Name: _____   Date: _____

5.5 Making Connections and Instantaneous Rate of Change   BLM 5–9

1. a) Sketch a graph of $f(x) = \sin x$ on the interval $x \in [-\pi, \pi]$.
b) For what value(s) of x does the instantaneous rate of change appear to equal zero?
c) For what value(s) of x does the instantaneous rate of change appear to reach a maximum value? a minimum value?

2. The height, h, in metres, of a car above the ground as a Ferris wheel turns can be modelled using the function

$h = 18 \sin\left(\dfrac{\pi t}{100}\right) + 20$, where t is the time, in seconds.

a) Determine the average rate of change of h in the following time intervals, rounded to three decimal places.
i) 6 s to 12 s
ii) 11 s to 12 s
iii) 11.9 s to 12 s
iv) 11.99 s to 12 s
b) Estimate a value for the instantaneous rate of change of h at $t = 12$ s.
c) Would you expect the instantaneous rate of change to be the same at $t = 3$ s? Justify your answer.

3. The variations in mean daily minimum temperatures for Fernie, British Columbia, a ski area in the interior of B.C., from January 1 to December 31, are shown.

Month	Temperature (°C)
1	−11.7
2	−8.7
3	−5.4
4	−1.3
5	2.5
6	6.3
7	8.0
8	7.4
9	3.5
10	−0.4
11	−4.9
12	−10.0

a) Write a sine function to model the data.
b) Make a scatter plot of the data. Then, graph the model on the same set of axes. How well does the curve fit the data in the scatter plot?
c) Use Technology Check your model using a sinusoidal regression. How does the regression equation compare with the model?
d) Describe what you would do if instead of using a sine function as your model you used a cosine function to model the data.

4. Refer to the sine function that you developed in part a) of question 3. Estimate the rate of change of the daily minimum temperature on October 1.

5. a) Sketch a graph of the secant function in the interval $x \in [0, 2\pi]$.
b) For what value of x does the instantaneous rate of change appear to equal zero?
c) Prepare a table similar to the one in the Investigate for the secant function.
d) Plot the instantaneous rates of change on the same set of axes as the secant function.
e) Describe the pattern formed by the instantaneous rates of change of the secant function.