Before we begin, are there any questions from last day's work? 4.3.3

Today's Learning Goal(s):

By the end of the class, I will be able to:

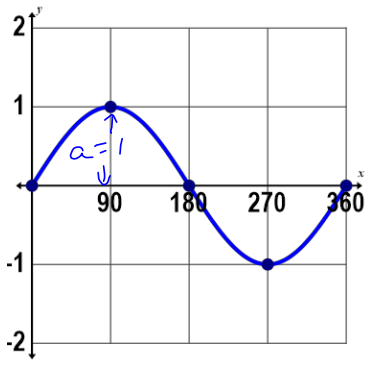
a) state the key properties of the sine and cosine functions.
b) perform horizontal and vertical translations to the sine and cosine functions.

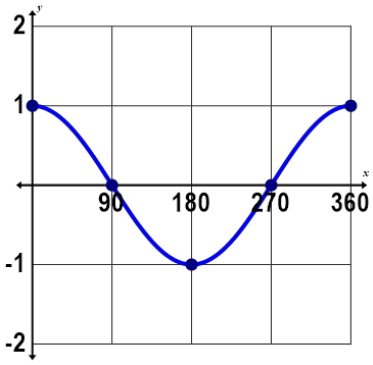
4.4.1 The Sine and Cosine Functions: Key Properties

Last day we created the graphs of:

Date: Oct. 30/18

a) $y = \sin x$ and b) $y = \cos x$





Key Properties

Domain: $\{x \in \mathbb{R}\}$

Maximum Value: 1

Minimum Value: -1

Range: $\{y \in \mathbb{R} \mid -1 \leq y \leq 1\}$

Intercepts: $0°, 180°, 360°$

Amplitude: 1 (always positive)

Period: $360°$

Increasing Interval: $0° \leq x \leq 90°,\ 270° \leq x \leq 360°$

Decreasing Interval: $90° \leq x \leq 270°$

Key Properties

Domain: $\{x \in \mathbb{R}\}$

Maximum Value: 1

Minimum Value: -1

Range: $\{y \in \mathbb{R} \mid -1 \leq y \leq 1\}$

Intercepts: $90°, 270°$

Amplitude: 1

Period: $360°$

Increasing Interval: $180° \leq x \leq 360°$

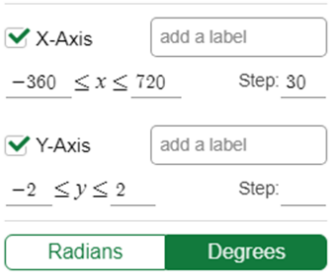
Decreasing Interval: $0° \leq x \leq 180°$

4.4.2 Investigating Horizontal and Vertical Translations

Using desmos, change your window settings to:

(Be certain to change to Degrees)

(You don't need to type the degree symbol in Desmos.)

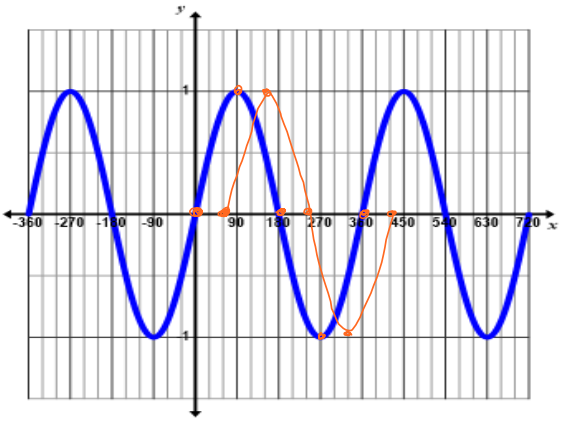


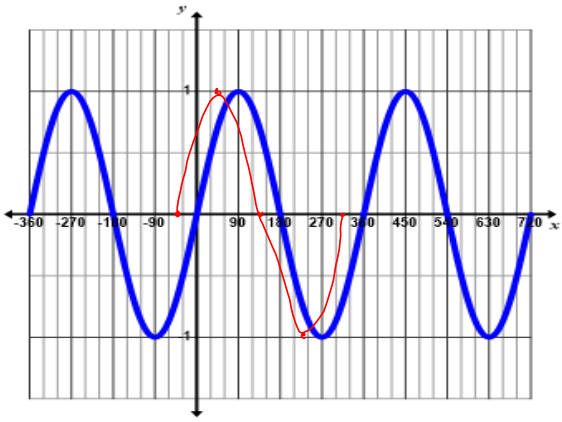
A. Comparing $y = \sin(x - d)$ to $y = \sin x$

1. Enter $y = \sin x$, then:
   a) Enter $y = \sin(x - 60°)$. Describe the transformation relative to $y = \sin x$.

translated 60^o to the right

   b) Sketch $y = \sin(x - 60°)$ on the grid on the top left of the next page.





   c) Turn off $y = \sin(x - 60°)$. Enter $y = \sin(x + 45°)$, then sketch it on the grid (above right). Describe this transformation relative to $y = \sin x$.

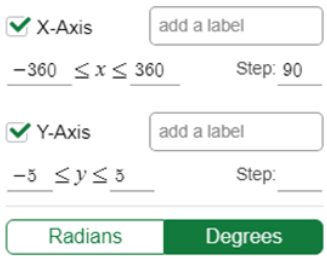
translated 45^o to the left

   d) Experiment with different values of d.
   Try $y = \sin(x - 25°)$, $y = \sin(x + 70°)$, etc.

If time permits, repeat the above, but replace all sin with cos. All else is the sa

B. Comparing $y = \sin x + c$ to $y = \sin x$

Modify the WINDOW settings:

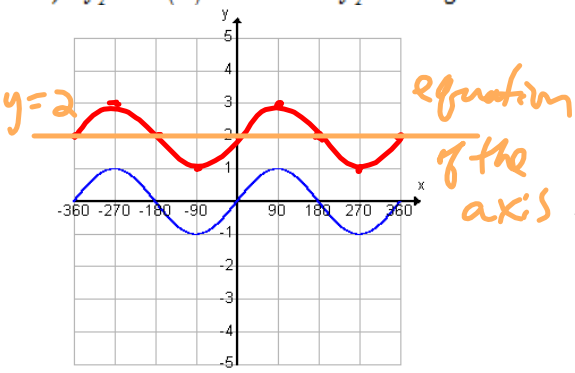


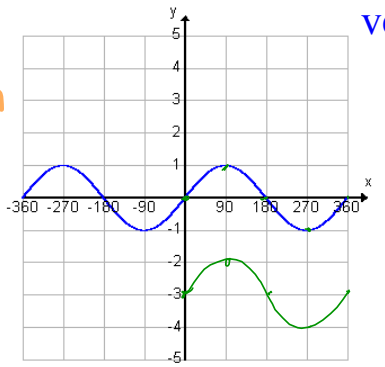
v.t. up 2 units

1. On the calculator, enter $y_1 = \sin x$, then :

a) $y_2 = \sin(x) + 2$. Sketch y_2 on the grid below. Describe the transformation relative to $y = \sin x$.

vertical translation up 2





b) Turn off y_2. Enter $y_3 = \sin(x) - 3$, then sketch it on the grid (above right).
Describe this transformation relative to $y = \sin x$.

vertical translation down 3

c) Experiment with different values of c.
Try $y = \sin(x) - 1$, $y = \sin(x) + 2.5$, etc.

If time permits, repeat the above, but replace all sin with cos. All else is the same

Summary

The graph of the function $y = \sin(x - d) + c$ is congruent to the graph of $y = \sin x$.
The differences are only in the placement of the graph.
Move the graph of $y = \sin x$:

$d°$ to the left when $d < 0$. [←] $d°$ to the right when $d > 0$. [→]

ex $d = -30°$

$x - (-30°) = (x + 30°)$

c units up when $c > 0$. [↑]

c units down when $c < 0$. [↓]

A vertical translation affects the range of the function,
but has no effect on the period, amplitude, or domain.
A horizontal translation slides a graph to the left or right,
but has no effect on the period, amplitude, domain, or range.