

Module 3: Investigating Proportionality

TOPIC 2: TRIGONOMETRY

This topic introduces students to trigonometric ratios through an investigation of right triangles. Lessons provide opportunities for students to discover and analyze these ratios and use them to solve application problems. Students also explore the reciprocals of the basic trigonometric ratios—sine, cosine, and tangent, along with their inverses—to determine unknown angle measures. Students explore complement angle relationships in right triangles and then solve real-world problems using any of the relationships defined in the topic.

Where have we been?

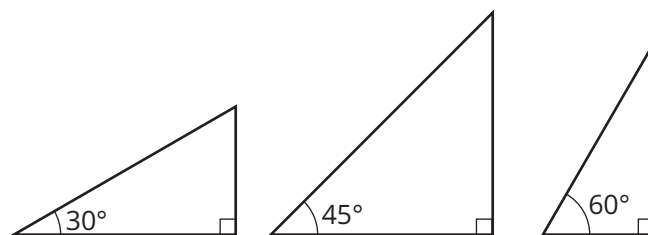
In middle school, students understand that slope is the steepness and direction of a line. They used similar triangles to explain why the slope between any two points on a line is the same. This understanding lays the groundwork for the development of tangent as the ratio of the opposite side (the vertical distance of a slope triangle) to the adjacent side (the horizontal distance of a slope triangle). For this reason, the tangent ratio is developed first, followed by sine and cosine.

Where are we going?

Trigonometry provides an important bridge between geometry and algebra. Understanding the trigonometric ratios in terms of side length ratios prepares students to study trigonometric functions in the next course. Students experience a concrete representation of the trigonometric ratios using triangles in this course.

Connecting Slope and Tangent

As the reference angle shown increases, the steepness of the hypotenuse increases. This steepness of the hypotenuse, which you know as the slope of the hypotenuse, is measured by the tangent ratio.

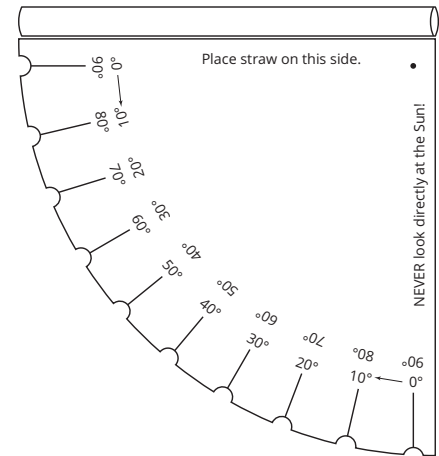


A Straw Luh Bee

Measuring angles on paper is easy when you have a protractor. But what about measuring angles in the real world? You can build an astrolabe (pronounced uh-STRAW-luh-bee) to help you.

You can find astrolabe cutouts online. You will probably want to glue the astrolabe to cardboard or heavy paper before cutting it out.

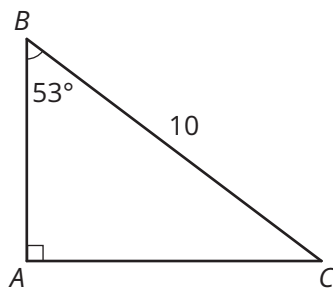
Cut a drinking straw to match the length of a straight edge. Tape the straw to the edge labeled so that it rests on the astrolabe. Poke a hole through the black dot shown and pass a string through this hole. Knot the string or tape it so that it stays in place. Finally, tie a weight to the end of the string. You're ready to go!



Talking Points

It can be helpful to understand trigonometry concepts for college admissions tests.

Here is an example of a sample question:



Based on the figure above, what is the approximate length of side AB ?

Use $\angle B$ as the reference angle and x for the unknown side. The cosine of the reference angle is the ratio $\frac{\text{adjacent}}{\text{hypotenuse}}$, or $\frac{x}{10}$. You will be able to use a calculator to determine that $\cos(53^\circ) \approx 0.602$. So, $0.602 \approx \frac{x}{10}$, which means that x , the unknown side, has a length of approximately 6.

Key Terms

reference angle

The legs of a right triangle are often referred to as the opposite side and the adjacent side. These references are based on the angle of the triangle that you are looking at, which is called the reference angle.

tangent (tan)

The tangent of an acute angle in a right triangle is the ratio of the length of the opposite side to the length of the adjacent side.

sine (sin)

The sine of an acute angle in a right triangle is the ratio of the length of the opposite side to the length of the hypotenuse.

cosine (cos)

The cosine of an acute angle in a right triangle is the ratio of the length of the adjacent side to the length of the hypotenuse.