

13-7: Translating Sine and Cosine Functions

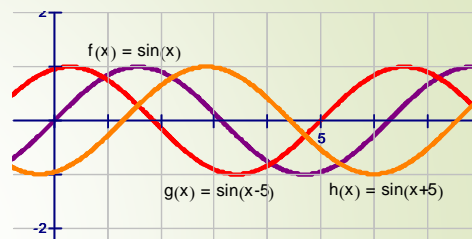
CP Algebra 2

Mr. Gallo

Translations

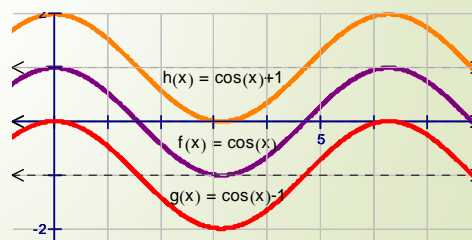
► Horizontal Translations

► Called **phase shifts**



► Vertical Translations

► Shifts the **midline** up and down



Stretches, Compressions and Reflections

Stretches

➤ $0 < b < 1$

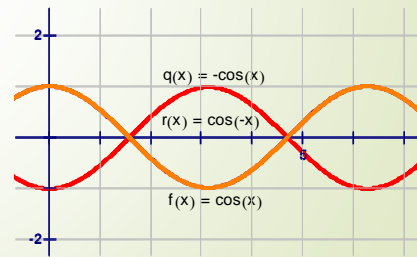
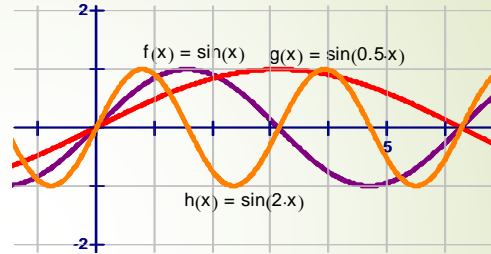
Compressions

➤ $1 < b$

Reflections

➤ $-a$ reflects over the x -axis

➤ $-b$ reflects over the y -axis



Families of Sine and Cosine Functions

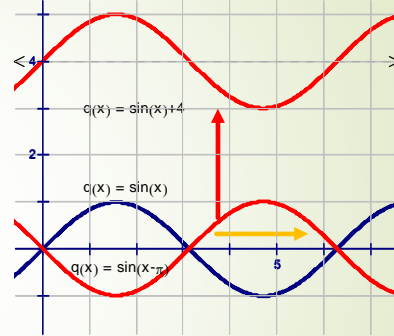
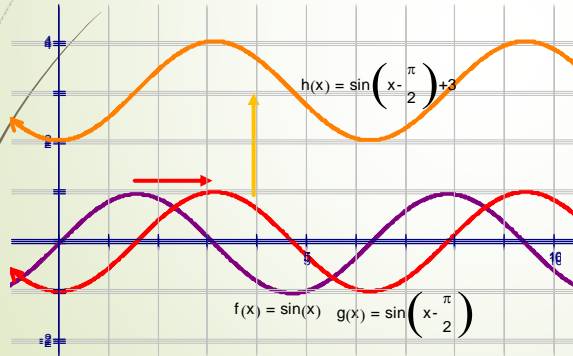
Parent Function	Transformed Function
$y = \sin x$	$y = a \sin b(x - h) + k$
$y = \cos x$	$y = a \cos b(x - h) + k$

- $|a|$ = amplitude (vertical stretch or shrink)
- $\frac{2\pi}{b}$ = period (when x is in radians and $b > 0$)
- h = phase shift, or horizontal shift
- k = vertical shift ($y = k$ is the midline)

Use the graph of the parent function $y = \sin(x)$. What is the graph of each translation in the interval $0 \leq x \leq 2\pi$?

a. $y = \sin x + 4$

b. $y = \sin(x - \pi)$

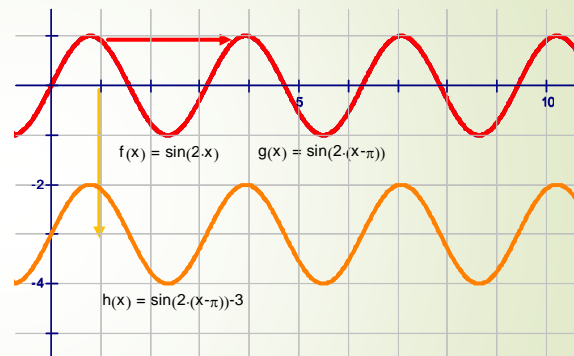


c. $y = \sin\left(x - \frac{\pi}{2}\right) + 3$

Use the graph of the parent function $y = \sin(2x)$. What is the graph of each translation in the interval $0 \leq x \leq 2\pi$?

d. $y = \sin 2(x - \pi) - 3$

1. Begin with a graph of $y = \sin(2x)$.
2. Translate the graph of $y = \sin(2x)$ to the right π units.
3. Then translate the graph down 3 units.



The table gives the average temperature in Los Angeles, California x months after the start of the calendar year ($0 \leq x \leq 12$). What cosine function models the temperature as a function of x ?

Month	Temp (°F)
1	57
2	58
3	59
4	62
5	64
6	67
7	72
8	73
9	72
10	67
11	64
12	59

Amplitude: $\frac{1}{2}(\max - \min) = \frac{1}{2}(73 - 57) = 8$

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

$12 = \frac{2\pi}{b}$

$\frac{\pi}{6} = b$

Phase Shift:

Max value for $y = \cos(x)$ is (0,1)

Max value for this data set is (8,73)

$h = 8 - 0 = 8$, which is the phase shift

Vertical Translation:

Midline for $y = \cos(x)$ is 0.

Midline for this data set is $\frac{73+57}{2} = 65$.

$k = 65 - 0 = 65$, which is the vertical translation of the midline.

$$y = a \cos b(x - h) + k$$

$$y = 8 \cos \frac{\pi}{6}(x - 8) + 65$$

Homework: p.880 #6-40 even