### Trigonometric Transformations Graphing

**Default Trig Function Graphs:**

<table>
<thead>
<tr>
<th>Function</th>
<th>Graph 1</th>
<th>Graph 2</th>
<th>Graph 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sin(x)</td>
<td><img src="image1" alt="Graph" /></td>
<td><img src="image2" alt="Graph" /></td>
<td><img src="image3" alt="Graph" /></td>
</tr>
<tr>
<td>Period:</td>
<td>$\frac{2\pi}{b}$</td>
<td>$\frac{2\pi}{b}$</td>
<td>$\frac{\pi}{b}$</td>
</tr>
<tr>
<td>Csc(x)</td>
<td><img src="image4" alt="Graph" /></td>
<td><img src="image5" alt="Graph" /></td>
<td><img src="image6" alt="Graph" /></td>
</tr>
<tr>
<td>Period:</td>
<td>$\frac{2\pi}{b}$</td>
<td>$\frac{2\pi}{b}$</td>
<td>$\frac{\pi}{b}$</td>
</tr>
<tr>
<td>Sec(x)</td>
<td><img src="image7" alt="Graph" /></td>
<td><img src="image8" alt="Graph" /></td>
<td><img src="image9" alt="Graph" /></td>
</tr>
<tr>
<td>Period:</td>
<td>$\frac{2\pi}{b}$</td>
<td>$\frac{2\pi}{b}$</td>
<td>$\frac{\pi}{b}$</td>
</tr>
<tr>
<td>Cot(x)</td>
<td><img src="image10" alt="Graph" /></td>
<td><img src="image11" alt="Graph" /></td>
<td><img src="image12" alt="Graph" /></td>
</tr>
<tr>
<td>Period:</td>
<td>$\frac{2\pi}{b}$</td>
<td>$\frac{2\pi}{b}$</td>
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</tr>
</tbody>
</table>
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Knowing the 4 Segments of Trig Transformations:

\[ Y = A \cdot \sin [ (B \cdot x - C)] + D \]

- \( A \) = amplitude
- \( B \) = period
- \( C \) = horizontal shift
- \( D \) = vertical shift

**Note:** If \( C \) is \(+\), the shift will be negative, aka to the left.

Example:
- \( 2 \sin (2x - 4) + 3; C = 4 \)
- \( 2 \sin (2x + 4) + 3; C = -4 \)

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Finding the 4 Segments of Trigonometric Transformations:

Amplitude: Increases the range from the midline, commonly multiplied in front of the function

Example:
- \( Y = \sin (0) \quad Y = 1 \cdot 1, \) So \( Y = 1 \)
- \( Y = 3 \cdot \sin (0) \quad Y = 3 \cdot 1, \) So \( Y = 3 \)

Midline: this is the vertical shift of the function. If no value is found for the midline, the default vertical shift is 0.

Example:
- \( Y = \sin(x) \) has an oscillating line of \( D = 0 \)
- \( Y = \sin(x) + 3 \) has an oscillating line of \( D = 3 \)

Period: length it takes to complete one cycle.

Example:

\[ \frac{2\pi}{b} \] is for \((\sin, \cos, \csc, \sec)\)

\[ \frac{\pi}{b} \] is for \((\tan, \cot)\)

**Note:** \( B \) by default for every function will be 1.

Ex:
- \( \sin(x) \) period: \( \frac{2\pi}{1} \)
- \( \cot(x) \) period: \( \frac{\pi}{1} \)
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Phase shift: This is the horizontal shift of the function

Formula: \( \frac{C}{B} \)

Example:

\[ Y = \sin (2x + 3) \]

Phase shift: \( -\frac{3}{2} \)

Where -3 is \( C \) and 2 is \( B \)

Practice Problems: Find the Amplitude and Period, then find the Midline and Phase shift if applicable

1. \( y = \sin (\pi \ast x) \)
2. \( y = 3 \ast \sin (x) \)
3. \( y = 2 \ast \sin (2x - \frac{\pi}{2}) - 1 \)
4. \( y = \sin (x - \frac{\pi}{2}) \)
5. \( y = \sin (x + \frac{\pi}{2}) \)
6. \( y = \sin (x) + 4 \)

Tip: Think of the period value as completing a full circle.

YOU TRY: Look at the graphs provided, look at the period lines (the vertical lines), and imagine connecting the circle together.

Ex: \( y = \sin(x) \)

Take the black dot on the left and connect it with the dot on the right, this is what a period looks like visually.
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A

B

C

D

E

F

Answers to Practice Problems

1 = B  
2 = A  
3 = E  
4 = F  
5 = C  
6 = D

Reference: Sabrina V. method for graphing trig transformations