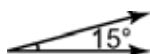


Chapter 5 BLM Answers

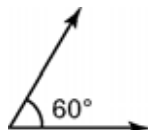
Prerequisite Skills

1. a) $c = 27$ mm b) $d = 16$ cm c) $n = 59$ m d) $s = 20$ cm
 2. a) $x = 42^\circ$ b) $x = 31^\circ$
 3. a) 0.8660 b) 1.000 c) 3.7321
 4. a) 0.8910 b) -0.9848 c) 2.4641 d) 0.3232

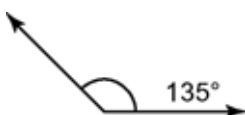
5. a)



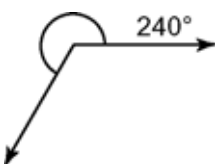
b)



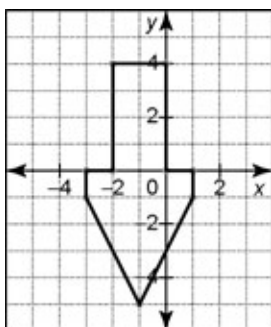
c)



d)



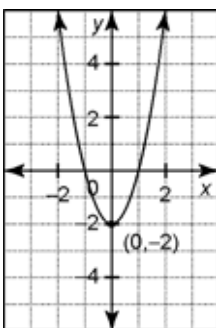
6. a)



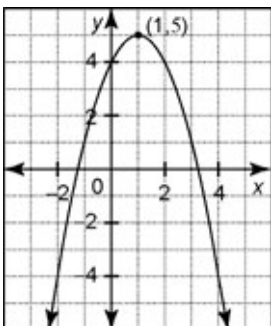
b) The points form an arrow design.

7. a) $y = x^2 - 3$ b) $y = (x - 7)^2 + 1$
 c) $y = \frac{1}{2}(x + 2)^2$ d) $y = -3x^2 - 4$

8. a)

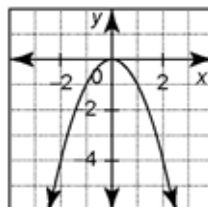


b)



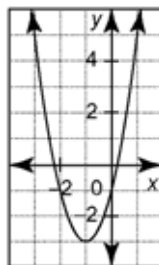
9. a) The domain is any real number less than or equal to -4.
 b) The range is any real number greater than or equal to -1 and less than or equal to 9.
 c) The domain is any real number greater than 0.
 d) The range is any real number.

10. a)



domain = $\{x \in \mathbf{R}\}$; range = $\{y \in \mathbf{R} \mid y \leq 0\}$

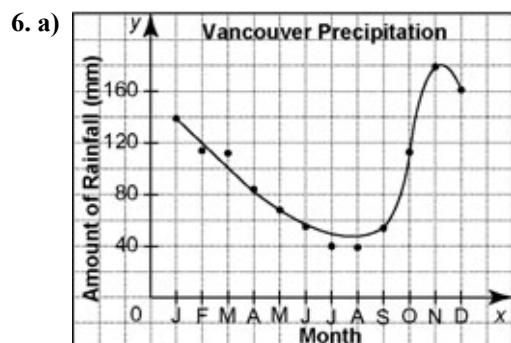
b)



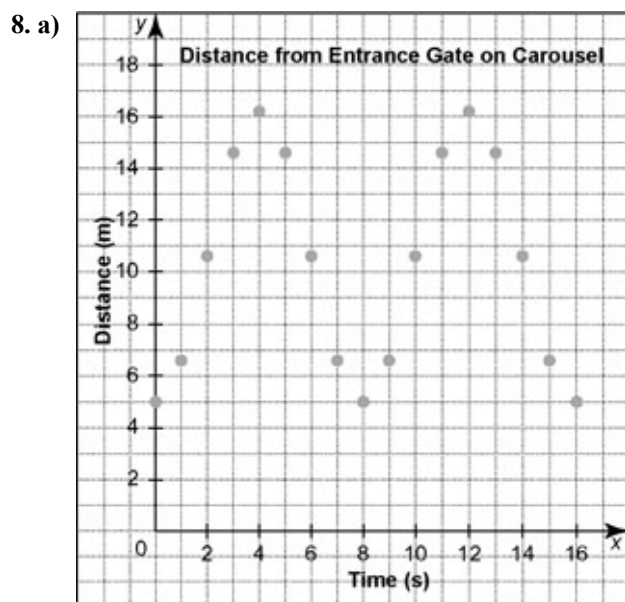
domain = $\{x \in \mathbf{R}\}$; range = $\{y \in \mathbf{R} \mid y \geq -3\}$

Section 5.1 Periodic Functions

1. a) periodic; e.g., the graph repeats its y -values in regular intervals of 3.
 b) not periodic; e.g., the graph does not repeat its y -values.
 2. a) period: 4; amplitude: 2; domain = $\{x \in \mathbf{R}\}$; range = $\{y \in \mathbf{R} \mid -1 \leq y \leq 3\}$
 b) period: 4; amplitude: 4.5; domain = $\{x \in \mathbf{R}\}$; range = $\{y \in \mathbf{R} \mid -6 \leq y \leq 3\}$
 3. a) -2.5, -1, 3 b) -7, 2, 8
 4. maximum value: 4; minimum value: 0; amplitude: 2; period: 1.75
 5. a) amplitude: 15; period: 1
 b) The amplitude will increase and the frequency will decrease. A heavier weight will stretch the spring more, increasing the amplitude. Since the weight is travelling a greater distance, the frequency is decreased.



- b) Yes, the data repeats its y -values each year.
 c) 179 mm and 39 mm; December and August
 7. Answers may vary.
 a) May: 5 °C; August: 22 °C
 b) The predictions should be accurate, since the periodic trend in temperature that has been observed is expected to continue.



- b) The y -values repeat after each period of 8 s.

Section 5.2 Circles and the Sine Ratio

1. Answers may vary.
 a) 435°, 795° b) 0°, 720° c) 270°, 630°
 2. a) coterminal; $90^\circ + 360^\circ(1) = 450^\circ$
 b) coterminal; $45^\circ + 360^\circ(2) = 765^\circ$
 c) not coterminal; $25^\circ + 360^\circ(1) = 385^\circ$
 d) not coterminal; $-60^\circ + 360^\circ(1) = 300^\circ$ and $-60^\circ + 360^\circ(2) = 660^\circ$
 3. a) $r = \sqrt{90}$; 18.4° b) $r = \sqrt{212}$; 285.9°
 4. a) P(0.985, 0.174) b) P(-0.500, 0.866)
 c) P(-0.866, -0.5) d) P(0.707, -0.707)
 5. a) 0.364; the tangent of an angle between 0° and 90° is positive
 b) -0.087; only the sine of an angle between 90° and 180° is positive

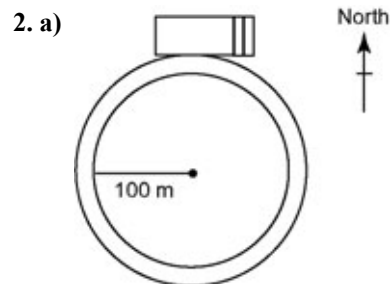
- c) -0.342; only the tangent of an angle between 180° and 270° is positive
 d) 0.9659; the cosine of an angle between 270° and 360° is positive
 6. Coterminal and non-coterminal angles may vary.
 a) 10°; 370°; 170° b) -75°; 285°; 255°
 c) 50°; 410°; 130° d) 90°; 450°; not possible
 7. Non-coterminal angles may vary.
 a) 60°; 120° b) 30°; 330°
 c) For angle θ with terminal arm in the third quadrant, the coordinates of point P(x , y) on the unit circle must both be negative. As such, the value of $\sin \theta = \frac{y}{r}$ and

$\cos \theta = \frac{x}{r}$ will both be negative. Diagrams may vary.

8. 1665°
 9. a) 150.0° b) 254.5° c) 334.5° d) 343.2°
 10. $-\frac{1}{15}$
 11. a) 17.3 m b) 11.8 m

Section 5.3 Investigate the Sine Function

1. a), c) Sketches may vary.
 b) period: 360°; amplitude: 1
 d) domain = $\{x \in \mathbf{R}\}$; range = $\{y \in \mathbf{R} \mid -1 \leq y \leq 1\}$
 e) $x = 210^\circ, 330^\circ, 570^\circ, 690^\circ$

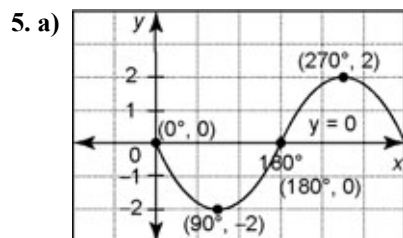


- b) Sketches may vary.
 c) Graph is identical to the graph of $y = \sin \theta$ except the amplitude is 100 m instead of 1.
 3. a) Sketches may vary. b) $y = \sin x$
 c) increasing: from $x = 0^\circ$ to $x = 90^\circ$, from $x = 270^\circ$ to $x = 450^\circ$, and from $x = 630^\circ$ to $x = 720^\circ$; decreasing: from $x = 90^\circ$ to $x = 270^\circ$, and from $x = 450^\circ$ to 630°
 4. a) 0.9 units b) -0.2 units c) 48.6° d) 194.5° and 345.5°
 5. a) $y = 0$ b) $y = -\frac{1}{90}x + 2$ c) $y = \frac{1}{90}x$
 6. a), b) Answers may vary.

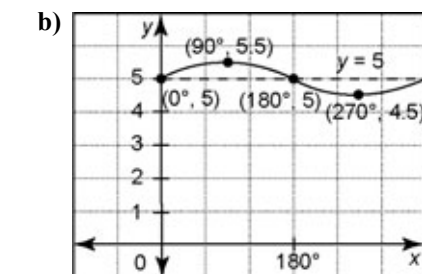
Section 5.4 Investigate Transformations of Sine Curves

1. Sketches may vary.
 a) period: 360°; amplitude: $\frac{4}{5}$; domain = $\{x \in \mathbf{R}\}$;
 range = $\{y \in \mathbf{R} \mid -\frac{4}{5} \leq y \leq \frac{4}{5}\}$

- b) period: 360° ; amplitude: 3; domain = $\{x \in \mathbf{R}\}$; range = $\{y \in \mathbf{R} \mid -3 \leq y \leq 3\}$
2. a) For $y = \sin x + 3.8$: period: 360° ; amplitude: 1; domain = $\{x \in \mathbf{R} \mid 0^\circ \leq x \leq 360^\circ\}$; range = $\{y \in \mathbf{R} \mid 2.8 \leq y \leq 4.8\}$; phase shift = 0° ; equation of horizontal axis: $y = 3.8$. For $y = \sin x - 3.8$: period: 360° ; amplitude: 1; domain = $\{x \in \mathbf{R} \mid 0^\circ \leq x \leq 360^\circ\}$; range = $\{y \in \mathbf{R} \mid -4.8 \leq y \leq -2.8\}$; phase shift = 0° ; equation of horizontal axis: $y = -3.8$.
- b) For $y = \sin(x - 45)$: period: 360° ; amplitude: 1; domain = $\{x \in \mathbf{R} \mid 0^\circ \leq x \leq 360^\circ\}$; range = $\{y \in \mathbf{R} \mid -1 \leq y \leq 1\}$; phase shift = 45° to the right; equation of horizontal axis: $y = 0$. For $y = \sin(x + 135)$: period: 360° ; amplitude: 1; domain = $\{x \in \mathbf{R} \mid 0^\circ \leq x \leq 360^\circ\}$; range = $\{y \in \mathbf{R} \mid -1 \leq y \leq 1\}$; phase shift = 135° to the left; equation of horizontal axis: $y = 0$.
3. a) $y = \sin x - 1$ b) $y = 2 \sin x + 1.5$
c) $y = 2 \sin(x - 120^\circ)$
4. a) Sketches may vary. b) $x = 0^\circ, 360^\circ$ c) $x = 90^\circ, 270^\circ$



domain = $\{x \in \mathbf{R} \mid 0^\circ \leq x \leq 360^\circ\}$;
range = $\{y \in \mathbf{R} \mid -2 \leq y \leq 2\}$

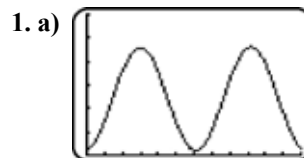


domain = $\{x \in \mathbf{R} \mid 0^\circ \leq x \leq 360^\circ\}$;
range = $\{y \in \mathbf{R} \mid 4.5 \leq y \leq 5.5\}$

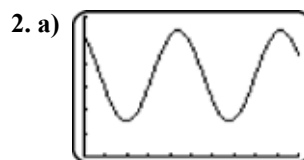
6. a) maximum points: $(90^\circ, 11), (450^\circ, 11)$; minimum points: $(270^\circ, 9), (630^\circ, 9)$
b) maximum points: $(270^\circ, 1), (630^\circ, 1)$; minimum points: $(90^\circ, -1), (450^\circ, -1)$
7. a) $y = 2 \sin x + 2$; increasing for the intervals 0° to 90° , 270° to 360° ; decreasing for the intervals 90° to 270°
b) $y = \sin(x + 90)$; increasing for the interval 180° to 360° ; decreasing for the interval 0° to 180°
8. a) Sketches may vary. b) $y = 2 \sin(\theta - 180^\circ) + 60$
c) Answers may vary. The graph's maximum and minimum would be 63 and 57 respectively, so the amplitude is 3 and the equation is $y = 3 \sin(\theta - 180^\circ) + 60$.

- d) Answers may vary. The graph would be phase shifted 180° to the right or left, so the equation would be $y = 2 \sin \theta + 60$ or $y = 2 \sin(\theta - 360^\circ) + 60$.

Section 5.5 Make Connections With Sine Functions

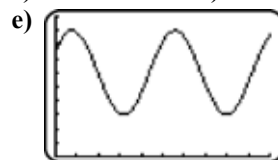


- b) 4.6 m; when $t \doteq 6.0$ and when $t \doteq 18.4$
c) 0.2 m; when $t \doteq 12.2$ d) 2.4 m



- b) The hares' population increases until resources are scarce, and then the population declines due to lack of food and an increase in predators.

- c) 509 hares d) 9.6 a



The equation for the red fox population is phase-shifted 90° to the left of the equation for the hare population. The fox population is much smaller but shows the same pattern of increasing and decreasing as the hare population.

3. a) Sketches may vary. b) approximately 5.2 mm
c) 12 mm d) 1.5 s
4. a) Sketches may vary.
b) period: 100 ms; amplitude: 6 cm c) 12 cm
d) The graph would have a lesser period and the 3.6 in the equation would be a greater number.
5. a) Sketches may vary.
b) amplitude: 20%; period: 450 ms
6. $D(t) = 10 \sin(6t + 180)$
7. a), b) Sketches may vary.

Chapter 5 Review

1. a) periodic; period: 5; amplitude: 3; domain = $\{x \in \mathbf{R}\}$; range = $\{y \in \mathbf{R} \mid -4 \leq y \leq 2\}$
b) not periodic
2. a) Sketches may vary.
b) Estimates may vary. 9.4 h; 9.2 h
c) Estimates may vary. 12.2 h
3. a) $\sqrt{125}$; 63.4° b) 20; 306.9°
c) $\sqrt{101}$; 185.7° d) $\sqrt{13}$; 123.7°

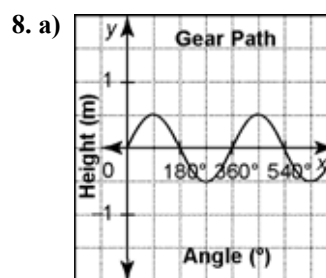
4. a) $P(0.996, 0.087)$ b) $P(0.259, 0.966)$
 c) $P(-0.996, 0.087)$ d) $P(0.259, -0.966)$
5. a) 0.985 units; -1 unit b) Answers may vary.
6. a) period: 360° ; amplitude: 7; phase shift: 90° to the left;
 domain = $\{x \in \mathbf{R}\}$; range = $\{y \in \mathbf{R} \mid -7 \leq y \leq 7\}$;
 equation of horizontal axis: $y = 0$.
 b) period: 360° ; amplitude: $\frac{1}{2}$; phase shift: 0° ; domain =
 $\{x \in \mathbf{R}\}$; range = $\{y \in \mathbf{R} \mid -2.5 \leq y \leq -1.5\}$; equation
 of horizontal axis: $y = -2$
7. a) 26.5 m; 90° b) 14.5 m
 c) The function and the graph would be phase shifted
 180° to the right or left.

Chapter 5 Practice Test

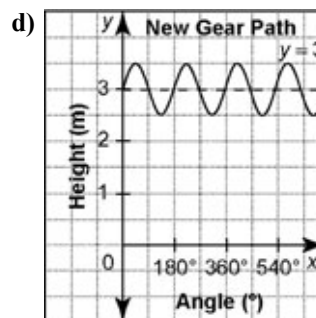
1. D 2. D 3. B 4. C
5. Coterminal and non-coterminal angles may vary.
 a) $\theta = 35^\circ; 395^\circ; 145^\circ$ b) $\theta = 241^\circ; 601^\circ; 299^\circ$
6. a) 4.9 cm b) 7.4 cm c) 11.4 cm
7. a), b) Sketches may vary.
8. a) $y = \sin x - 2$ b) $y = \frac{1}{2} \sin x$ c) $y = 3 \sin(x - 45^\circ)$
9. a) Sketches may vary.
 b) Equations may vary. $y = \frac{1}{2} \sin x$ c) $y = \frac{1}{2} \sin x + 2$
 d) The graph would be phase-shifted 90° to the left.
10. a) Sketches may vary. b) 360 mm, 280 mm
 c) 296.5 mm d) 300 mm

Chapter 5 Test

1. C 2. B 3. D 4. B
5. Answers may vary. a) $\theta = 5^\circ; 175^\circ$ b) $\theta = 247^\circ; 293^\circ$
6. Sketches may vary.
 a) period: 360° ; amplitude: 6; phase shift: 0° ;
 domain = $\{x \in \mathbf{R}\}$; range = $\{y \in \mathbf{R} \mid -6 \leq y \leq 6\}$;
 equation of horizontal axis: $y = 0$
 b) period: 360° ; amplitude: 1; phase shift: 0° ;
 domain = $\{x \in \mathbf{R}\}$; range = $\{y \in \mathbf{R} \mid 3.5 \leq y \leq 5.5\}$;
 equation of horizontal axis: $y = 4.5$
 c) period: 360° ; amplitude: 1; phase shift: 270° to the
 right; domain = $\{x \in \mathbf{R}\}$; range = $\{y \in \mathbf{R} \mid -1 \leq y \leq 1\}$;
 equation of horizontal axis: $y = 0$.
7. a) $y = \sin x + 1$ b) $y = 2 \sin(x + 270^\circ)$

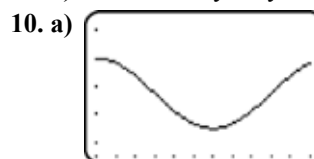


b) $y = 0.5 \sin x$ c) $y = 0.5 \sin x + 3$



e) $y = 0.5 \sin(2x) + 3$

9. a) Sketches may vary. b) 3 m c) 15 m d) 60°



- b) 147 000 000 km and 152 000 000 km c) July
 d) May and September