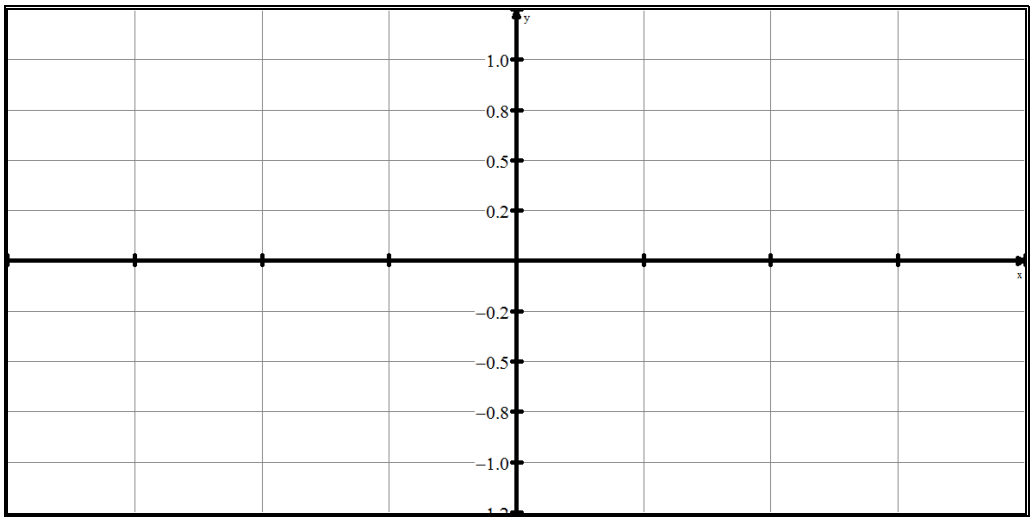
(A) Lesson Objectives

a. Work with the equation $f(x)=A\sin(B(x-C))+D$ in the context of word problems using the TI-84 and graphic approaches to answering application questions.

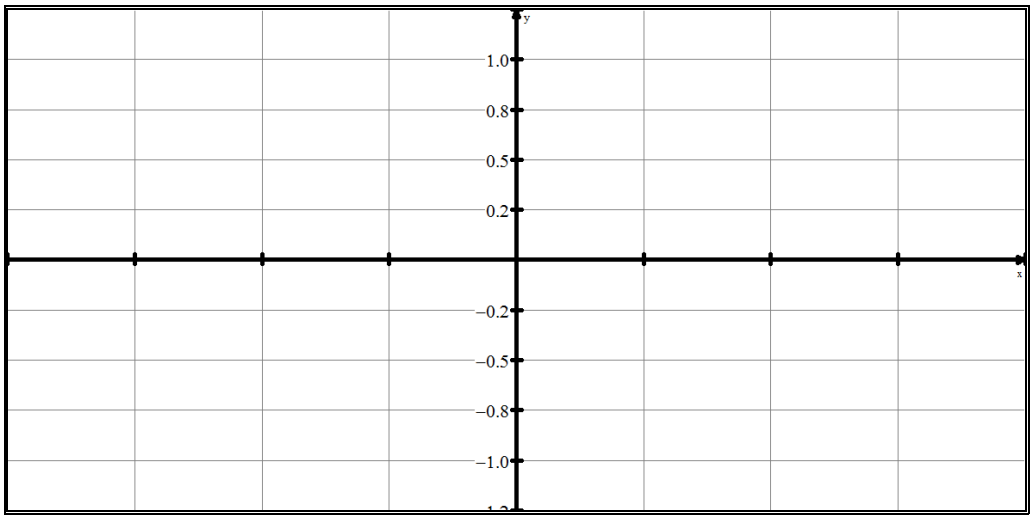
b. Use the graphing calculator to answer application questions involving the key terms related to periodic phenomenon (periodic, period, amplitude, axis of the curve (equilibrium axis)) and relate them back to the context of the problem/equation

(B) Review of Basics

a. Basic sinusoidal functions ➔ Graph and analyze 2 periods of $f(x)=\sin(x)$



b. Basic sinusoidal functions ➔ Graph and analyze 2 periods of $f(x)=\cos(x)$

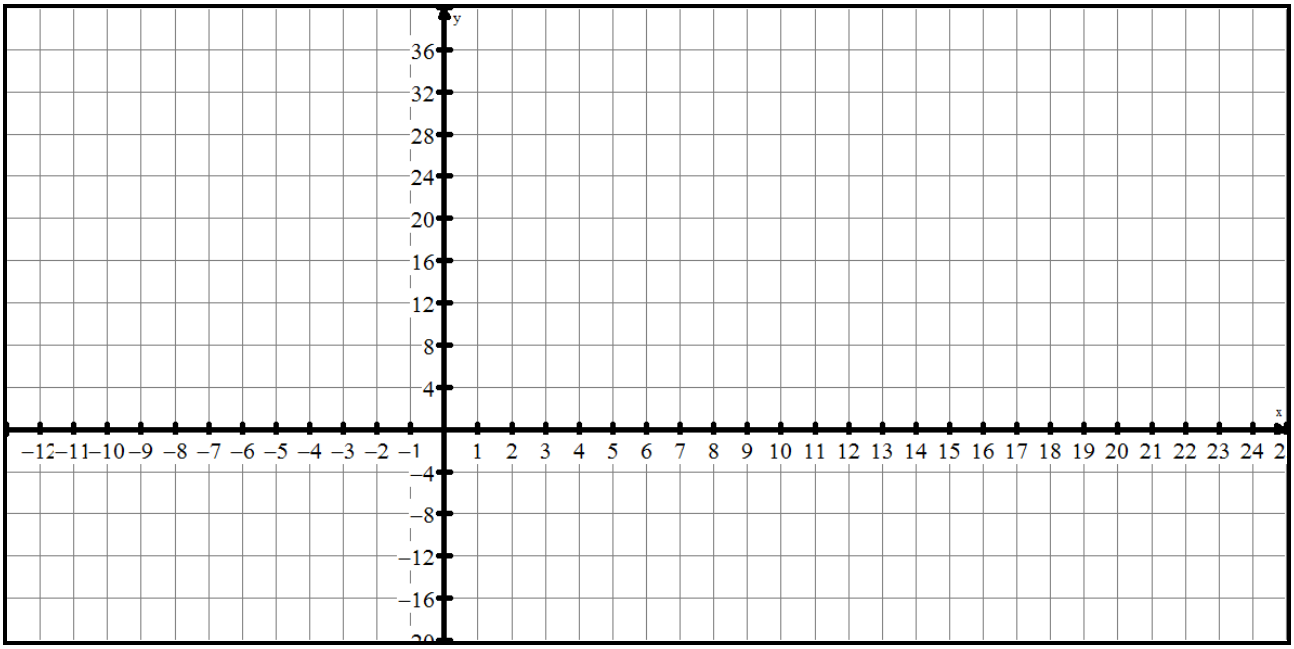


c. Basic Transformations of Sinusoidal Functions:

(C) Example #1 – Annual Temperatures

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.

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.

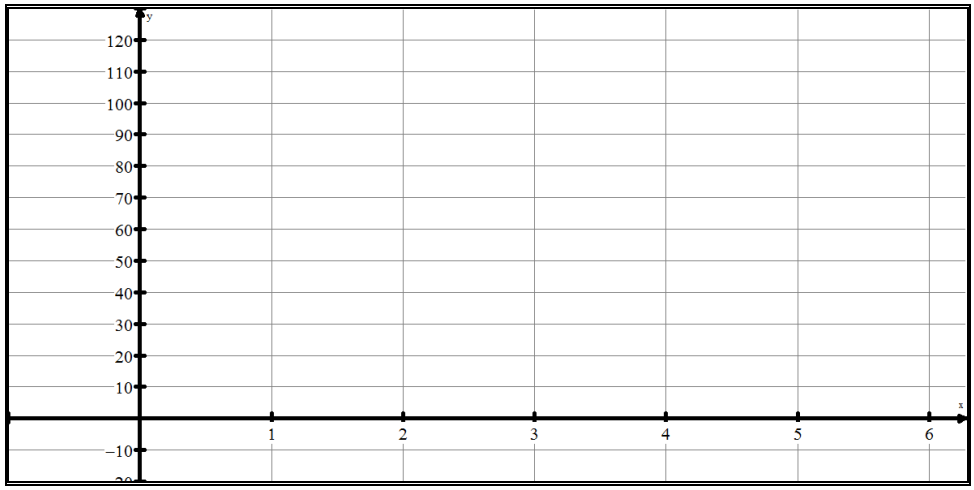
i. When will the temperature be predicted to be 12°?

j. Solve the equation $0 = -22\cos(30t) + 10$ and explain the solution in the context of the problem.

(D)Example #2 – Blood Pressure

Each person's blood pressure is different. But there is a range of blood pressure values that is considered healthy. The function $P(t) = -20\cos(300t) + 100$ models the blood pressure, P, in millimetres of mercury, at time, t, in seconds of a person at rest.

a. Sketch the graph of $P(t) = -20\cos(300t) + 100$ for $0 \le t \le 6$.



b. What is the period of the function? What does the period represent for an individual?

c. What is the amplitude? Explain the amplitude in the context of the problem

d. How many times does this person's heart beat each minute?

e. What is the range of the function? Explain the meaning of the range in terms of a person's blood pressure.

f. What is the predicted blood pressure at 4 seconds of rest??

g. Evaluate $P(24)$ and explain the solution in the context of the problem.

h. When will the blood pressure be predicted to be 90 mm Hg?

i. Solve the equation $88 = -20\cos(300t) + 100$ and explain the solution in the context of the problem.

(E) Example #3 – Hours of Daylight

The function $D(t) = 4\sin\left[\frac{360}{365}(t-80)\right]^{\circ} + 12$ is a model of the number of hours of daylight, *D*, on a specific day, *t*, on the 50° of north latitude.

a. Explain why a trigonometric function is a reasonable model for predicting the number of hours of daylight.

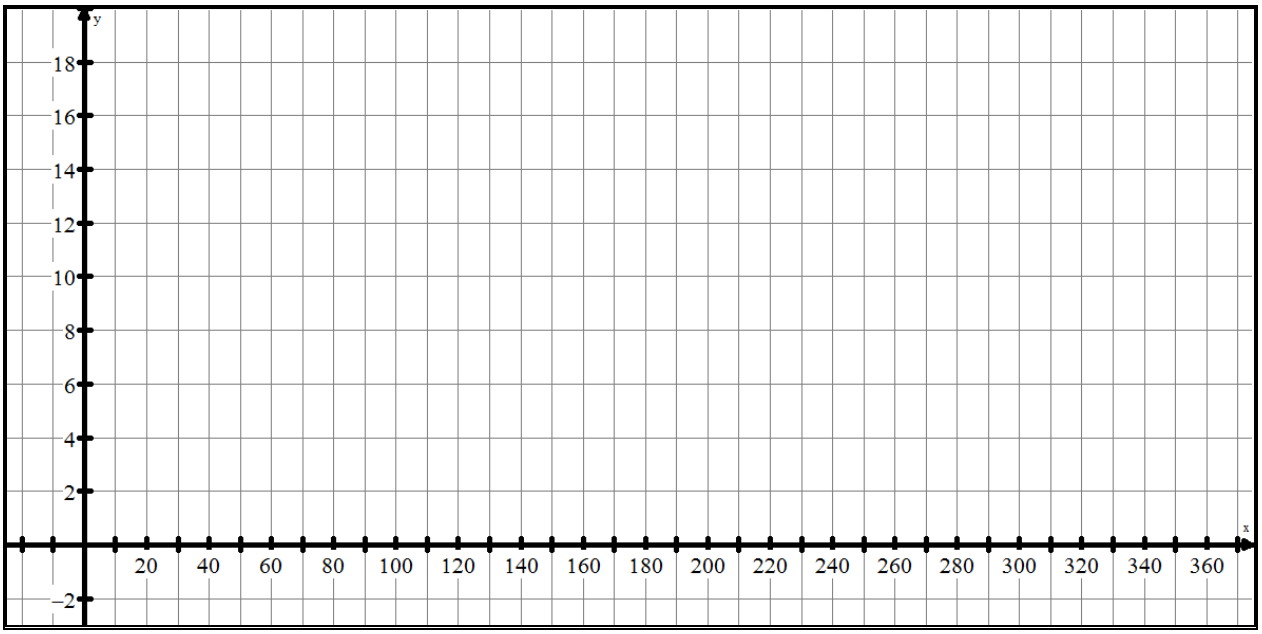
b. How many hours of daylight do March 21 and September 21 have? What is the significance of each of these days?

c. What is the significance of the number 80 in the model?

d. How many hours of daylight do June 21 and December 21 have? What is the significance of each of these days?

e. Explain what the number 12 represents in the model.

f. Graph the model.



g. What are the maximum hours of daylight? the minimum hours of daylight? On what days do these values occur?

h. Use the graph to determine *t* when $D(t) = 15$. What dates correspond to *t* ?

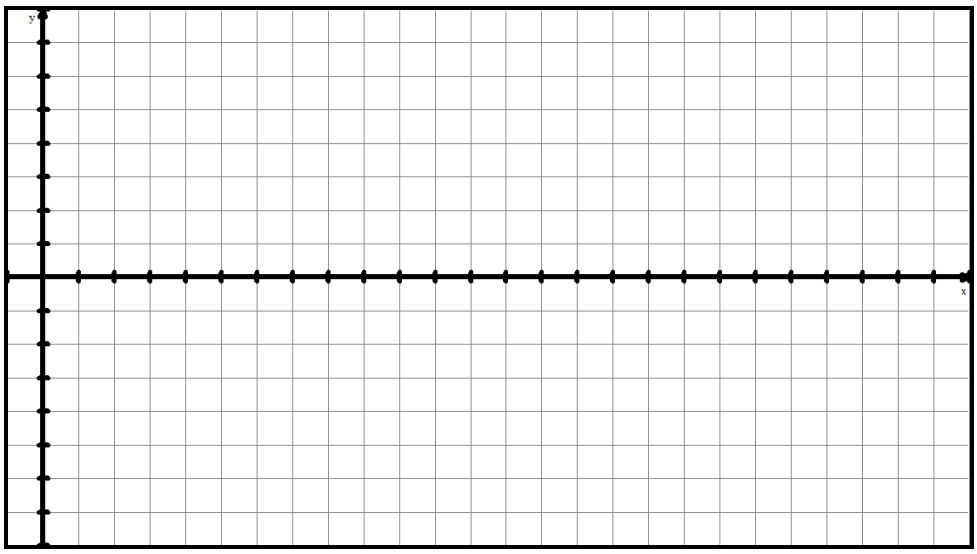
i. Evaluate $D(246)$ and explain the solution in the context of the problem.

(F) Example #4 – Temperatures in Kapuskasing (Nelson 11 Chap 5.7, p465, Q15)

15. The table shows the average monthly high temperature for one year in Kapuskasing.

Time (months)	J	F	M	A	M	J	J	A	S	O	N	D
Temperature (°C)	−18.6	−16.3	−9.1	0.4	8.5	13.8	17.0	15.4	10.3	4.4	−4.3	−14.8

Source: Environment Canada.



a. Complete a scatter plot (by hand & on GDC)

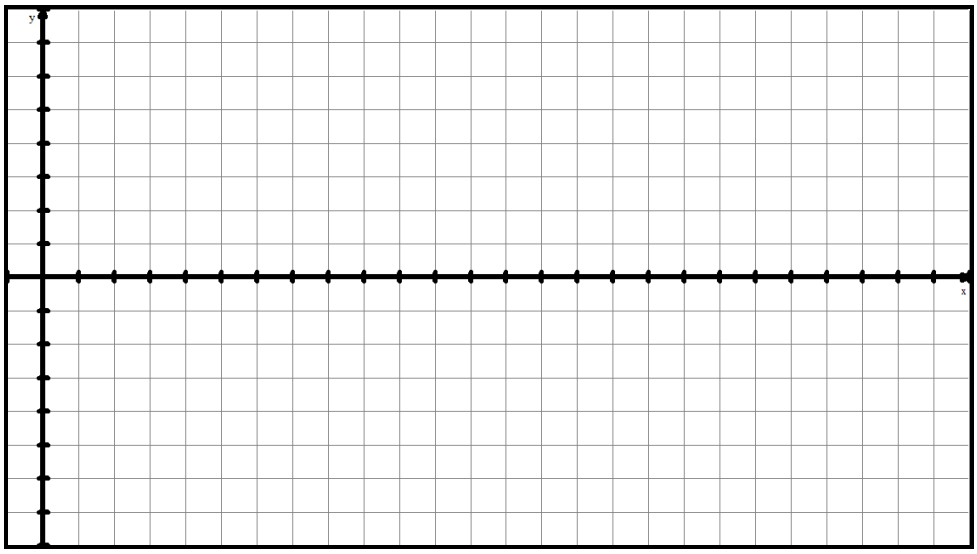
b. Determine equation

c. What is the average monthly temperature for the 38th month?

(G)Example #5 – Water Levels in the Bay of Fundy (Nelson 11, Chap 5.7, p466, Q16)

16. The depth of water in a harbour on the Bay Fundy that faces the ocean changes each hour, as shown.

Time (h)	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
Depth (m)	5.5	6.3	8.5	11.5	14.5	16.7	17.5	16.7	14.5	11.5	8.5	6.3	5.5



a. Complete a scatter plot (by hand & on GDC)

b. Determine equation.

c. Use the equation to determine the depth of water at 10:30. Verify your answer using the graph.

d. When is the water 7 m deep?