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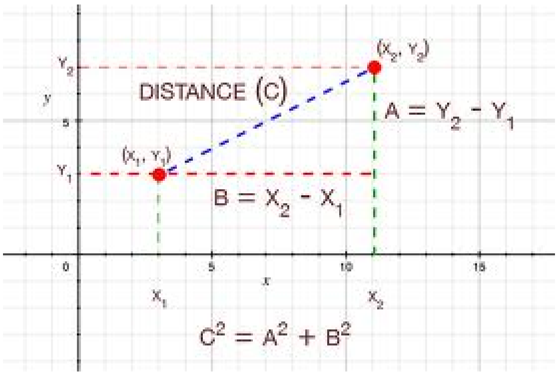
Distance between two points

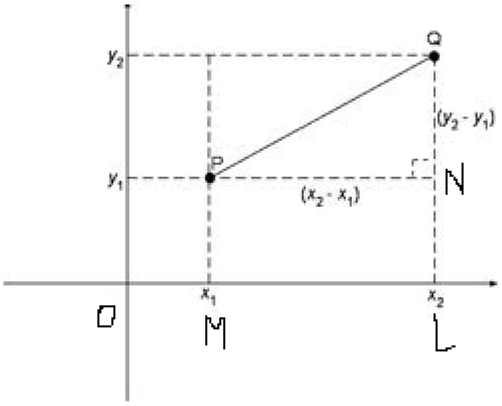
Created: Thursday, 14 July 2011 07:49 | Published: Thursday, 14 July 2011 07:49 | Written by Super User | Print



The distance between any two points in the plane is the length of the line segment joining them.

The distance between two points P(x1, y1) and Q(x2, y2) is given by
PQ = ?(x2 – x1)2 + (y2 – y1)2
PQ = ? (Difference of abscissae)2 + (Difference of ordinates)2

Let P(x1, y1) and Q(x2, y2) are two given points in the plane.



Draw PM and QL perpendicular from P and Q on x – axis. From P draw PN perpendicular to QL on x – axis. Then,

OM = x1
OL = x2
PM = y1
QL = y2
PN = ML = OL – OM = x2 – x1
QN = QL – NL = QL – PM = y2 – y¬¬1

So, ?PNQ is a right triangle right angled at N. Therefore, by Pythagoras theorem, we have
PQ2 = PN2 + QN2
PQ2 = (x2 – x1)2 + (y2 – y¬¬1)2
PQ = ?(x2 – x1)2 + (y2 – y¬¬1)2

Hence, distance between any two points is given by
? (Difference of abscissae)2 + (Difference of ordinates)2

Important Note:
- If O is the origin and P(x, y) is any point, then from the above formula, we have

OP = ?(x – 0)2 + (y – 0)2
OP = ?x2 + y2
- In order to prove that a given figure is a:

i) Square, prove that four sides are equal and the diagonals are also equal.

ii) Rhombus, prove that four sides are equal.
iii) Rectangle, prove that opposite sides are equal and the diagonals are also equal.
iv) Parallelogram, prove that opposite sides are equal.
v) Parallelogram but not a rectangle, prove that its opposite sides are equal but the diagonals are not equal.
vi) Rhombus but not a square, prove that its all sides are equal but the diagonals are not equal.
• For three points to be collinear, prove that the sum of the distances between two pairs of points is equal to the third pair of points.

Example: Find the distance between the points: P (-6, 7) and Q (-1, -5)
Here x1 = -6, y1 = 7 and x2 = -1, y2 = -5
PQ = ?(x2 – x1)2 + (y2 – y¬¬1)2

PQ = ?(-1 + 6)2 + (-5 - 7)2
PQ = ?25 + 144
PQ = ?169 = 13 units

Example: Find a point on x – axis which is equidistant from A (2, -5) and
B (-2, 9).

We know that a point on x – axis is of the form (x, 0). SO, let P(x, 0) be the point equidistant from A (2, -5) and B (-2, 9). Then,
PA = PB
?(x – 2)2 + (0 + 5)2 = ?(x + 2)2 + (0 – 9)2
(x – 2)2 + 25 = (x + 2)2 + 81
x2 – 4x + 4 + 25 = x2 + 4x + 4 + 81
-8x = 56
x = -7

Hence, the required point is (-7, 0)

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Reference Links :

- http://en.wikipedia.org/wiki/Distance
- http://en.wikipedia.org/wiki/Abscissa
- http://www.thefreedictionary.com/ordinates
- http://en.wikipedia.org/wiki/Perpendicular
- http://en.wikipedia.org/wiki/Pythagorean_theorem
- http://www.thefreedictionary.com/collinear

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