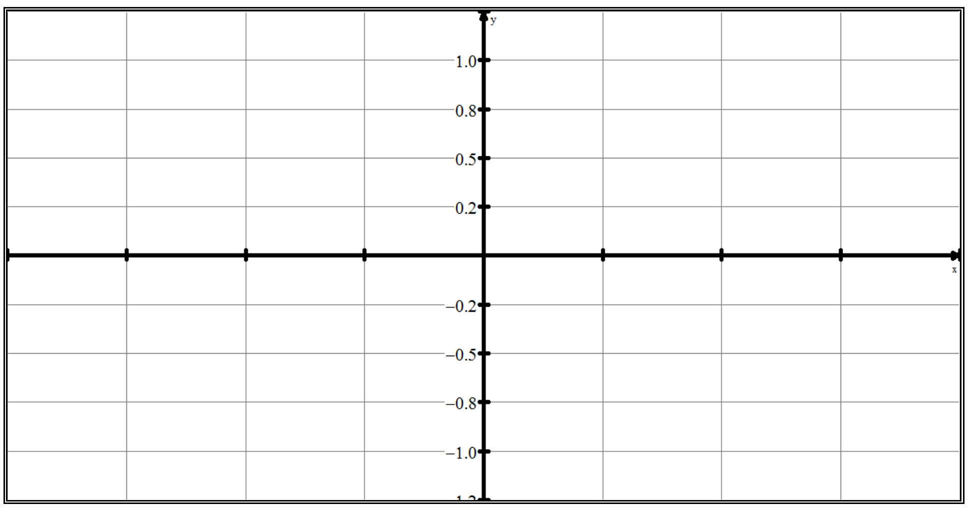
(A) Lesson Context

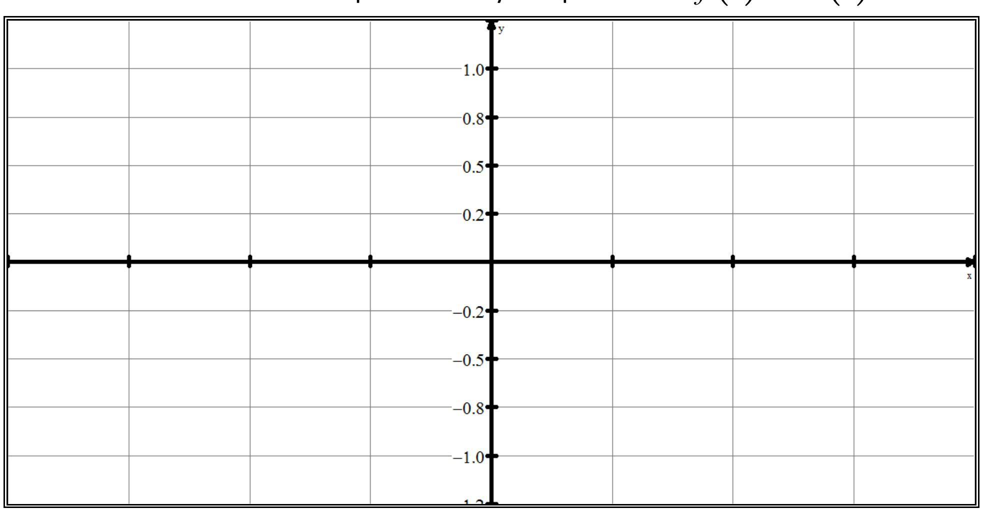
BIG PICTURE of this UNIT:	• How do work through geometry based problems, wherein triangles are used to model the problem • How do we model phenomenon that are periodic in nature		
CONTEXT of this LESSON:	Where we've been We have graphed periodic phenomenon, described features of their graphs & seen the graph of two parent functions	Where we are How do we apply the basic ideas of function transformations to f(x) = sin(x) and to f(x) = cos(x)	Where we are heading How do we mathematically model phenomenon that are periodic in nature)

(B) Fast Five:

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) GRAPHING INVESTIGATION of $f(x) = A\sin\left(k\left(x+C\right)\right)+D$ and $f(x) = A\cos\left(k\left(x+C\right)\right)+D$

Complete the following steps, recording all observations and graphs on a google doc that you will share with me at the end of class

a. Graph three periods of y = sin(x) & analyze (State the domain, range, period, amplitude, axis of the curve, max, min, zeroes). Where does a sine curve "start"?

b. Graph three periods of y = cos(x) & analyze (domain, range, period, amplitude, axis of the curve, max, min, zeroes). Where does a cosine curve "start"?

c. Graph y = Asin(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

d. Graph y = Acos(x) (use slider on DESMOS). Do your observations/conclusions about the effect of A from Part (C) change?

e. Graph y = cos(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.

f. Graph y = sin(x) + D (use slider on DESMOS). Do your observations/conclusions about the effect of D from Part (E) change?

g. Graph y = 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

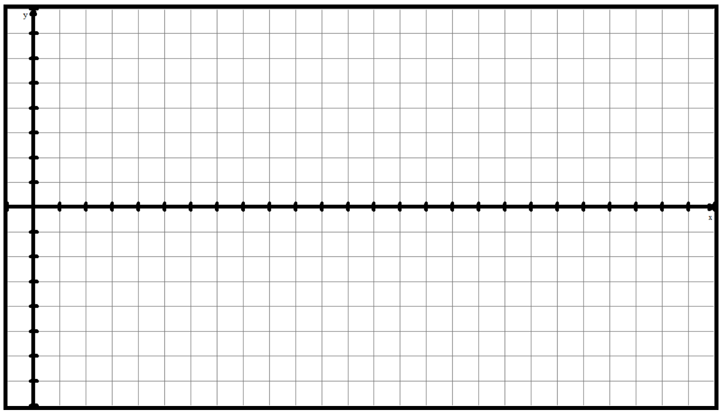
h. Graph y = cos(kx) (use slider on DESMOS). Do your observations/conclusions about the effect of k from Part (G) change?

i. CONSOLIDATION: There are data sets on the next page for which I have created two scatter plots on DESMOS. YOUR TASK ➔ (i) PREDICT what the equation should be BEFORE you use technology (there are enough clues in the data set!!) Then (ii) go to the Lesson Notes page and open the DESMOS scatterplots and use the sliders to ESTIMATE the equation of the sinusoidal that best fits the data set. Finally, use your TI-84 and perform a SINREG to determine the equation that best fits the data set.

(D)Modeling Periodic Phenomenon – Using AsinK(x + C) + D or A cosK(x + C) + D

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

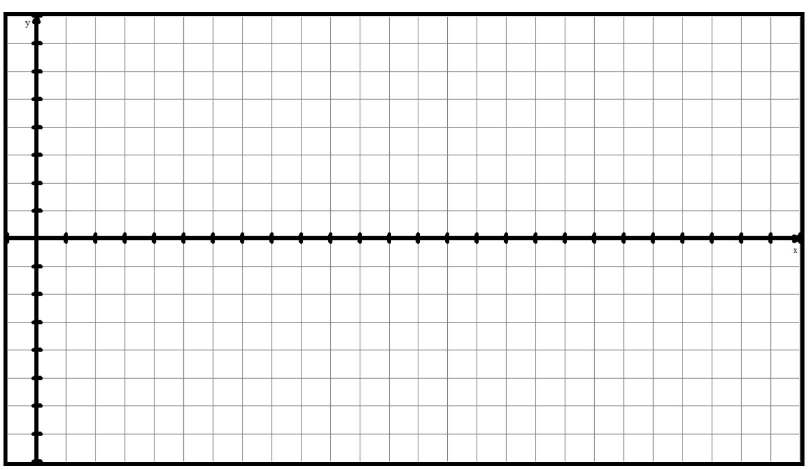


a. Complete a scatter plot (by hand & on GDC & DESMOS)
b. Determine equation
c. Use the equation to determine the depth of water at 10:30. Verify your answer using the graph.
d. When is the water 7 m deep?

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

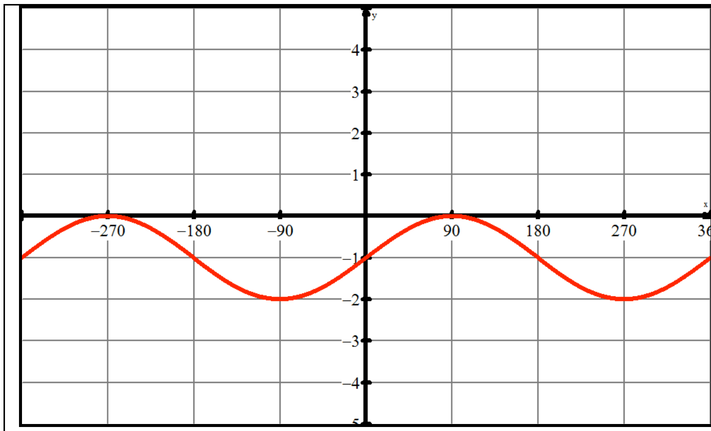
Time (months)	J	F	M	A	M	J	J	A	S	O	N	D
Temperature (°C)	−18.6	−16.3	−9.1	0.4	8.5	13.8	17.0	15.4	10.3	4.4	−4.3	−14.8

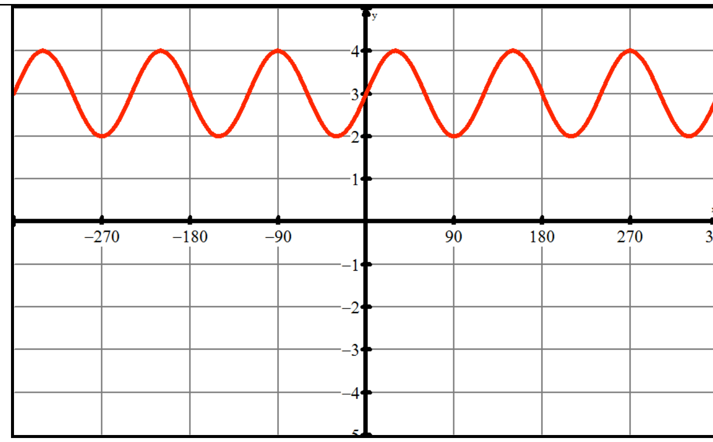
Source: Environment Canada.

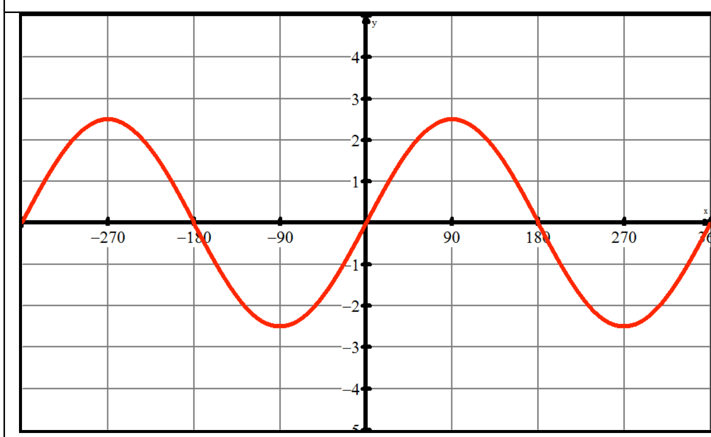


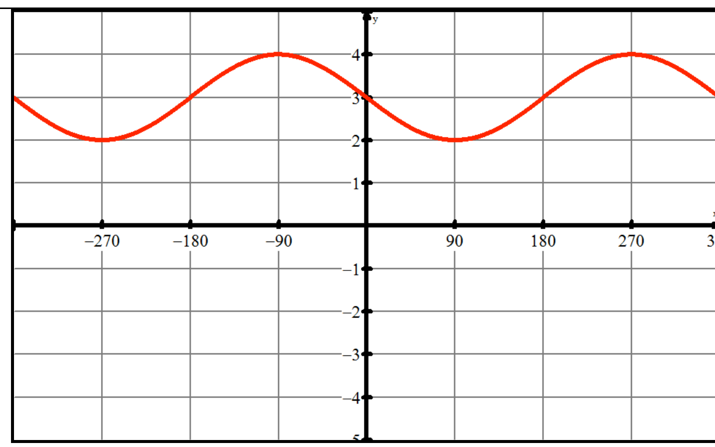
a. Complete a scatter plot (by hand & on GDC & DESMOS)
b. Determine equation.
c. What is the average monthly temperature for the 38th month?

Practice – From Graph to Equation



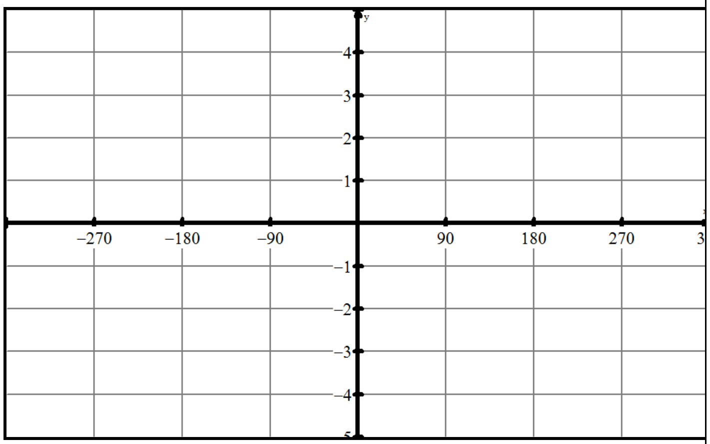




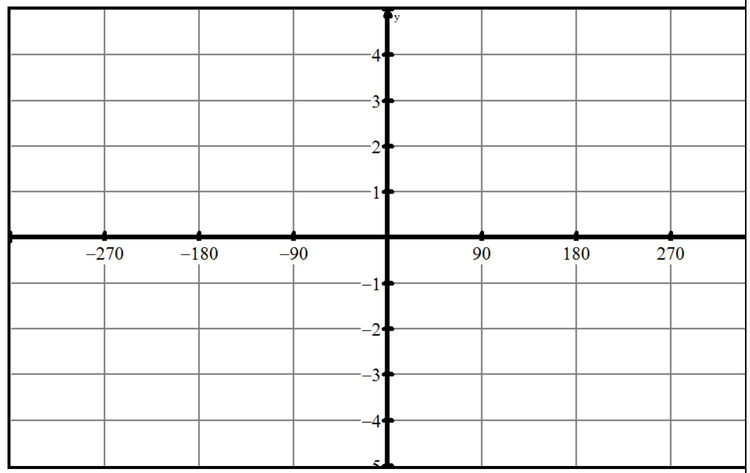


(A) Practice – From Equation to Graph – NO CALCULATOR

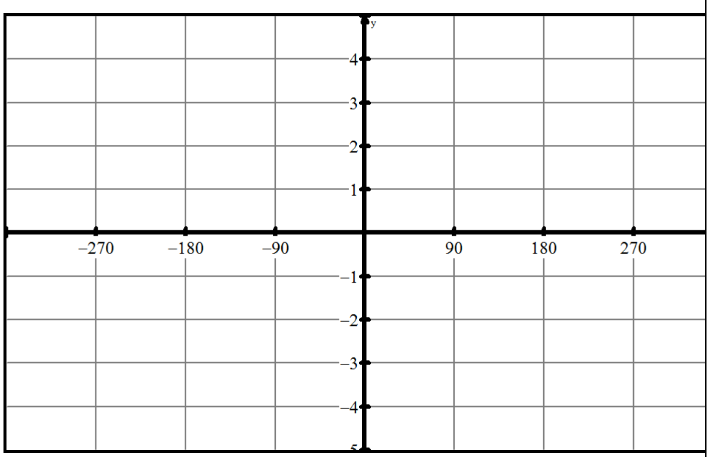
f(x) = 3 sin(x) – 1



g(x) = 3cos(2x)



f(x) = sin(x + 45) – 2



g(x) = ½ cos(x – 90)