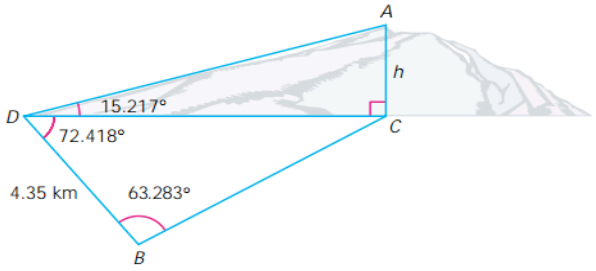
BIG PICTURE of this Unit

- 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) 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 $\angle C$.

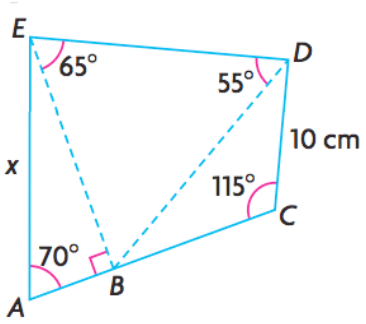
(b) Use ΔBDC and the sine law to determine DC.

(c) Use ΔADC to calculate h.

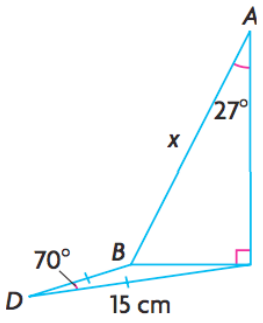
2. (CA) The height, h, of a basket on a water wheel at time t is given by $h(t) = \sin(6t)°$, where t is in seconds and h is in meters. {15,19,21}
   a. How high is the basket at 14 seconds?
   b. When will the basket first be 0.5 m under water?

3. (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)



4. (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

5. (CA, but eventually CI) Graph the sinusoidal function $f(x) = 3\sin(x) + 1$ on your TI-84. Use the graph (or your knowledge of the equation to answer the following questions: {16,17}

   a. NEATLY and CAREFULLY, sketch the function into your notebooks. Label the five "critical points" on your sketch.
   b. Detemine the amplitude of this function. Show/explain how you determined your answer.
   c. Detemine the period of this function. Show/explain how you determined your answer.
   d. Determine the equation of the axis of the curve. Show/explain how you determined your answer.
   e. Find the x-intercepts of the function if the domain is $0° \leq x \leq 720°$.
   f. Find the extrema (max & min points) of the function, on the same domain of $0° \leq x \leq 720°$.
   g. In which domain interval(s) are the values of $f(x)$ **increasing**?

6. (CA) Solve the following trig based equation: {16,21}

   a. From your **home screen on the TI-84**, use the TI-84 to solve the trig equation $0.6 = \cos(x)$. Explain how you did it and what your answer means.
   b. Now, **use a graph** to evaluate $y = \cos(x)$ for $0° \leq x \leq 720°$ when $y = 0.6$. Answer to the nearest degree.
   c. Explain how the two answers (Q(a) and Q(b)) are the **same** and yet are **different**. Why are they different?

7. (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) $y = 12\cos(3x) + 5$

8. (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.

9. (CA) Solve the following: {8,9,10}

   a. Solve for side ***a*** in ΔABC if $\angle A = 63°$, ***b*** = 10 cm and ***c*** = 12 cm.

   b. Solve for angle A in ΔABC if ***a*** = 15 cm, ***b*** = 12.5 cm and $\angle B = 53°$.

   c. Solve for side ***a*** in ΔABC if $\angle A = 47°$, ***b*** = 100 cm and $\angle C = 71°$.

   d. Solve for angle A in ΔABC if ***a*** = 7 cm, ***b*** = 10 cm and ***c*** = 12 cm.

10. (CA) The point P(-5,-8) is on the terminal arm of an angle, θ, in standard position. Determine all values of θ, given the domain of $-540° \leq \theta \leq 270°$. {11,12}

11. (CA) Mr. Smith and Mr. Santowski are trying to figure out the height of a new building recently constructed in Cairo. They call it the Super Building. Mr. Smith started from the base of the building and walked for a while… then took an angle measurement from the ground to the top of the building… the device read 80.8858o. Then Mr. Smith realized he didn't count how far he was away from the base of the building. Mr. Santowski, not wanting to walk back, said… I have an idea. Mr. Santowski walked 13 more meters away from their current location and took another angle measurement from the ground. The measuring device read 73.3. It was now that Mr. Santowski could figure out how tall the building is. {2,4,8,9,10}

    a. Draw a picture of this problem.

    b. How tall is the building? Show your work.

    c. How far was Mr. Smith from the base of the building when he took his first measurement?

12. (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.

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

1. We have another unit that we can use to measure angles, called radians. Go on line to find out what a radian is. Record your definition and an example to illustrate what 1 radian is.

2. Convert the following angle measures from degrees to radians:

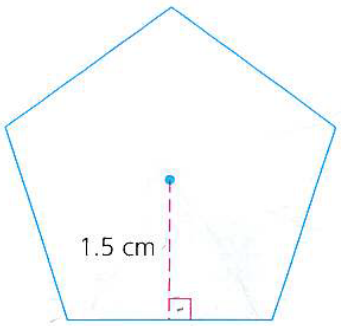
    (i) 45° (ii) -225° (iii) 780° (iv) 1° (v) -390° (vi) 75°

3. Convert the following angle measures from radians to degrees.

(i) $\frac{7\pi}{4}$ (ii) $\frac{-11\pi}{6}$ (iii) $\frac{17\pi}{3}$ (iv) 1 radian (v) 2.35 radians (vi) $\frac{7\pi}{2}$

4. 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?