Section 5.5 **Making Connections and Instantaneous Rates of Change**

Instantaneous rates of change of a sinusoidal function follow a sinusoidal pattern.

Many real-world processes can be modelled with a sinusoidal function, even if they do not involve angles.

Modelling real-world processes usually require transformations of the basic sinusoidal functions.

Example 1: The height, h, in metres, of a car above the ground as a ferris wheel turns can be modelled using the function $h = 20sin(\pi t/60) + 25$, where t is the time, in seconds.

a) Determine the average rate of change of h over each time interval, rounded to 3 decimal places.

i) 5s to 10s ii) 9s to 10s iii) 9.9s to 10s iv) 9.99s to 10s

b) Estimate a value for the instantaneous rate of change of h at t = 10s.

c) What physical quantity does this instantaneous rate of change represent?

d) Would you expect the instantaneous rate of change of h to be the same at t = 15s? Justify you answer.

Example: The variations in maximum daily temperatures for Moose Factory, Ontario, on the first of the month from January to December are shown.

Month	Variation in Temp °C
1	-14
2	-14
3	-4.9
4	3.2
5	11
6	19.1
7	22.4
8	20.6
9	15.9
10	8.3
11	-1.7
12	-10

a) Write a sinusoidal function, (both a sine and a cosine function), to model the data.

b) Make a scatter plot of the data. Then graph one of your models on the same set of axes and compare the graphs.