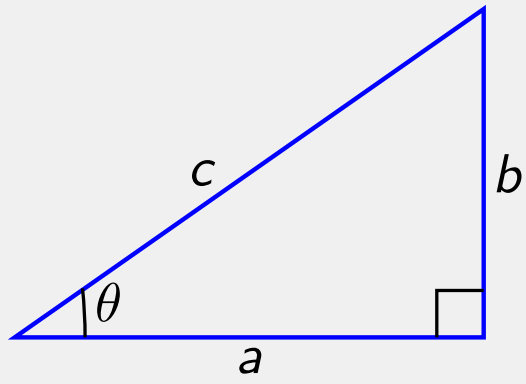
Trigonometric Functions

6.2 Definition 1 of Trigonometric Functions: Right Triangle Ratios

October 26, 2010

Definition 1: Trigonometric Functions

Let θ be an acute angle in a right triangle,

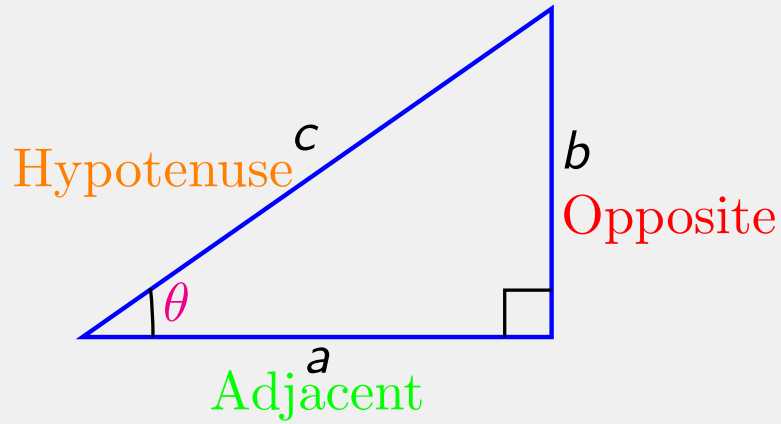


then

$$\sin\theta = \frac{b}{c} \qquad \cos\theta = \frac{a}{c} \qquad \tan\theta = \frac{b}{a}$$

$$\csc\theta = \frac{c}{b} \qquad \sec\theta = \frac{c}{a} \qquad \cot\theta = \frac{a}{b}$$

Definition 1: Trigonometric Functions (Alternate Form)



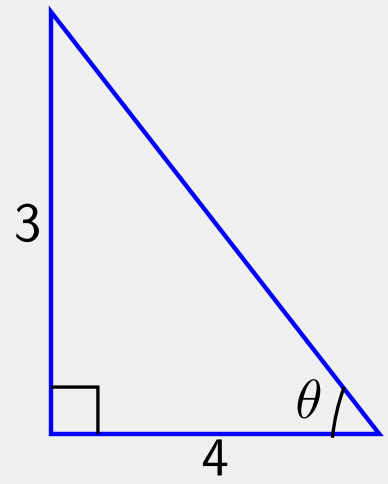
$$\sin\theta = \frac{opposite}{hypotenuse} \qquad \cos\theta = \frac{adjacent}{hypotenuse} \qquad \tan\theta = \frac{opposite}{adjacent}$$

$$\csc\theta = \frac{1}{\sin\theta} = \frac{hypotenuse}{opposite} \qquad \sec\theta = \frac{1}{\cos\theta} = \frac{hypotenuse}{adjacent}$$

$$\cot\theta = \frac{1}{\tan\theta} = \frac{adjacent}{opposite}$$

Example

For the given triangle,

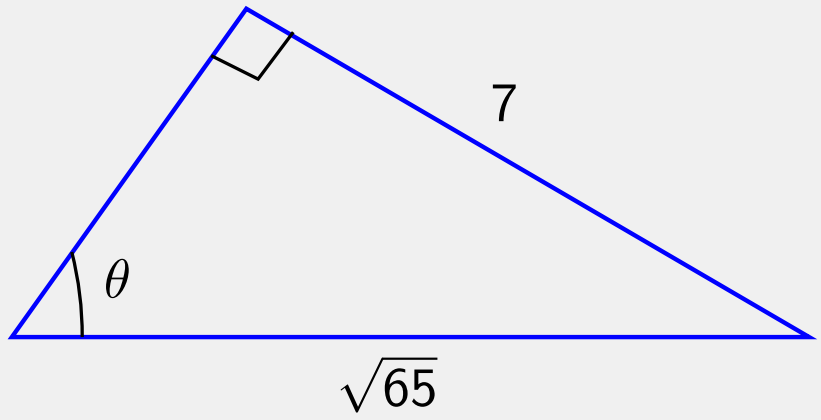


calculate

- $\sin\theta$
- $\tan\theta$
- $\csc\theta$

Example

For the given triangle,



calculate

- $\cos\theta$
- $\tan\theta$
- $\sec\theta$

Cofunction Theorem

A trigonometric function of an angle is always equal to the cofunction of the complement of the angle. If $\alpha + \beta = 90°$, then

- $\sin\beta = \cos\alpha$
- $\sec\beta = \csc\alpha$
- $\tan\beta = \cot\alpha$

Cofunction Identities

$$\sin\theta = \cos(90° - \theta) \quad \cos\theta = \sin(90° - \theta)$$

$$\tan\theta = \cot(90° - \theta) \quad \cot\theta = \tan(90° - \theta)$$

$$\sec\theta = \csc(90° - \theta) \quad \csc\theta = \sec(90° - \theta)$$

Example

Write each function value in terms of its cofunction.

(a) $\sin 30^\circ$

(b) $\tan x$

(c) $\csc 40^\circ$

Example

Evaluate the six trigonometric functions for an angle that measures $30°$.

Example

Evaluate the six trigonometric functions for an angle that measures $45°$.

Example

Use a calculator to find the values of

(a) $\sin 75°$
(b) $\tan 67°$
(c) $\sec 52°$
(d) $\cos 30°$

Round your answers to four decimal places.