

Moving Functions Around Cartesian Coordinates

Cartesian coordinates is a space defined by ordered pairs of numbers (a, b) . The x-axis is assigned the independent variable – often time.

the y-axis is the dependent variable.

Cartesian coordinates were invented by Descartes to help his student Queen Christina of Denmark to visualise algebra.

Transformations

Suppose we plot $f(x)$

$$= (x - 4)^2 + 5.$$

We observe a quadratic curve with a minimum at coordinate $(4, 5)$.

But why does the asymmetry between 4 and 5 occur in the original expression? Why does +5 dutifully move the curve up

but we need to insert -4 to move the curve to the right?

Consider the transformations necessary to move the coordinate system 5 units down and 4 units to the left.

To move the x coordinate down we adjust the **y value** because we're changing where x intersects the y-axis.

$$y \Rightarrow y - 5 \text{ moves x-axis down}$$

However to move the y coordinate right we adjust the x value because we're changing where y intersects the x-axis.
 $x \Rightarrow x - 4$ moves y-axis to the left

Insert these transformations into $y = x^2 \Rightarrow y - 5 = (x - 4)^2$ which rearranged gives $y = (x - 4)^2 + 5$ which is the required result.

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