Recall: Let A, B, h > 0 and y = f(x)

<table>
<thead>
<tr>
<th>Function of the form...</th>
<th>Transforms the graph of y = f(x)...</th>
</tr>
</thead>
<tbody>
<tr>
<td>y = f(x)+k</td>
<td>up k units</td>
</tr>
<tr>
<td>y = f(x)-k</td>
<td>down k units</td>
</tr>
<tr>
<td>y = f(x-h)</td>
<td>right h units</td>
</tr>
<tr>
<td>y = f(x+h)</td>
<td>left h units</td>
</tr>
<tr>
<td>y = Af(x)</td>
<td>by a vertical stretch/shrink factor of A</td>
</tr>
<tr>
<td>y = f(Bx)</td>
<td>by a horizontal stretch/shrink factor of 1/B</td>
</tr>
<tr>
<td>y = -f(x)</td>
<td>by a reflection across the x-axis</td>
</tr>
</tbody>
</table>

Goal: To graph trig functions of the form \( y = Af(Bx-h) + k \), where A, B, h, and k are constants

Example: Graph 1 full period of . . .

\( a) \ y = 2 \sin \left( x + \frac{\pi}{6} \right) \)

\( \text{(phase): } - \frac{\pi}{6} \)

\( \text{helper fcn: } y = 2 \sin x \) [Graph helper fcn as a dotted curve and then translate as needed]

\( \text{amp} = 2 \)
b) \[ y = \cos \left( 2x + \frac{\pi}{3} \right) \]

Phase shift: \[ 2x - \frac{\pi}{2} = 0 \]
\[ x = \frac{\pi}{4} \]

P.S. \( \frac{\pi}{4} \)

helper: \[ y = \cos 2x \]
\[ \rho = \frac{2\pi}{2} = \pi \]
\[ \text{Amp} = 1 \]

---

c) \[ y = 3 \sin \left( \frac{\pi x}{2} \right) - 2 \]

helper: \[ y = 3 \sin \left( \frac{\pi x}{2} \right) \]

y-shift: down 2 = \(-2\)

P.S. \[ \frac{\pi x}{2} + 1 = 0 \]
\[ \frac{\pi x}{2} = -1 \cdot \frac{2}{\pi} \]
\[ x = -\frac{2}{\pi} \approx -0.6 \]

\[ \rho = \frac{\pi}{\frac{2}{\pi}} = 2 \pi \cdot \frac{\pi}{2} = 4 \]
\[ \text{Amp} = 3 \]
Let $y = -3 \cos \left( \frac{2x + \pi}{4} \right) - 5$

Find

a) Amplitude

$Amp = 3$

b) Period

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

c) Phase shift

$2x + \frac{\pi}{4} = 0$

$2x = -\frac{\pi}{4}$

$x = -\frac{\pi}{8}$

d) Vertical shift

$-5$

-graph two periods

$y = \frac{3}{2} \cot \left( \frac{2x - \pi}{2} \right)$

helper:

$y = \frac{3}{2} \cot (2x)$

$\rho = \frac{\pi}{2}$

Phase shift: $2x - \frac{\pi}{2} = 0$

$x = \frac{\pi}{4}$

Final graph is in Green
Ex. The graph of voltage from an alternating household circuit is shown below. Find an equation that gives voltage at time $t$.

Ex. Find the equation of the graph in red

Ex. Find the first positive x-intercept of $y = x \cos(x)$ using a calculator.

Ex. Find the equation of the graph in red

Ex. Find the first positive x-intercept of $y = x \cos(x)$ using a calculator.