Topic: Linear Graphs

The Cartesian Plane

Figure 1 shows a ***Cartesian plane*** consisting of two perpendicular lines intersecting at the point ***O***.

The point ***O*** is known as the _____.

The ***horizontal axis*** is known as the ___ axis. The ***vertical axis*** is known as the ___ axis.

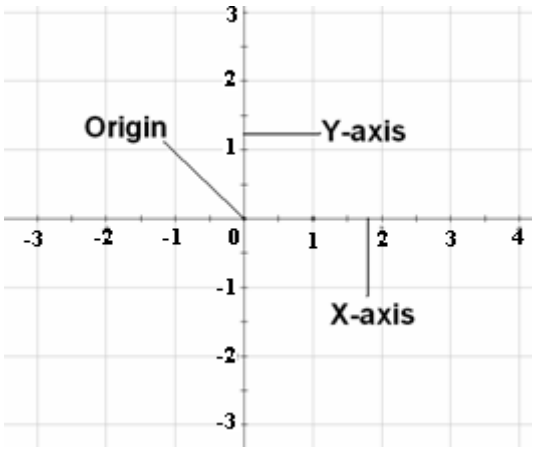


Figure 1

Coordinates of a Point

The ***position of any point*** in the plane can be determined by its distance from each axes.

In Figure 2, point ***A*** is 3 units to the right of the *y*-axis and 1 unit above the *x*-axis, its position is described by the coordinates **(3, 1).**

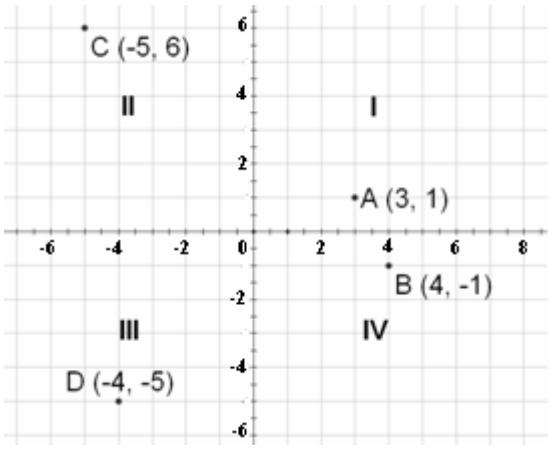


Figure 2

What ordered pair represents the origin ***O*** ? _____

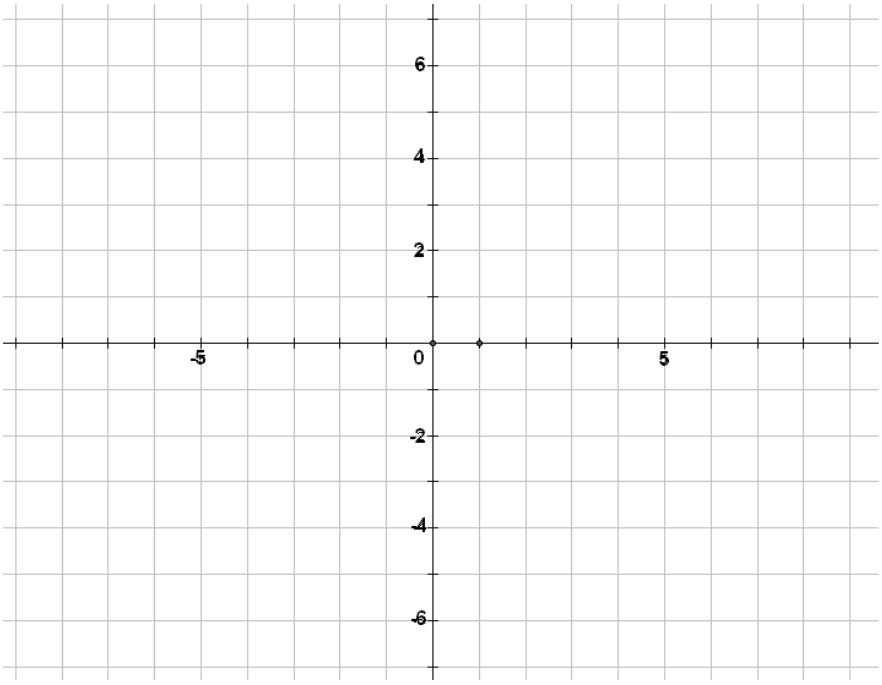
In Summary, each point *P* in the cartesian plane can be located by a coordinate in the form **(*x*, *y*)**.

We call ***x*** the ***x* - coordinate** of *P* and ***y*** the ***y* - coordinate** of *P*. In other words, we say that *P* has coordinates **(*x*, *y*)**.

Exercise 1

Plot the following points on the grid below ***in pencil***.

$(5,-1)$, $(7,\ 1)$, $(4,\ 3)$, $(6,\ 6)$, $(-6,6)$, $(-5,-1)$, $(-4,\ 3)$, $(-7,\ 1)$, $(-3,\ 5)$, $(3,\ 5)$.



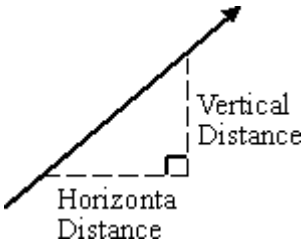
The Mathematician and the Fly

According to legend, the French Mathematician and philosopher Rene Descartes (1596-1650) did some of his best thinking in bed. He was a sickly child and so was allowed to stay in bed each morning as long as he liked. This practice he carried into adulthood, seldom getting up before noon. One morning as he watched a fly crawl about the ceiling, near the corner of his room, he was struck with the idea that the fly's position could best be described by the connecting distances from it to the two adjacent walls. These became the coordinates of his rectangular coordinate system, and were appropriately named after him (Cartesian coordinates) and not the fly.

The Concept of Gradient

The steepness of a line is called its **GRADIENT** (or *slope*).

The gradient of a line is defined as the ratio of its _____ distance to its _____distance.



In other words, $gradient = \dfrac{vertical\ \ distance}{horizontal\ \ distance}$

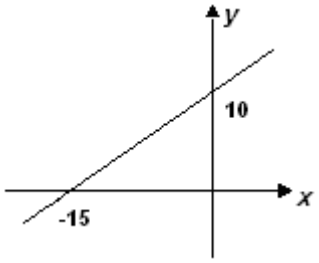
What is the gradient of a horizontal line? _____

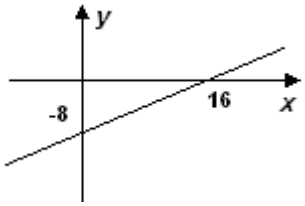
What is the gradient of a vertical line? _____

Finding the gradient of a straight line in a Cartesian Plane

(a) Positive Gradients

Lines that *climb from left to the right* are said to have *positive gradient/slope*.

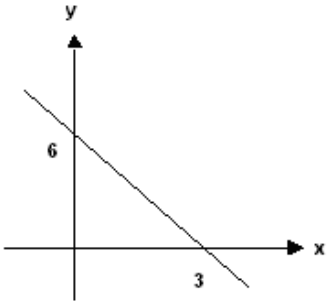


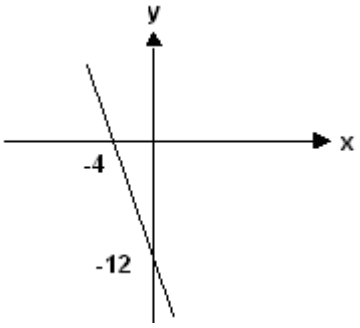


Gradient = **Gradient =**

(b) Negative Gradients

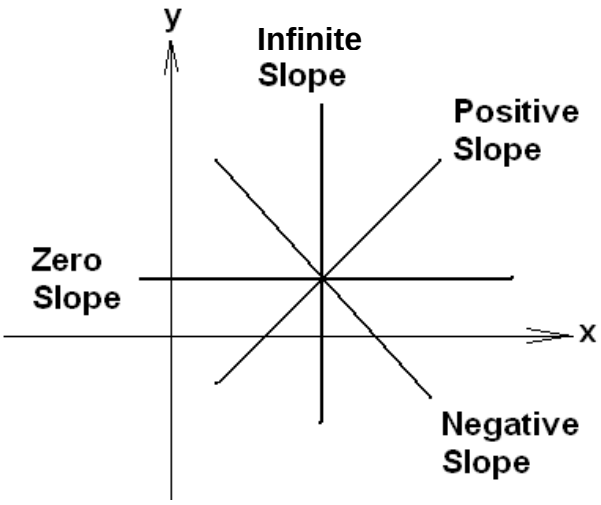
Lines that *descend from left to the right* are said to have *negative gradient/slope*.



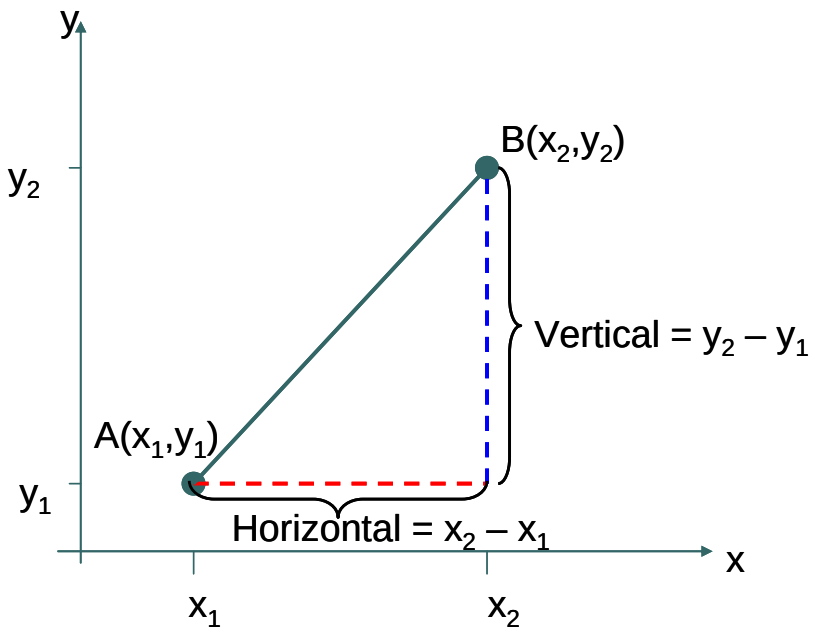


Gradient = **Gradient =**

In Summary,



Gradient Formula

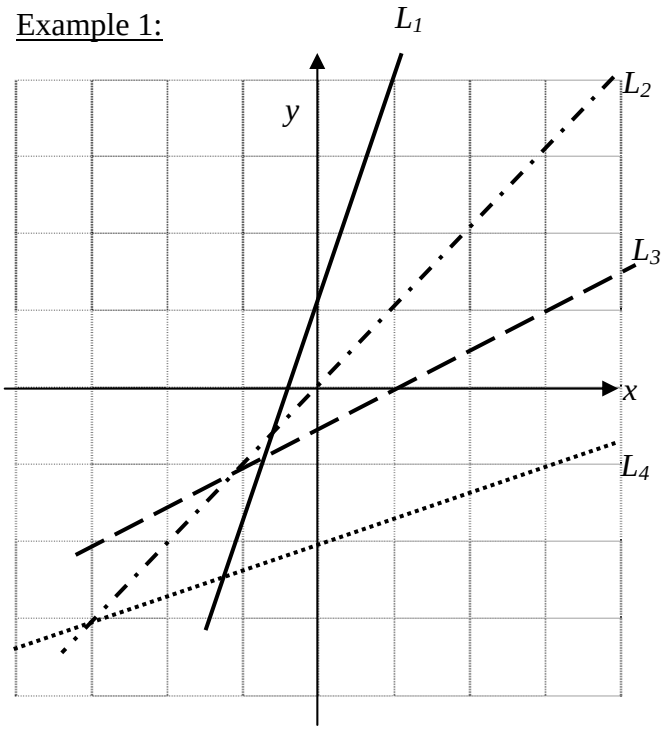


Gradient

$$= \frac{\text{vertical distance}}{\text{horizontal distance}}$$

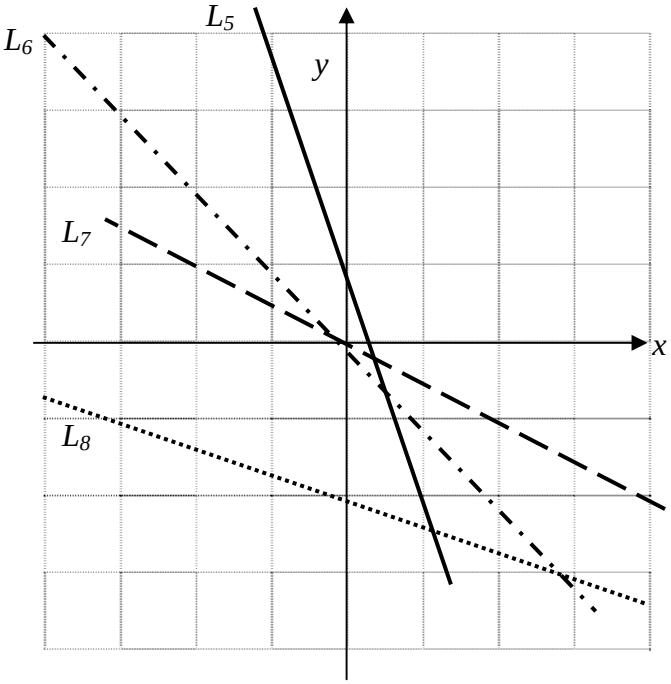
$$= \frac{y_2 - y_1}{x_2 - x_1}$$

Example 1:



L_1	$m =$
L_2	$m =$
L_3	$m =$
L_4	$m =$

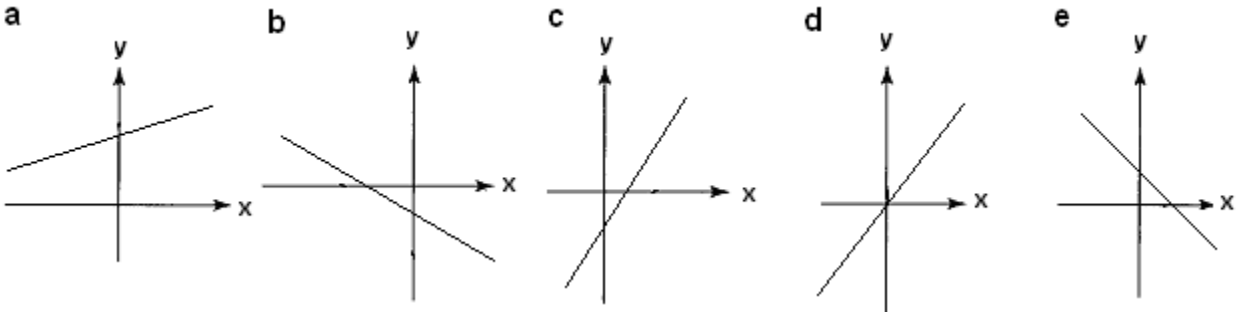
Example 2:



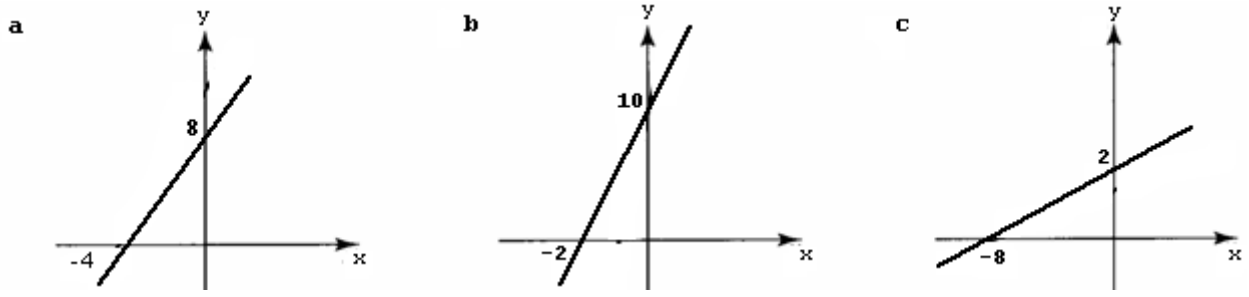
L_5	$m =$
L_6	$m =$
L_7	$m =$
L_8	$m =$

Exercise 2

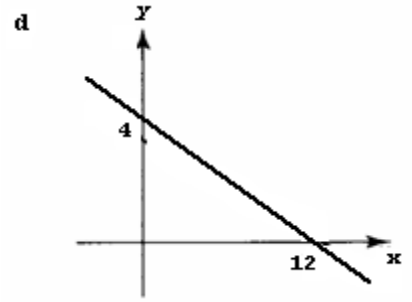
1 Arrange the following in order from smallest to largest gradient (consider the negative values as well). [The same scale has been used to draw each graph.]



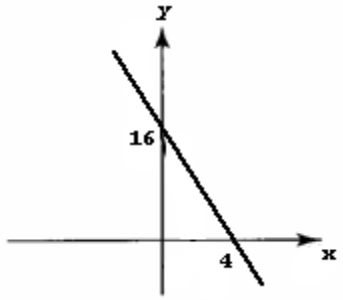
2 Calculate the gradient of each of the following linear graphs.



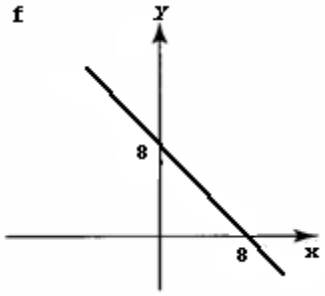
d



e

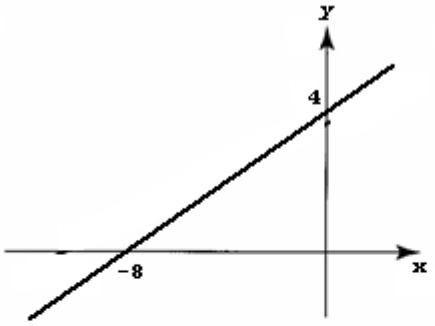


f

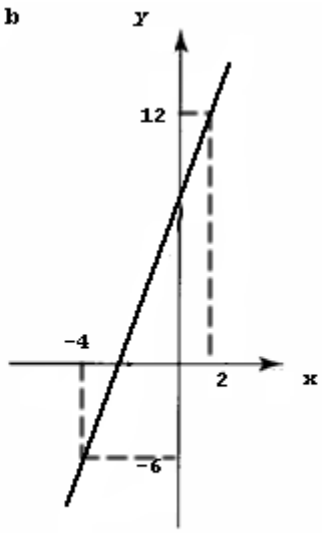


3 Find the gradients of the following lines.

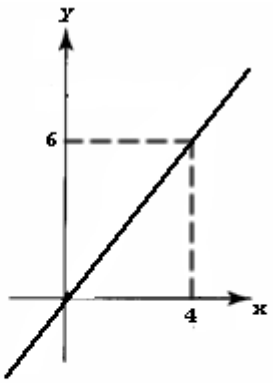
a



b



c



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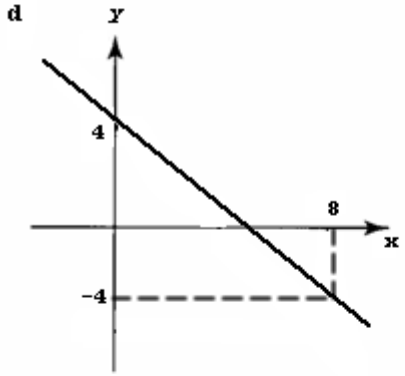
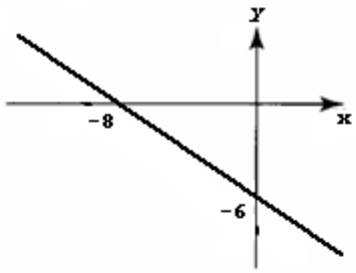


e



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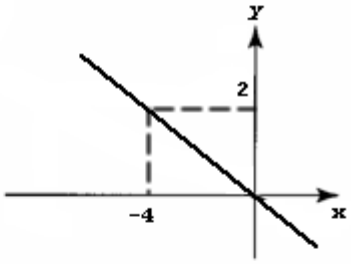
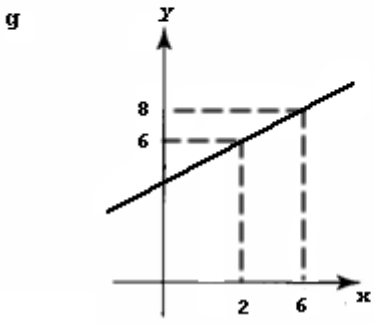
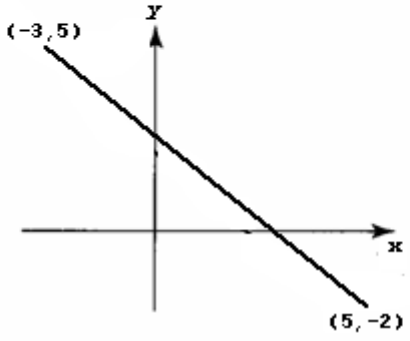


g



h



i