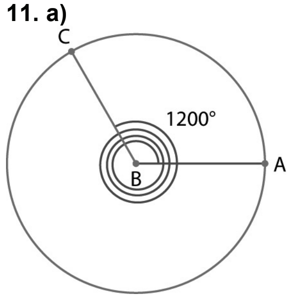
8. a) 2 = 1 + 1
1 radian is about 60°.
60° + 60° = 120°
2 radians is about 120°.
Therefore 2 radians is greater than 100°.
b) 0.5 is one half of 1.
1 radian is about 60°.
One half of 60° is 30°.
0.5 radians is about 30°.
Therefore 45° is greater than 0.5 radians.
c) 5 = (5)(1)
1 radian is about 60°.
(5)(60°) = 300°
5 radians is about 300°.
Therefore 5 radians is greater than 280°.
d) 6.5 = (6)(1) + 0.5
1 radian is about 60°.
0.5 radians is about 30°.
(6)(60°) + 30° = 390°
6.5 radians is about 390°.
Therefore 400° is greater than 6.5 radians.

9. Disagree, e.g., the measure of an angle independent of the circle radius. The central angle, measured in radians, in a circle with a radius of 5 m will be the same as an equivalent angle in a circle with a radius of 10 m. For example, 180° is equal to π radians for a circle of any radius.

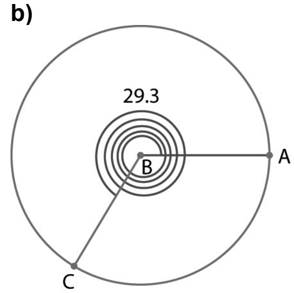
10. e.g., Use benchmarks to estimate the radian measure equivalent of angles greater than 360°, where 1 radian is about 60°, 3.2 radians is about 180° and 6.3 radians is about 360°. For example, determine the radian measure of
i) 480° **ii)** 525° **iii)** 650°
i) 480° = 8 · 60°, and 8 · 1 = 8
OR 480° = 360° + 90° + 30°, and
6.3 + 1.6 + 0.5 = 8.4
ii) 525° < 540°
540° = 9 · 60°, and 9 · 1 = 9
OR 540° = 360° + 180°, and 6.3 + 3.2 = 9.5
ii) 650° < 660°
660° = 11 · 60°, and 11 ·1 = 11
OR 660° = 360° + 180° + 120°, and

$$2\pi + \pi + \frac{\pi}{3} = \frac{10\pi}{3}$$

11. a)



b)



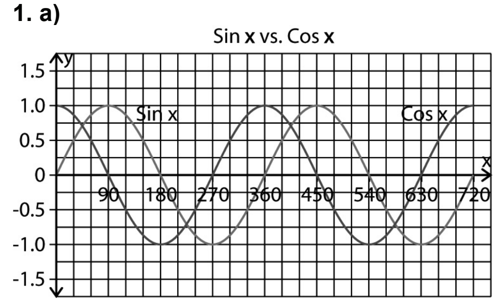
12. a) The estimate is 4.0 radians. This is because the sum of 3.2 radians (180°) and 0.8 radians (45°) is 4.0 radians or 225°. The measured angle is 227°.

b) The estimate is 3.0 radians or about 170°. This is because it looks slightly less than 3.2 radians. The measured angle is 170°.

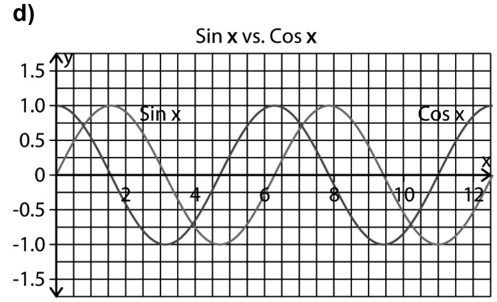
c) This estimate is 5.9 radians because the section of the circle that is not measured looks to be approximately a sixteenth of the circle. 6.3 divided by 16 is about 0.4. 6.3 subtracted by 0.4 is 5.9 radians. This is approximately 337° in degree. The measured angle is 342°.

Lesson 8.2: Exploring Graphs of Periodic Functions, page 524

1. a)



b) When the value of sin *x* is a maximum, cos *x* is at zero. When the value of cos *x* is a minimum, *x* is equal to 180° and 540°.
c) When the value of cos *x* is a maximum, sin *x* is at zero. The value of sin *x* is a minimum when *x* is equal to 270° and 630°.
d)



2. The graph of y = sin x repeats itself after it passes through 360° or 2π.

3. e.g. The graph is symmetrical along the x-axis, with the axis of symmetry being at 90° and 270°, respectively. The graph is rotationally symmetrical around the point (180°, 0).

4. e.g., The graph is symmetrical along the x-axis, with the axis of symmetry being at 180° and 360°, respectively. The graph is rotationally symmetrical around the point (270°, 0).

5. a) The y-intercept of the graph of y = sin x is 0.
b) The y-intercept of the graph of y = cos x is 1.

6. Using the graph from chapter 1,
a) The x-intercepts of the graph of y = sin x for the interval from 0° to 720° are 0°, 180°, 360°, 540° and 720°.
b) The x-intercepts of the graph of y = cos x for the interval from 0° to 720° are 90°, 270°, 450°, and 630°.

7. e.g., The up-and-down pattern in the graph of y = sin x looks like the repeating pattern of waves in a lake.

8. Yes, because each point on the sine graph corresponds to a point on the cosine graph with the same y-coordinate but with an x-coordinate of 90° less. For example, consider the x-intercepts for
y = cos x and y = sin x on 0° to 720°:

y = cos x	y = sin x	y = cos x translated left by 90°
90°	0°	0°
270°	180°	180°
450°	360°	360°
630°	540°	540°
…	720°	720°

The same results occur for any value of y = cos x.

9. e.g., It would look like the graph of cos x, as it would start at 1, decrease to 0 after spinning 90°, then decrease to 21 after spinning 180°, and so on.

History Connection, page 496

A. Looking for more precise values is a way to test the capabilities of newer computers. It is an interesting intellectual exercise. The digits in the decimal value of π occur in a random order, so it is a good random-number generator and it is useful for breaking codes.

B. i) The total surface area is 8.273… km^2.
ii) Using 3.2 as the value of π, the total surface area would have been 8.427… km^2. There would be 0.153… km^2 of wasted steel.

Lesson 8.3: The Graphs of Sinusoidal Functions, page 536

1. a)
$$\text{Amplitude} = \frac{\text{max} - \text{min}}{2}$$
$$\text{Amplitude} = \frac{3.5 - (-3.5)}{2}$$
$$\text{Amplitude} = \frac{7}{2}$$
$$\text{Amplitude} = 3.5$$
The amplitude of the graph is 3.5 cm, and its range is $\{y \mid -3.5 \le y \le 3.5,\ y \in \mathrm{R}\}$.

b)
$$\text{Amplitude} = \frac{\text{max} - \text{min}}{2}$$
$$\text{Amplitude} = \frac{1 - (-3)}{2}$$
$$\text{Amplitude} = \frac{4}{2}$$
$$\text{Amplitude} = 2$$
The amplitude of the graph is 2 cm, and its range is $\{y \mid -3 \le y \le 1,\ y \in \mathrm{R}\}$.

2. a) Equation of the midline:
$$y = \frac{\text{max} + \text{min}}{2} \qquad \text{Amplitude} = \frac{\text{max} - \text{min}}{2}$$
$$y = \frac{3.5 + 0.5}{2} \qquad \text{Amplitude} = \frac{3.5 - 0.5}{2}$$
$$y = \frac{4}{2} \qquad \text{Amplitude} = \frac{3}{2}$$
$$y = 2 \qquad \text{Amplitude} = 1.5$$
The equation of the midline of this graph is y = 2 cm, and its amplitude is 1.5 cm.
b) Equation of the midline:
$$y = \frac{\text{max} + \text{min}}{2} \qquad \text{Amplitude} = \frac{\text{max} - \text{min}}{2}$$
$$y = \frac{3 + (-5)}{2} \qquad \text{Amplitude} = \frac{3 - (-5)}{2}$$
$$y = \frac{-2}{2} \qquad \text{Amplitude} = \frac{8}{2}$$
$$y = -1 \qquad \text{Amplitude} = 4$$
The equation of the midline of this graph is y = –1 cm, and its amplitude is 4 cm.

3. a)
$$\text{Period} = \text{second max} - \text{first max}$$
$$\text{Period} = 120° - 0°$$
$$\text{Period} = 120°$$
The period of this graph is 120°.
b)
$$\text{Period} = \text{second max} - \text{first max}$$
$$\text{Period} = 3.75 - 0.75$$
$$\text{Period} = 3$$
The period of this graph is 3.