Please Note

These pdf slides are configured for viewing on a computer screen.

Viewing them on hand-held devices may be difficult as they require a "slideshow" mode.

Do not try to print them out as there are many more pages than the number of slides listed at the bottom right of each screen.

Apologies for any inconvenience.

Introduction to Functions

Numeracy Workshop

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STUDY Smarter
Learning, Language and Research Skills

Introduction

Here we introduce and gain confidence with **functions** and their graphs.
Drop-in Study Sessions: Monday, Wednesday, Thursday, 10am-12pm, Meeting Room 2204, Second Floor, Social Sciences South Building, **every week.**

Website: Slides, notes, worksheets.

http://www.studysmarter.uwa.edu.au → Numeracy → Online Resources

Email: *geoff.coates@uwa.edu.au*

Workshops that follow this one

Week 6: Tuesday 9/4 (12-12.45pm): Domain and range

Week 7: Tuesday 16/4 (12-12.45pm): Functions and transformations

Functions

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Set A $\longrightarrow$	Set B
1	5
2	7
3	9
4	

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We can assign, or *map*, elements of A to elements of B using arrows as follows:

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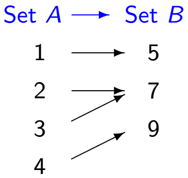

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This is just one example of a function between A and B.

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  (However, you can send two different numbers to the same number.)

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Is this a function?

$$\begin{tikzcd}[row sep=small]
1 \arrow[dr] & \\
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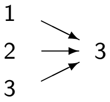

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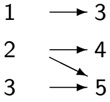

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$$
\begin{tikzcd}[row sep=small]
1 \arrow[r] & 3 \\
2 \arrow[r, red] \arrow[dr, red] & \color{red}{4} \\
3 \arrow[r] & \color{red}{5}
\end{tikzcd}
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No, because 2 gets sent to both 4 and 5.

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The notation is standard:

$$\boxed{f(\text{input}) = \text{output}}$$

Note: We are used to "$f(x)$" standing for "$f \times x$" where f and x are variables. If we really wanted to say this, we would write "fx".

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We use equations instead.

Functions

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Here, x is the input, and $2x^2$ is the output.

This allows us to specify the **image** (output) of any real number (input).

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(Or $3 \to 18$.)

Clearly, this rule does not send any number to two outputs.

Graphing functions

It is often useful to represent function rules graphically on the **Cartesian Plane** (or (x, y) co-ordinate system).

If you are already familiar with drawing the graphs of functions such as $f(x) = x^2$, click here to skip this section.

The Cartesian Plane

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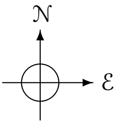

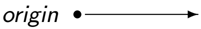

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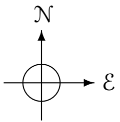
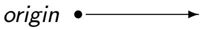
Example: Start at the origin. Then, walk three metres East and five metres North.





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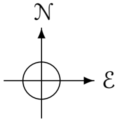

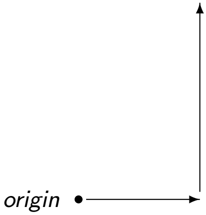

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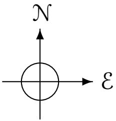

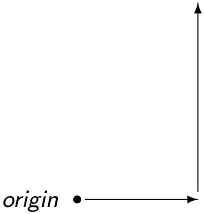

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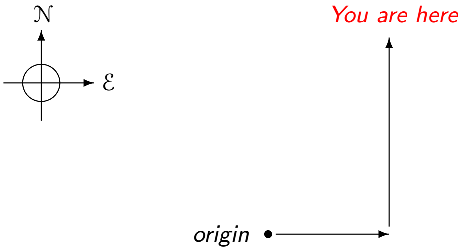

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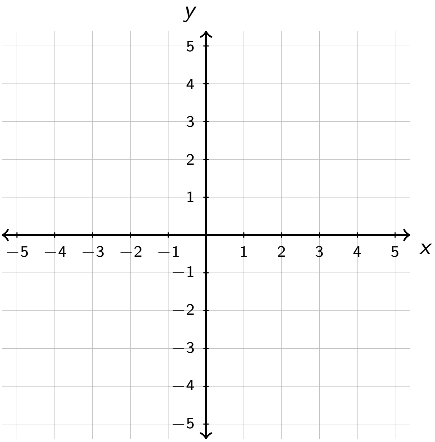
The most commonly used two-dimensional coordinate system is the Cartesian plane.



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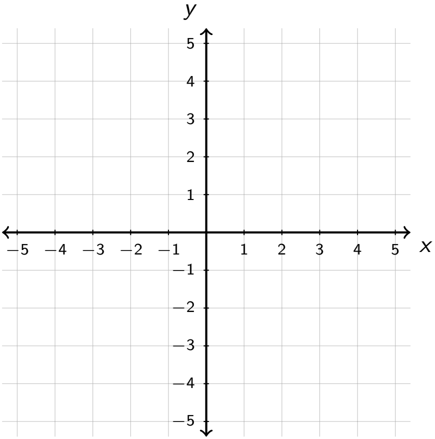
We specify points in the Cartesian plane as an ordered pair (x, y).



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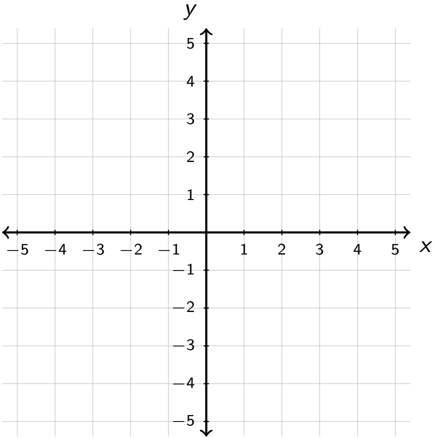
Examples: A: $(3, 2)$



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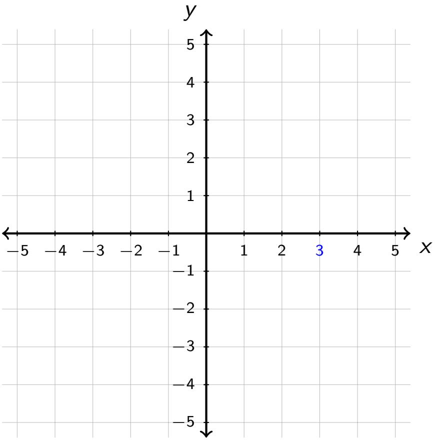

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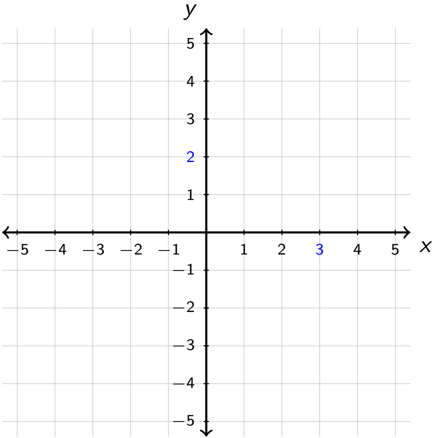

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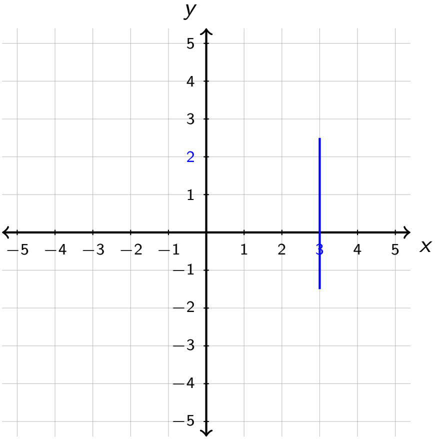

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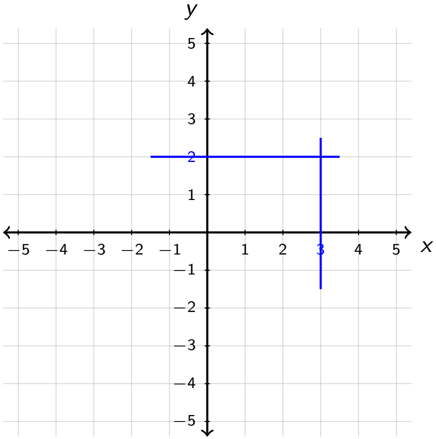

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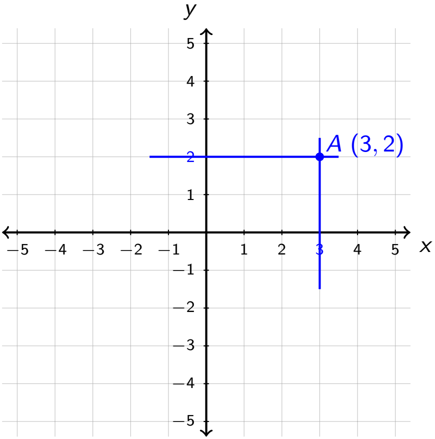

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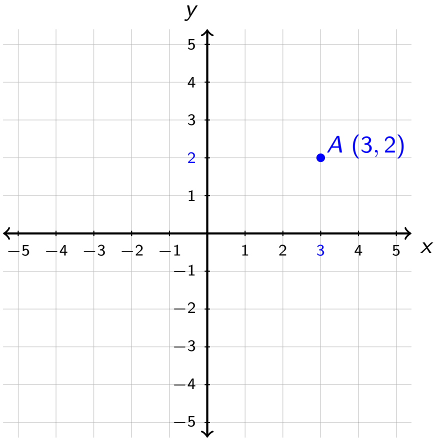
Examples: A: $(3, 2)$ B: $(-1, 4)$



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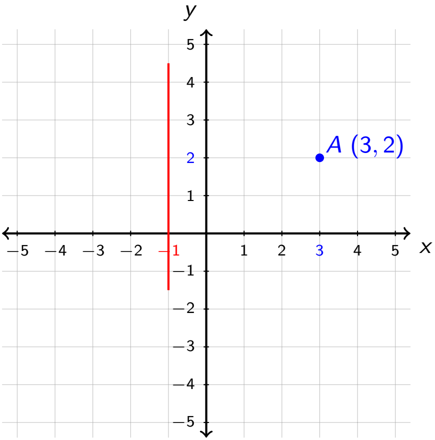

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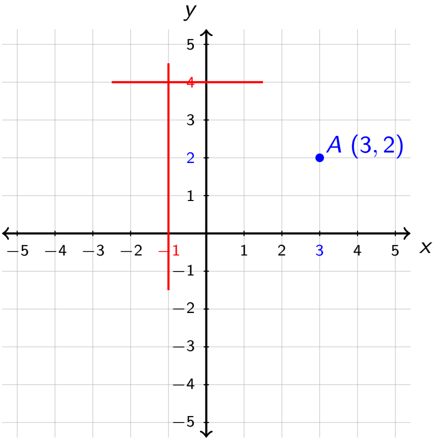

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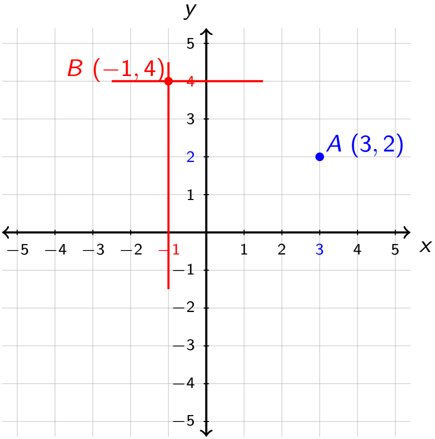

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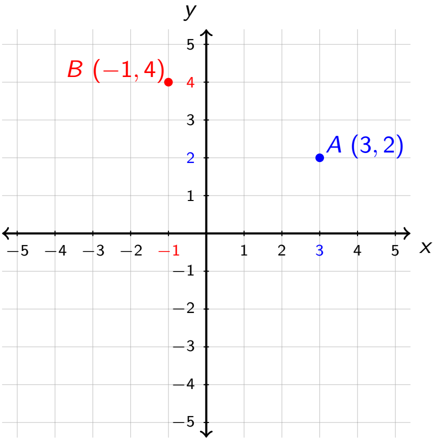

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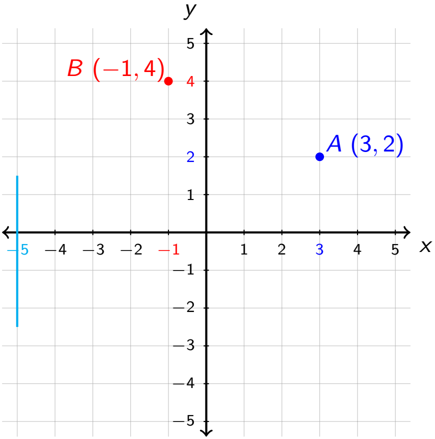

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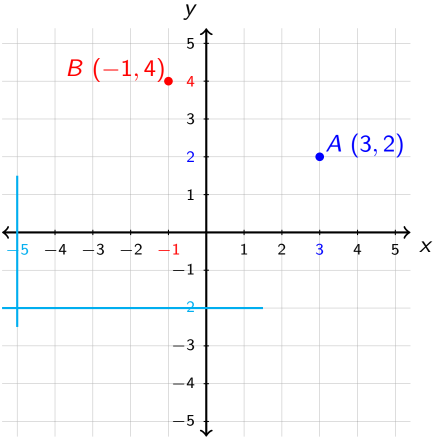

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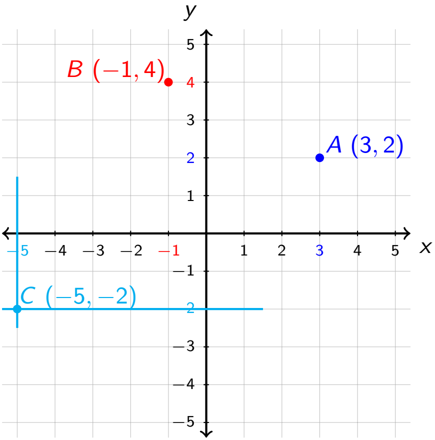

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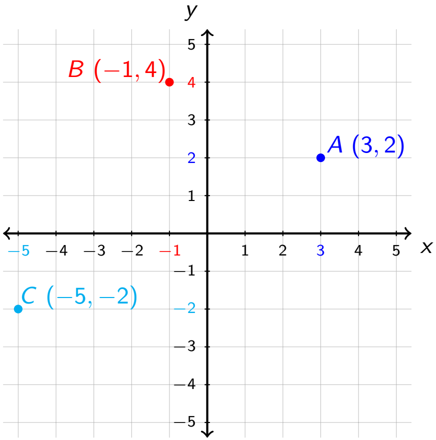

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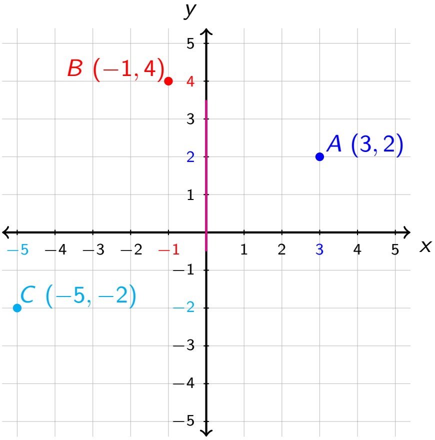

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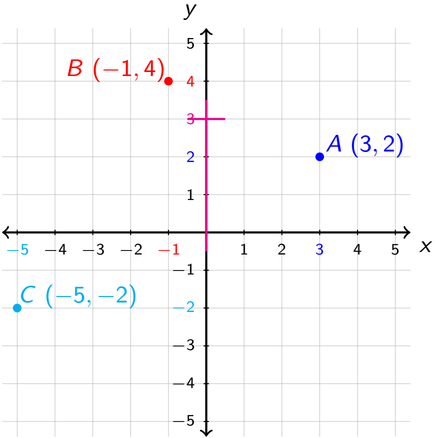

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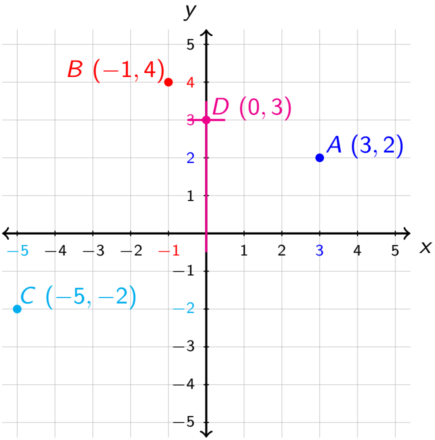

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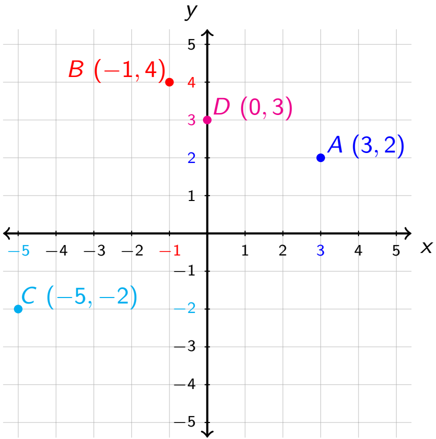

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Example: Consider the equation

$$y = x^2$$

This says that whatever number x is, y is always the square of this number.

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An equation which involves two variables is a mathematical way to express the relationship that exists between them.

Example: Consider the equation

$$y = x^2$$

This says that whatever number x is, y is always the square of this number.

So, y and x are related to each other in some way.

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By feeding values through our relationship, we obtain coordinates which we can display in the Cartesian plane!

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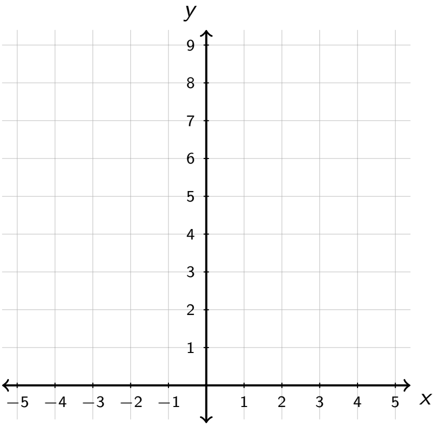
Graph the coordinates: $(0,0),(1,1),(2,4),(3,9)$



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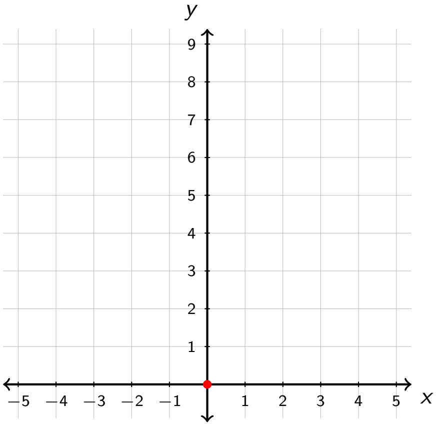

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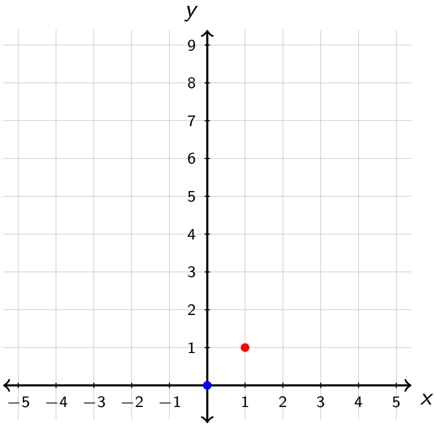

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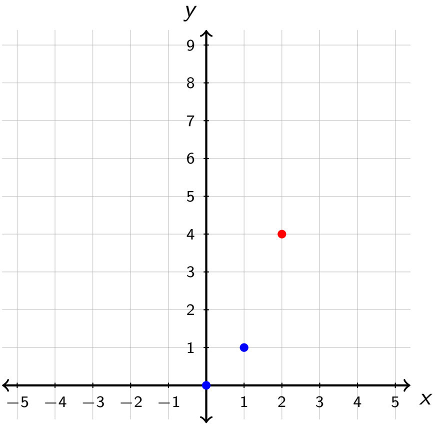

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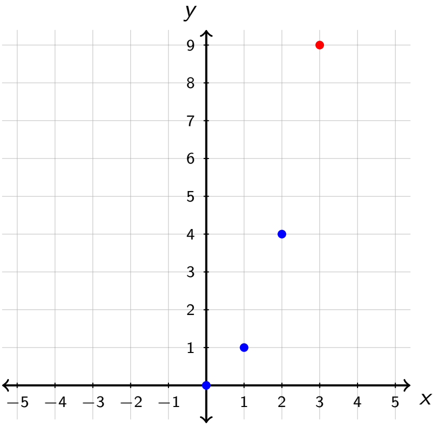

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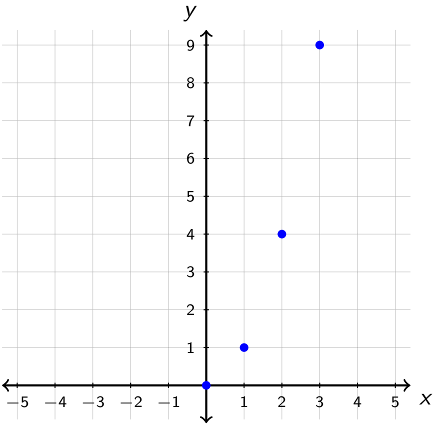

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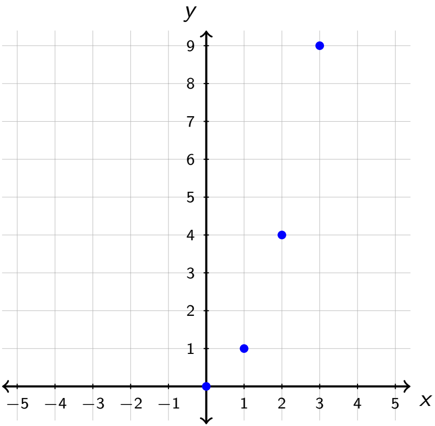

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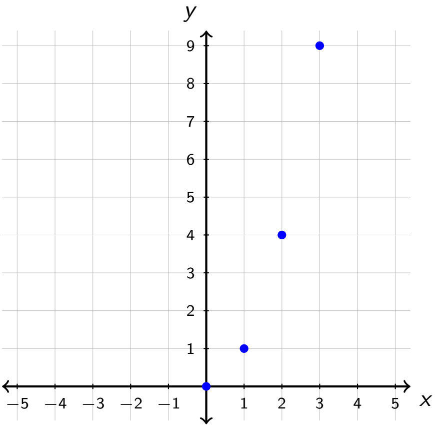

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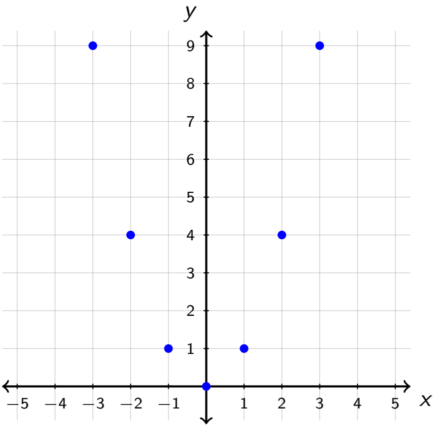

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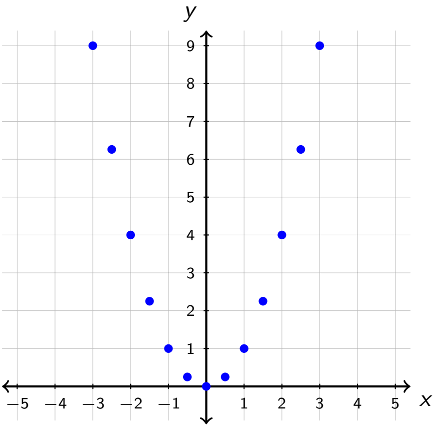

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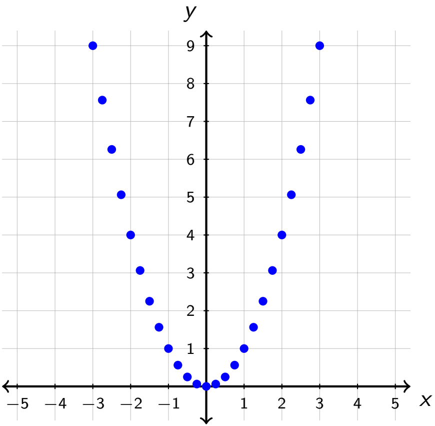

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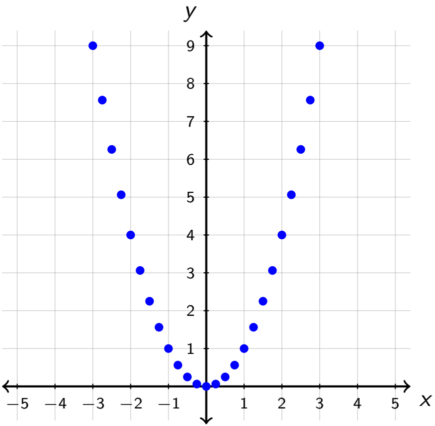

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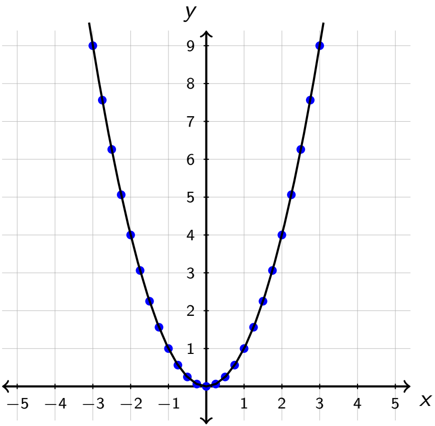

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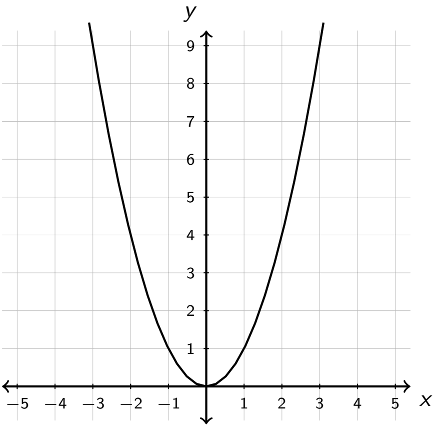

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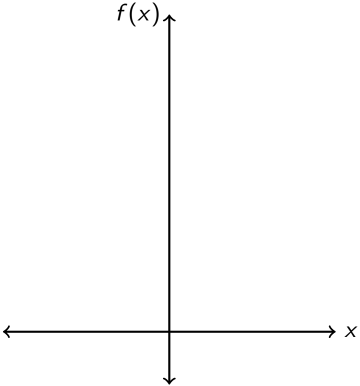
Visually, functions pass the "vertical line test". Vertical lines strike the graph **once** or not at all.



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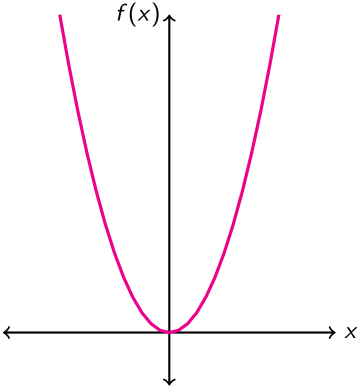

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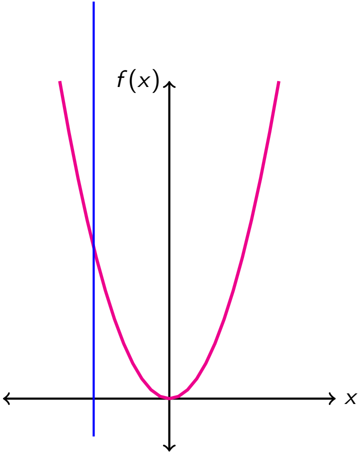

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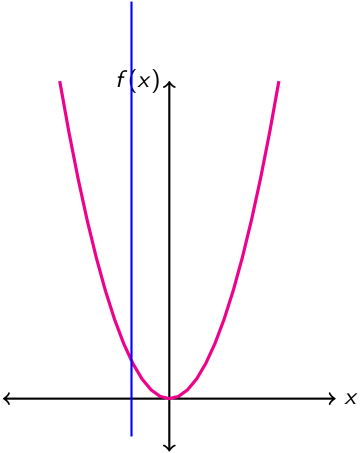

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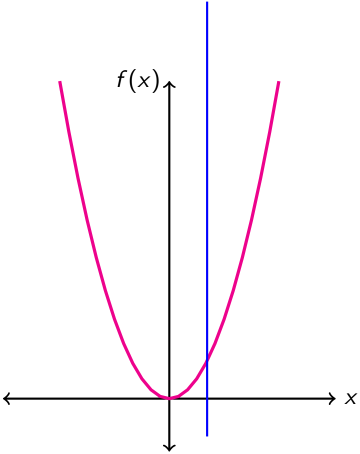

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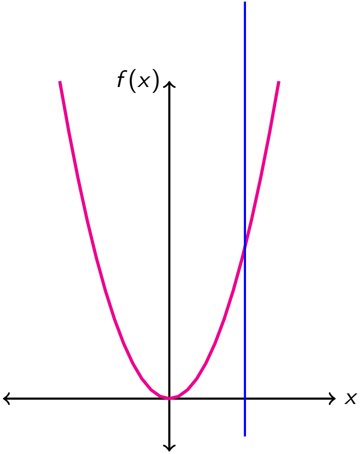

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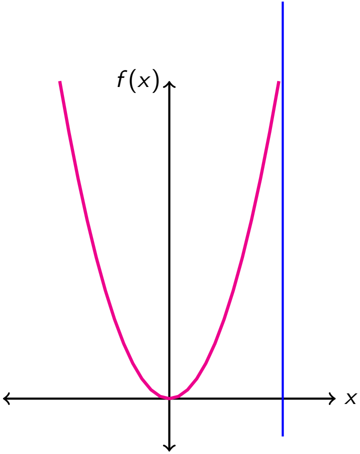

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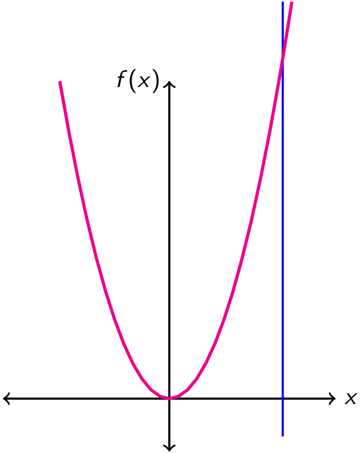

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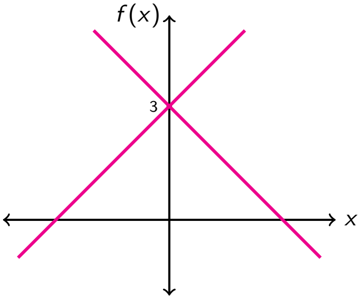

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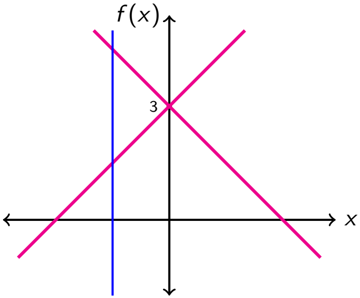

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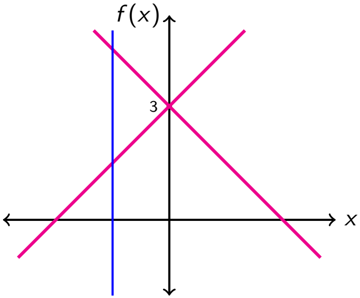

Does not pass the vertical line test.

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The y notation is friendlier to rearrange.

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This is the equation of a straight line - which will clearly pass the vertical line test.

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No, because if we re-arrange it, we get $y = \pm\sqrt{9 - x^2}$. One value of x gives two values of y!

For example, if $x = 0$, $y = \pm 3$ (which should be obvious from the original equation).

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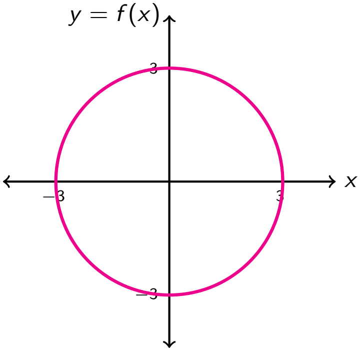

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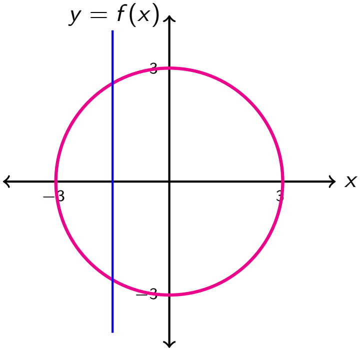

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Using STUDYSmarter Resources