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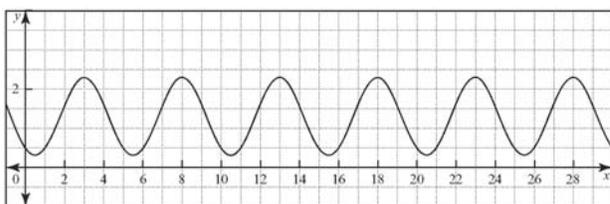
5.5 Data Collecting and Modelling

BLM 5-10

1. Anna collected data on the average mean temperature for her city.

Month ($t = 0$ is January)	Mean Temperature ($^{\circ}\text{C}$)
0	-9
1	-7
2	-1.5
3	6
4	13.75
5	19
6	21
7	19
8	13.25
9	5.75
10	-1.75
11	-7

- Graph the data.
 - Is the data representative of a sinusoidal function? Explain.
 - Model the data using a cosine function. State the equation of the function.
 - Graph the data and the cosine function on the same axes.
 - Comment on the fit of the function.
2. A motion sensor recorded the motion of a child on a swing. The data was graphed, as shown.



- Is the function periodic? Explain.
- Use the graph to estimate the maximum and minimum values of the swing.
- Use your answer in part b) to determine the amplitude of the function.
- Determine the vertical shift of the function.
- Determine the horizontal shift of the function, if the motion were to be modelled using a sine function.
- Estimate the period of the function.

- The height of the blade of a wind turbine as it turns through an angle of θ is given by the function $h(\theta) = 8.5 \sin(\theta + 180^{\circ}) + 40$, with height measured in metres.
 - Find the maximum and minimum positions of the blade.
 - Explain what the value of 40 in the equation represents.
 - Explain what the value of the amplitude represents.
 - Sketch the function over two cycles.
- Pedro's blood pressure can be modelled using the equation $P = -21 \cos 300t + 90$, where t is in seconds and P is the height of a column of mercury in millimetres.
 - Determine the period of the function.
 - What is the frequency of his heart rate, in beats per minute?
 - Determine the minimum and maximum values of the function.
 - Sketch the function from $t = 0$ to $t = 6$.
- A unicorn on a carousel moves up and down as the carousel turns. It completes 5 cycles with an amplitude of 25 cm every time the carousel completes one revolution.
 - Model this using a cosine function, using h for the height of the unicorn and θ for the angle that the carousel has rotated.
 - Determine the first three angles of rotation at which the displacement of the unicorn is 15 cm.
 - Sketch the function for two full rotations of the carousel.
- The number of millions of visitors that a tourist attraction gets can be modelled using the equation $y = 2.3 \sin [30(x + 1)] + 4.1$, where $x = 1$ represents January, $x = 2$ represents February, and so on.
 - Determine the period of the function and explain its meaning.
 - Graph the function for 12 months.
 - Which month has the most visitors?
 - Which month has the least visitors?

