

### Why use this resource?

This resource explores inverses of trigonometric functions and could be used to introduce them. Students do not need to have met the concept of principal values already and in fact this concept will arise naturally from trying to answer the questions posed.

The problem could be considered in one activity, or could be explored in sections.

### Preparation

The associated resource [Inverse trigonometric functions](#) can be used as pre-reading for this resource. It could be given as a self-study task either on paper or as a link to the web page.

You might want to print [cards](#) for the second matching activity.

### Possible approach

Display graphs A, B and C (or distribute the printed sheets) and ask students to think-pair-share about what they observe in the graphs before moving on to answer the first question in the resource.

The “More graphs” toggle (and second page of the printable) can follow immediately or be used later with students working in pairs or small groups. The final questions can be used to prompt thinking about the nature of inverse functions and the significance of domain.

### Key questions

These questions relate to the first part of the task and more general thinking about principal value ranges.

- What are the similarities and differences in the three graphs?
- What issues may arise when considering the output from one function as the input for another?
- How can we resolve such issues?
- If we need to restrict the domain for trigonometric functions, should we always use the same interval?
- Would different restrictions yield the same results? What issues might arise?

## Possible support

As a warm-up, students could be asked to draw the graphs of  $y = \tan x$  and  $y = \arctan x$  and give domains and ranges as a mini-whiteboard “show me” or paired task.

Working with calculators and specific values may help students to get started, but they should be encouraged to explain how these specific values have been used to decide which graphs show the given functions.

## Possible extension

Students could try to find a function (or restricted domain) which might yield graphs G and H (these could be checked with [Desmos](#) or graphing calculators).

- What graph would you get for  $y = \arccos(\sin x)$  or  $y = \cos(\arcsin x)$ ?
- What about  $y = \tan(\arccos x)$  or  $y = \arctan(\cos x)$ ?