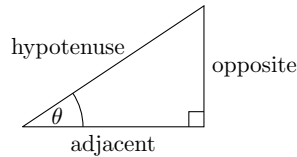


Trig Word Problems

Basic Trig

Basics



$$\cos(\theta) = \frac{\text{adj}}{\text{hyp}} \quad \sin(\theta) = \frac{\text{opp}}{\text{hyp}} \quad \tan(\theta) = \frac{\text{opp}}{\text{adj}}$$

$$\tan(\theta) = \frac{\sin(\theta)}{\cos(\theta)} \quad \sec(\theta) = \frac{1}{\cos(\theta)}$$

$$\csc(\theta) = \frac{1}{\sin(\theta)} \quad \cot(\theta) = \frac{\cos(\theta)}{\sin(\theta)}$$

Trig Identities useful in Integration

Pythagorean Identity: $\sin^2(\theta) + \cos^2(\theta) = 1$

Half-Angle Formulas: $\cos^2 x = \frac{1 + \cos(2x)}{2}$ $\sin^2 x = \frac{1 - \cos(2x)}{2}$

Double-Angle Formulas: $\cos(2x) = \cos^2 x - \sin^2 x$ $\sin(2x) = 2 \sin x \cos x$

Add./Subst. Formulas: $\cos(s + t) = \cos s \cos t - \sin s \sin t$
 $\sin(s + t) = \sin s \cos t + \cos s \sin t$
 $\cos(s - t) = \cos s \cos t + \sin s \sin t$
 $\sin(s - t) = \sin s \cos t - \cos s \sin t$

Problem 1. The average monthly temperature in degrees Fahrenheit for the city of Nome, Alaska, fluctuates periodically between a low of 3 in January and a high of 58 in July.

- Find a trigonometric function $N(m)$ that models the average temperature of Nome, where m is in months after January. That is, $m = 0$ corresponds to January.
- Without solving the equation, how many solutions should the equation $N(m) = 32$ have in the interval $[0, 12]$?

Problem 2. Diego has a 10 foot ladder. He places it against a wall so that the angle it forms with the ground is equal to 60 degrees.

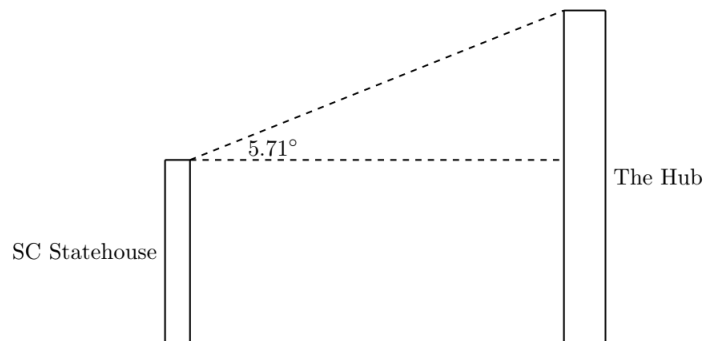
i. Sketch the situation, labeling as many parts of your drawing as possible from the information given.

ii. How high off of the ground is the top of Diegos ladder?

iii. How far away from the wall is the foot of the ladder?

iv. Diego decides to move the ladder so that the angle it forms with the ground is now equal to 45 degrees. How high off the ground is the top of his ladder now?

Problem 3. Suppose you know that the height of the South Carolina Statehouse is 180 feet, and that the height of the second tallest building in downtown Columbia, the Hub, is 325 feet. Use the information shown in the figure below to determine the horizontal distance between the two buildings.



(Figure not drawn to scale)

Problem 4. The top of a 200-foot vertical tower is to be anchored by cables to the ground.

i. Draw a sketch of the tower and cables.

ii. If the cables are 400 feet long, what angle do they form with the ground?

iii. If the cables are instead anchored 200 feet from the tower, what angle do they form with the ground?

Problem 5. Suppose you are 20 meters high on a Ferris wheel whose diameter is 30 meters, that the wheel makes one full rotation every 4 minutes, and that you boarded at ground level (the 6:00 position). How long might you have been on the wheel? Is this is the only possibility? [Hint: Sketch a picture first.]