANCE DC} = 577.02$$

$$\text{DISTANCE BC} = 327.27$$

$$\text{DISTANCE AB} = 370.00$$

## POLICY ON GRADING:

THE CORRECT ANSWER IS THE ANSWER LISTED ABOVE. ANSWERS WHICH EITHER VARY FROM THE EXACT ANSWER OR ARE NOT TO THE SAME PRECISION ARE INCORRECT FOR THE PURPOSE OF THIS CONTEST. NO PARTIAL CREDIT IS TO BE GRANTED.