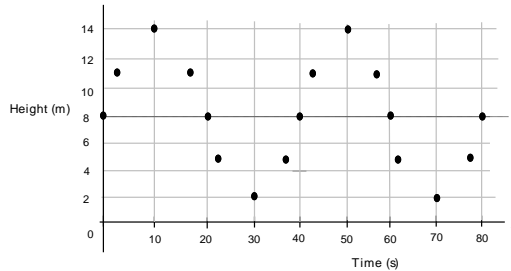


Solutions 6

CHAPTER 6: Sinusoidal Functions

1. Information about the movement of a Ferris wheel is shown below.



(a) How long does it take for the Ferris wheel to make five complete rotations?

$$\begin{aligned} 1 \text{ complete turn takes } 40 \text{ seconds} \\ 5 \text{ complete turns takes } 200 \text{ seconds} \end{aligned}$$

(b) What is the height of the axle supporting the Ferris wheel?

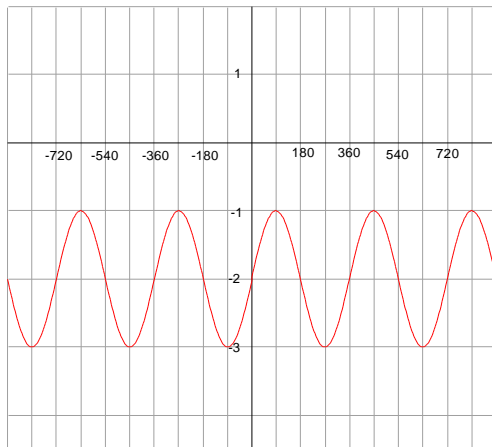
$$\text{axis} = 8 \text{ m}$$

(c) Calculate the speed at which the wheel is rotating.

$$\begin{aligned} \text{Circumference of the wheel} &= 2\pi r \\ &= 2\pi(6) \\ &= 37.68 \text{ m} \end{aligned}$$

$$\begin{aligned} \text{Speed} &= \text{distance/time} && \text{distance travelled is circumference of the wheel} \\ &= 37.68/40 \\ &= 0.942 \text{ m/s} \end{aligned}$$

2. Given the following graph, complete the given analysis.



Amplitude: 1

Period: 360°

Range: $\{y \in \mathbb{R} \mid -3 \leq y \leq -1\}$

Number of cycles from -540 to 540: 3

Axis: $y = -2$

3. Describe the transformation $g(x) = -2\sin x + 1$ and then sketch it.

The sinusoidal curve $y = \sin x$ has been:

- vertically stretched by a factor of 2
- reflected in the x-axis
- vertically translated up 1 unit

4. What is the range for each of the following sinusoidal functions?

(a) $f(x) = 0.5 \sin x - 4$

$$\{y \in \mathbb{R} \mid -4.5 \leq y \leq -3.5\}$$

(b) $f(x) = \sin(x - 180^\circ)$

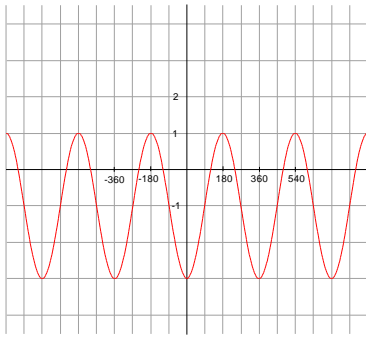
$$\{y \in \mathbb{R} \mid -1 \leq y \leq +1\}$$

5. The function $f(x) = \sin x$ has been translated 60° to the right, vertically stretched by a factor of 3 and reflected in the x-axis. Write the new equation.

$$y = -3 \sin(x - 60^\circ)$$

6. Write the equation for the sinusoidal function.

(a)

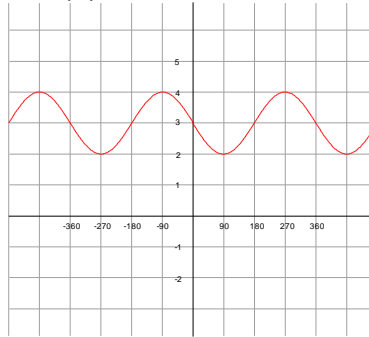


$$y = 2 \sin(\theta - 90^\circ) - 1$$

Other answers exist.

See the teacher

(b)



$$y = \sin(\theta + 180^\circ) + 3$$

Other answers exist.

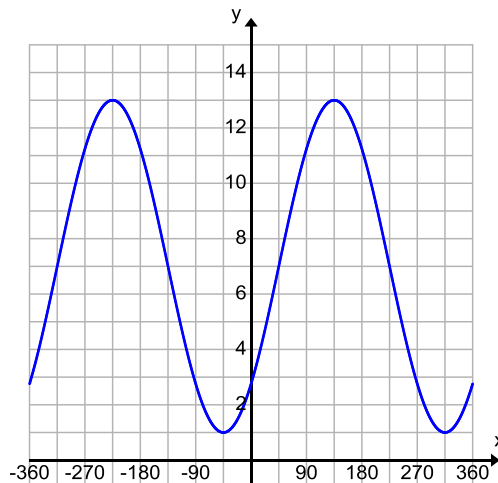
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7. Complete the chart below.

Sinusoidal Function	Maximum	Minimum
(a) $f(x) = 3 \sin x$	3	-3
(b) $f(x) = -\sin(x - 45^\circ) + 6$	7	5
(c) $f(x) = -0.25 \sin x - 1.5$	-1.25	-1.75

8. The height of a Ferris wheel is modeled by the function $h(x) = 6 \sin(x - 45^\circ) + 7$, where $h(x)$ is in metres and x is the number of degrees the wheel has rotated from the boarding position of a rider.

(a) Sketch the curve.



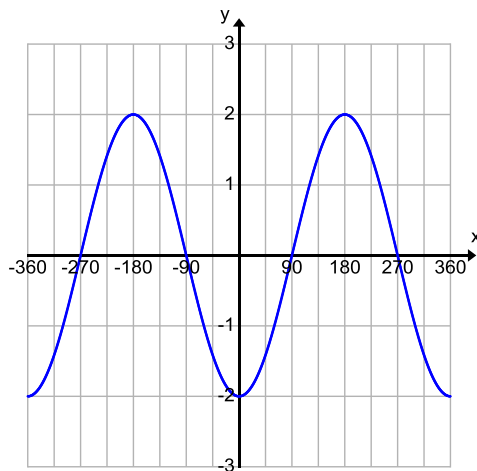
- (b) When the rider has rotated 400° from the boarding position, how high above the ground is the rider?

$$\begin{aligned} \text{sub } x &= 400^\circ \\ y &= 6\sin(400^\circ - 45^\circ) + 7 \\ &= 6\sin(355^\circ) + 7 \\ &= 6(-0.0872) + 7 \\ &= -0.5229 + 7 \\ &= 6.5 \text{ m} \end{aligned}$$

The rider is approx. 6.5 metres above the ground

9. Sketch each sinusoidal function on the grid provided.

(a) $f(x) = 2\sin(x - 90^\circ)$



(b) $f(x) = 0.5\sin(x - 60^\circ) - 2$

