BIG PICTURE of this Unit

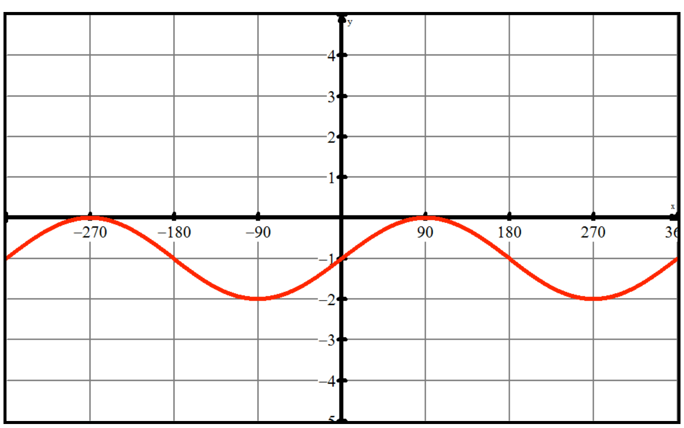
- How can we extend our geometry skills with triangles to go beyond right triangles to (i) obtuse triangles and (ii) circles and Cartesian Planes?
- What do triangles have to do with sinusoidal functions in the first place?
- How can we connect previously learned function concepts and skills to sinusoidal 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. (CA, but eventually CI) For the following sinusoidal functions, determine the (i) amplitude, (ii) the period, and (ii) the axis of the curve. Explain/show how you determined your answers. Include diagrams if necessary to support your answers. {16,17}

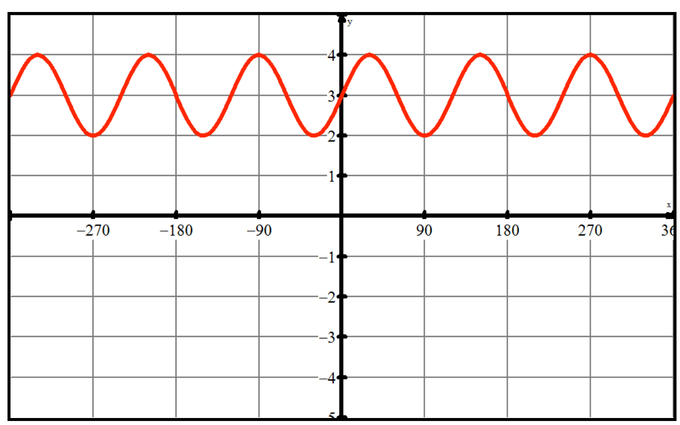
   (a) $y = 2\sin(3x)$ (b) $y = \cos(0.5x) - 3$ (c) $y = 3\sin(x) + 4$ (d) $y = 12\cos(3x) + 5$

2. (CI) Given the following 4 graphs of sine curves, determine: (i) the amplitude, (ii) the period, (iii) the equation of the equilibrium axis and hence, determine the equation of each curve. {17,18}

(i)



(ii)



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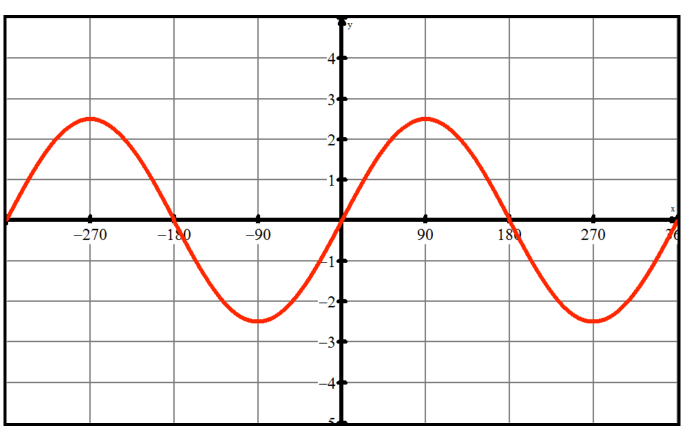
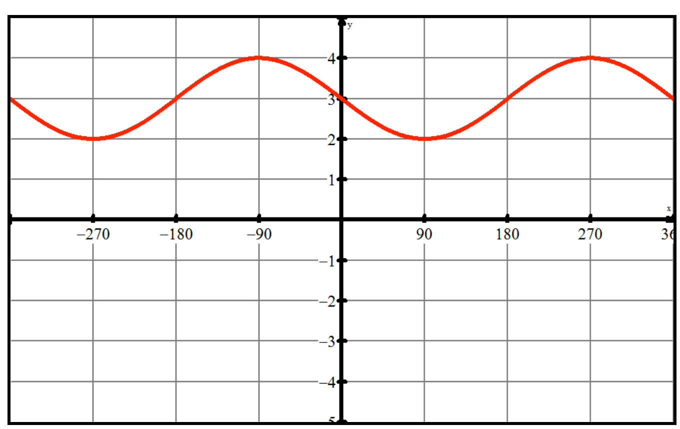


(iv)



3. (CA) Solve the following equations, using the method of your choice. {16,21}

    a. Evaluate $y = \sin(x)$ given the domain of $-90° \leq x \leq 540°$ when $y = -0.3$. Answer to the nearest degree.
    b. Evaluate $y = \cos(x)$ given the domain of $0° \leq x \leq 540°$ when $y = -0.7$. Answer to the nearest degree.
    c. Given that $h(t) = \cos(20t)°$, what is the value of t when $h(t) = 0.3$ given the domain of $-10 \leq x \leq 50$? Answer to the nearest tenth.
    d. Given that $h(t) = 4\sin(30t)°$, what is the value of t when $h(t) = 3.2$ given the domain of $-10 \leq x \leq 50$? Answer to the nearest tenth.

4. (CA) The average monthly temperature, T, in degrees Celsius in the Kawartha Lakes was modelled by $T(t) = -22\cos(30t)° + 10$, where t represents the number of months. For $t = 0$, the month is January; for $t = 1$, the month is February, and so on. {15,17,19}

    a. Sketch the graph from your GDC.
    b. What is the period? Explain the period in the context of the problem.
    c. What is the amplitude? Explain the amplitude in the context of the problem.
    d. What is the maximum temperature? the minimum temperature?
    e. What is the range of temperatures for this model?
    f. What is the annual/yearly average temperature?
    g. What is the predicted temperature on April 15th?
    h. Evaluate $T(18.75)$ and explain the solution in the context of the problem.
    i. When will the temperature be predicted to be 12°?
    j. Solve the equation $0 = -22\cos(30t) + 10$ and explain the solution in the context of the problem.

5. (CI) Using the domain of $\{x \in R \mid -360° \leq x \leq 360°\}$, graph the following two "parent functions": $f(x) = \sin(x)$ and $g(x) = \cos(x)$ in your notebooks. {16,21}

    a. Label the five key points within each cycle.
    b. State the period and amplitude of each function.
    c. Use the graphs to solve the following equations for x, given the domain of $\{x \in R \mid -360° \leq x \leq 360°\}$

        i. $\sin(x) = 1$ ii. $1 + \cos(x) = 0$ iii. $\cos(x)(\cos(x) - 1) = 0$ (HINT: Let B = cos(x))

6. (CA) LAB Exercise – The Ambiguous Case (SSA triangles) {8,9,10}

Objective: Use the pipe cleaners to create as many triangles as possible.

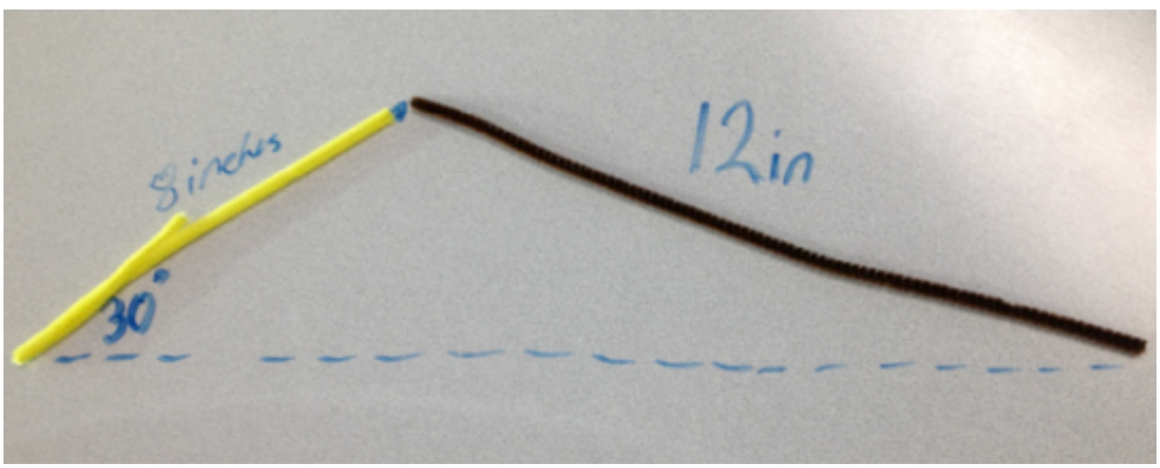
a. Draw an extended baseline that is at least 24 inches in length and label **one end** as point A. Do **not** label a second end point. **Part of this side** will become side AC of a triangle.

b. Use one pipe cleaner that is 8 inches long and place one end at point A. You have now created side AB of a triangle (where point B is at the end of this pipe cleaner.

c. Measure the angle at A such that it is exactly 30°.

d. Side BC is a second pipe cleaner (darker color) and it will be 12 inches long.

e. Now record the measure of each side and each angle and record these measurements in a diagram of this triangle you have created, ΔABC. (see diagram)



f. To create other triangles, keep side AB as 8 inches and keep angle A as 30°. Now side BC can be shortened by 1 inch increments, so it will now be 11 inches. Once again, record the measure of each side and each angle and record these measurements in a diagram of this triangle you have created, ΔABC.

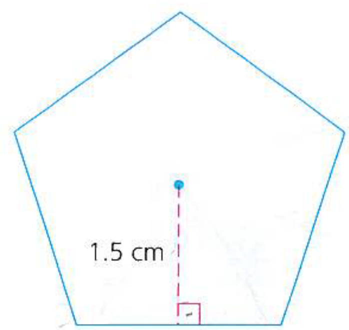
g. Continue creating triangles by shortening side BC by 1 inch increments. Record all triangles you constructed by drawing diagrams.

h. Determine the sine ratio of a 60° angle as well as a 120° angle. Hence, or otherwise, find $\sin^{-1}(0.5)$

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

1. Solve the following word problems:

26. **Thinking, Inquiring, Problem Solving:** Find the perimeter and area of this regular pentagon.



27. An airplane is flying from Montreal to Vancouver. The wind is blowing from the west at 60 km/h. The plane flies at 750 km/h relative to the air. If the pilot wishes to fly at a heading of N65°W

(a) what heading should he take to compensate for the wind?

(b) what is the speed of the plane relative to the ground?