Title Distance between two points

Ingredients

Sketch

At/Through $[t_i, t_f]$

Owner System

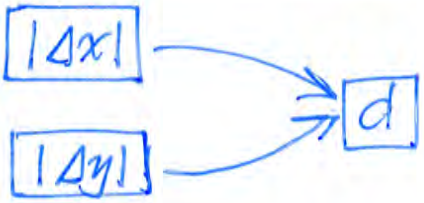
Quantity x-displacement | y-displacement | Distance

Variable Δx | Δy | d

Giver

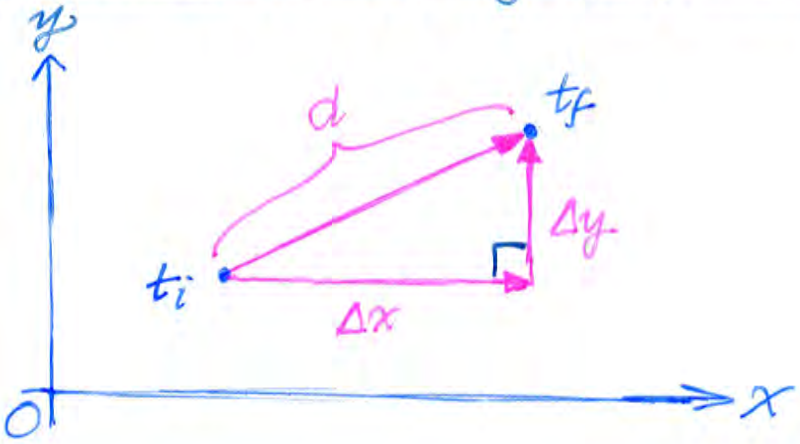
Recipe

Diagram the relationship



Graphically present quantities

Right triangle for applying Pythagoras's theorem



Mathematical relationship

$$d = \sqrt{(\Delta x)^2 + (\Delta y)^2}$$

Recipe number **K9**: The **title** of this recipe sheet is "**Distance between two points**".

The top half of this sheet consists of an "**Ingredients**" section with a row labeled "Sketch", a row labeled "At/Through", a row labeled "Owner", a row labeled "Quantity", a row labeled "Variable", and a row labeled "Giver." In this sheet, the row labeled "Giver" isn't used.

For the "Sketch", draw an overhead view showing two snapshots of a cart, initially more toward the lower-left and then finally more toward the upper-right. Draw trailing motion-blur streaks or so-called "whooshies" to emphasize instantaneous motion in each snapshot. Draw a dashed bubble around the earlier snapshot of the cart, at the left, to indicate that the cart is the so-called "System". Draw an arrow labeled +x to indicate that the positive-x direction points to the right. From the tail of the arrow you just drew, draw another arrow labeled +y to indicate that the positive-y direction points up the page.

In the rows of the "Ingredients" section other than the row for the sketch, document the following relationships, using flowchart paths, if helpful: The "Owner" is the "System". Through the course of the interval from initial time t_i (t-sub-i) to final time t_f (t-sub-f), the "System" accrues three quantities. One "Quantity" is the "x-displacement" denoted by the "Variable" (Delta x). Another "Quantity" is the "y-displacement" denoted by the "Variable" (Delta y). The third "Quantity" is the "Distance" denoted d.

The bottom half of this sheet consists of a "**Recipe**" section with a row labeled "Diagram the relationship", a row labeled "Graphically present quantities", and a row labeled "Mathematical relationship".

In the row labeled, "Diagram the relationship", draw a flowchart arrow showing that the absolute value of the x-displacement contributes to the distance d. Draw another arrow showing that the absolute value of the y-displacement also contributes to the distance d. Recite a story: "Both how far apart your initial and final positions are in the x-direction and how far apart your initial and final positions are in the y-direction contribute to how far apart your initial and final positions are overall."

In the row labeled "Graphically present quantities", write the title "Right triangle for applying Pythagoras's theorem". Create a horizontal axis pointed toward the right and labeled x. Create a vertical axis pointed up the page and labeled y. Label the origin of the x-y-axis system. In the coordinate plane, draw two dots (one toward the lower-left, and the other toward the upper-right), simplistically representing snapshots of the cart from the sketch. Label the dot at the left with the initial time t_i (t-sub-i) and the dot at the right with the final time t_f (t-sub-f). Draw an arrow from the dot at the left to the dot at the right. Use a brace to label the size of this diagonal arrow as distance d. Using this diagonal arrow as a hypotenuse, draw the rest of a right triangle by drawing a horizontal leg with an arrowhead pointing to the right and also drawing a vertical leg with an arrowhead pointing up. Label the horizontal leg (Delta x) and label the vertical leg (Delta y). Draw a perpendicular sign in the right angle of the triangle.

In the row labeled, "Mathematical relationship", write (d = square root of the sum of the square of Delta x and the square of Delta y).