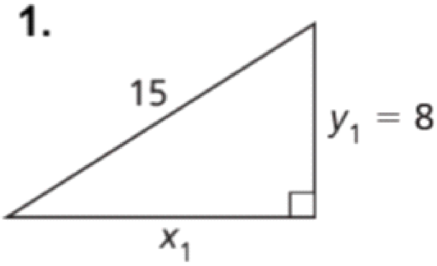
Warm Up

Find the measure of the missing leg in the right triangle, and then calculate the ratio $\frac{y_1}{x_1}$.

1.



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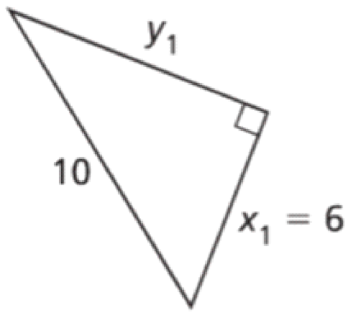

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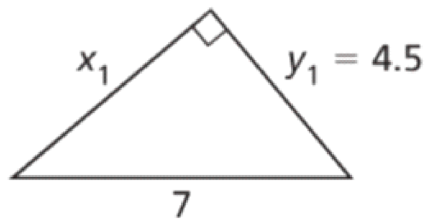


Essential Question

How do trigonometric ratios relate angle measures to side lengths of right triangles?

Needed Vocab:

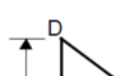
- **Cosine**
- **Inverse Ratios**
- **Sine**
- **Tangent**
- **Trigonometric Ratios**

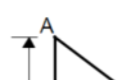
Goal: "I can. . .

Use trigonometric ratios to find lengths and angle measures of right triangles."

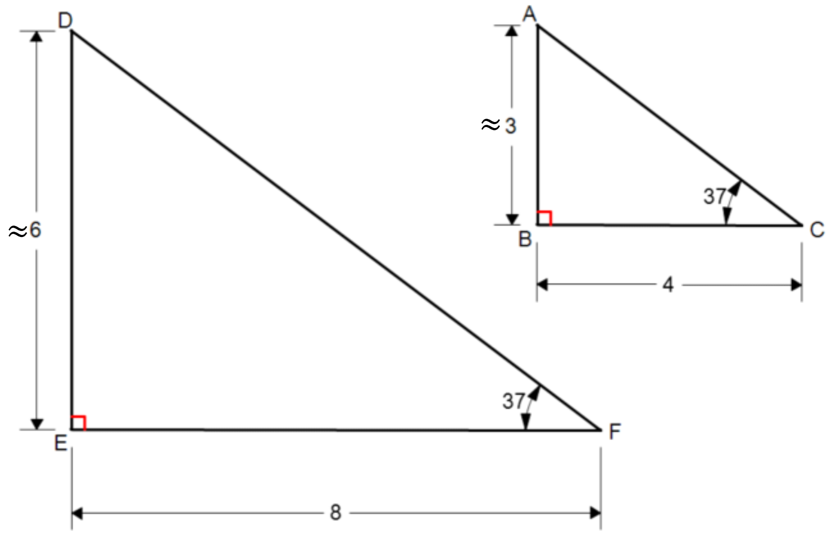
Answer the following questions in order:

- Are the two triangles similar?





- Are the two triangles similar?
- What is the approximate ratio between the side lengths of the triangle for each individual triangle?
- In your calculator, what is the number you get when you press tan(37)?



Trigonometric ratios are the consistent relationships between the side lengths of right triangles.

Sine compares the opposite side length over the hypotenuse of the triangle.

$$Sin(\theta) = \frac{Opp.}{Hyp.}$$

Cosine compares the adjacent side length over the hypotenuse of the triangle.

$$Cos(\theta) = \frac{Adj.}{Hyp.}$$

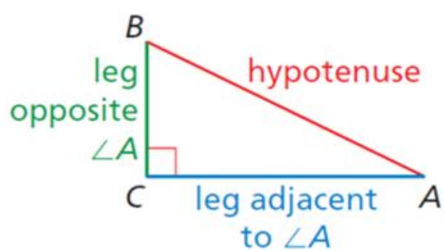
Tangent compares the opposite side length over the adjacent side length of the triangle.

$$Tan(\theta) = \frac{Opp.}{Adj.}$$

Sine and Cosine Ratios

Let $\triangle ABC$ be a right triangle with acute $\angle A$. The sine of $\angle A$ and cosine of $\angle A$ (written as $\sin A$ and $\cos A$) are defined as follows.

$$\sin A = \frac{\text{length of leg opposite } \angle A}{\text{length of hypotenuse}} = \frac{BC}{AB}$$



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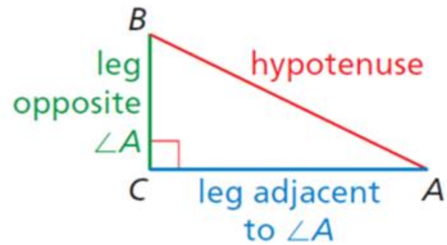
$$\cos A = \frac{\text{length of leg adjacent to } \angle A}{\text{length of hypotenuse}} = \frac{AC}{AB}$$

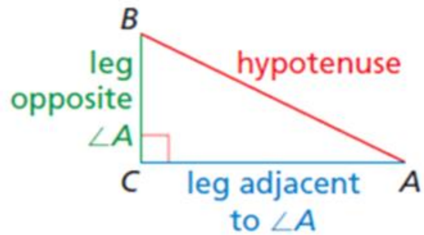


Tangent Ratio

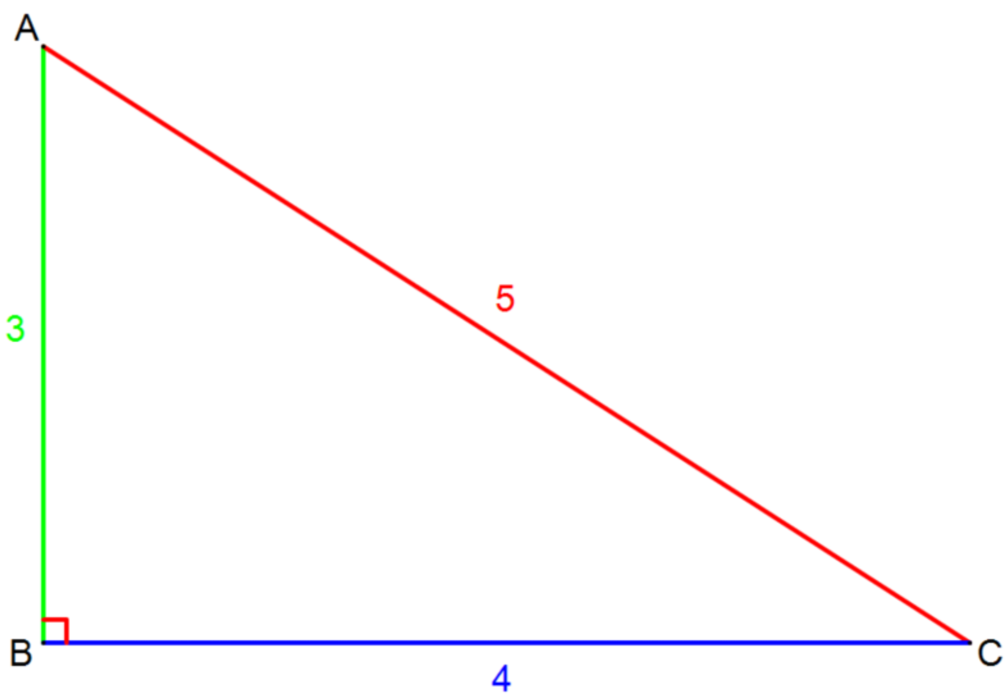
Let $\triangle ABC$ be a right triangle with acute $\angle A$.

The tangent of $\angle A$ (written as $\tan A$) is defined as follows.

$$\tan A = \frac{\text{length of leg opposite } \angle A}{\text{length of leg adjacent to } \angle A} = \frac{BC}{AC}$$



Example 1 What are the Sine, Cosine, and Tangent ratios for angle A?

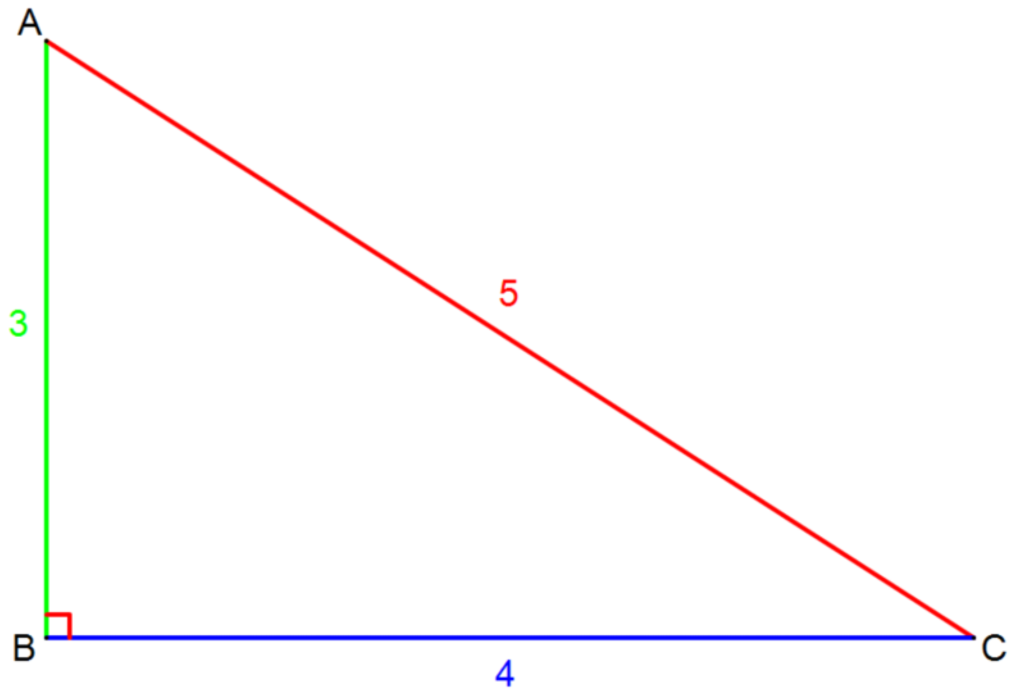


$Sin(A) =$ ——

$Cos(A) =$ ——

$Tan(A) =$ ——

What are the Sine, Cosine, and Tangent ratios for angle C?



$Sin(C) = \underline{\qquad}$

$Cos(C) = \underline{\qquad}$

$Tan(C) = \underline{\qquad}$

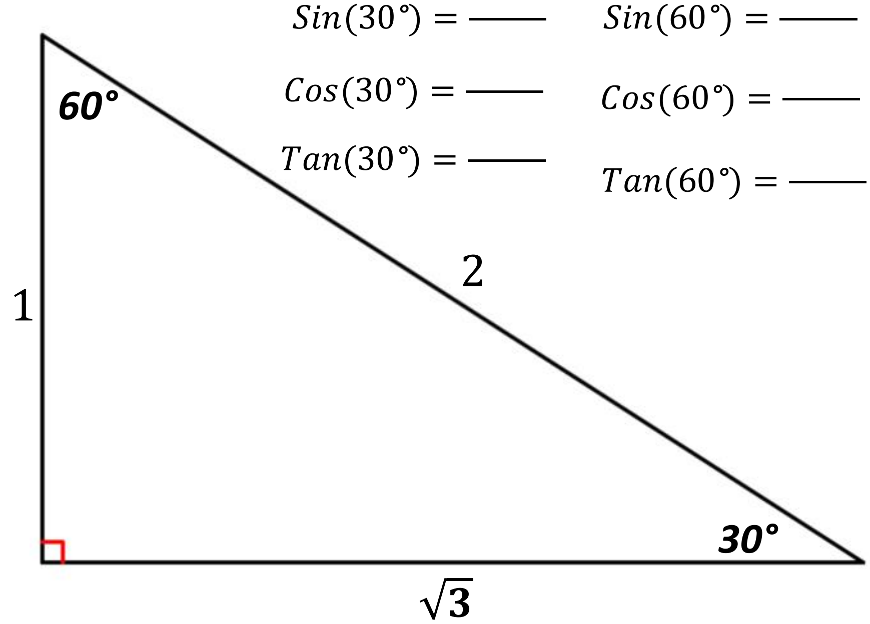
Example 2

What are the trig ratios of our special right triangles?

$Sin(30°) = \underline{\qquad}$ $Sin(60°) = \underline{\qquad}$

$Cos(30°) = \underline{\qquad}$ $Cos(60°) = \underline{\qquad}$

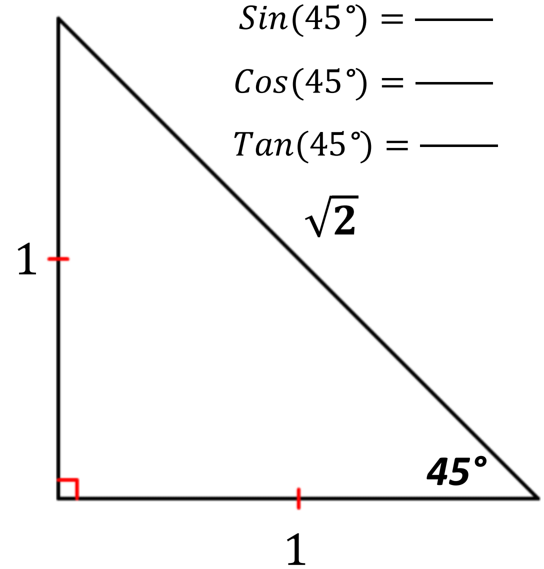
$Tan(30°) = \underline{\qquad}$ $Tan(60°) = \underline{\qquad}$



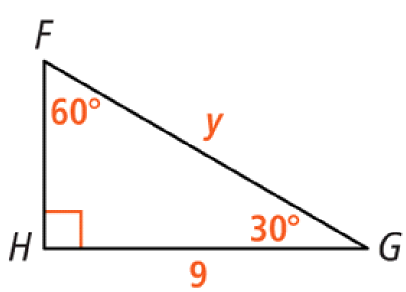
$Sin(45°) = \underline{\qquad}$

$Cos(45°) = \underline{\qquad}$

$Tan(45°) = \underline{\qquad}$



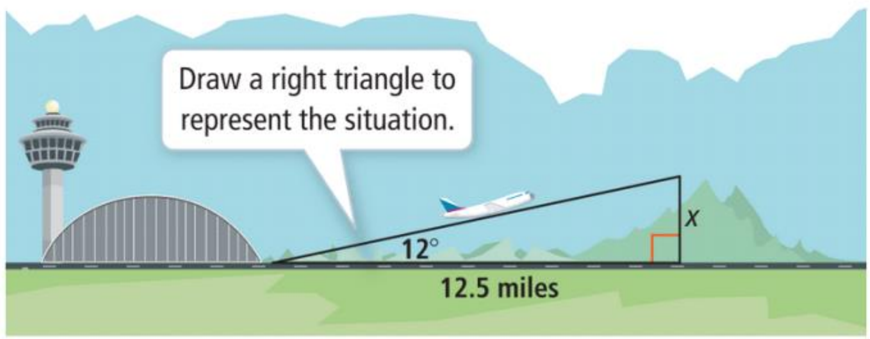
a. In ΔFGH, what is the value of y?



b. How can you write an equivalent expression for cos 70° using sine? An equivalent expression for sin 34° using cosine?

Example 3

A plane takes off and climbs at a 12° angle. Is that angle sufficient enough to fly over an 11,088-foot mountain that is 12.5 miles from the runway or does the plane need to increase its angle of ascent?



If a plane climbs at 5° and flies 20 miles through the air as it climbs, what is the altitude of the plane, to the nearest foot?

Inverse Ratios are used when you know the side lengths and need the angles.

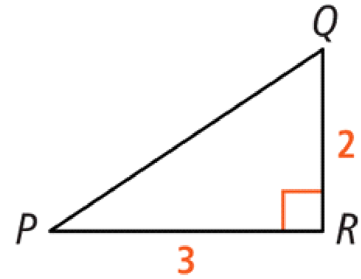
$$Sin(\theta) = \frac{Opp.}{Hyp.} \qquad \theta = Sin^{-1}\left(\frac{Opp.}{Hyp.}\right)$$

$$Cos(\theta) = \frac{Adj.}{Hyp.} \qquad \theta = Cos^{-1}\left(\frac{Adj.}{Hyp.}\right)$$

$$Tan(\theta) = \frac{Opp.}{Adj.} \qquad \theta = Tan^{-1}\left(\frac{Opp.}{Adj.}\right)$$

What is the m∠P?

What is the m∠Q?



When solving for angle measures or side lengths in right triangles, what is given will dictate what trig ratio you should be using. Make sure to memorize those ratios.

https://tinyurl.com/scvjeu8

Homework

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