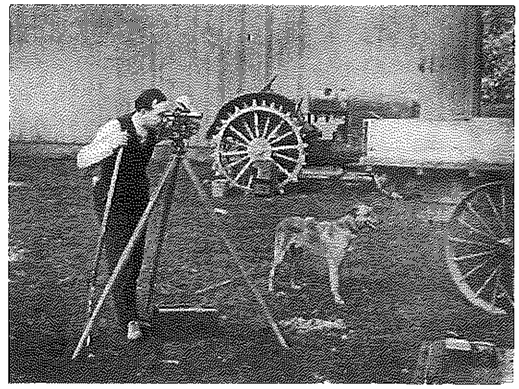
5.8 Triangle Areas by Trig



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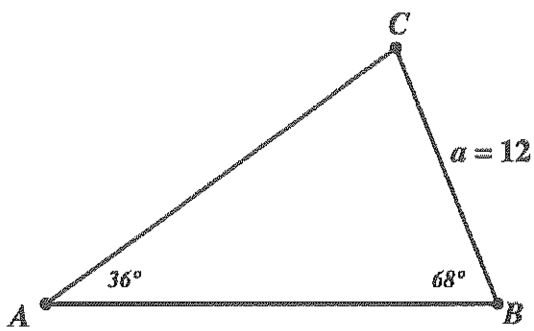
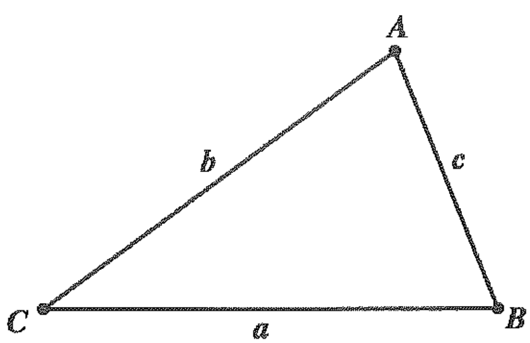
A Practice Understanding Task

Find the area of the following two triangles using the strategies and procedures you have developed in the past few tasks. For example, draw an altitude as an auxiliary line, use right triangle trigonometry, use the Pythagorean theorem, or use the Law of Sines or the Law of Cosines to find needed information.

1. Find the area of this triangle.



2. Find the area of this triangle.



Jumal and Jabari are helping Jumal's father with a construction project. He needs to build a triangular frame as a component of the project, but he has not been given all the information he needs to cut and assemble the pieces of the frame. He is even having a hard time envisioning the shape of the triangle from the information he has been given.

Here is the information about the triangle that Jumal's father has been given.

- Side a = 10.00 meters
- Side b = 15.00 meters
- Angle A = 40.0°

Jumal's father has asked Jumal and Jabari to help him find the measure of the other two angles and the missing side of this triangle.

Carry out each student's strategy as described below. Then draw a diagram showing the shape and dimensions of the triangle that Jumal's father should construct. (Note: To provide as accurate information as possible, Jumal and Jarbari decide to round all calculated sides to the nearest cm—that is, to the nearest hundredth of a meter—and all angle measures to the nearest tenth of a degree.)

<u>Jumal's Approach</u>

- Find the measure of angle B using the Law of Sines
- Find the measure of the third angle C
- Find the measure of side c using the Law of Sines
- Draw the triangle

Jabari's Approach

- Solve for c using the Law of Cosines: $a^2 = b^2 + c^2 - 2bc\cos(C)$

    (Jabari is surprised that this approach leads to a quadratic equation, which he solves with the quadratic formula. He is even more surprised when he finds two reasonable solutions for the length of side c.)

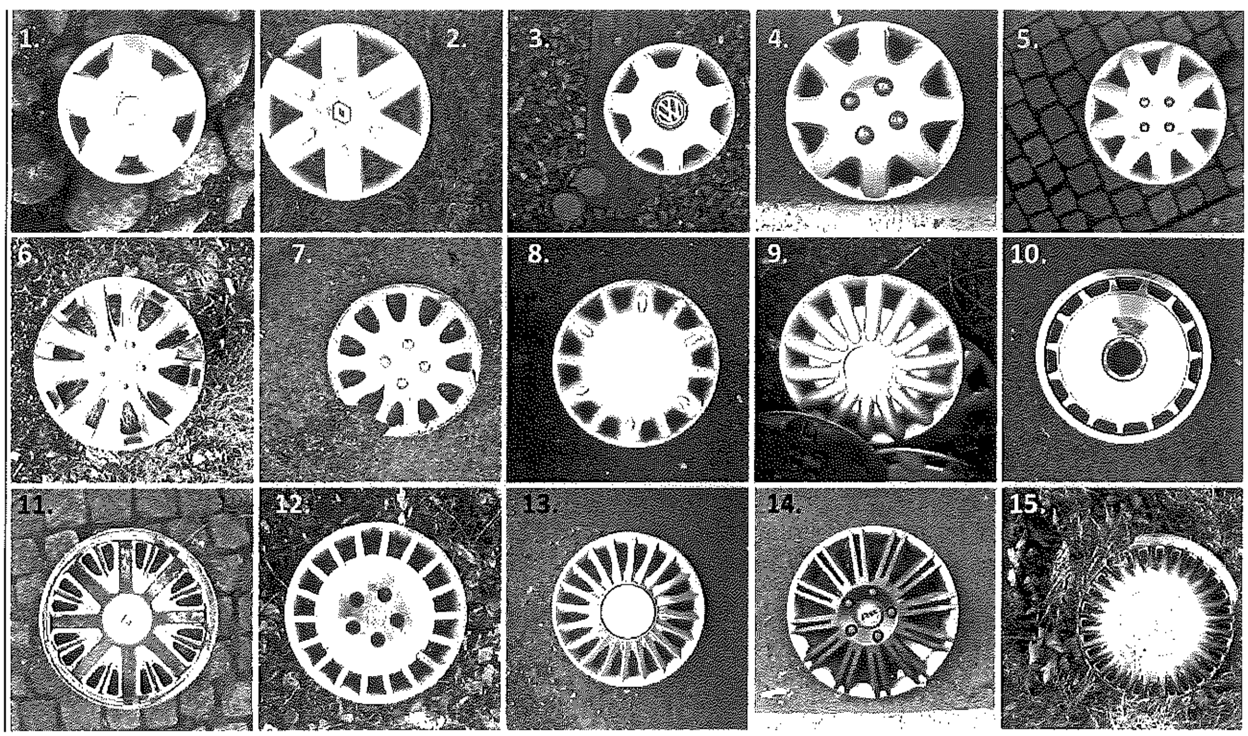
- Draw both possible triangles and find the two missing angles of each using the Law of Sines

READY, SET, GO! Name Period Date

READY

Topic: Rotational symmetry

Hubcaps have *rotational symmetry*. That means that a hubcap does not have to turn a full circle to appear the same. For instance, a hubcap with this pattern,  will look the same every ¼ turn. It is said to have 90º *rotational symmetry* because for each quarter turn it rotates 90º. **State the *rotational symmetry* for the following hubcaps. Focus your answer on just the spokes, not the center design.**(Answers will be in degrees.



SET

Topic: Area formulas for triangles

Area of an Oblique Triangle: The area of **any** triangle is one-half the product of the lengths of two sides times the sine of their included angle. $Area = \frac{1}{2}bc\ \sin A = \frac{1}{2}ab\ \sin C = \frac{1}{2}ab \sin B$

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Find the area of the triangle having the indicated sides and angle.

16. $C = 84.5°$, $a = 32$, $b = 40$

17. $A = 29°$, $b = 49$, $c = 50$

18. $B = 72.5°$, $a = 105$, $c = 64$

19. $C = 31°$, $a = 15$, $b = 14$

20. $A = 42°$, $b = 25$, $c = 12$

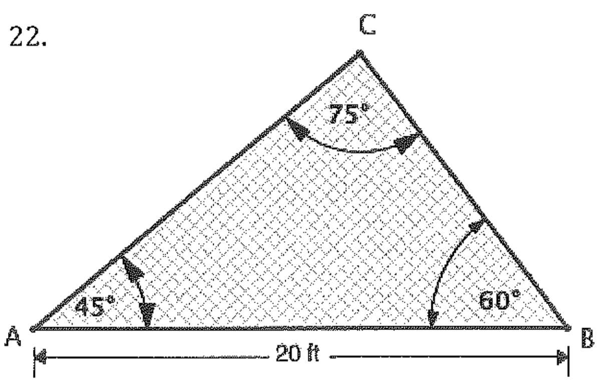
21. $B = 85°$, $a = 15$, $c = 12$

Another formula for the area of a triangle can be derived from the *Law of Sines*.

$Area = \frac{c^2 \sin A \sin B}{2 \sin C}$

Use this formula to find the area of the triangles.

22.



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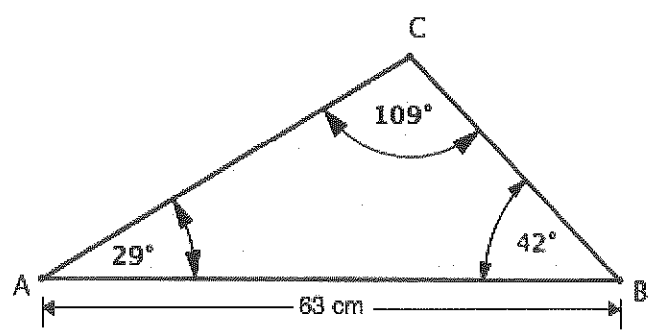


Perhaps you used the *Law of Cosines* to establish the following formula for the area of a triangle. The formula was known as early as circa 100 B.C. and is attributed to the Greek mathematician, Heron.

Heron's Area Formula: Given any triangle with sides of lengths *a, b,* and *c*, the area of the triangle is:

$Area = \sqrt{s(s-a)(s-b)(s-c)}$ where $s = \frac{(a+b+c)}{2}$.

Find the area of the triangle having the indicated sides.

24. $a = 11,\ b = 14,\ c = 20$

25. $a = 12,\ b = 5,\ c = 9$

26. $a = 12.32,\ b = 8.46,\ c = 15.05$

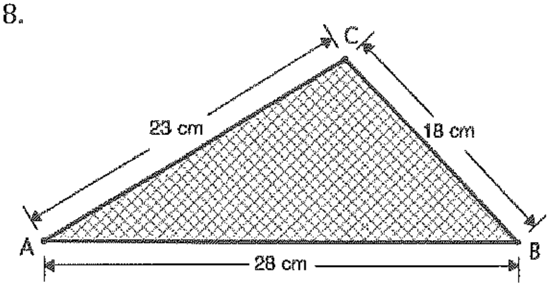
27. $a = 5,\ b = 7,\ c = 10$

GO

Topic: Distinguishing between the *law of sines* and the *law of cosines*

Indicate whether you would use the *Law of Sines* or the *Law of Cosines* to solve the triangles. Do not solve.

28.



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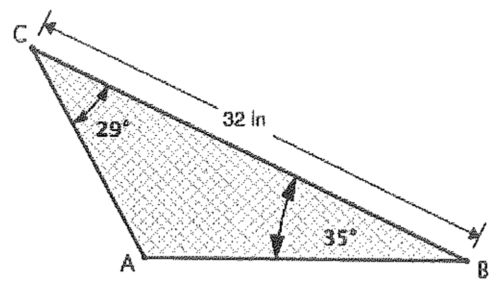

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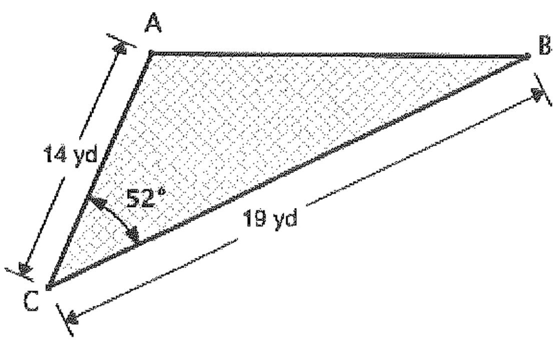

31.