Before you label a graph, ask one small question: **What are the units?** "12" is not a complete measurement. It might mean 12 boxes, 12 boxes per hour, or 12 dollars. The units—and the quantity being measured—tell readers what the number actually represents.

This distinction matters in workplace dashboards, science charts, and math classes. A total answers a different question from a rate. If a graph's axes or table headings blur those meanings, a reader may mistake "how much has accumulated?" for "how quickly is it changing?" Clear labels help you avoid unit mistakes and make your chart useful to someone who did not create it.

Start with the question, not the chart

Before choosing a graph or writing an axis label, rewrite the situation as one clean sentence. For example: *"The dashboard records the cumulative number of packages shipped since the start of the Monday shift."* That sentence identifies the recorded quantity, the time reference, and what the numbers mean.

Then ask: **What question should the graph answer?**

- **Total question:** How many packages have been shipped so far?
- **Rate question:** How quickly are packages being shipped?

These questions are related, but their answers have different units. A total might be measured in *packages*; a rate might be measured in *packages per hour*. Calling a total a rate—or labeling a rate as if it were a total—is a common source of confusion.

Totals and rates are different quantities

A **total** counts or measures an amount. It might be the number of items in inventory, the distance traveled, or the revenue earned so far. Its units describe the amount itself.



A **rate** describes how much a quantity changes over a specified amount of time or another input. Its units combine two measures. For example, "packages per hour" means packages divided by hours. "Dollars per month" means dollars divided by months.

What the graph records Example axis label What the value means Cumulative packages shipped Packages shipped (packages) Total packages shipped since the stated start time Shipping speed Shipping rate (packages/hour) Packages shipped per hour Inventory on hand Inventory (items) Items currently in stock Average inventory change Average change rate (items/day) Change in inventory divided by elapsed days

Notice that a rate needs a time unit in its label. “Shipping rate” is not quite enough if the reader does not know whether the denominator is hours, minutes, or shifts. Write *packages/hour*, not just *packages*.

Label both axes with the quantity and its units

A useful axis label says what is measured and gives the units. If time is on the horizontal axis and cumulative sales are on the vertical axis, a clear pair of labels might be:

- **Horizontal axis:** Time since opening (hours)
- **Vertical axis:** Cumulative sales (dollars)

This is more informative than “Time” and “Sales.” Time could mean clock time, elapsed time, or workdays. Sales could mean dollars, number of transactions, or dollars per hour. Include enough detail to remove the likely ambiguity.

For a graph of a rate itself, label the vertical axis with rate units:

- **Horizontal axis:** Time since shift began (hours)
- **Vertical axis:** Shipping rate (packages/hour)

Those labels make a different claim from a graph of cumulative packages shipped. They tell the reader that the plotted vertical values are rates, not accumulated counts.

Make the start time explicit

“Time” alone often hides an important choice. A chart may use calendar time, such as 9:00 a.m., or elapsed time, such as 2 hours after a shift starts. If the vertical quantity accumulates from a starting point, name that point too.

For example, “Cumulative packages shipped since 7:00 a.m.” tells readers when the count began. Without that reference, a value of 120 packages could mean 120 packages shipped during the current shift, during the day, or since the dashboard was first installed.

Useful labels include:

- Elapsed time since order opened (minutes)
- Inventory at the end of each day (items)
- Revenue accumulated since January 1 (dollars)
- Packages shipped during each hour (packages/hour)

Be careful with phrases such as “per hour.” They can describe a rate measured within each hour, while “after one hour” may refer to an elapsed-time point. The axis label should match the actual recording method.

Intervals matter when you calculate an average rate

An average rate of change always refers to an interval. To calculate it, compare the change in the recorded quantity with the elapsed change in the input quantity. If Q is a quantity measured at times t_1 and t_2, the average rate is

\[\textaverage rate of change=\fracQ(t_2)-Q(t_1)t_2-t_1. \]

The units come from dividing the units of \(Q\) by the units of time. If the quantity is packages and time is measured in hours, the result is packages per hour.

Suppose a team has shipped 40 packages by 9:00 a.m. and 100 packages by 11:00 a.m. The change is 60 packages over 2 hours, so the average rate over that interval is 30 packages per hour. That does *not* automatically mean the team shipped exactly 30 packages in every hour. It is the average for the whole 9:00–11:00 interval.

When reporting an average rate, name the interval in the chart, caption, or nearby text. “Average shipping rate, 9:00–11:00 a.m. (packages/hour)” is more precise than “Rate: 30.” A rate without its interval can hide changes that occurred inside it.



Keep time units consistent

If one time value is in minutes and another is in hours, convert before calculating. For example, 90 packages in 30 minutes is 3 packages per minute, or 180 packages per hour. Both are valid rates, but they are not the same numerical value. State which time unit you use.

Likewise, a rate of 2 dollars per day is not a rate of 2 dollars per week. If a table records daily values while a graph summarizes weekly averages, label each clearly. This is a simple way to avoid unit mistakes when information moves between reports.

Choose table column units as carefully as axis labels

Tables need the same care as graphs. Put units in column headings so they remain attached to the values when someone copies, sorts, or exports the data. Avoid relying on a note that may get separated from the table.

Time since shift began (hours) Cumulative packages shipped (packages) Packages shipped during interval (packages) Average rate during interval (packages/hour) 0 0 — — 1 24 24 24 2 54 30 30

This table separates three ideas: elapsed time, the cumulative total, and what happened during each one-hour interval. The first row has no preceding interval, so a rate for that interval is not available. That is clearer than inserting a zero, which could incorrectly suggest that the rate was measured and found to be zero.

For a table column, prefer “Average rate during interval (packages/hour)” to “Rate.” Prefer “Ending inventory (items)” to “Stock.” If each row represents a particular time window, include that window in a time or interval column, such average rate of change as “Interval (9:00–10:00 a.m.).” These headings make the **table column units** visible where readers need them.

Draw jumps as jumps—not as events that happened between readings

Some quantities change in discrete events. A shipment may arrive at 10:15 a.m., increasing inventory from 42 items to 70 items at once. If measurements are made immediately before and after the arrival, a straight sloping line between the points suggests that inventory increased gradually throughout the interval. That may not be what happened.

For a quantity that stays constant between sudden events, use a step graph: a horizontal segment for the unchanged amount, followed by a vertical jump when the event occurs. The shape communicates that the total changed at a particular time. Add a note such as “Inventory updated when shipments were received” if the event rule is not obvious.

Do not use a step graph automatically. A smoothly changing measurement may be better represented by a line, and a rate may vary continuously. Choose a connection style that reflects how the data were recorded and what happened between timestamps. If you do not have information about what happened between two measurements, avoid drawing a line that implies you do.

A quick checklist for clear labels

1. **Name the recorded quantity.** Is it a cumulative total, a current amount, a change over an interval, or a rate?
2. **Write the units.** Include compound units such as dollars/month or items/hour for rates.
3. **Define the time reference.** Say whether time is clock time, elapsed time, or a named period—and identify the start time when needed.
4. **Specify intervals.** State which time span an average rate summarizes.
5. **Match the display to the data.** Use step segments for totals that change in jumps; do not imply unrecorded activity between observations.
6. **Check the table, too.** Put units in column headings so values make sense on their own.

Use digital tools to support clear explanations

MathJax can render equations such as the average-rate formula so that symbols and fractions are easier to read in web-based lessons. But polished math notation does not replace plain-language labels. Write “average change in inventory (items/day)” near the formula so readers can interpret its units.

Runestone, an interactive publishing platform used for educational materials, can support practice with graphs, tables, and questions. An activity might ask learners to distinguish a cumulative total in packages from a rate in packages per hour, or to identify which interval an average rate describes. Interactive checks are especially useful when readers are learning to notice missing units or ambiguous time references.

Bottom line: label what the number means

Clear axis labels connect a number to a quantity, a unit, and—when relevant—a time reference. A total answers “how much?” A rate answers “how much per unit of time?” Average rates belong to stated intervals, and

cumulative totals need a clear starting point. Apply the same discipline to graph axes and table column units, and readers are much less likely to confuse a total with a rate.

When in doubt, read your label aloud with one plotted value: “At 2 hours since the shift began, the team had shipped 54 packages in total.” If that sentence is not clear—or if the units do not fit—revise the label before publishing the chart.