

### Nspire Activity: Switching Things Around



In this activity, you will use graphs of the sine and cosine functions to construct graphs of and define the inverse trig functions  $y = \sin^{-1}(x)$  and  $y = \cos^{-1}(x)$ .

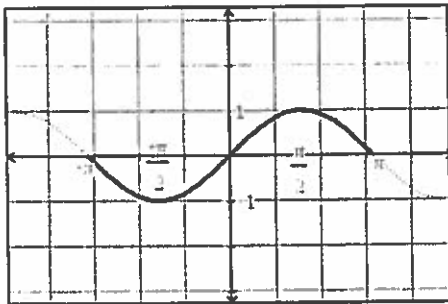
#### Part 1: Defining the Inverse Sine Function

1. Move to page 2.2 of the Nspire document and examine the graph of one period of the sine function,  $y = \sin x$ . State the domain and range for the period below the graph in step #3.
2. There is a point plotted on the sine function. There is also a point on the grid corresponding to a point on the inverse sine graph. List the coordinates for these points on the two graphs below and explain the relationship between the coordinate pairs.

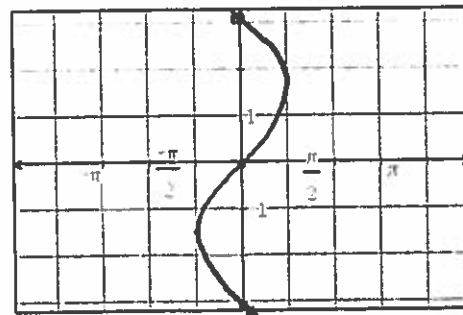
Point on  $y = \sin x$ :  $(-\pi, 0)$       Point on inverse sine graph:  $(0, -\pi)$   
 Relationship: The x- and y- coordinates are switched (inverses)

3. You will observe an animation where the point on the function  $y = \sin x$  is traced while corresponding points on the inverse sine graph are plotted. Press play to observe the animation. Then, sketch the inverse sine graph below and state its domain and range. Answer the question that follows.

Sine Function



Inverse Sine Graph



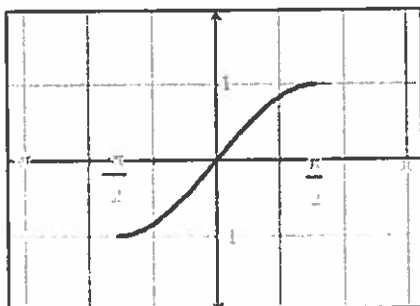
Domain:  $[-\pi, \pi]$       Range:  $[-1, 1]$       Domain:  $[-1, 1]$       Range:  $[-\pi, \pi]$

*Looking at the sketch of the inverse sine graph, can you explain the 'issue' with the graph?*

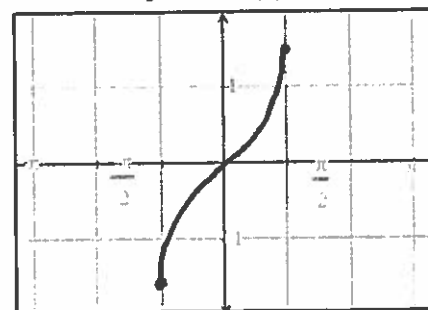
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4. Move to page 3.2. You will see a 'restricted' version of  $y = \sin x$ . Sketch its graph and list its domain and range. Press play to observe the animation of the inverse graph for this restricted version of  $y = \sin x$ . Then, sketch the graph of  $y = \sin^{-1}(x)$  and list the domain and 'restricted' range for  $y = \sin^{-1}(x)$ .

$y = \sin x$



$y = \sin^{-1}(x)$



Domain:  $[-\pi/2, \pi/2]$       Range:  $[-1, 1]$       Domain:  $[-1, 1]$       Range:  $[-\pi/2, \pi/2]$

**Part 2: Defining the Inverse Cosine Function**

5. Move to page 4.2 of the Nspire document and examine the graph of one period of the cosine function,  $y = \cos x$ . State the domain and range for the period below the graph in step #7.

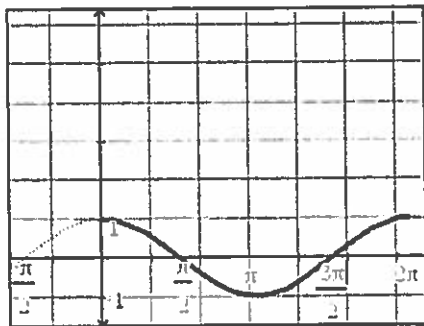
6. There is a point plotted on the cosine function. There is also a point on the grid corresponding to a point on the inverse cosine graph. List the coordinates for these points on the two graphs below and explain the relationship between the coordinate pairs.

Point on  $y = \cos x$ : (0, 1)      Point on inverse cosine graph: (1, 0)

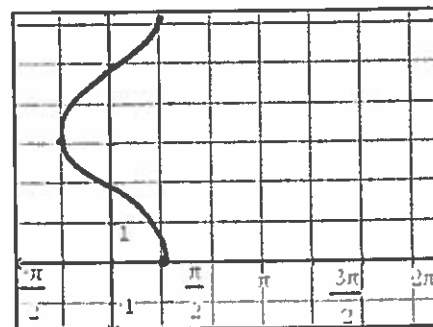
Relationship: The x- and y- coordinates are switched.

7. You will observe an animation where the point on the function  $y = \cos x$  is traced while corresponding points on the inverse cosine graph are plotted. Press play to observe the animation. Then, sketch the inverse cosine graph below and state its domain and range. Answer the question that follows.

**Cosine Function**



**Inverse Cosine Graph**

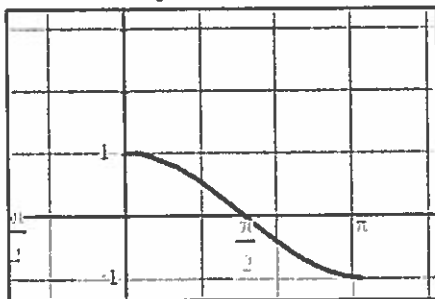


Domain: [0, 2π]      Range: [-1, 1]

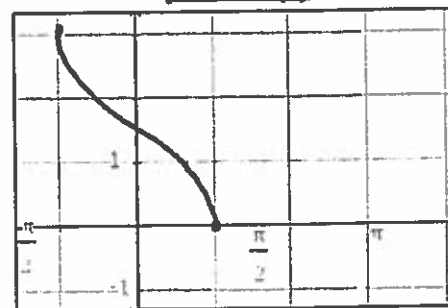
Domain: [-1, 1]      Range: [0, 2π]

8. Move to page 5.2. You will see a 'restricted' version of  $y = \cos x$ . Sketch its graph and list its domain and range. Press play to observe the animation of the inverse graph for this restricted version of  $y = \cos x$ . Then, sketch the graph of  $y = \cos^{-1}(x)$  and list the domain and 'restricted' range for  $y = \cos^{-1}(x)$ . Answer the question that follows.

**$y = \cos x$**



**$y = \cos^{-1}(x)$**



Domain: [0, π]      Range: [-1, 1]

Domain: [-1, 1]      Range: [0, π]

Why is the restriction for  $y = \cos^{-1}(x)$  different than for  $y = \sin^{-1}x$ ? Explain.

The range of values needed to 'cover' all cosine values from [-1, 1] is [0, π].