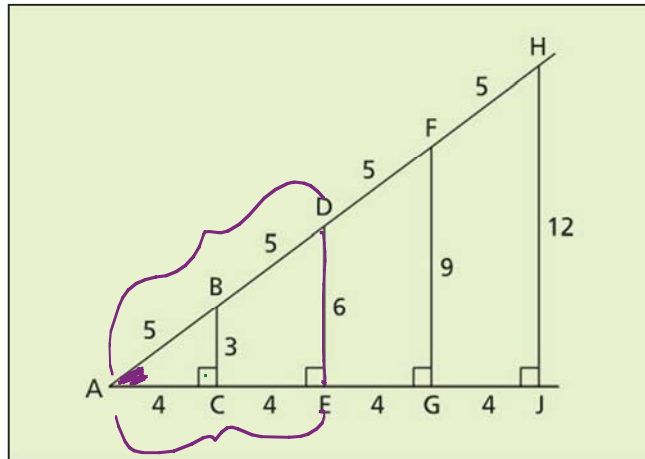


2.4-2.5 The Sine and Cosine Ratios

Constructing Your Understanding

A. Examine the nested right triangles below.



- $\angle A$ is common to each triangle. How are the other acute angles in each triangle related? Equal
- How do you know? $\angle A$ is the same + all right \angle 's
- How are the triangles related? They are similar

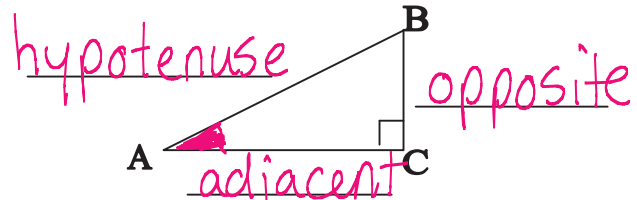
B. Complete this table.

| Triangle | Measures of Sides | | | Ratios | |
|-----------------|-------------------|--------------------------|-----------------------------|--|---|
| | Hypotenuse | Side opposite $\angle A$ | Side adjacent to $\angle A$ | $\frac{\text{Side opposite } \angle A}{\text{Hypotenuse}}$ | $\frac{\text{Side adjacent to } \angle A}{\text{Hypotenuse}}$ |
| $\triangle ABC$ | 5 | 3 | 4 | $\frac{3}{5}$ | $\frac{4}{5}$ |
| $\triangle ADE$ | 10 | 6 | 8 | $\frac{6}{10} = \frac{3}{5}$ | $\frac{8}{10} = \frac{4}{5}$ |
| $\triangle AFG$ | 15 | 9 | 12 | $\frac{9}{15} = \frac{3}{5}$ | $\frac{12}{15} = \frac{4}{5}$ |
| $\triangle AHJ$ | 20 | 12 | 16 | $\frac{12}{20} = \frac{3}{5}$ | $\frac{16}{20} = \frac{4}{5}$ |

- How do the ratios compare? Same
- What do you think the value of each ratio depends on? Angle A

In a right triangle, the ratios that relate each leg to the hypotenuse depend only on the measure of the acute angle, and not on the size of the triangle. These ratios are called the sine ratio and the cosine ratio.

The Primary Trigonometric Ratios



- The tangent ratio

The tangent of an angle, A, is the ratio of the length of the opposite side over the length of the adjacent side.

- The sine ratio

The sine of an angle, A, is the ratio of the length of the opposite side over the length of the hypotenuse.

- The cosine ratio

The cosine of an angle, A, is the ratio of the length of the adjacent side over the length of the hypotenuse.

In short: $\sin A = \frac{\text{opp}}{\text{hyp}}$; $\cos A = \frac{\text{adj}}{\text{hyp}}$; $\tan A = \frac{\text{opp}}{\text{adj}}$

To recall these trigonometric ratios quickly, remember the acronym:

S O H C A H T O A

You can use a scientific calculator to determine the measure of an angle:

- When you know its sine, use \sin^{-1} "sine inverse"
- When you know its cosine, use \cos^{-1} "cosine inverse"

SOHCAHTOA
 ↑ ↑

Ex. #1: Determine the measures of $\angle G$ and $\angle H$ to the nearest tenth of a degree.

We have "adj" + "hyp"

$$\cos G = \frac{\text{adj}}{\text{hyp}}$$

$$\cos G = \frac{6}{14}$$

$$\cos G = 0.4285714286$$

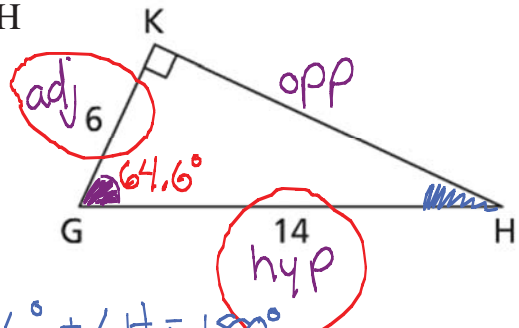
$$\angle G = \cos^{-1}(0.4285714286)$$

$$\angle G = 64.6^\circ$$

Angles in Δ add to 180°

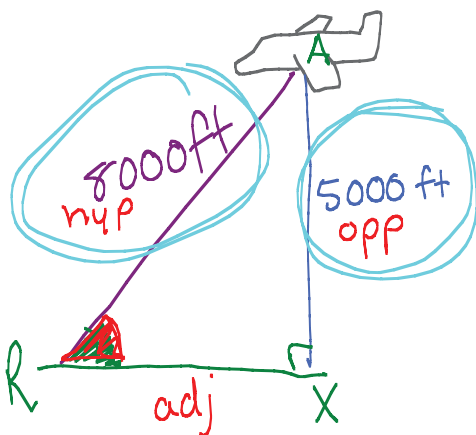
$$90^\circ + 64.6^\circ + \angle H = 180^\circ$$

$$\angle H = 180^\circ - 90^\circ - 64.6^\circ = 25.4^\circ$$



On a Separate Piece of Paper Complete Check Your Understanding #2 p. 93

Ex. #2: A water bomber is flying at an altitude of 5000 ft. The plane's radar shows that it is 8000 ft. from the target site. What is the **angle of elevation** of the plane measured from the target site, to the nearest degree?



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$$\sin R = \frac{\text{opp}}{\text{hyp}}$$

$$\sin R = \frac{5000}{8000}$$

$$\angle R = \sin^{-1}\left(\frac{5000}{8000}\right)$$

$$\angle R = 38.682187\dots$$

$$\angle R = 39^\circ$$

On a Separate Piece of Paper Complete Check Your Understanding #3 p. 94