BIG PICTURE of this Unit

- How can we extend our geometry skills with triangles to go beyond right triangles to (i) obtuse triangles and (ii) circles and Cartesian Planes?
- What do triangles have to do with sinusoidal functions in the first place?
- How can we connect previously learned function concepts and skills to sinusoidal functions?
- How can use the equation of a sinusoidal function be used to analyze for key features of a graph of a sinusoidal curve?
- When and how can triangles and sinusoidal functions be used to model real world scenarios?

1. (CI) Use online resources to find out what the term "**angles in standard position**" means. Illustrate your understanding by drawing an example of an angle in standard position. {11}

   a. Use your diagram (or additional diagrams) & your understanding to explain/illustrate the following terms:
      i. Terminal arm
      ii. Initial arm
      iii. Coterminal angles
      iv. Negative angles
      v. Principal angle
      vi. Related acute angle (also called the reference angle)

   b. Now, for the following angles (-225°, 315°, 120°, 510°), draw the angle in standard position and illustrate and calculate the:
      i. Principal angle and the related acute angle
      ii. The next two positive coterminal angles as well as the next two negative coterminal angles

2. (CI) Draw diagrams of the following **angles in standard position**: {11}

   (a) 50° (b) 150° (c) 250° (d) 350° (e) -50° (f) 410°

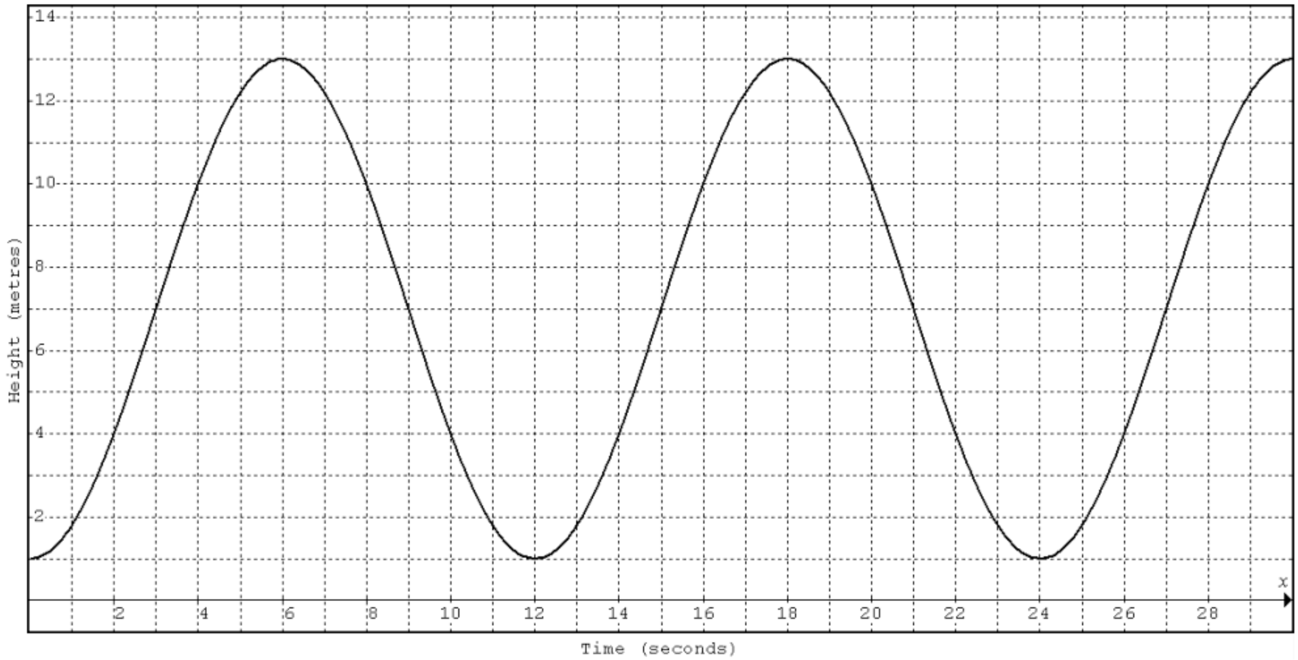
3. (CA) Puzzling questions with trig ratios: use your calculator to evaluate the sine ratios of the following angles: {1,11}

   (a) sin(50°) (b) sin(150°) (c) sin(250°) (d) sin(350°) (e) sin(-50°)

   (f) sin(130°) (g) sin(410°) (h) sin(-230°) (i) sin(770°) (j) sin(-310°)

   a. Describe any patterns you observe. (HINT: It may be VERY helpful to sketch these angles in standard position)
   b. Hence or otherwise, solve for x in the equation $\sin(x) = 0.766$ (or also written as $\sin^{-1}(0.766) = x$)

4. (CI) Victoria rode on a Ferris wheel at Cluney Amusements. The graph models Victoria's height above the ground in metres in relation to time in seconds. The data was recorded while the ride was in progress. {15}



a. What is the height of the axle on the Ferris wheel?

b. What is the radius of the Ferris wheel?

c. What is the maximum height of the Ferris wheel?

d. How long does it take for the Ferris wheel to complete one revolution?

e. Victoria boards the Ferris wheel at its lowest point. How high above the ground is this?

f. Within the first 20 seconds, how many times is Victoria at a height of 7 m above the ground?

g. What is Victoria's approximate height above ground at 16 seconds?

h. What is Victoria's approximate height above the ground at 57 seconds?

i. Find the **period** of this function. Label it.

j. Find the **range** of this function. Label it.

k. What is the minimum point… call that the **Trough.** Label it!

l. What is the maximum point… call that the **Peak.** Label it!

m. **Equation of the Axis/Sinusoidal Axis/Equilibrium Axis:** The equation of the horizontal line halfway between the minimum and maximum…Find if for the graph. $y = \dfrac{Max.\ Value + Min.\ Value}{2}$

n. **Amplitude:** Half the distance between the maximum and the minimum. Find it for the graph. Label it.

5. (CA) Louise is a naturalist studying the effect of acid rain on the fish population in lakes. As part of her research, she needs to know the length of Lake Labarge. Louise makes the measurements shown below. How long is the lake? {8}

Diagram for Q5.

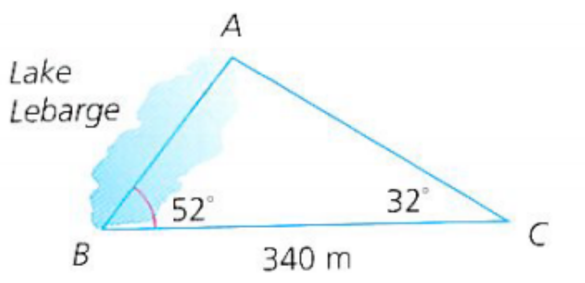
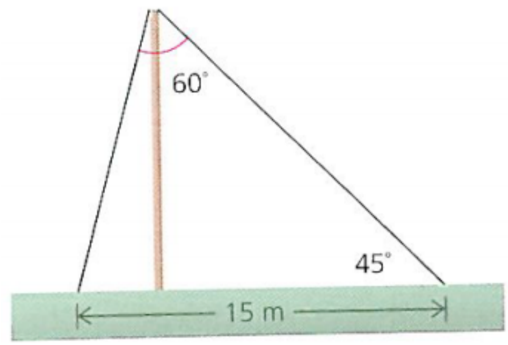


Diagram for Q6.



6. (CA) A radio wire is supported by two wires on opposite sides as shown above. The wires form an angle of 60° at the top of the tower. On the ground, the ends of the wires are 15.0 m apart and one wire is at a 45° angle to the ground. How long will the wires be? {8}

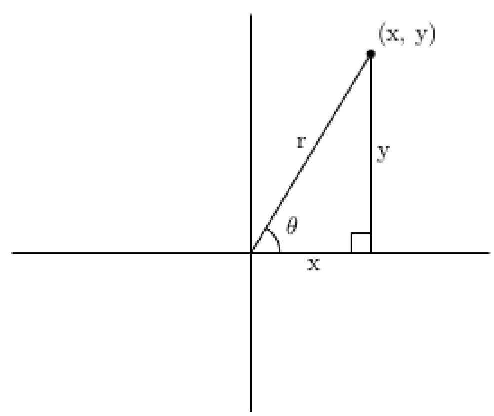
Higher Level Questions for More Complex Concepts OR an EXTENSION of basic concepts involved with triangle trigonometry and sinusoidal functions.

1. **Working with Identities**: Use online resources to find out what we mean by the term " mathematical identities)

   a. Hence, explain WHY $(x+y)^2 = x^2 + 2xy + y^2$ is an example of a mathematical identity.

   b. Hence, explain WHY $x^2 = x + 6$ is NOT an example of a mathematical identity.

   c. Hence, show why/why not $4(x-2) = (x-2)(x+2) - (x-2)^2$ is/is not an identity



Two very common trig identities are (i) the quotient trig identities and then the (ii) the Pythagorean trig identities (see below).

d. Prove that $\tan x = \dfrac{\sin x}{\cos x}$ and prove that $\sin^2 x + \cos^2 x = 1$. (HINT: Use the diagram to guide your "proof")

2. To prove that a trig equation is also an identity, you will use these two given "facts" (i.e the quotient and the Pythagorean identities) to help develop proofs.

   Two helpful video links ➔ https://youtu.be/Zktxkfr9zJE from Mathispower4u and then https://youtu.be/UpvnqqxmtHk from MathScience Genius

   a. Prove that $\tan x + \dfrac{1}{\tan x} = \dfrac{1}{\sin x \cos x}$ is an identity.
   b. Prove that $\sin^4 x - \cos^4 x = \sin^2 x - \cos^2 x$ is an identity.
   c. Prove that $\dfrac{\sin^2 x}{1 - \cos x} = 1 + \cos x$ is an identity.