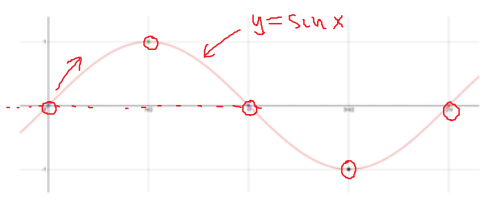
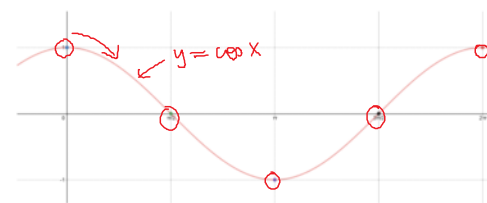
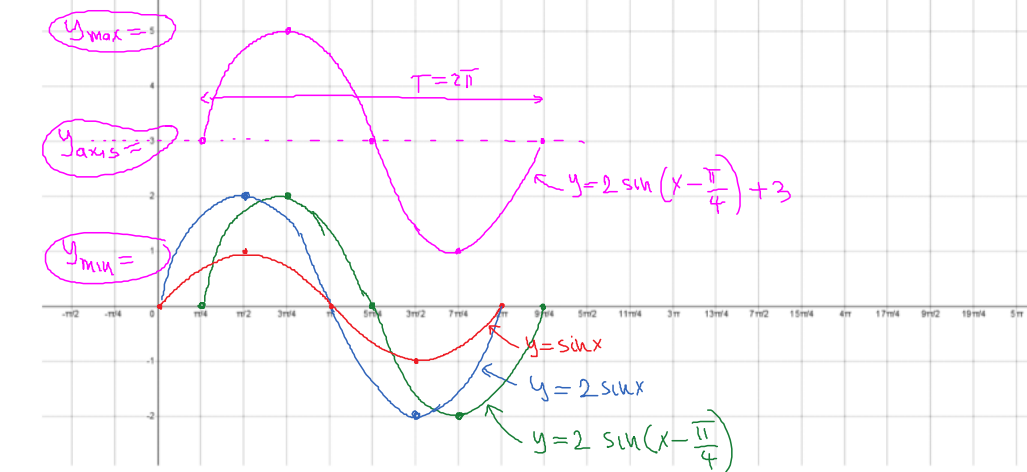
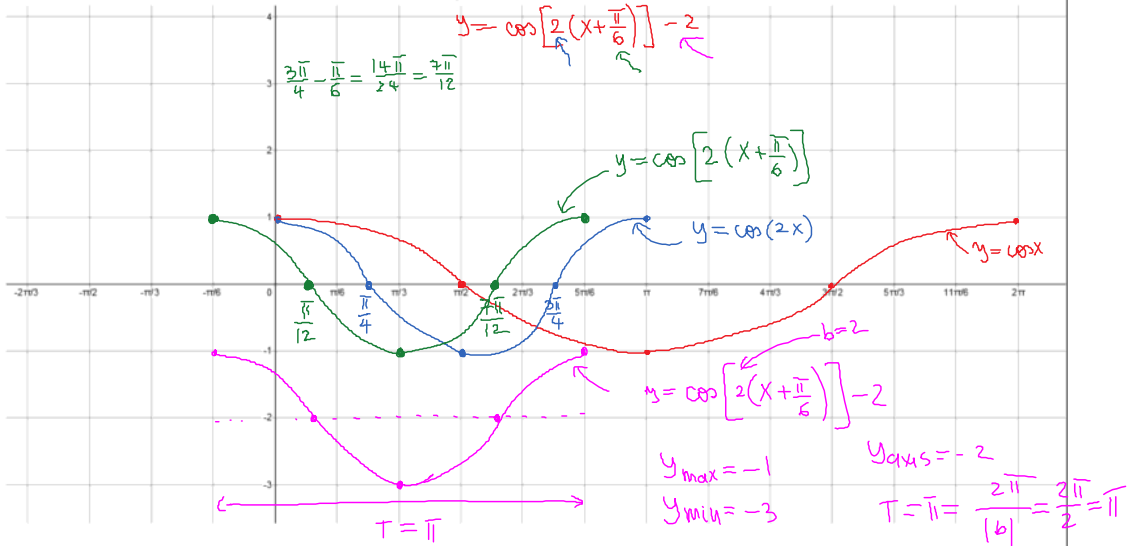


**6.4 Transformations of Trigonometric Functions**

<p><b>A Transformations</b></p> <p>Let analyze the graphs of <math>y = a \sin[b(x-c)] + d</math> or <math>y = a \cos[b(x-c)] + d</math>.</p> <ul style="list-style-type: none"> <li>The graph is scaled vertically by a factor of <math> a </math>. If <math>a &lt; 0</math> then the graph is also reflected in the x-axis.</li> <li>If <math> a  &gt; 1</math> then the graph is expanded vertically and if <math> a  &lt; 1</math> then the graph compressed vertically.</li> <li>The graph is translated vertically upward if <math>d &gt; 0</math> or downward if <math>d &lt; 0</math> by <math> d </math> units.</li> <li>The equation of the axis is <math>y = d</math>.</li> </ul>	<ul style="list-style-type: none"> <li>The graph of is scaled horizontally by a factor of <math>1/ b </math>. If <math>b &lt; 0</math> then the graph is also reflected in the y-axis.</li> <li>The graph is translated horizontally to the right if <math>c &gt; 0</math> or to the left if <math>c &lt; 0</math> by <math> c </math> units.</li> <li>The graph is horizontally compressed if <math> b  &gt; 1</math> and is horizontally expanded if <math> b  &lt; 1</math>.</li> <li>The period of the graph is <math>T = \frac{2\pi}{ b }</math>.</li> </ul>
<p><b>B Key Points</b></p> <p>Use the five key points presented in the following diagrams to graph the sine and the cosine functions using transformations:</p> 	
<p><b>Ex 1. Use transformations to graph the function <math>y = -2 \sin(\pi/4 - x) + 3</math> on the grid provided below.</b></p> <p><math>y = -2 \sin\left[-\left(x - \frac{\pi}{4}\right)\right] + 3 = 2 \sin\left(x - \frac{\pi}{4}\right) + 3</math></p> <p><math>\sin(-\theta) = -\sin\theta</math></p> 	

Ex 2. Use transformations to graph the function  $y = \cos(2x + \pi/3) - 2$  on the grid provided below.

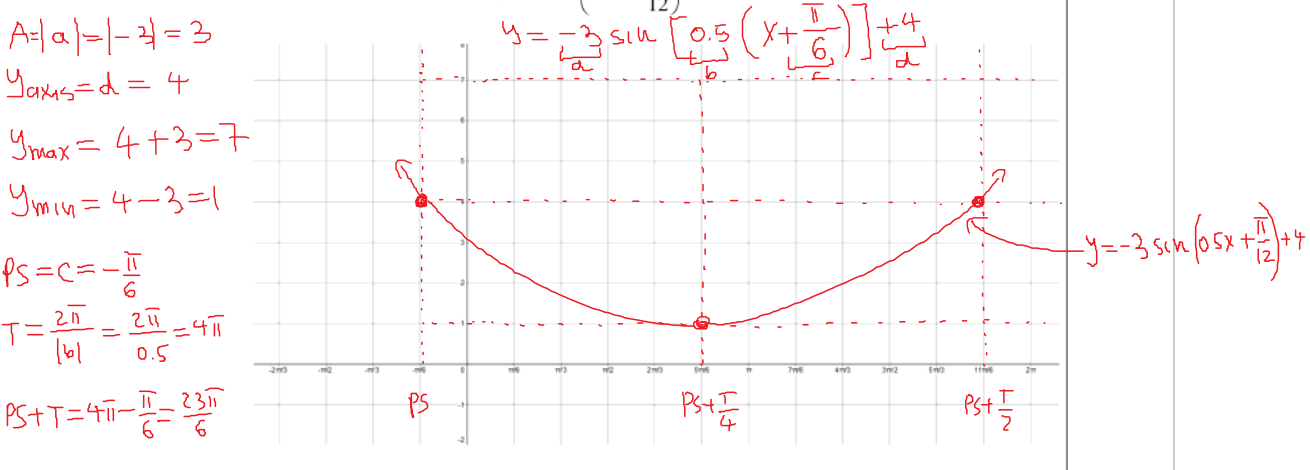


**C Shortcut to the graphs of**

- $y = a \sin[b(x-c)] + d$  or  $y = a \cos[b(x-c)] + d$
- The maximum value is  $y_{\max} = d + |a|$  ①
  - The minimum value is  $y_{\min} = d - |a|$  ②
  - The amplitude is  $A = \frac{y_{\max} - y_{\min}}{2} = |a|$  ③

- The equation of the axis is  $y = \frac{y_{\max} + y_{\min}}{2} = d$  ④
  - The period is  $T = \frac{2\pi}{|b|}$  ⑤
  - The phase shift is  $PS = c$  ⑥
- PS = Phase Shift

Ex 3. Use the shortcut method to graph the function  $y = -3 \sin\left(0.5x + \frac{\pi}{12}\right) + 4$  on the grid provided below.



Reading: Nelson Textbook, Pages 337-343

Homework: Nelson Textbook, Page 344: #4, 6, 8, 9, 11, 14, 16

$PS + \frac{T}{2} = 2\pi - \frac{\pi}{6} = \frac{11\pi}{6}$   
 $PS + \frac{T}{4} = \pi - \frac{\pi}{6} = \frac{5\pi}{6}$

