Frequency, Wavelength and Period

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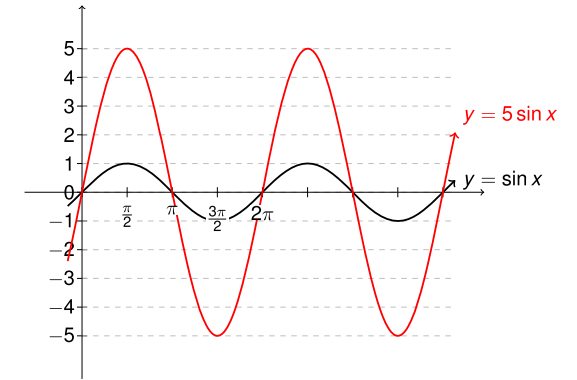

Preliminaries and Objectives

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 $y = \pm A \cos(Bx)$.
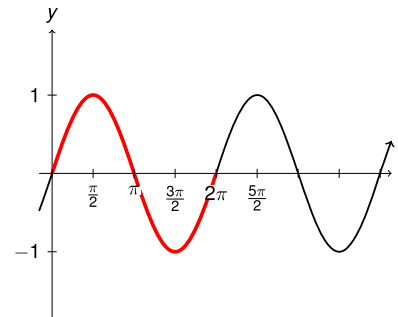

Amplitude = 5

$y = 5 \sin x$

$y = \sin x$

B changes the width of the graph
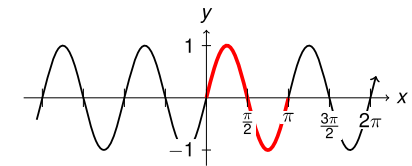
$y = \sin(Bx)$

Wavelength and Period

$y = \sin x$
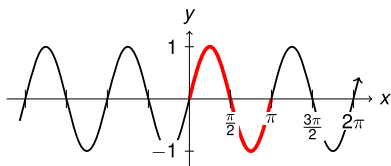

Wavelength and Period

$y = \sin(2x)$

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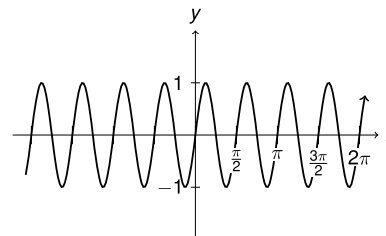

Wavelength and Period

$y = \sin(2x)$

$$\text{Frequency} = \frac{2}{2\pi} = \frac{1}{\pi}$$

Period and Frequency

$y = \sin 4x$

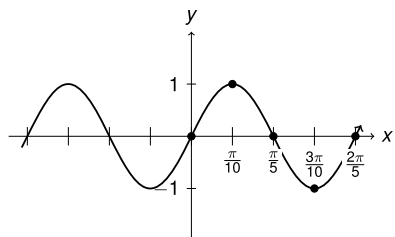$$\text{Period} = \frac{2\pi}{4} = \frac{\pi}{2} \qquad \text{Frequency} = \frac{4}{2\pi} = \frac{2}{\pi}$$

General Formulas

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

$$\text{Frequency} = \frac{B}{2\pi}$$
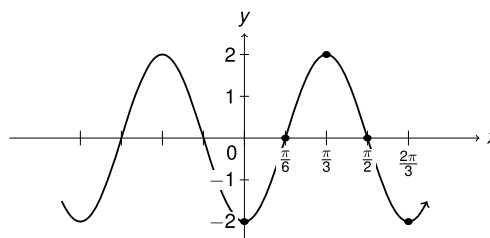
Graphing a Wave Adjusted for Period

$$y = \sin(5x)$$

Period $= \dfrac{2\pi}{5}$ $\qquad$ $Q = \dfrac{2\pi}{20} = \dfrac{\pi}{10}$

Graphing a Wave Adjusted for Period and Amplitude

$$y = -2\cos 3x$$

Period $= \dfrac{2\pi}{3}$ $\qquad$ $Q = \dfrac{2\pi}{12} = \dfrac{\pi}{6}$

Finding the Equation of a Wave from its Graph

$-3\sin\left(\tfrac{1}{2}x\right)$

Amplitude $= A = 3$

Period $= \dfrac{2\pi}{B} = 4\pi \;\Rightarrow\; B = \dfrac{2\pi}{4\pi} = \dfrac{1}{2}$

Finding the Equation of a Wave from its Graph

$2\cos(6x)$

Amplitude $= A = 2$

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

Recap

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

$$\text{Period} = \dfrac{2\pi}{B}; \qquad \text{Frequency} = \dfrac{B}{2\pi}$$

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