Linear Functions and Graphs

Topical Enduring Understanding
Class:
  • Algebra represents relationships that can be modelled mathematically.
• Relationships can be represented with lines in 2-dimensional planes
• A function is a relationship between an independent variable (input) and a dependent variable (output)
• A linear relationship can be expressed in the form of $y = mx + c$
• The gradient of a linear graph is the ratio of the vertical change to the horizontal change

Topical Essential Questions
• Do we always need to know the exact numerical values of quantities?
• How would knowledge of ratios and rates help us facilitate testing and prediction?
• What are the key features of a linear graph?
• How can a linear graph be used in real life?

A Cartesian coordinate system is one that specifies each point uniquely in a plane by a pair of numerical coordinates (ordered pair). The invention of Cartesian coordinates in the 17th century by René Descartes (Latinised name: Cartesius) (1596-1630) revolutionised mathematics by providing the first systematic link between Euclidean geometry and algebra. Using the Cartesian coordinate system, geometric shapes (such as curves) can be described by Cartesian equations: algebraic equations involving the coordinates of the points lying on the shape. For example, a circle of radius 2 may be described as the set of all points whose coordinates x and y satisfy the equation $x^2 + y^2 = 4$.

Introduction: Linear Function
A function performs one or more operations on the inputs (i.e. values it takes in) to produce outputs
(i.e. the results). The operations performed on the inputs are known as the rule of the function. Formally, function describes the relationship between two sets in which each element of the first set, called the domain of the function, is matched with exactly one element in the second set, called the range of the function.

In order to plot points in the plane, we need to draw a pair of axes, one horizontal (x–axis) and the other vertical (y–axis). These axes resemble number lines.
• The two axes divide the plane into four quadrants that are numbered in an anticlockwise direction.
• The point where both axes meet is called the origin (0, 0) and is labelled O.
• The position of any point in the Cartesian plane can be indicated in terms of its coordinates. Each point has two coordinates: the x-coordinate, the horizontal step from O, and the y-coordinate, the vertical step from O.

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The process of examining a situation and then developing a model that accurately represents that situation is called mathematical modelling. Constructing and interpreting mathematical models is one of the most important uses of mathematics in the real world.

Point to Ponder...
We only need to plot 3 points to obtain the graph of a linear function. In fact, a straight line can be determined by plotting 2 points. What is the purpose of the 3rd point?

The equation of a straight line is in the form of $y = mx + c$ where m and c are constants. What are "m" and "c"?
he equation of a straight line is in the form of
$y = mx + c$
where the constant m is the gradient of the line and the constant c is the y-intercept.
The y-intercept refers to the y-coordinate of the point of intersection of the line with the y-axis.