The Dragon Academy
G11 Functions and Applications
Term 4
Assignment 5
Due date: Tue May 28 2019

May 24, 2019

1 Problems

Read the Mid-Chapter Review starting on page 355 of our book and do exercies 1-8.
Following is a copy of those pages for those without book.

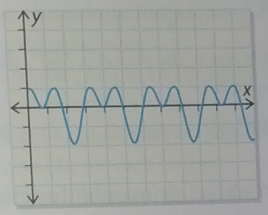
2 Problem statements

6 Mid-Chapter Review

FREQUENTLY ASKED Questions

Q: What are periodic functions?

A: Periodic functions repeat at regular intervals. As a result, their graphs have a repeating pattern.



Study Aid
- See Lesson 6.2, Examples 1 and 2.
- Try Mid-Chapter Review Questions 1, 2, and 3.

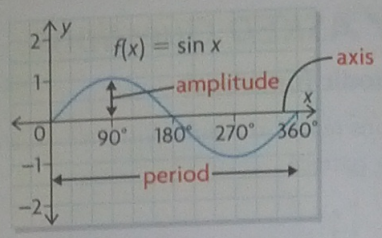
Q: What are the characteristics of a sinusoidal function?

A: Sinusoidal functions, like other periodic functions, repeat at regular intervals. Unlike other periodic functions, sinusoidal functions form symmetrical waves, where any portion of the wave can be horizontally translated onto another portion of the curve. The three most important characteristics of a sinusoidal function are the period, the equation of the axis, and the amplitude.

Study Aid
- See Lesson 6.3, Examples 1 and 2.
- Try Mid-Chapter Review Questions 4 and 5.

Period	Equation of the Axis	Amplitude
The period is the change in x corresponding to one cycle. (A cycle of a sinusoidal function is a portion of the graph from one point to the point at which the graph starts to repeat.) One way to determine the period is to look at the change in x's between two maximum values.	The equation of the axis is the equation of the line halfway between the maximum and minimum values on a sinusoidal function. It can be determined from the following formula: $y = \frac{(\text{maximum value} + \text{minimum value})}{2}$	The amplitude is the vertical distance from the function's axis to the minimum or maximum value.

EXAMPLE



For the function $f(x) = \sin x$, the period is 360°, the equation of the axis is $y = 0$, and the amplitude is 1.

The domain is $\{x \in \mathbf{R}\}$, and the range is $\{f(x) \in \mathbf{R} \mid -1 \leq f(x) \leq 1\}$.

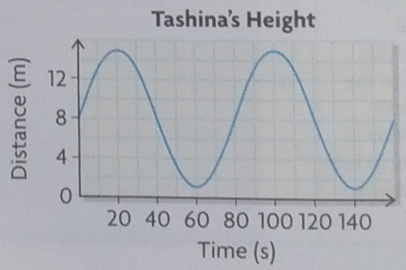
Q: Why do you learn about sinusoidal functions?

A1: Many situations can be modelled using sinusoidal functions. Examples are:

- the motion of objects in a circular orbit
- the motion of a pendulum
- the motion of vibrating objects
- the number of hours of sunlight for a particular latitude
- the phase of the Moon
- the current for an AC circuit

A2: When the graph of a sinusoidal function models a repeating situation, the graph can be used to make predictions.

EXAMPLE



The graph represents Tashina's ride on a Ferris wheel. According to the graph,

- it takes 80 s to complete one revolution (the period)
- the axle is 7 m above the ground ($y = 7$, the equation of the axis)
- the radius of the Ferris wheel is 6.5 m (the amplitude)
- we can predict that at 200 s, Tashina's height on the Ferris wheel will be 8 m

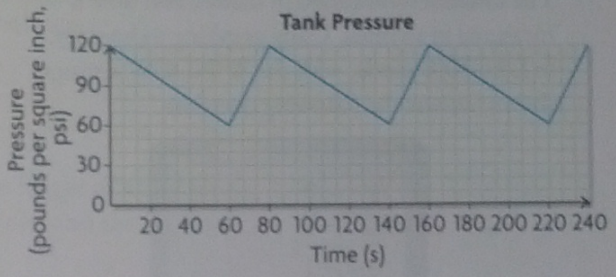
PRACTICE Questions

Lesson 6.2

1. Which of the following situations would produce a periodic graph?
   a) Angelo is bouncing a tennis ball in the air with his racket. He strikes the ball with the same force each time such that the ball reaches the same maximum height.
      - independent variable: time
      - dependent variable: height of the ball
   b) A super ball is released from a third-storey window. The ball bounces back up to 80% of its previous height on each bounce.
      - independent variable: time
      - dependent variable: height of the ball
   c) A police cruiser is parked on the street with its siren on.
      - independent variable: time
      - dependent variable: intensity of the sound coming from the siren
   d) Alicia's investment fund doubles every eight years.
      - independent variable: time
      - dependent variable: total amount of money in the fund
   e) Lexi is driving through a parking lot that has speed bumps placed at regular intervals.
      - independent variable: the distance Lexi travels
      - dependent variable: the force exerted on the shock absorbers in her vehicle

2. Explain what each characteristic means for a periodic curve. Show each on a labelled diagram.
   a) cycle
   b) period
   c) amplitude
   d) equation of the axis
   e) maximum and minimum

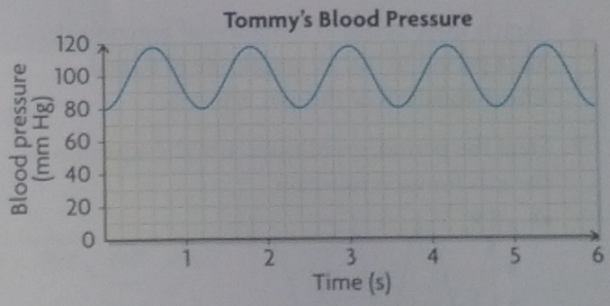
3. A power nailer on an assembly line fires continuously. The compressed air that powers the nailer is contained in a large tank, and the pressure in this tank changes as the nailer is fired. A pump maintains a certain level of pressure in the tank. The pressure in the tank in terms of time can be represented by the graph shown.



   a) Is this function periodic?
   b) At what pressure does the pump turn on?
   c) At what pressure does the pump turn off?
   d) What is the period of the function? Include the units of measure.
   e) How long does the pump work at any one time?

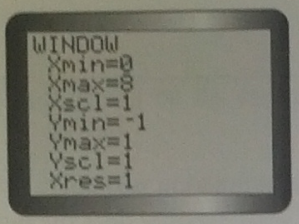
Lesson 6.3

4. Tommy's blood pressure in terms of time can be modelled by a sinusoidal function. The graph shown represents this relationship.



   a) What is the period of the function?
   b) How many times does Tommy's heart beat each minute?
   c) What is the range of the function? Explain the meaning of this range in terms of Tommy's blood pressure.

5. The pendulum on a grandfather clock swings uniformly back and forth. For a particular clock, the distance the pendulum moves to the left and right of its resting position in terms of time can be modelled by the function $d(t) = 0.25 \sin(180t)°$. The distance is measured in metres, and time is measured in seconds. Using graphing technology, in DEGREE mode, with the WINDOW settings shown, answer the following questions.



a) What is the period of the function, and what does it represent in this situation? (*Hint:* The period for this function is going to be quite short.)

b) What is the equation of the axis, and what does it represent in this situation?

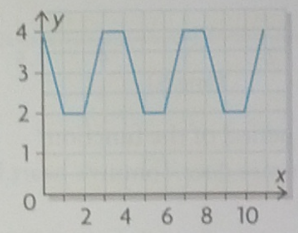
c) What is the amplitude of the function, and what does it represent in this situation?

d) What will be the distance of the pendulum from its resting position at 10.2 s?

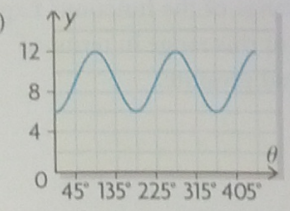
6. Sketch three cycles of a sinusoidal function that has a period of 30, an amplitude of 6, and whose equation of the axis is $y = 5$.

7. State the period, amplitude, and the equation of the axis for each function.

a)

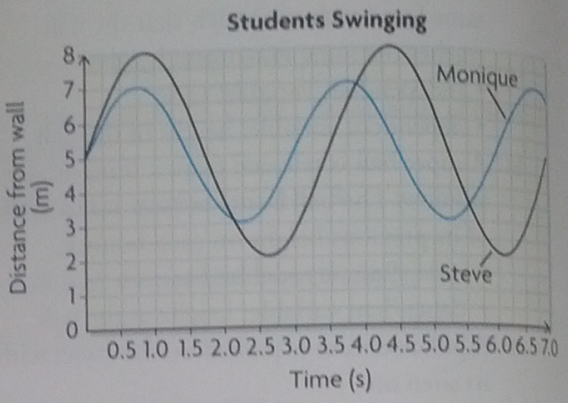


b)



Lesson 6.4

8. Steve and Monique are swinging on separate swings beside a school. The lengths of the ropes on each swing differ. Their distances from one wall of the school in terms of time can be modelled by the graphs shown.



a) Compare the two curves. Refer to the periods, amplitudes, and the equations of the axes.

b) Compare Monique's motion on the swing with Steve's motion.

c) State the range of each function.

9. A Ferris wheel at the county fall fair has a radius of 12 m and rotates once every 60 s. At its lowest point, a rider is 2 m above the ground. Another Ferris wheel at an amusement park has a radius of 15 m and rotates once every 75 s. On this ride, the highest point a passenger reaches is 33 m above the ground.

a) On the same graph, sketch the height of a passenger above the ground for two complete revolutions of both wheels.

b) Compare the period, amplitude, and the equation of the axis of both graphs.

c) Which Ferris wheel is travelling faster? Explain how you know.