LF L1 Distance

Wednesday, November 2, 2022 1:15 PM

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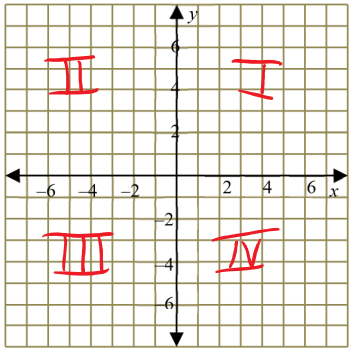
Lesson 1 Distance

Terminology

Quadrants:



Cartesian Plane: flat two-dimensional surface divided into 4 quadrants

(x,y) **Ordered Pair**: values describing a specific point on the Cartesian plane

Abscissa: x-coordinate

Ordinate: y-coordinate

(0,0) **Origin**: point where x and y axes meet

Horizontal & Vertical Distances

Horizontal Distance Formula
For any point P (x, y) and Q (x_2, y_2):

$PQ = |x_2 - x_1|$

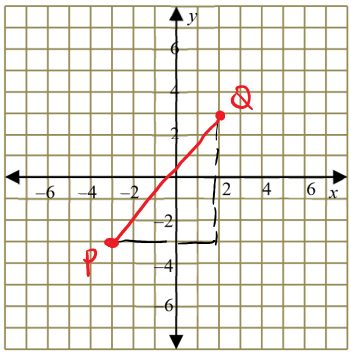
absolute value (values come out positive)

Vertical Distance Formula
For any point P (x, y) and Q (x_2, y_2):

$PQ = |y_2 - y_1|$

Example

Determine the length of PQ given P(x_1, y_1) and Q(x_2, y_2)



$$d = (x_2 - x_1)^2 + (y_2 - y_1)^2$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Distance Formula

For any points P(x_1, y_1) and Q(x_2, y_2) the distance PQ is:

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Example 1

Determine the distance between A (–5, 3) and B (4, 1) to one decimal place.

x_1 y_1 x_2 y_2

$$AB = \sqrt{(4-(-5))^2 + (1-3)^2}$$

$$= \sqrt{9^2 + (-2)^2}$$

$$= \sqrt{81 + 4}$$

$$= \sqrt{85}$$

Example 2 – Classifying Triangles

1. **Scalene** – all sides and angles are different
2. **Equilateral** – all sides equal, all angles are 60°
3. **Isosceles** – two equal sides, two equal angles

Note: Use simplified radicals for your solutions – No Calculators!

Classify a triangle with vertices A(–4, 3), B(–2, –4), C(3, 5) as scalene, isosceles, or equilateral.

$AB = \sqrt{(-2-(-4))^2+(-4-3)^2}$
$= \sqrt{4+49}$
$= \sqrt{53}$

$BC = \sqrt{(3-(-2))^2+(5-(-4))^2}$
$= \sqrt{25+81}$
$= \sqrt{106}$

$AC = \sqrt{(3-(-4))^2+(5-3)^2}$
$= \sqrt{49+4}$
$= \sqrt{53}$

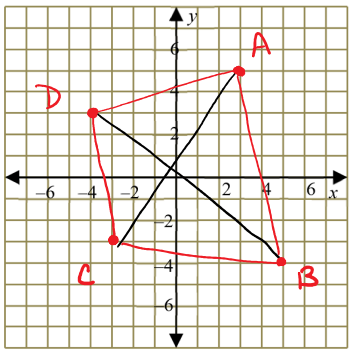
∴ isosceles triangle

Example 3– Diagonals of a Quadrilateral

Given quadrilateral ABCD where A (3, 5), B (5, –4), C (–3, –3), and D (–4, 3), determine the length of its diagonals.

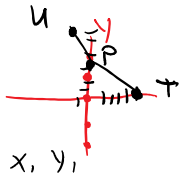
*Sketch first, you may not know the diagonals.

→ AC and BD



$AC = \sqrt{(-3-3)^2+(-3-5)^2}$
$= \sqrt{36+64}$
$= \sqrt{100}$
$= 10$

$BD = \sqrt{(-4-5)^2+(3-(-4))^2}$
$= \sqrt{81+49}$
$= \sqrt{130}$



Example 4 – Equidistant

- "Equal distance from"

x_2 y_2
$P(0, y)$

Determine the coordinates of the point on the *y*-axis that is equidistant from T(5, 0) and U(1, 6).

x_1, y_1

$PT = PU$

$\sqrt{(0-5)^2+(y-0)^2} = \sqrt{(0-1)^2+(y-6)^2}$

$\sqrt{25+y^2} = \sqrt{1+y^2-12y+36}$

$\left(\sqrt{25+y^2}\right)^2 = \left(\sqrt{y^2-12y+37}\right)^2$

$25 + y^2 = y^2 - 12y + 37$

$-12 = -12y$

$1 = y$

$P(0, 1)$

$(y-6)(y-6)$

$-6y-6y$