

Chapter

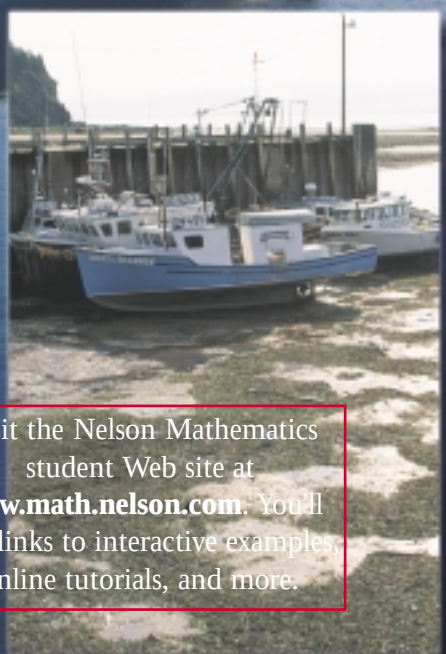
5

Modelling Periodic Functions

Many events in nature happen over and over again. For instance, the tides rise and fall each day as the Earth turns and the moon's gravity pulls at the ocean waters. The moon waxes and wanes from a full moon to a new moon each month. Many animals and birds migrate great distances and are often seen at the same time of the year at very specific locations as they travel on their journey. The sound waves produced by a vibrating vocal chord or a vibrating string help to identify a specific person's voice or the type of musical instrument being played. All of these are examples of periodic phenomena.

In this chapter, you will

- investigate periodic phenomena and study their properties
- model periodic data using graphs and functions involving trigonometry
- extend the notion of trigonometry from angles and sides in a triangle to include any real number on the coordinate plane
- identify specific trigonometric functions
- investigate transformations of trigonometric functions
- solve problems that can be modelled using trigonometric functions
- solve trigonometric equations with and without technology
- use technology to develop models to assist in problem solving



Visit the Nelson Mathematics student Web site at www.math.nelson.com. You'll find links to interactive examples, online tutorials, and more.

Connections



The Chapter Problem

How Much Daylight?

Naomi is a fishing guide in the Far North. She keeps track of the number of hours of daylight each day where she works. She uses this data to give her customers the best opportunity to maximize their catches and still stay within catch limits.

She averaged the number of hours of daylight each month, starting in January, and recorded the data shown.

Month	J	F	M	A	M	J	J	A
Average Daylight Each Day (h)	5.5	8.0	11.0	13.5	16.3	19	19.5	18.5

Month	S	O	N	D	J	F	M	A
Average Daylight Each Day (h)	15.8	13.0	10.7	7.8	5.5	7.9	11.2	13.5

Month	M	J	J	A	S	O	N	D	J
Average Daylight Each Day (h)	16.5	19.2	19.6	17.9	14.8	12.6	10.5	7.5	5.7

In this chapter, you will learn about modelling periodic functions to answer these questions.

- Explain how Naomi could use this data to help her customers maximize their fishing experience.
 - Show that the data is periodic and it can be modelled by a trigonometric function.
 - Determine the trigonometric model that describes this situation. Use the model to predict the average number of hours of daylight 252 months later. Use the model to determine which months from the start of the millennium have an average of about 10 h of daylight.

Challenge 1

Average monthly temperature depends on location. Use the Internet to find the average monthly temperature for your town or city for a two-year period. If you cannot find this information for your municipality, look for a location close to where you live.

Organize the data so that a scatter plot, a curve of best fit, and a mathematical model can be found. Describe in detail the mathematical model and its curve of best fit as they relate to the context of the problem.

Challenge 2

Many recreation centres have wave action pools. Research how the waves are made. Explain how the waves are generated, how the length of a wave is determined, and how the height of the crest and the depth of the trough of a wave are maintained. Construct a working model of a wave action pool and develop an equation that models the situation.



Web Challenge

For a related Internet activity, go to www.math.nelson.com.

