8 Chapter Review

FREQUENTLY ASKED Questions

Study Aid
- See Lesson 8.4, Examples 1, 2, and 3.
- Try Chapter Review Questions 8 and 9.

Q: How can you determine the characteristics of a sinusoidal function from its equation?

A: Sinusoidal equations can be written in the following form:

$$y = a \sin b(x - c) + d$$

Characteristics of $y = a \sin b(x - c) + d$	Example $y = 3 \sin 1.256(x - 1.5) + 1$
• The amplitude of the function is a.	Amplitude: 3
• The equation of the midline is $y = d$.	Equation of the midline: $y = 1$
• The maximum value is the sum of the value of the midline and the amplitude, or $d + a$.	Maximum value: $1 + 3$, or 4
• The minimum value is the difference between the value of the midline and the amplitude, or $d - a$.	Minimum value: $1 - 3$, or -2
• The range is $\{y \mid (d - a) \leq y \leq (d + a), y \in \mathrm{R}\}$.	Range: $\{y \mid -2 \leq y \leq 4, y \in \mathrm{R}\}$
• The horizontal translation from y = sin x is c.	Horizontal translation: 1.5
• The period is $\frac{2\pi}{b}$.	Period $= \frac{2\pi}{1.256}$ or 5.002...

Study Aid
- See Lesson 8.5, Examples 1 to 3.
- Try Chapter Review Questions 11 and 12.

Q: How can you model periodic data and use your model to solve a problem?

A: Draw a scatter plot to display the data. Determine the equation of a sinusoidal regression function that models the data, and graph the function. Check that your graph is a reasonable fit to the data.

To determine the x-values for a given y-value, graph a horizontal line at the given y-value and determine the intersection points.

To determine the y-value for a given x-value, use the table feature, or identify a point on the sinusoidal function with the given x-value, or substitute x into the regression equation and solve.

PRACTISING

Lesson 8.1

1. Estimate, to the nearest tenth, each measure in radians.

a) 15°
b) 113°
c) 220°
d) 555°

2. Estimate to the nearest degree, each measure in degrees.

a) 9.5
b) 5.24
c) 0.5
d) 11.0

Lesson 8.2

3. **a)** For the function $y = \sin x$, determine the values of x where $\sin x < 0$ for the interval 0° to 720°.

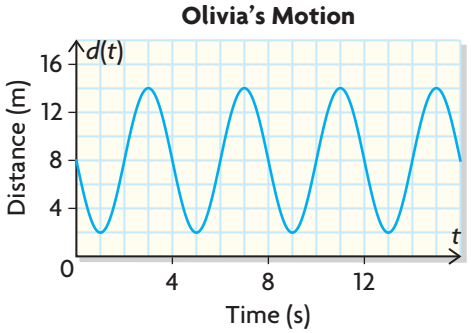
b) For the function $y = \cos x$, determine the values of x where $\cos x > 0$ for the interval 0° to 720°.

Lesson 8.3

4. Determine the range, amplitude, period, and equation of the midline of each function.

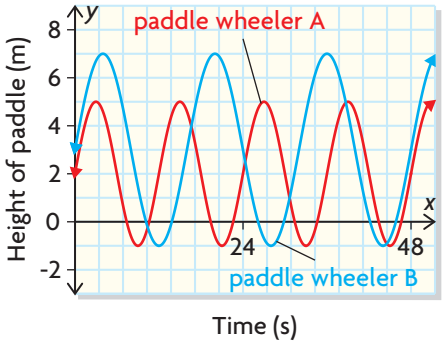
a) $y = 2 \sin (x + 60°) - 2$
b) $y = \sin 4(x - 30°) - 1.5$

5. Olivia was swinging back and forth in front of a motion detector. Her distance from the detector, in terms of time, can be modelled by the graph shown.



a) What is the equation of the midline? What does it represent in this situation?
b) What is the amplitude of the function?
c) What is the period of the function? What does it represent in this situation?
d) How close did Olivia get to the motion detector?
e) At $t = 7$ s, would it be safe to run between Olivia and the motion detector? Provide your reasoning.

6. Marianna collected data on the revolution of two paddle wheels on two different boats. She used the data to construct two graphs.



a) Determine the radius of each wheel, the height of the axle relative to the water, and the time taken to complete one revolution.
b) Which paddle wheel is travelling faster? Explain.

7. When an emergency vehicle approaches you at 30 m/s, the sound of the siren can be modelled by the equation

$$y = \sin 5510.35\, x$$

where x represents the time in seconds. As the vehicle drives away, the sound can be modelled by the equation:

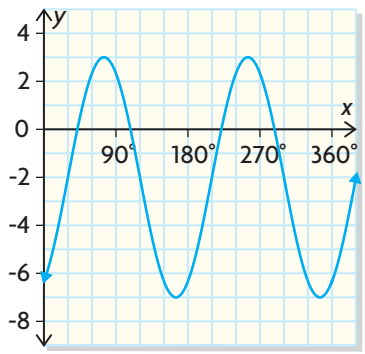
$$y = \sin 4618.14\, x$$

a) Graph each equation. Does the siren have a higher frequency as it approaches you or as it drives away from you?
b) What is the frequency, in cycles per second (Hz), for each equation?

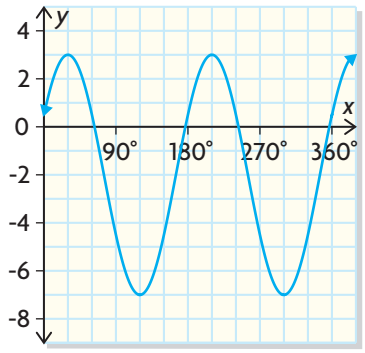
Lesson 8.4

8. Match each graph with the corresponding equation below.

a) **Graph A**



b) **Graph B**



i) $y = 3 \sin 2(x - 30°)$
ii) $y = 5 \cos 2(x - 30°) - 2$
iii) $y = 5 \cos 2(x + 75°) - 2$
iv) $y = 5 \sin 2(x - 30°) - 2$

9. Consider the function

$$y = 4 \sin 6(x - 2.5) + 3$$

a) Describe the graph of this function by stating the amplitude, equation of the midline, range, period, and horizontal translation of $y = \sin x$.

b) Verify your description using technology.

10. The signals from WiFi transmitters can be modelled using sinusoidal functions. Two such functions are

$$y = \sin 15.08\, x \text{ and}$$
$$y = \sin 31.42\, x$$

where the signal, y, is measured in gigahertz (GHz) and the time, x, is measured in nanoseconds.

What is the frequency of each of the WiFi signals above, in cycles per nanosecond?

Lesson 8.5

11. The average monthly temperatures for Humboldt, Saskatchewan, are given in the table below. Predict the average temperature in Humboldt on December 8.

Month	Average (°C)	Month	Average (°C)
Jan.	–17.9	Jul.	17.4
Feb.	–13.6	Aug.	16.7
Mar.	–6.8	Sep.	10.7
Apr.	3.2	Oct.	3.9
May	10.8	Nov.	–7.0
Jun.	15.3	Dec.	–15.2

12. The average monthly low temperatures in Edmonton, Alberta, and Rio de Janeiro, Brazil, are given in the table below.

Month	Edmonton (°C)	Rio de Janeiro (°C)
Jan.	–19.1	23.3
Feb.	–16.3	23.5
Mar.	–9.9	23.3
Apr.	–2.2	21.9
May	3.4	20.4
Jun.	7.7	18.7
Jul.	9.5	18.4
Aug.	8.3	18.9
Sep.	3.3	19.2
Oct.	–2.4	20.2
Nov.	–11.0	21.4
Dec.	–16.7	22.4

Predict the difference in the average low temperatures for the two cities on June 28.