Frequency, Wavelength and Period
Preliminaries

- Graph \( y = \sin x \) and \( y = \cos x \)
- Amplitude
- Transformations of graphs (stretching vertically and horizontally).

Objectives

- Given an equation, find the period (wavelength) and frequency.
- Given a graph, find the period (wavelength) and frequency.
- Graph waves of the form \( y = \pm A \sin(Bx) \) and \( y = \pm A \sin(Bx) \).
Amplitude = 5

\[ y = 5 \sin x \]

\[ y = \sin x \]
B changes the width of the graph

\[ y = \sin(Bx) \]
$y = \sin x$
Wavelength and Period

\[ y = \sin(2x) \]

![Graph of \( y = \sin(2x) \)]
y = \sin(2x)

\text{Period} = \frac{2\pi}{2} = \pi
Wavelength and Period

\[ y = \sin(2x) \]

Frequency: 
\[ \text{Frequency} = \frac{2}{2\pi} = \frac{1}{\pi} \]
Period and Frequency

\[ y = \sin 4x \]

The graph shows the function \( y = \sin 4x \) with key points marked at \( \frac{\pi}{2}, \pi, \frac{3\pi}{2}, \) and \( 2\pi \).
Period and Frequency

\[ y = \sin 4x \]

Period \( = \frac{2\pi}{4} = \frac{\pi}{2} \)

Frequency : 

\[ \text{Frequency} = \frac{4}{2\pi} = \frac{2}{\pi} \]
$y = \sin 4x$

Period $= \frac{2\pi}{4} = \frac{\pi}{2}$

Frequency $= \frac{4}{2\pi} = \frac{2}{\pi}$
General Formulas

Period = \frac{2\pi}{B}

Frequency = \frac{B}{2\pi}
$y = \sin(5x)$

Period $= \frac{2\pi}{5}$
Graphing a Wave Adjusted for Period

\[ y = \sin(5x) \]

Period \( = \frac{2\pi}{5} \)

\[ Q = \frac{2\pi}{20} = \frac{\pi}{10} \]
Graphing a Wave Adjusted for Period

\[ y = \sin(5x) \]

Period \[ = \frac{2\pi}{5} \]

\[ Q = \frac{2\pi}{20} = \frac{\pi}{10} \]
Graphing a Wave Adjusted for Period

\[ y = \sin(5x) \]

Period \( = \frac{2\pi}{5} \)

\[ Q = \frac{2\pi}{20} = \frac{\pi}{10} \]
Graphing a Wave Adjusted for Period and Amplitude

\[ y = -2 \cos 3x \]

Period \[= \frac{2\pi}{3}\]
Graphing a Wave Adjusted for Period and Amplitude

\[ y = -2 \cos 3x \]

\[
\begin{align*}
\text{Period} &= \frac{2\pi}{3} \\
Q &= \frac{2\pi}{12} = \frac{\pi}{6}
\end{align*}
\]
Graphing a Wave Adjusted for Period and Amplitude

\[ y = -2 \cos 3x \]

Period \[ = \frac{2\pi}{3} \]

\[ Q = \frac{2\pi}{12} = \frac{\pi}{6} \]
Graphing a Wave Adjusted for Period and Amplitude

\[ y = -2 \cos 3x \]

Period \[ = \frac{2\pi}{3} \]

\[ Q = \frac{2\pi}{12} = \frac{\pi}{6} \]
Finding the Equation of a Wave from its Graph

\[ y = \sin \left( \frac{1}{2} x \right) \]

Amplitude, \( A = 3 \)

Period, \( B = \frac{2\pi}{4} = \frac{\pi}{2} \)

\[ \sin \left( \frac{1}{2} x \right) \]
Finding the Equation of a Wave from its Graph

\[- \sin \left( \frac{1}{2} x \right)\]

Amplitude: \(A = 3\)

Period: \(2\pi\)

\[B = \frac{4\pi}{4\pi} = \frac{1}{2}\]
Finding the Equation of a Wave from its Graph

Amplitude $= A = 3$

$-3 \sin (x)$
Finding the Equation of a Wave from its Graph

Amplitude \( = A = 3 \)

Period \( = \frac{2\pi}{B} = 4\pi \) \( \Rightarrow \) \( B = \frac{2\pi}{4\pi} = \frac{1}{2} \)
Finding the Equation of a Wave from its Graph

\[ y = \cos(\pi x) \]

Amplitude \( A = 2 \)

Period \( B = \frac{\pi}{3} \)

\[ B = \frac{\pi}{3} \cdot 2 \pi = \frac{2\pi}{3} \]

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Frequency, Wavelength and Period
Finding the Equation of a Wave from its Graph

Amplitude $= A = 2$

Period $= \frac{2 \pi}{B}$
Finding the Equation of a Wave from its Graph

Amplitude $= A = 2$

Period $= \frac{2\pi}{B} = \frac{\pi}{3} \Rightarrow B = 2\pi \cdot \frac{3}{\pi} = 6$

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Frequency, Wavelength and Period
Recap

- Period (wavelength) is the $x$-distance between consecutive peaks of the wave graph.

\[
\text{Period} = \frac{2\pi}{B}; \quad \text{Frequency} = \frac{B}{2\pi}
\]

- Use amplitude to mark $y$-axis, use period and quarter marking to mark $x$-axis.
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