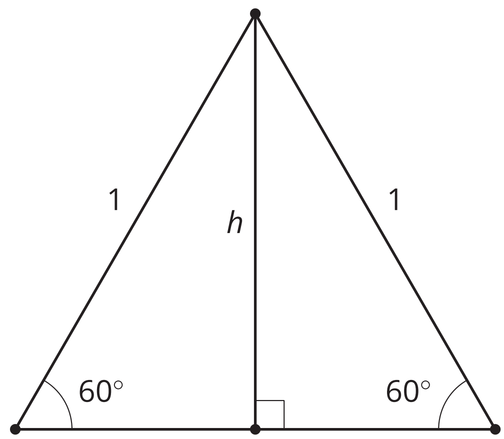
Unit 4, Lesson 11

Solving Problems with Trigonometry

Let’s solve problems about right triangles.

11.1 Practicing Perimeter

Find the area and perimeter of this triangle.



11.2 Card Sort: Circles and Polygons

Your teacher will give you a set of cards containing polygons. Arrange the cards in order from shortest to longest polygon perimeter. Be prepared to explain your reasoning.

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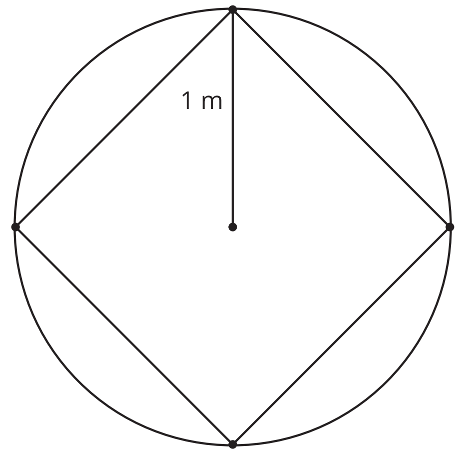
11.3 Growing Regular Polygons

1. Here is a square inscribed in a circle with radius 1 meter. What is the perimeter of the square? Explain or show your reasoning.



2. What is the perimeter of a regular pentagon inscribed in a circle with radius 1 meter? Explain or show your reasoning.

3. What is the perimeter of a regular decagon inscribed in a circle with radius 1 meter? Explain or show your reasoning.

4. What is happening to the perimeter as the number of sides increases?

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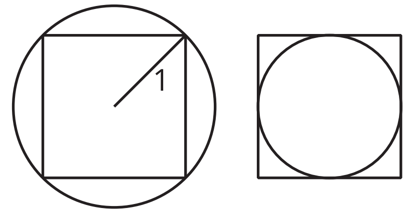
Are you ready for more?

Here is a diagram of a square inscribed in a circle and another circle inscribed in the same square.



1. How much shorter is the perimeter of the small circle than the perimeter of the large circle?

2. If the square were replaced with a regular polygon with more sides, would your previous answer be larger, smaller, or the same? Explain or show your reasoning.

11.4 Climbing Everest

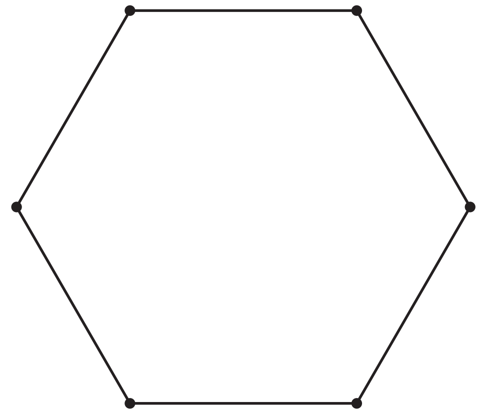
Mount Everest is the tallest mountain on Earth. The peak is 8,849 meters above sea level. It is a challenging hike that is completed in sections.

section	hiking distance (km)	elevation change (m)	angle of elevation (°)
Base to Camp 1	6	2,087	
Camp 1 to 2	2.8	1,315	
Camp 2 to 3		2,625	30–45
Camp 3 to 4		2,460	40
Camp 4 to Summit		2,944	60

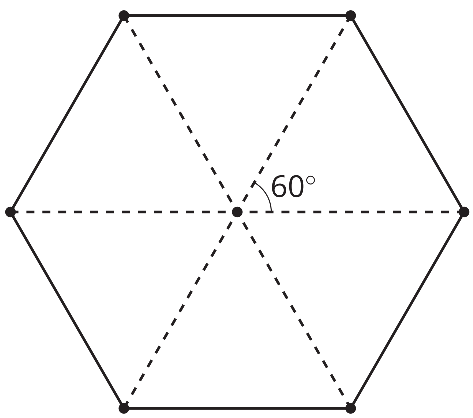
1. Complete the table.
2. Write an equation relating distance, d, elevation, e, and angle, α, that could represent any section of a hike.

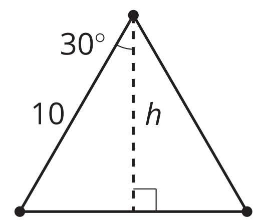
Lesson 11 Summary

We know how to calculate the unknown sides and angles of right triangles using trigonometric ratios and the Pythagorean Theorem. We can use the same strategies to solve some problems with other shapes—for example, given a regular hexagon with side length 10 units, find its area.



Decompose the hexagon into 6 isosceles triangles. The angle at the center is 60 degrees because $360 \div 6 = 60$. That means we created 6 equilateral triangles because the base angles of isosceles triangles are congruent.





To find the area of the hexagon, we can find the area of each triangle. Drawing in the altitude to find the height of the triangle creates a right triangle, so we can use trigonometry. In an isosceles (and an equilateral) triangle, the altitude is also the angle bisector, so the angle is 30 degrees. That means $\cos(30) = \frac{h}{10}$, so h is about 8.7 units. The area of one triangle is about $\frac{1}{2}(10)(8.7)$, or 43.5, square units. So the area of the hexagon is 6 times that, or about 261 square units.

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