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. INVESTIGATION of $f(x) = A \sin\left(k(x+C)\right) + D$. Complete the following steps & record all observations {16,17}

a. Graph $f(x) = A\sin(x)$ (use slider on DESMOS) and explain what happens when:
   i. $A > 1$
   ii. $0 < A < 1$
   iii. $A < 0$
   iv. Which features PREDICTABLY change when the value of A change? (Circle choices: domain, range, period, amplitude, axis of the curve). Explain HOW the selected features change

b. Graph $f(x) = \sin(kx)$ (use slider on DESMOS) and explain what happens when:
   i. $k > 1$
   ii. $0 < k < 1$
   iii. $k < 0$
   iv. Which features PREDICTABLY change when the value of k change? (Circle choices: domain, range, period, amplitude, axis of the curve). Explain HOW the selected features change

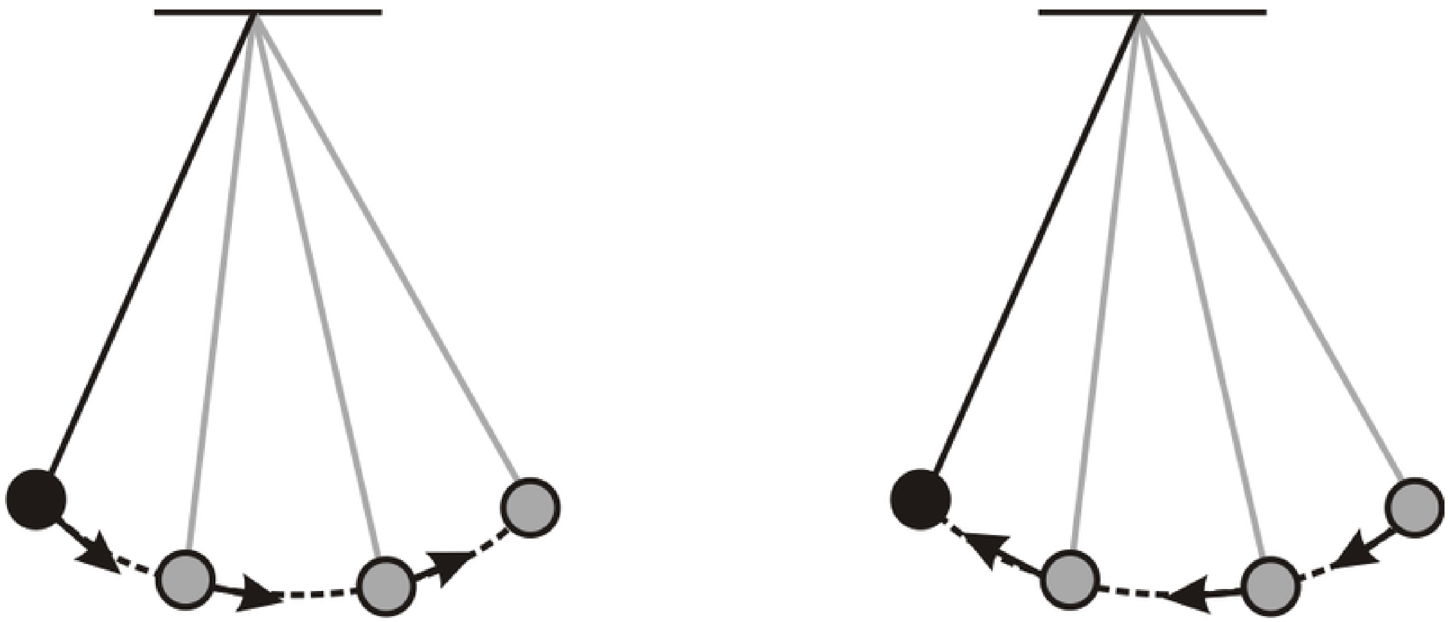
c. Graph $f(x) = \sin(x) + D$ (use slider on DESMOS) and explain what happens when:
   i. $D > 0$
   ii. $D < 0$
   iii. Which features PREDICTABLY change when the value of D change? (Circle choices: domain, range, period, amplitude, axis of the curve.) Explain HOW the selected features change.

d. Graph $f(x) = \sin(x - \mathrm{C})$ (use slider on DESMOS) and explain what happens when:
   i. $C > 0$
   ii. $C < 0$
   iii. Which features PREDICTABLY change when the value of C change? (Circle choices: domain, range, period, amplitude, axis of the curve). Explain HOW the selected features change

2. LAB Exercise - Pendulum Lab {17,18,19}

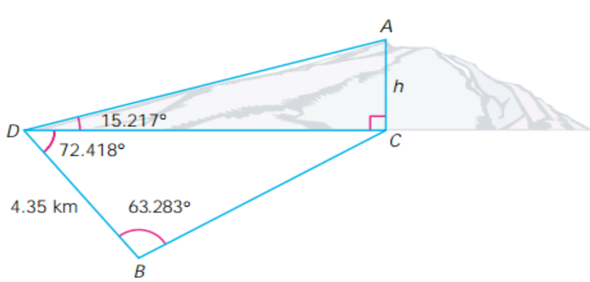
TASK: To create a data set of time (independent variable) and position (dependent variable), one that you will plot on a graph and one from which you will ultimately write a sinusoidal equation

You will construct a pendulum from the materials provided. You will also need to record some initial conditions from your experimental set up. Write up your experimental procedure and initial measurements, get it approved by me and then run the experiment to collect your data.



3. (CA) Determine the height of the mountain. {2,4,8,9,10}

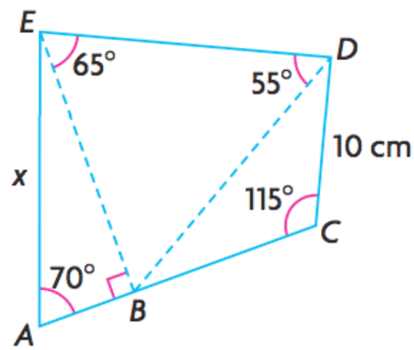
16. A surveyor uses a diagram to help determine the height, h, of a mountain.



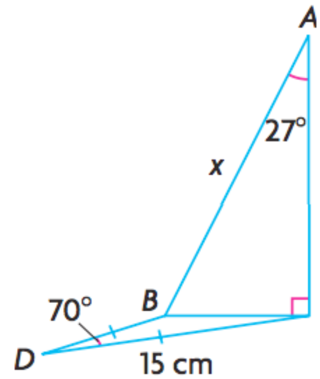
(a) Use ΔBDC to determine $\angle C$.
(b) Use ΔBDC and the sine law to determine DC.
(c) Use ΔADC to calculate h.

4. (CA) In these two problems, solve for the indicated side and round final answer correct to the nearest tenths. {2,4,8,9,10}

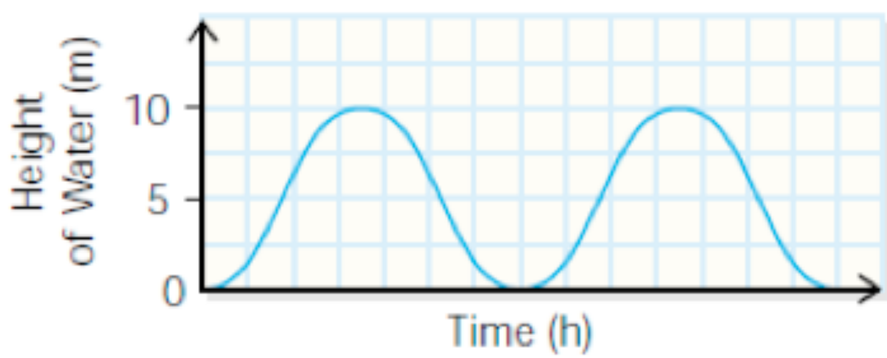
(a)



(b)



5. The Bay of Fundy, which is between New Brunswick and Nova Scotia (in Canada), has the highest tides in the world. At low tide, there is no water on the beach, while at high tide, the water covers the beach. Below, is a graph showing the relationship between the height of the water, (in meters) as a function of the time (in hours) {15,17,19}



a. Why can you use a periodic function to model tides?
b. What is the change in the depth of the water from low tide to high tide?
c. Determine the equation of the axis of the curve.
d. What is the amplitude of the curve?
e. What is the period of the curve.
f. Given your work in Q1, predict an equation for the function.

6. (CI) For the following given angles $(143°, -132°, 419°, -60°)$, sketch the angle and then determine: {11}

   a. the principle angle

   b. the related acute angle (or reference angle)

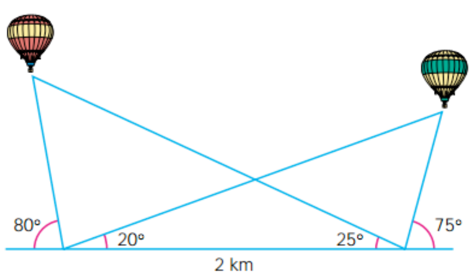
   c. the next 2 positive and negative co-terminal angles

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

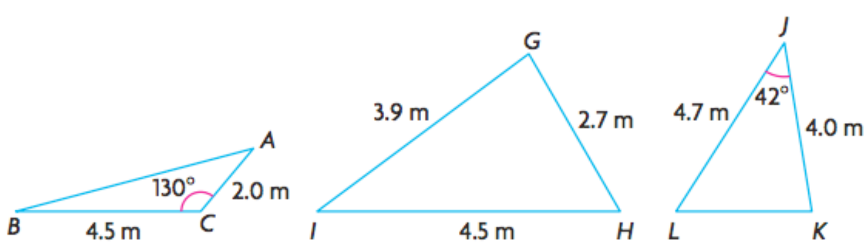
20. Two hot air balloons are moored directly over a level road. The diagram shows the angle of elevation of the balloons from two observers 2 km apart.

(a) To the nearest tenth of a kilometre, how far apart are the balloons?

(b) Which balloon is higher, and by how many metres?



10. In setting up for an outdoor concert, a stage platform has been dismantled into three triangular pieces as shown.



There are three vehicles available to transport the pieces. In order to prevent damaging the platform, each piece must fit exactly inside the vehicle. Explain how you would match each piece of the platform to the best-suited vehicle. Justify your reasoning with calculations.