

Sinusoidal Functions Review

Answer key Final answers only. Try first, then check.

CORE SKILLS

- K1**
- a) 8
 - b) Amplitude 3; axis $y = 4$
 - c) 6
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- K2**
- a) $\sin 240^\circ = -\frac{\sqrt{3}}{2}$; $\cos 240^\circ = -\frac{1}{2}$
 - b) $\cos 135^\circ = -\frac{\sqrt{2}}{2}$; $\sin 330^\circ = -\frac{1}{2}$
 - c) Zeros $90^\circ, 270^\circ$; maximum points $(0^\circ, 1), (360^\circ, 1)$; minimum point $(180^\circ, -1)$
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- K3**
- a) Amplitude 3; period 180° ; 30° right; axis $y = 1$
 - b) Amplitude 4; period 1080° ; range $[-6, 2]$
 - c) Period 120° ; 30° left
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- K4**
- a) $(-45^\circ, 3), (0^\circ, 1), (45^\circ, 3), (90^\circ, 5), (135^\circ, 3)$
 - b) $3 - \sqrt{3}$
 - c) $x = 90^\circ$ and $x = 270^\circ$
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- K5**
- a) Max 5, min 1; amplitude 2; axis $y = 3$
 - b) Period 120° ; $k = 3$
 - c) e.g. $y = 2 \sin(3(x - 30^\circ)) + 3$ (any $d = 30^\circ + 120^\circ n$ works)

REAL WORLD

- A1**
- a) Amplitude 20 mmHg; axis $P = 100$; period 0.8 s
 - b) $P(t) = 20 \cos(450t) + 100$; $P(0.3) = 100 - 10\sqrt{2} \approx 85.9$ mmHg
 - c) k changes: $k = 900$ (period 0.4 s). No: k is a constant in the model, so it only fits a stretch of time where the heart rate stays the same.
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- A2**
- a) $h(t) = -12 \cos(4.5t) + 14$
 - b) $14 + 6\sqrt{2} \approx 22.5$ m
 - c) $t = \frac{80}{3} \approx 26.7$ s and $t = \frac{160}{3} \approx 53.3$ s
 - d) Never: $\cos(4.5t) = -\frac{7}{6}$ has no solution. The top of the wheel is 26 m, so the poster's 28 m is wrong.
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- A3**
- a) Amplitude 6 m; period 12 h; axis $d = 8$ (m)
 - b) e.g. $d(t) = 6 \cos(30(t - 3)) + 8$
 - c) $t = 7$ h and $t = 11$ h
 - d) Any start from $t = 0$ to $t = 5$ h, or from $t = 11$ to $t = 12$ h. A start between 5 h and 11 h runs into water shallower than 5 m.

THINK IT THROUGH

- T1**
- a) 13 and 8: not the same function
 - b) The 90° shift acts on $2(x - 10^\circ)$, so it moves the graph 45° , and to the left: $y = 5 \sin(2(x + 35^\circ)) + 8$
 - c) $2(x - 55^\circ) = 2(x + 35^\circ) - 180^\circ$, a half-period shift, and $\sin(\theta - 180^\circ) = -\sin \theta$, so $-5 \sin(2(x - 55^\circ)) = 5 \sin(2(x + 35^\circ))$.
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- T2**
- a) $y = 4 \sin(4(x - 7.5^\circ)) + 3$
 - b) $y = 4 \cos(4(x - 30^\circ)) + 3$
 - c) Shifting by a full period (90°) gives the same graph, so $d = 7.5^\circ + 90^\circ n$ works for every integer n , e.g. 97.5° and -82.5° .

BOSS LEVEL

- Boss**
- a) $x = 10^\circ, 50^\circ, 130^\circ, 170^\circ, 250^\circ, 290^\circ$
 - b) 900°
 - c) $k = 2$
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