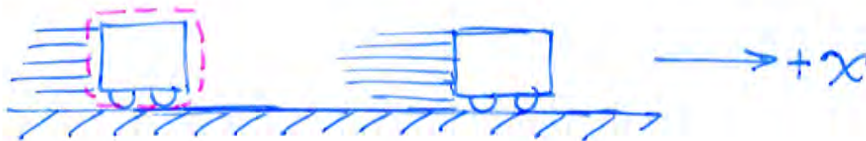


Title

x -displacement as area under v_x - t plot

Ingredients

Sketch



At/Through



Owner

System

Quantity



Variable



Giver

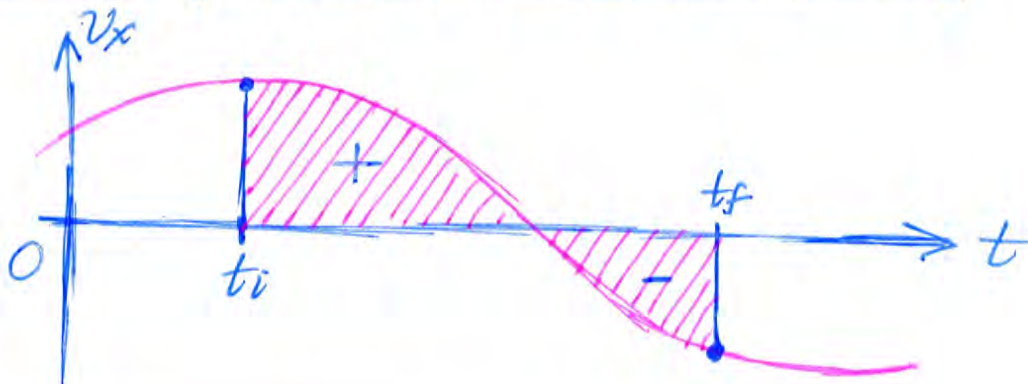
Recipe

Diagram the relationship



Graphically present quantities

On v_x - t plot: Shade the regions between the graph and the t axis



Mathematical relationship

Signed area between v_x - t plot and t axis = Δx

Recipe number **K4**: The **title** of this recipe sheet is “**x-displacement as area under (v-sub-x-t) plot**”.

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 two snapshots showing a cart moving toward the right across a firm surface. 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.

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”. At time t , the “System” has the “Quantity” called “x-velocity” denoted v_x (v-sub-x). On the interval from initial time t_i (t-sub-i) to final time t_f (t-sub-f), the “System” accrues the “Quantity” called “x-displacement” denoted (Δx).

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 area under the (v-sub-x-t) plot contributes to the x-displacement (Δx).

In the row labeled “Graphically present quantities”, write the title “On (v-sub-x-t) plot: Shade the regions between the graph and the t axis”. Create an axis system with x-velocity v_x (v-sub-x) on the vertical axis and time t on the horizontal axis. Draw a smooth plot with some variety of v_x (v-sub-x) values including positive and negative values (the exact shape isn’t very important). Surrounding a portion of the plot with positive and negative values of x-velocity v_x (v-sub-x), draw two tickmarks on the t axis, one at the left labeled with the initial time t_i (t-sub-i) and one at the right labeled with the final time t_f (t-sub-f). From the tickmark at the left, extend a vertical segment to reach the graph. Draw a dot where the vertical segment meets the graph. From the tickmark at the right, extend a vertical segment to reach the graph. Draw a dot where this vertical segment meets the graph. Between the vertical segments, shade the regions between the graph and the t axis. Mark each shaded region above the t axis with a plus, and mark each shaded region below the t axis with a minus

In the row labeled, “Mathematical relationship”, write “Signed area between (v-sub-x-t) plot and t axis = (Δx)”.