

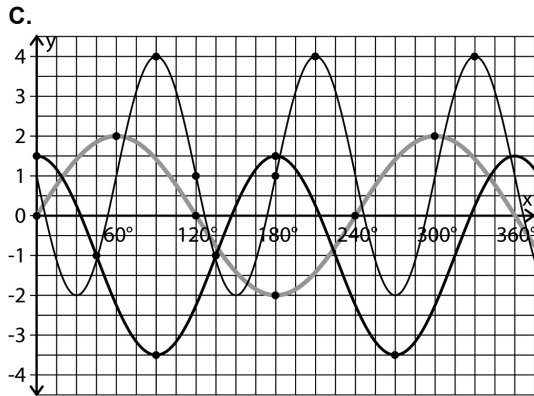
14. a) e.g., I think the sidereal period is shorter than the synodic period because there are more cycles in a given period. The sidereal period involves 13 cycles, while the synodic involves 12 for a period of one year.

b) The period of the two graphs will be different (with the synodic being longer), but all other attributes will be the same.

Applying Problem-Solving Strategies, page 578

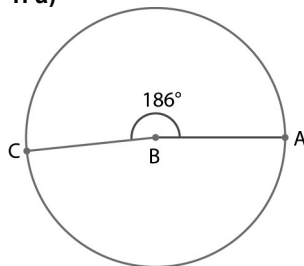
A. The x -axis has points at 0° , 120° , and 240° . They are evenly spaced, so they could be on the midline of a graph.

B. There are points at $(60^\circ, 2)$, $(180^\circ, -2)$ and $(300^\circ, 2)$. 60° is midway between 0° and 120° , 180° is midway between 120° and 240° , and 300° is 60° past 240° . These points are either 2 above or 2 below the x -axis, so they could all belong to the same graph. This graph has an amplitude of 2, a midline at $y = 0$, and a period of 240° .



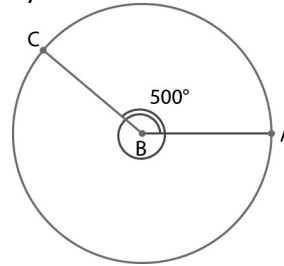
Chapter Self-Test, page 579

1. a)



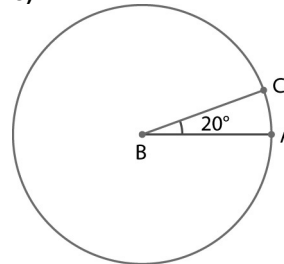
e.g., $186^\circ = 180^\circ + 6^\circ$
 180° is about 3.2 radians.
 6° is one tenth of 60° , which is about 1 radian.
 One tenth of 1 radian is 0.1.
 $3.2 + 0.1 = 3.3$ radians
 Therefore the measure is about 3.3 radians.

b)



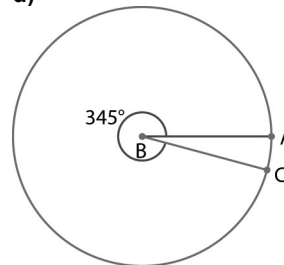
e.g., 500° is slightly less than $360^\circ + 180^\circ - 30^\circ$, or 510° .
 360° is about 6.3 radians.
 180° is about 3.2 radians.
 30° is one half of 60° , which is about 1 radian.
 30° is about 0.5 radians.
 $6.3 + 3.2 - 0.5 = 9.0$ radians.
 510° is about 9.0 radians.
 Therefore the measure is about 8.8 radians.

c)



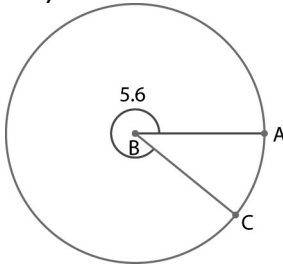
e.g., 20° is one third of 60° .
 60° is about 1 radian.
 $\frac{1}{3} = 0.333\dots$
 Therefore the measure is about 0.3 radians.

d)



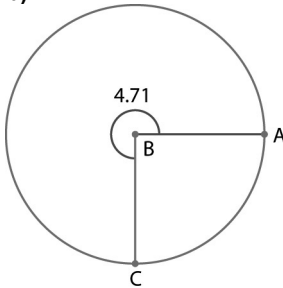
e.g., $345^\circ = 360^\circ - 15^\circ$
 360° is about 6.3 radians.
 15° is one quarter of 60° .
 60° is about 1 radian.
 One quarter of 1 radian is 0.25 radians.
 $6.3 - 0.25 = 6.05$.
 Therefore the measure is about 6.1 radians.

2. a)



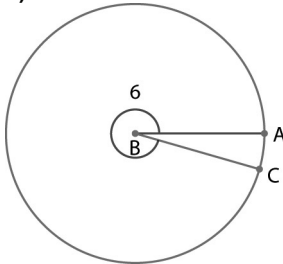
e.g., $5.6 = 3.2 + 1.6 + 0.8$
 3.2 radians is about 180° .
 1.6 radians is about 90° .
 0.8 radians is about 45° .
 $180^\circ + 90^\circ + 45^\circ = 315^\circ$.
 The measure is about 315° .

b)



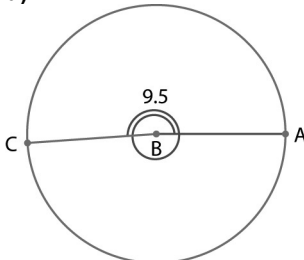
e.g., 4.71 is slightly greater than 4.7 .
 4.7 radians is about 270° .
 Therefore the measure is about 270° .

c)



e.g., $6 = (6)(1)$
 1 radian is about 60° .
 $(6)(60^\circ) = 360^\circ$.
 Therefore the measure is about 360° .

d)



e.g., $9.5 = 6.3 + 3.2$
 6.3 radians is about 360° .
 3.2 radians is about 180° .
 $360^\circ + 180^\circ = 540^\circ$.
 Therefore the measure is about 540° .

3. a) The x-intercepts of the basic sine function between 0° and 360° are 0° , 180° and 360° . The x-intercepts of the graph of $y = 2 \sin 3x$ will occur three times as often based on $b = 3$. For the interval from 0° to 720° the x-intercepts are 0° , 60° , 120° , 180° , 240° , 300° , 360° , 420° , 480° , 540° , 600° , 660° , and 720° .

b) The x-intercepts of the basic sine function between 0 and 2π are 0 , $3.141\dots$ and $6.283\dots$. The x-intercepts of the graph of $y = 2 \sin 3x$ will occur three times as often based on $b = 3$. For the interval from 0 to 12.566 the x-intercepts are 0 , $1.047\dots$, $2.094\dots$, $3.141\dots$, $4.189\dots$, $5.236\dots$, $6.283\dots$, $7.330\dots$, $8.378\dots$, $9.425\dots$, $10.472\dots$, $11.519\dots$, and $12.566\dots$.

4. a) Range: $\{y \mid -1 \leq y \leq 7, y \in \mathbb{R}\}$

$$\text{Maximum} = d + a$$

$$\text{Maximum} = 3 + 4$$

$$\text{Maximum} = 7$$

$$\text{Minimum} = d - a$$

$$\text{Minimum} = 3 - 4$$

$$\text{Minimum} = -1$$

$$\text{Amplitude} = \frac{\text{max} - \text{min}}{2}$$

$$\text{Amplitude} = \frac{7 - (-1)}{2}$$

$$\text{Amplitude} = \frac{8}{2}$$

$$\text{Amplitude} = 4$$

$$\text{period} = \frac{360^\circ}{b}$$

$$\text{period} = \frac{360^\circ}{3}$$

$$\text{period} = 120^\circ$$

Horizontal translation = 20° to the right

Equation of the midline:

$$y = d$$

$$y = 3$$

The range of this graph is $\{y \mid -1 \leq y \leq 7, y \in \mathbb{R}\}$, and its amplitude is 4 . The period is 120° , and the horizontal translation is 20° to the right. The equation of the midline is $y = 3$.

b) Range: $\{y \mid -6 \leq y \leq -2, y \in \mathbb{R}\}$

$$\text{Maximum} = d + a$$

$$\text{Maximum} = -4 + 2$$

$$\text{Maximum} = -2$$

$$\text{Minimum} = d - a$$

$$\text{Minimum} = -4 - 2$$

$$\text{Minimum} = -6$$

$$\text{Amplitude} = \frac{\text{max} - \text{min}}{2}$$

$$\text{Amplitude} = \frac{-2 - (-6)}{2}$$

$$\text{Amplitude} = \frac{4}{2}$$

$$\text{Amplitude} = 2$$

$$\text{period} = \frac{360^\circ}{b}$$

$$\text{period} = \frac{360^\circ}{2}$$

$$\text{period} = 180^\circ$$

Horizontal translation = 60° to the right

Equation of the midline:

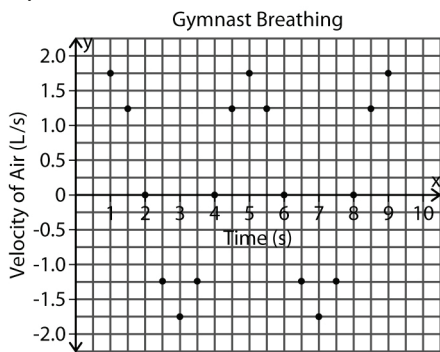
$$y = d$$

$$y = -4$$

The range of this graph is $\{y \mid -6 \leq y \leq -2, y \in \mathbb{R}\}$, and its amplitude is 2. The period is 180° and the horizontal translation is 60° to the right. The equation of the midline is $y = -4$.

5. To determine the equation of the sinusoidal regression function, plot the data using a graphing calculator and use the data to determine the equation. The equation of the sinusoidal regression function for this data is $y = 19.557... \sin(0.476...x - 1.762...) + 6.141...$

6. a)



The equation of the sinusoidal regression function for this data is

$$y = 1.751... \sin(1.570...x)$$

b) Period = second maximum – first maximum

$$\text{Period} = 5 - 1$$

$$\text{Period} = 4$$

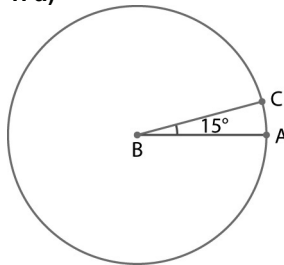
The period of this graph is 4 s.

c) e.g., Positive and negative velocities correspond to exhalations and inhalations (or vice versa).

e) The velocity of air being 0 L/s corresponds to the x-intercepts of the graph. Between 9 s and 19 s, the velocity of the air will be 0 at 10 s, 12 s, 14 s, 16 s, and 18 s.

Chapter Review, page 581

1. a)



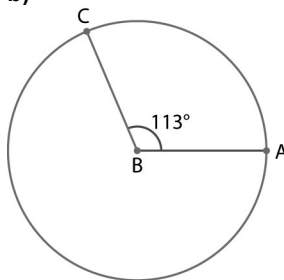
e.g., 15° is one quarter of 60° .

60° is about 1 radian.

One quarter of 1 radian is 0.25 radians.

It is about 0.3 radians.

b)



e.g., 113° is slightly less than $180^\circ - 60^\circ$, or 120° .

180° is about 3.2 radians.

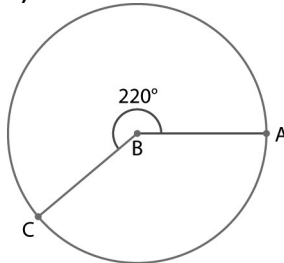
60° is about 1 radian.

$$3.2 - 1 = 2.2$$

120° is about 2.2 radians.

It is about 2.1 radians.

c)



e.g., 220° is slightly greater than $180^\circ + 30^\circ$, or 210° .

180° is about 3.2 radians.

30° is one half of 60° .

60° is about 1 radian.

One half of 1 radian is 0.5 radians.

$$3.2 + 0.5 = 3.7$$

210° is about 3.7 radians.

It is about 3.9 radians.