Chicken or the Egg?

What do you plan first?

Problems/Projects or Mathematical Practices?

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Lesley University Summer Institute

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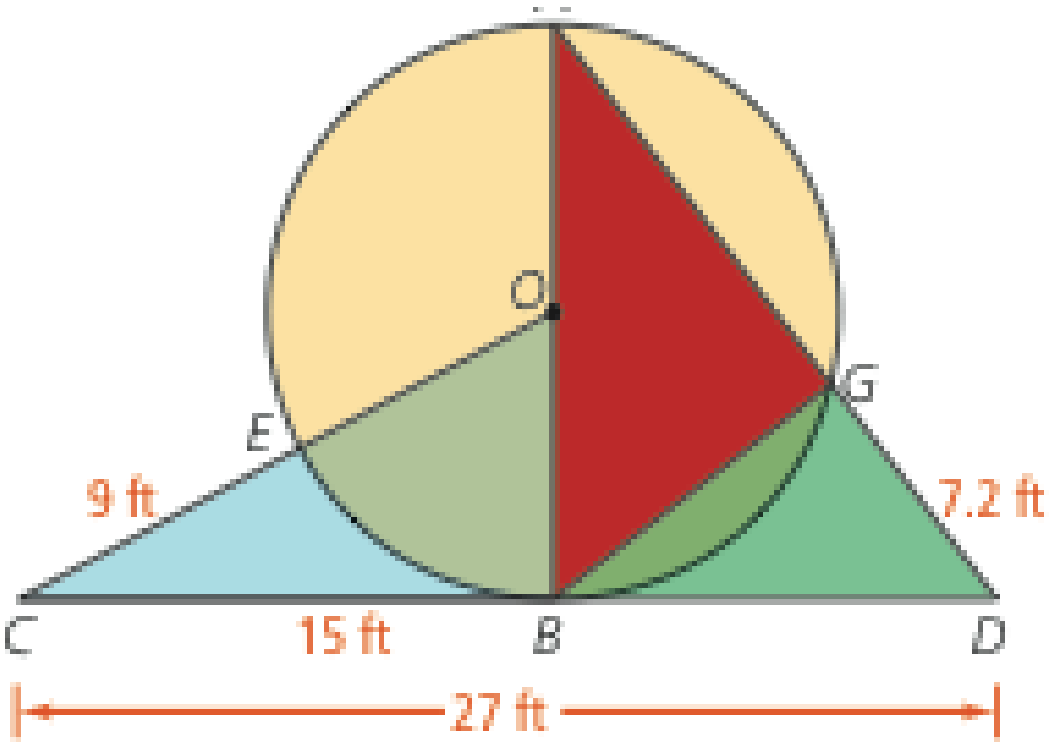
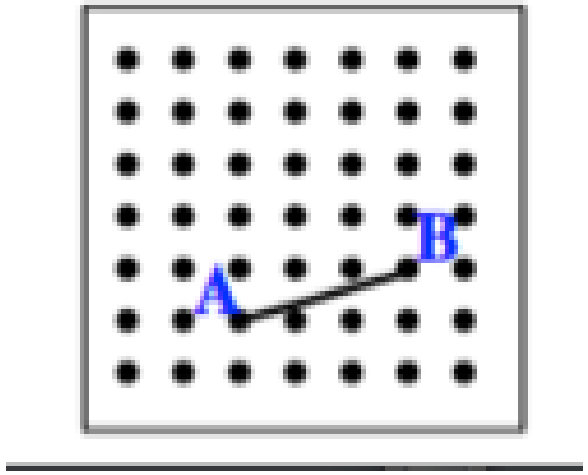
Mathematical Practices

- **MP1 Make sense of problems and persevere in solving them.**
- **MP2 Reason abstractly and quantitatively.**
- **MP3 Construct viable arguments and critique the reasoning of others.**
- **MP4 Model with mathematics.**
- **MP5 Use appropriate tools strategically.**
- **MP6 Attend to precision.**
- **MP7 Look for and make use of structure.**
- **MP8 Look for and express regularity in repeated reasoning.**

The logo of the Sunshine Sailboat Company features several triangular sails in front of a circular sun. The company plans to make a large version of the logo for a showroom display, as shown in the diagram below. The red sail will be made of copper. In the diagram, *CD* is tangent to circle O at point *B*. What is the area of the red triangle?

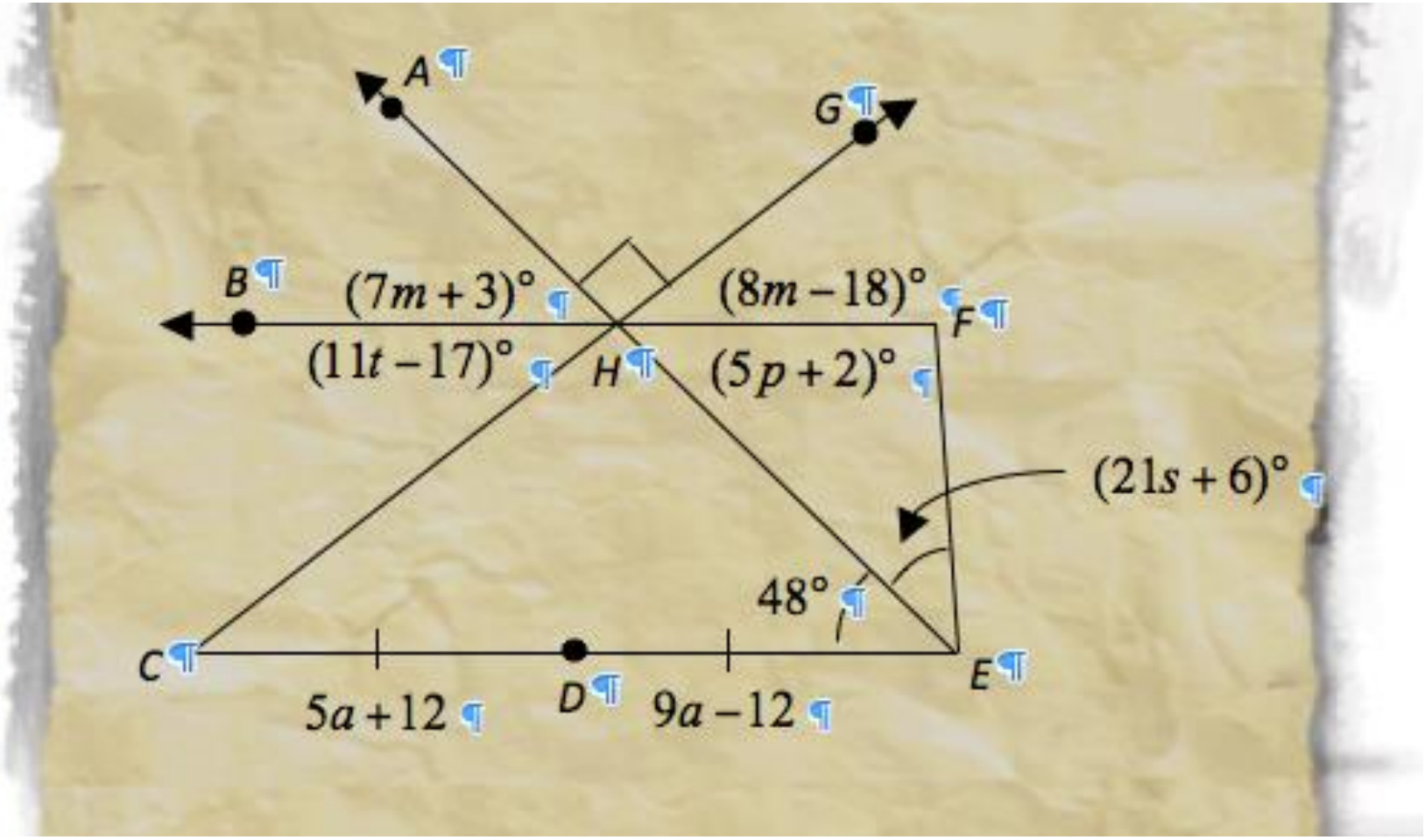


Make an isosceles triangle (ΔABC) on your geoboard using AB as one of the sides. How many different isosceles triangles can you make on your geoboard with AB as one of the sides?

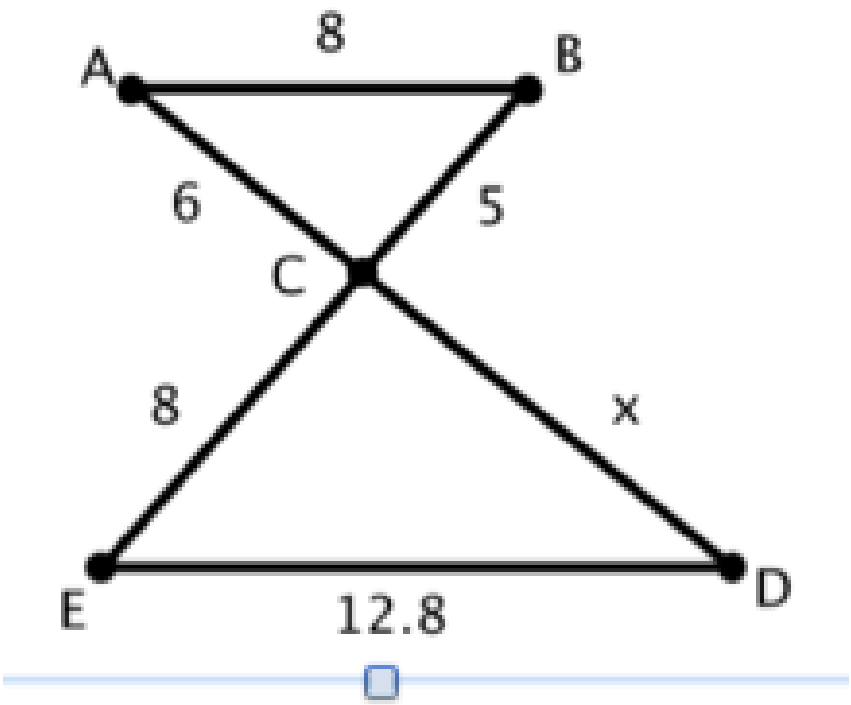


While browsing in an antique store, Cameron found a sheet of paper that came from an old book of riddles. The page is shown below.

Arrange the variables, least to greatest.



In the figure below the two triangles are similar and points A, C, and D are collinear and points E, C, and B are collinear. What is the length of CD?

- 

A town plans to begin construction of New Street, as shown in the diagram below. New Street will begin along North Avenue, 3 mi north of the intersection of North Avenue and Wilson Road. New Street will be perpendicular to Main Street

The construction company wants to determine where along Main Street to place the intersection with New Street.

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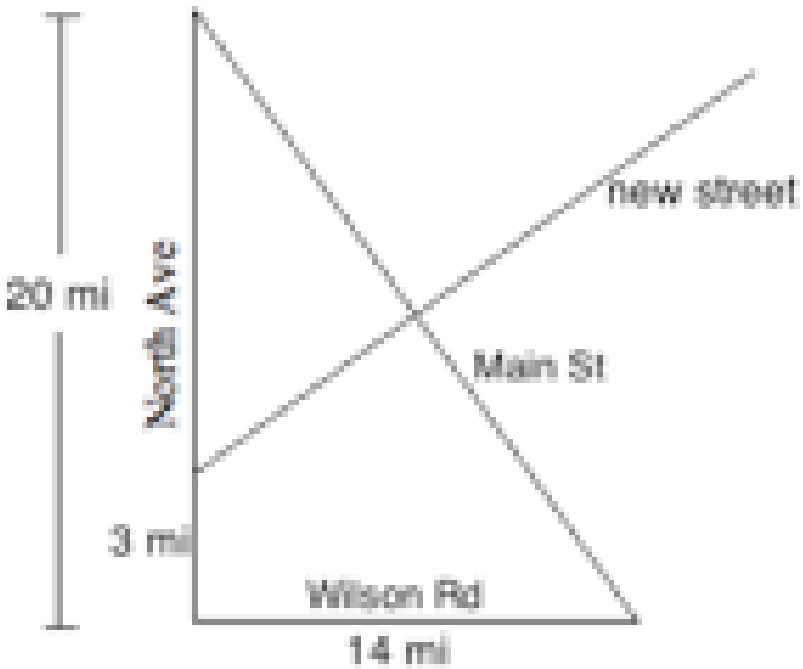
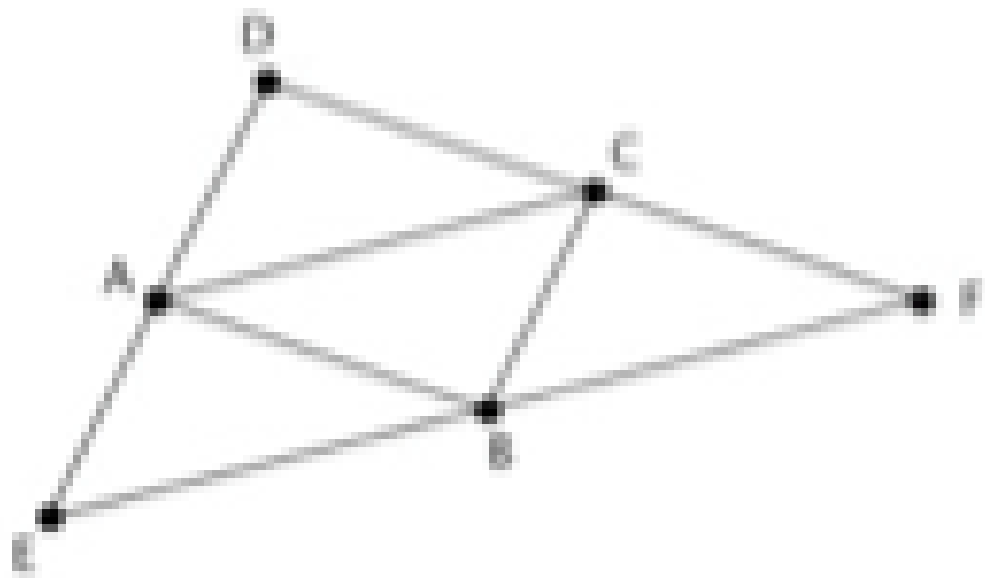


- Two vertices of a triangle are located at (0, 4) and (0, 10). The area of the triangle is 12 square units. Where is the third vertex located?

- Given three vertices of a parallelogram are at A(1, 2), B(4, 1) and C(5, 3), where can the fourth vertex be located?

Given three non-collinear points A, B, and C as vertices, students found they could form a parallelogram by placing the fourth vertex at any one of exactly three positions, points D, E, and F. Students noticed that A, B, and C seem to be midpoints of the sides of tr. DEF. They are now trying to prove their conjecture.



Sandra's Deli is a very popular lunch spot in the downtown area. After a great deal of planning, Sandra decides to sell two of the most popular types of lunches, boxed in an aluminum container. She will first sell them at her deli, and if things go well she would like to sell the lunch boxes in grocery stores.

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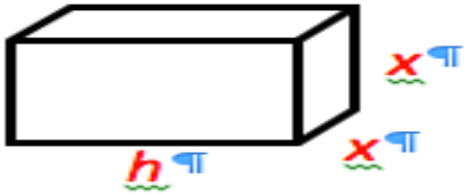
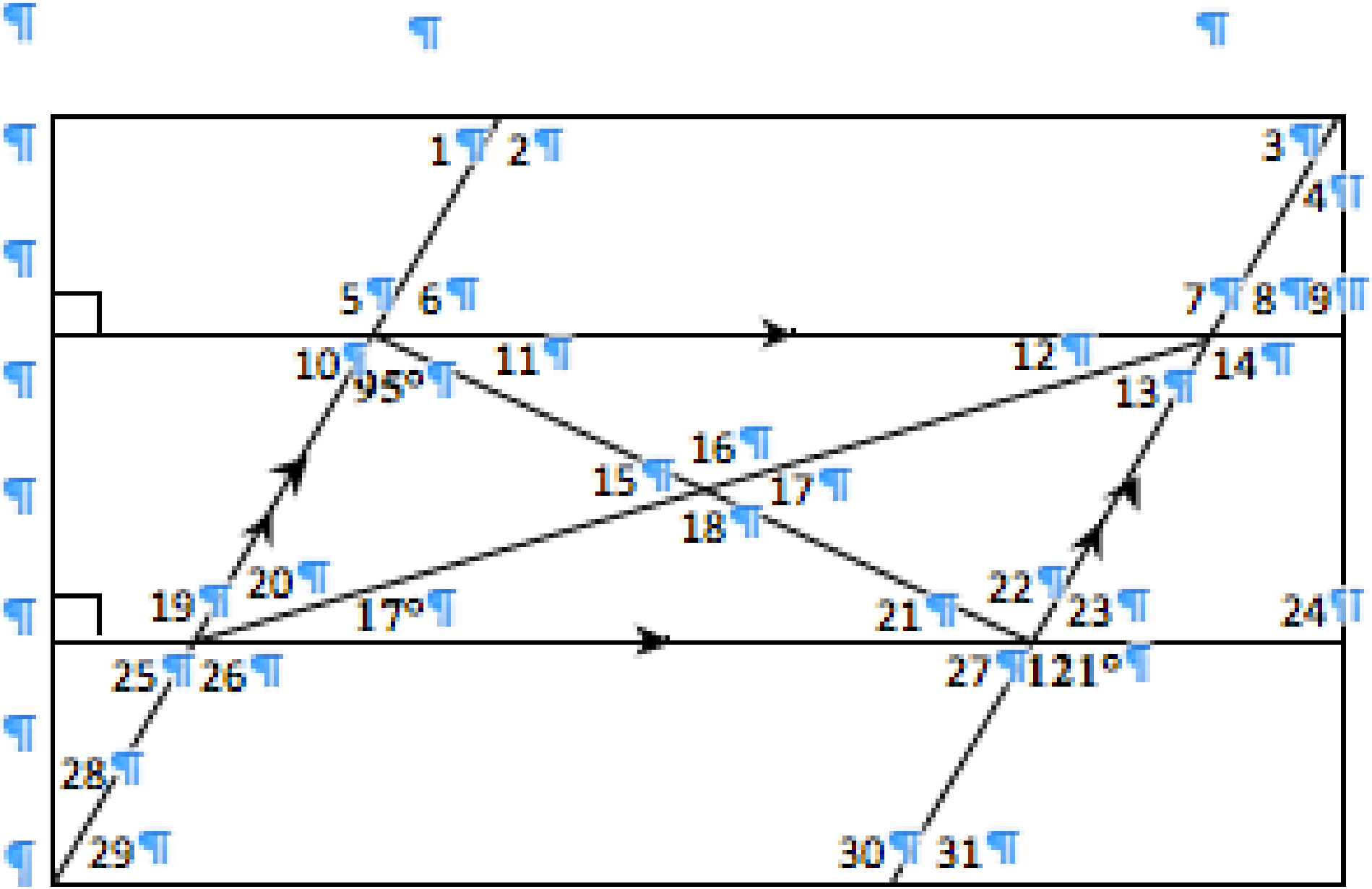


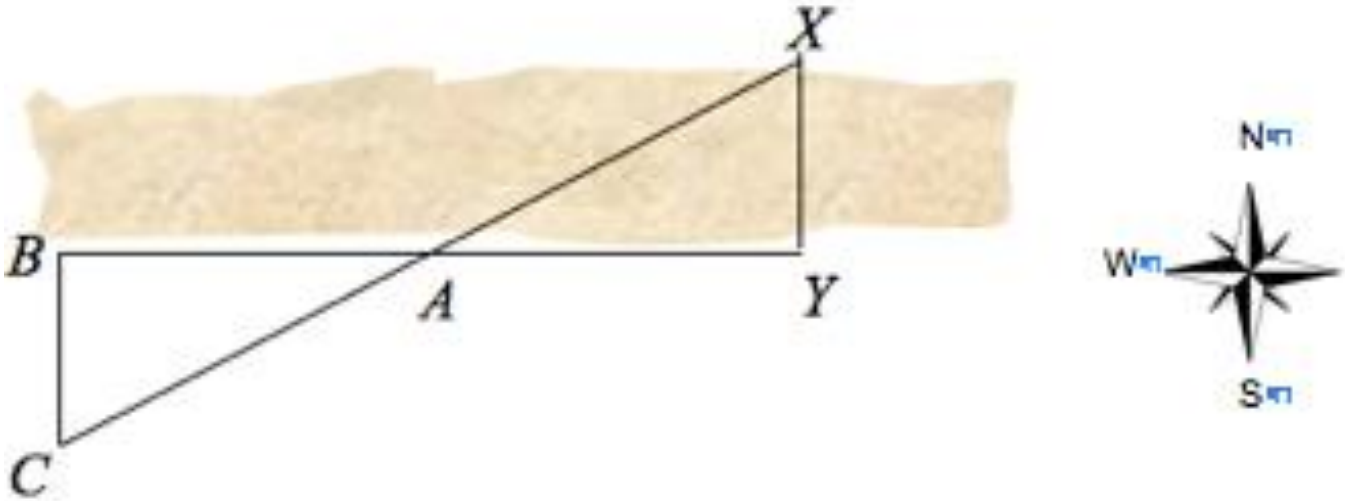
Sandra wants each box to hold 355 cubic inches. The aluminum for packaging the lunches is expensive, so a box should use the least amount of aluminum possible.

Kiana works for a city's planning department. The city is developing a new park, and Kiana is reviewing the plans for the builders. The park is rectangular with two sets of parallel walkways that go through the park.

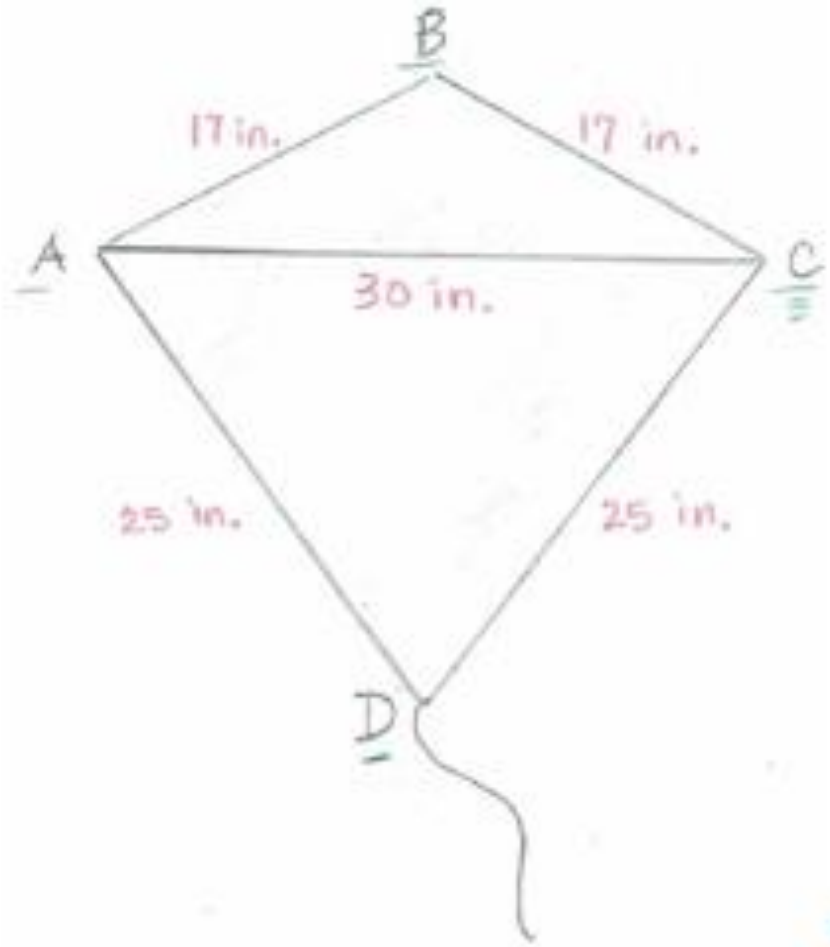
- Kiana notices that only a few angle measures are provided in the blueprint. She would like to add additional angle measures to make it easier for the builders to create the correct paths.


1
2
3
4
5
6
7
8
9
10
95°
11
12
13
14
15
16
17
18
19
20
17°
21
22
23
24
25
26
27
121°
28
29
30
31

Jamal wants to estimate the distance across a canyon. He stands at point *Y*, locates a tree directly across the canyon, and labels the tree as point *X* on a diagram. He then walks west along the canyon 500 feet and marks point *A*. After walking another 500 feet in the same direction, he turns 90º and walks south, perpendicular to the canyon. He stops when his location appears to form a straight line with points *A* and *X*. Jamal measures the distance *BC* as 327 feet.

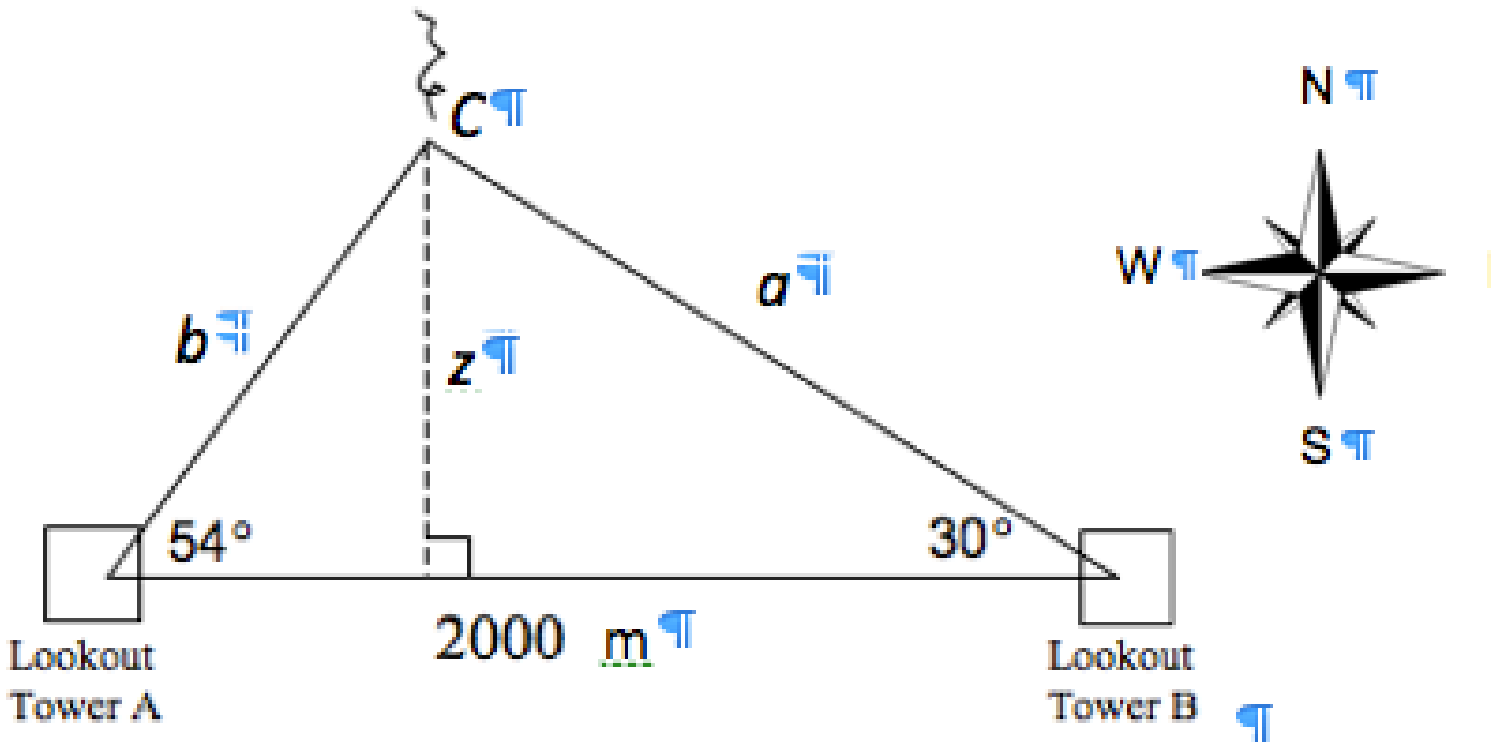


Alejandro plans to make a paper kite. In his sketch, shown below, he included the lengths of the wooden dowels that will form the frame and the horizontal support. He forgot to show the kite's vertical support in his sketch.



Rangers in the two lookout towers at a state forest notice a plume of smoke, as shown in the diagram. The towers are 2000 m apart. One ranger observes the smoke at an angle of 54°. The other ranger observes it an angle of 30°. Both angles are measured from the line that connects the two towers. When the rangers call to report the fire, they must give the fire department the approximate distance from their lookout tower to the fire.

How far to the north and west of Lookout Tower B is the fire?



Justin wants to measure the thickness of a paper towel, but his ruler is not the proper measuring device. He is able to take the measurements shown in the diagram.

He also reads some additional information from the packaging, which is written below.

70 SHEETS PER ROLL

EACH 9.0 IN. BY 11.0 IN.

5.25 in.
1.75 in.
11 in.

- Problem Solving Strategies
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- 1. Act out the problem
- 2. Work backwards
- 3. Guess and check
- 4. Use technology
- 5. Look at multiple perspectives (graphical, algebraic, arithmetic)
- 6. Look back
- 7. Look for a pattern
- 8. Make a list
- 9. Make a mathematical model
- 10. Make a table
- 11. Make an equation
- 12. Make conjectures
- 13. Plan and reflect
- 14. Represent the problem with visuals such as graphs, tables, and equations
- 15. Solve a simpler problem
- 16. Transference
- 17. Use logical reasoning
- 18. Use dimensional analysis
- 19. Understand the problem (I notice/Wonder)

Correlation of Mathematical Practices and Problem Solving Strategies

- **MP1 Make sense of problems and persevere in solving them.**
  - **1, 2, 5, 7, 9, 10, 11, 12, 13, 15, 19**
- **MP2 Reason abstractly and quantitatively.**
  - **1, 2, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 18, 19**
- **MP3 Construct viable arguments and critique the reasoning of others.**
  - **5, 9, 13, 14, 16, 17, 19**
- **MP4 Model with mathematics.**
  - **1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14**
- **MP5 Use appropriate tools strategically**
  - **4, 5, 7, 8, 9, 10, 11, 12, 14, 16, 1**
  - **MP6 Attend to Precision**
  - **1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 14, 15, 17**
- **MP7 Look for and make use of structure.**
  - **1, 7, 8, 9, 10, 11, 13, 14, 15, 17, 19**
- **MP8 Look for and express regularity in repeated reasoning**
  - **1, 2, 3, 5, 7, 8, 12, 16, 18**