Frequency, Wavelength and Period

University of Minnesota

Preliminaries and Objectives

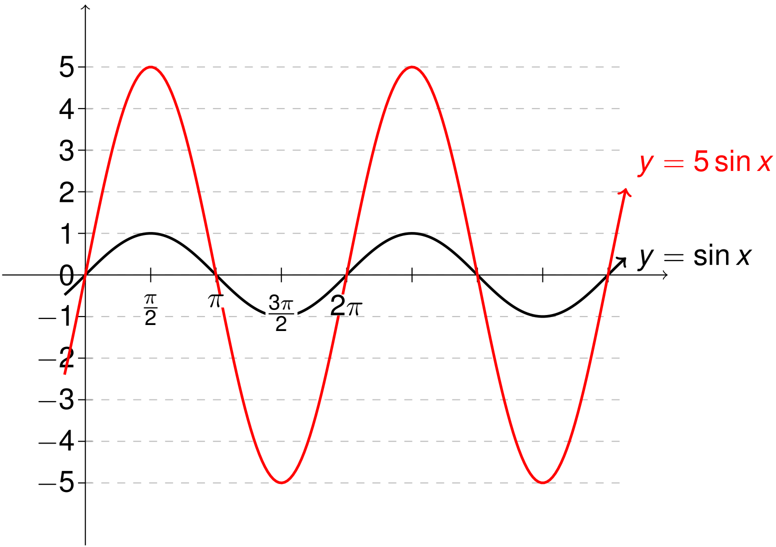
Preliminaries

- 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 $y = \pm A\sin(Bx)$.

Amplitude = 5

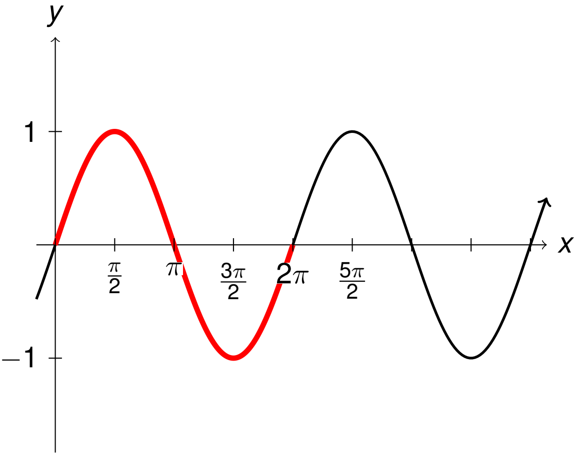


B changes the width of the graph

$$y = \sin(Bx)$$

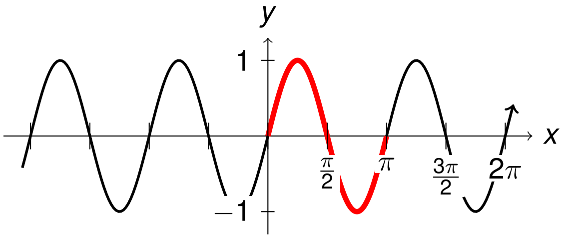
Wavelength and Period

$$y = \sin x$$



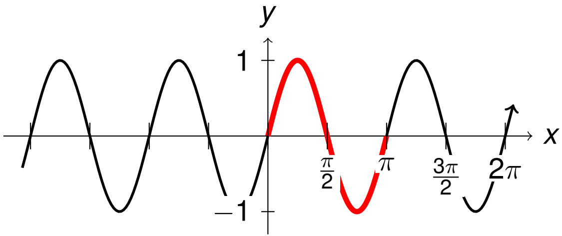
Wavelength and Period

$$y = \sin(2x)$$



Wavelength and Period

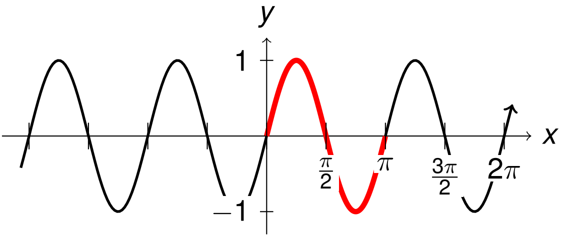
$$y = \sin(2x)$$



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

Wavelength and Period

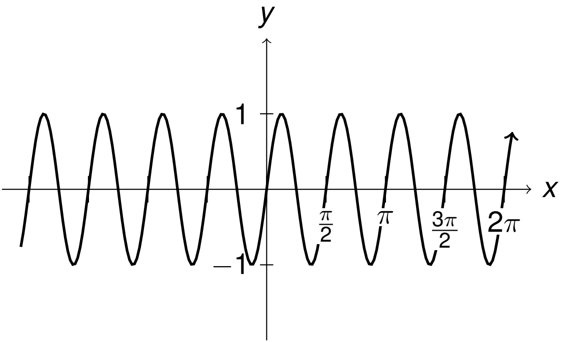
$$y = \sin(2x)$$



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

Period and Frequency

$$y = \sin 4x$$



Period and Frequency

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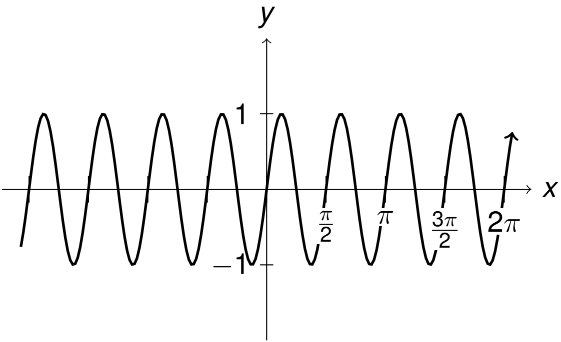
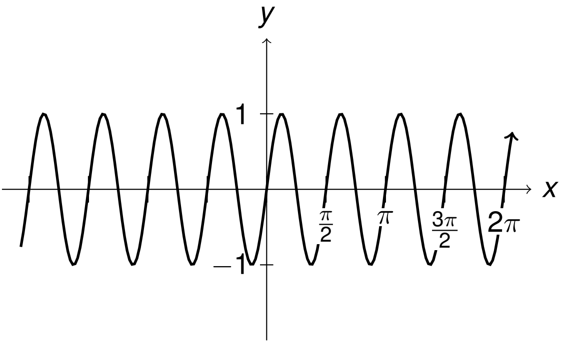


$$\text{Period } = \frac{2\pi}{4} = \frac{\pi}{2}$$

Period and Frequency

$$y = \sin 4x$$



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

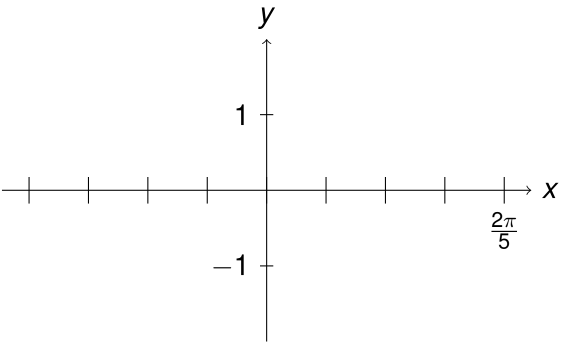
General Formulas

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

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

Graphing a Wave Adjusted for Period

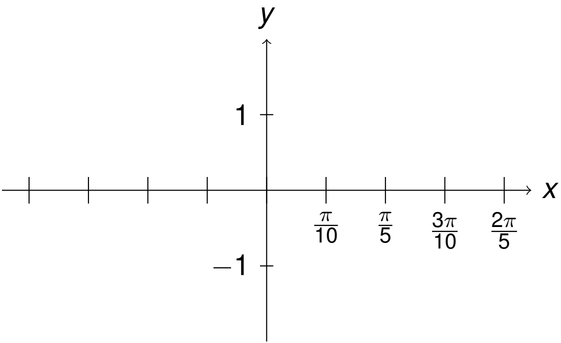
$$y = \sin(5x)$$



$$\text{Period} = \frac{2\pi}{5}$$

Graphing a Wave Adjusted for Period

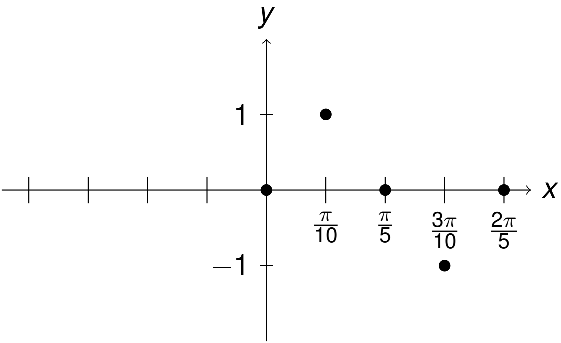
$$y = \sin(5x)$$



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

Graphing a Wave Adjusted for Period

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



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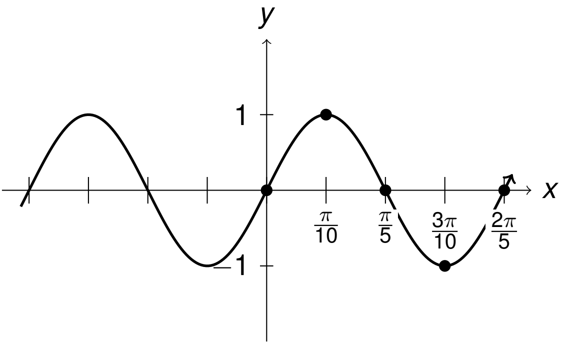
Graphing a Wave Adjusted for Period

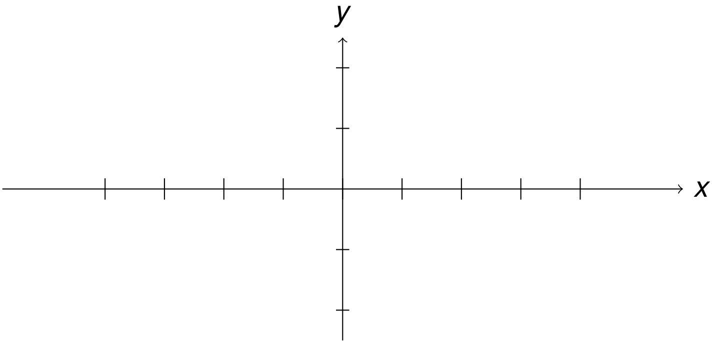
$$y = \sin(5x)$$



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

Graphing a Wave Adjusted for Period and Amplitude

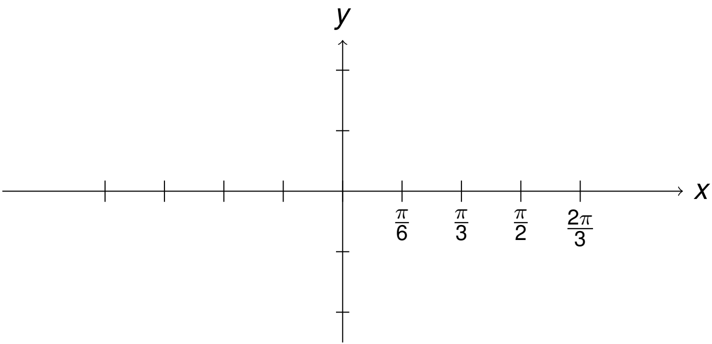
$$y = -2\cos 3x$$



$$\text{Period} = \frac{2\pi}{3}$$

Graphing a Wave Adjusted for Period and Amplitude

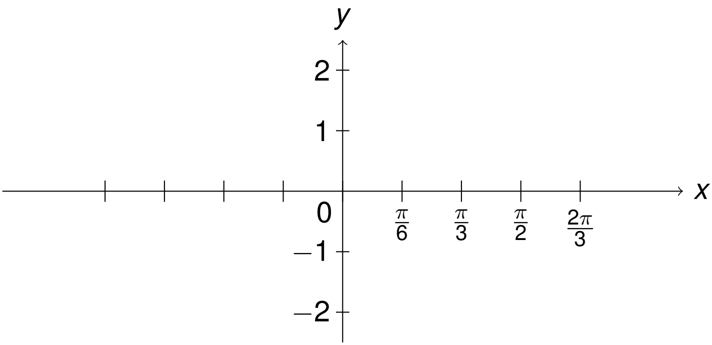
$$y = -2\cos 3x$$



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

Graphing a Wave Adjusted for Period and Amplitude

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



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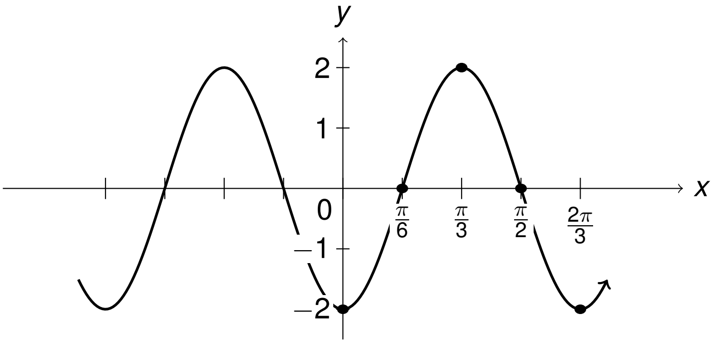
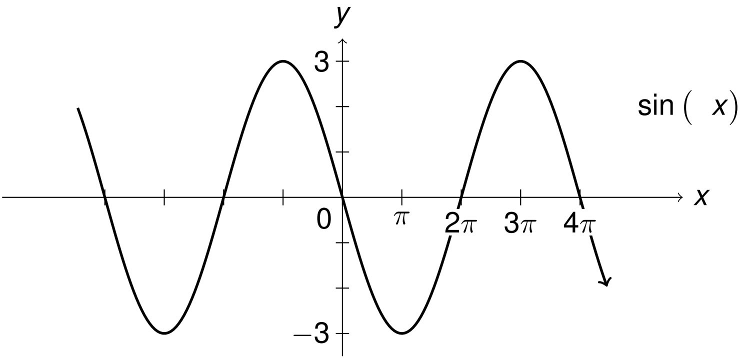
Graphing a Wave Adjusted for Period and Amplitude

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



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

Finding the Equation of a Wave from its Graph



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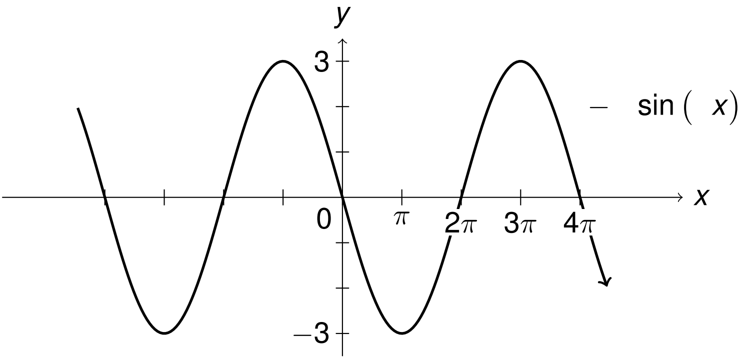
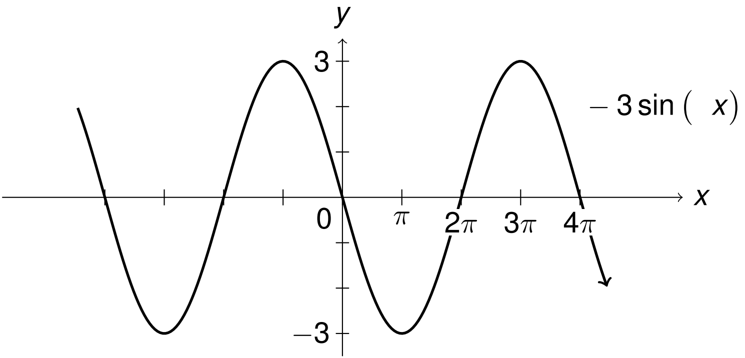
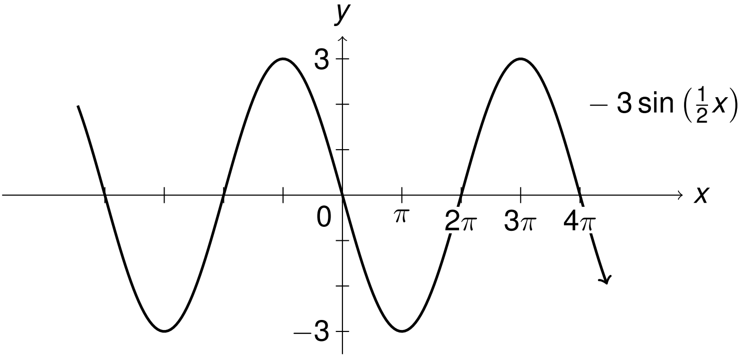


Finding the Equation of a Wave from its Graph



$$\text{Amplitude} = A = 3$$

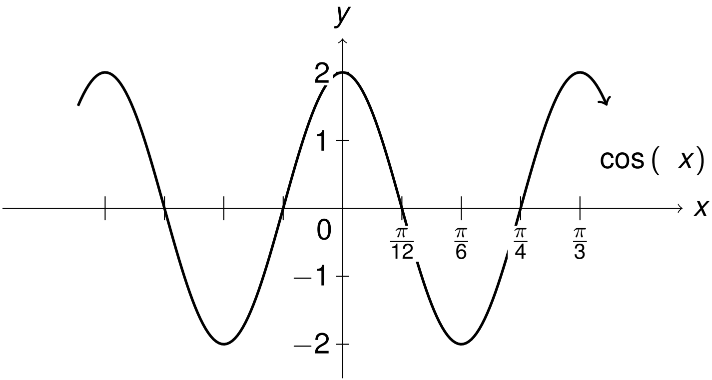
Finding the Equation of a Wave from its Graph



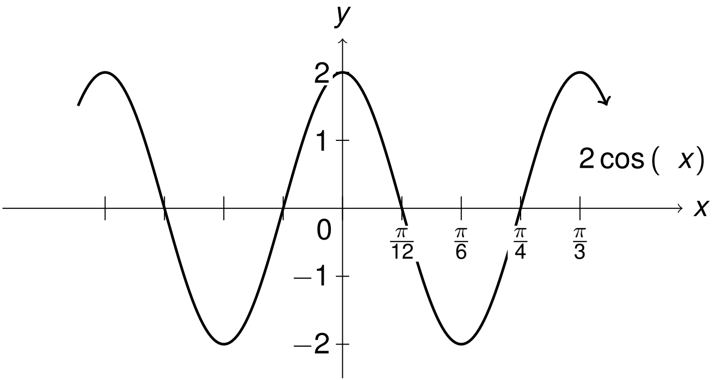
$$\text{Amplitude} = A = 3$$

$$\text{Period} = \frac{2\pi}{B} = 4\pi \Rightarrow B = \frac{2\pi}{4\pi} = \frac{1}{2}$$

Finding the Equation of a Wave from its Graph

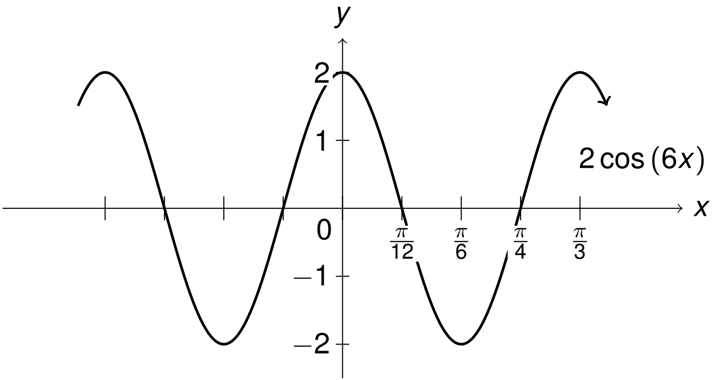


Finding the Equation of a Wave from its Graph



Amplitude $= A = 2$

Finding the Equation of a Wave from its Graph



$$\text{Amplitude } = A = 2$$

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

Recap

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

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

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

Credits

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