Bellwork

Draw a graph to represent the height of one car with respect to time.

Can you think of any other real world examples of motion that would use this same type of graph?

Unit 4B: Graphing Trigonometric Functions

4.5 Graphing Sine and Cosine
4.5 Day 2: Graphing Sine and Cosine
4.6 Graphing Tangent and Cotangent
4.6 Day 2 Graphing Secant and Cosecant
4.7 Inverse trig functions
4.5: Graphing Sine and Cosine

GOAL: Graph sine and cosine functions. Analyze transformations a, b, c, d to sine and cosine graphs.

Graph of Sine Function

<table>
<thead>
<tr>
<th>x (radians or degrees)</th>
<th>0</th>
<th>π/2</th>
<th>3π/2</th>
<th>2π</th>
</tr>
</thead>
<tbody>
<tr>
<td>y = sin(x)</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>-1</td>
</tr>
</tbody>
</table>
Graph of Cosine Function

\[ y = \cos(x) \]

- **amplitude**: represents half the distance between the maximum and minimum values.

- **period**: the distance between any set of repeating points on the graph of a function.
General Equations:
\[ y = a \sin(bx - c) + d \quad y = a \cos(bx - c) + d \]

<table>
<thead>
<tr>
<th>Type of transformation</th>
<th>How to find/what it affects.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Vertical stretch or compression</td>
</tr>
<tr>
<td>b</td>
<td>Horizontal stretch or compression</td>
</tr>
<tr>
<td>c</td>
<td>Phase shift (horizontal)</td>
</tr>
<tr>
<td>d</td>
<td>Vertical shift</td>
</tr>
</tbody>
</table>

Example 1: Scaling
\[ y = 3 \sin x \]

<table>
<thead>
<tr>
<th>x</th>
<th>0</th>
<th>( \frac{\pi}{2} )</th>
<th>( \pi )</th>
<th>( \frac{3\pi}{2} )</th>
<th>2\pi</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>-3</td>
<td>0</td>
</tr>
</tbody>
</table>

\[ 3 \sin x \]
\[ 3(1) \quad 3(0) \quad 3(-1) \quad 3(0) \]
Example 1: Scaling

\[ y = \cos \frac{x}{2} \]

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>( \frac{\pi}{2} )</th>
<th>( \pi )</th>
<th>( \frac{3\pi}{2} )</th>
<th>2( \pi )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \cos \frac{x}{2} )</td>
<td>1</td>
<td>( \cos \frac{\pi}{4} )</td>
<td>( \cos \frac{\pi}{2} )</td>
<td>( \cos \frac{3\pi}{4} )</td>
<td>( \cos \pi )</td>
</tr>
<tr>
<td>( \cos \frac{3\pi}{2} )</td>
<td>( \cos \frac{3\pi}{4} )</td>
<td>0</td>
<td>( \cos \frac{3\pi}{4} )</td>
<td>( \cos \pi )</td>
<td>( -1 )</td>
</tr>
</tbody>
</table>

Example 2: Find the period and amplitude

\[ y = 2 \sin 5x \]

- \( \text{amp} = |a| = |2| = 2 \)
- \( \text{per} = \frac{2\pi}{b} = \frac{2\pi}{5} \)

\[ y = \frac{1}{4} \sin 2\pi x \]

- \( \text{amp} = |\frac{1}{4}| = \frac{1}{4} \)
- \( \text{per} = \frac{\frac{2\pi}{2\pi}}{2\pi} = \frac{1}{2\pi} \)

\[ y = -\cos \frac{2x}{3} \]

- \( \text{amp} = |-1| = 1 \)
- \( \text{per} = \frac{2\pi}{\frac{2\pi}{3}} = \frac{3\pi}{2} \)
Example 3: describe the relationship between the graphs of \( f \) and \( g \)

\[
f(x) = \sin x \quad \quad g(x) = -\sin 2x
\]

- Reflection over \( x \)-axis
- Horizontal compression
- Period: \( \pi \)

Example 3: describe the relationship between the graphs of \( f \) and \( g \)

\[
f(x) = \cos x \quad \quad g(x) = \frac{1}{2} \cos(x + \pi)
\]

- Vertical compression \( x = -\pi \)
- Amplitude: \( \frac{1}{2} \)
- Phase shift: left \( \pi \)
4.5 Day 1 Assignment

p. 326 # 6, 9, 11, 15, 20, 21, 25, 27-30, 31, 33, 73, 76, 77, 78, 95-97