What are the units? The rate is measured in millimeters per hour (mm/h), the time in hours, and the accumulated rainfall in millimeters (mm). Keeping those units visible helps us answer the question without confusing a rate with a total.

If rain falls at a steady rate of 6 mm per hour for 2 hours, the total amount of rain is **12 mm**. The calculation is simple, but understanding what the numbers mean makes the answer much more useful—especially when reading a weather chart, work dashboard, or other report.

First, Say What the Question Is Asking

Here is the word problem rewritten as one clean sentence:

Find the accumulated rainfall during a two-hour interval when the rainfall rate is 6 millimeters per hour throughout that interval.

This wording makes two things clear: we are looking for a total, and we are looking at a specific time interval. The question is not asking how quickly the rain is falling. It already gives us that rate. It asks how much rain accumulates over time.

Rate and Total Are Different Questions

A **rate** describes how much of something changes per unit of time. In this example, 6 mm/h means that, under the stated steady-rate assumption, the rainfall depth increases by 6 millimeters in each hour.

A **total** describes an accumulated amount over a specified interval. The total rainfall after two hours is not 6 mm/h; it is 12 mm. The units tell us the difference:

- **Rate:** 6 mm/h (millimeters per hour)
- **Elapsed time:** 2 h (hours)
- **Accumulated amount:** 12 mm (millimeters)

People sometimes call a total a “rate,” particularly when looking at charts or dashboards. That can lead to misunderstandings. A depth of 12 mm says how much rain accumulated. A rate of 6 mm/h says how quickly that depth is increasing at a particular time—or, if it is an average, how quickly it increased on average during an interval.

Use Rate Times Time

When a rate stays constant over a time interval, multiply the rate by the length of that interval:

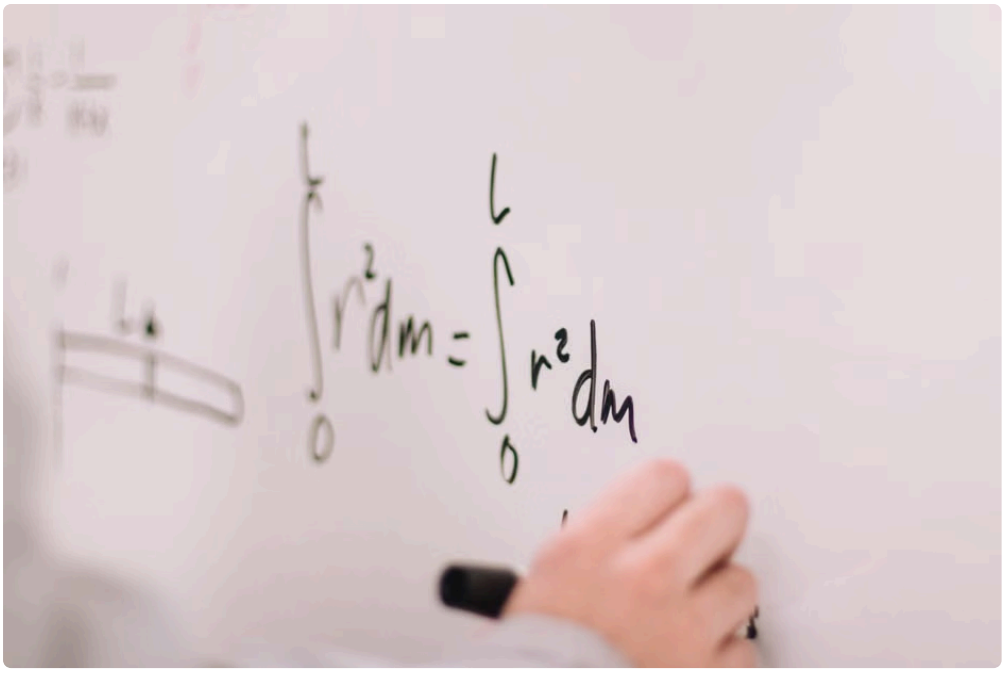
$$\text{accumulated rainfall} = \text{rainfall rate} \times \text{elapsed time}$$

Substitute the values in the question:

$$6\ \frac{\text{mm}}{\text{h}} \times 2\ \text{h} = 12\ \text{mm}$$

The hour units cancel, leaving millimeters. That cancellation is a useful check: the question asks for an amount of rainfall, so the answer should be a depth, not a depth-per-time rate.

So, at a steady rate of 6 mm/h for 2 h, the **12 mm rainfall** is the accumulated rainfall over the two-hour interval.



Why the Units Matter

Units do more than decorate the numbers. They tell us which operation makes sense and help us catch mistakes. If we multiply 6 mm/h by 2 h, we get millimeters. If we report "12 mm/h," we have mistakenly given the result in rate units, even though we calculated a total.

It also matters that the time is in hours. If the duration were given as 120 minutes, we would need to convert it or use a rate expressed per minute. Since 120 minutes equals 2 hours, either of these equivalent calculations works:

- 6 mm/h × 2 h = 12 mm
- 0.1 mm/min × 120 min = 12 mm

Do not mix hours and minutes without stating the conversion. A rate of 6 mm/h multiplied by 120 minutes is not ready to calculate as written: the time units do not match. Convert 120 minutes to 2 hours, or convert the rate to millimeters per minute first.

Define the Recorded Quantity and the Start Time

In a real weather report, "how much rain?" can refer to more than one recorded quantity. It might mean the amount collected in a rain gauge during a selected interval, the running accumulated rainfall since a specified start time, or a rainfall rate displayed at a particular moment. Before calculating or comparing values, find out which quantity the instrument or dashboard is showing.

The **start time** matters because an accumulated total is always tied to an interval. For example, "12 mm" could mean 12 mm accumulated between 6:00 and 8:00, or it could mean 12 mm accumulated since midnight. Those are different statements, even if the displayed number happens to be the same.

It helps to write the interval directly:

- From 6:00 a.m. to 8:00 a.m.: 2 hours
- Rate during that interval: 6 mm/h
- Accumulated rainfall during that interval: 12 mm

If a dashboard says “12 mm” but does not show the period or reset time, look for labels such as “last 2 hours,” “today,” “since midnight,” or “since the gauge was reset.” Without that context, the number may be accurate but incomplete.

What If the Rainfall Rate Changes?

The calculation above assumes the rate is constant at 6 mm/h for the full two hours. If the rate changes, multiplying one rate by the entire duration may not give the right total. We need to know how the rate varied, or at least the average rate over the interval.

For example, suppose the rate is 4 mm/h for the first hour and 8 mm/h for the second hour. The accumulated rainfall is:

$$ (4\ \textmm/h)(1\ \texth) + (8\ \textmm/h)(1\ \texth) = 12\ \textmm $$

The total is still 12 mm, but the rate was not 6 mm/h at every moment. In this case, 6 mm/h is the **average rate** over the two hours:

$$ \textaverage rate = \frac\texttotal rainfall\textelapsed time = \frac12\ \textmm2\ \texth = 6\ \textmm/h $$

That distinction is important: a rate of 6 mm/h throughout the interval and an average rate of 6 mm/h over the interval do not tell us the same thing about what happened at every moment. They do, however, produce the same two-hour total when the average rate is 6 mm/h.

Intervals Matter for Average Rate of Change

In precalculus and calculus, average rate of change compares how much a quantity changes over a stated interval with how much time passes during that interval. If $R(t)$ represents accumulated rainfall at time t, then the average rate from time t_1 to time t_2 is:

$$ \fracR(t_2)-R(t_1)t_2-t_1 $$

For rainfall, the numerator is the change in accumulated depth, measured in millimeters. The denominator is elapsed time, measured in hours. The resulting units are mm/h.

Suppose a gauge records 3 mm at 6:00 and 15 mm at 8:00. The change is 12 mm over 2 hours, so the average rate over that interval is 6 mm/h. But those two readings alone do not prove that the rate was exactly 6 mm/h at every point in between. Rain could have fallen steadily, or more heavily during one part of the interval and lightly during another.

Always name the interval when reporting an average rate. “The average was 6 mm/h from 6:00 to 8:00” is more informative than “the rate was 6 mm/h,” which might be mistaken for an instantaneous reading or a constant rate.

How to Read a Rainfall Graph

A graph’s axes should be labeled. For a graph of accumulated rainfall, the horizontal axis might show time and the vertical axis might show rainfall depth in millimeters. The graph then answers questions about how much rain had accumulated by particular times.

If the accumulated rainfall rises from 0 mm at 6:00 to 12 mm at 8:00, the average rate over that interval is the slope of the line connecting those two points:

$$ \frac12\ \textmm-0\ \textmm8\ \texth-6\ \texth = 6\ \textmm/h $$

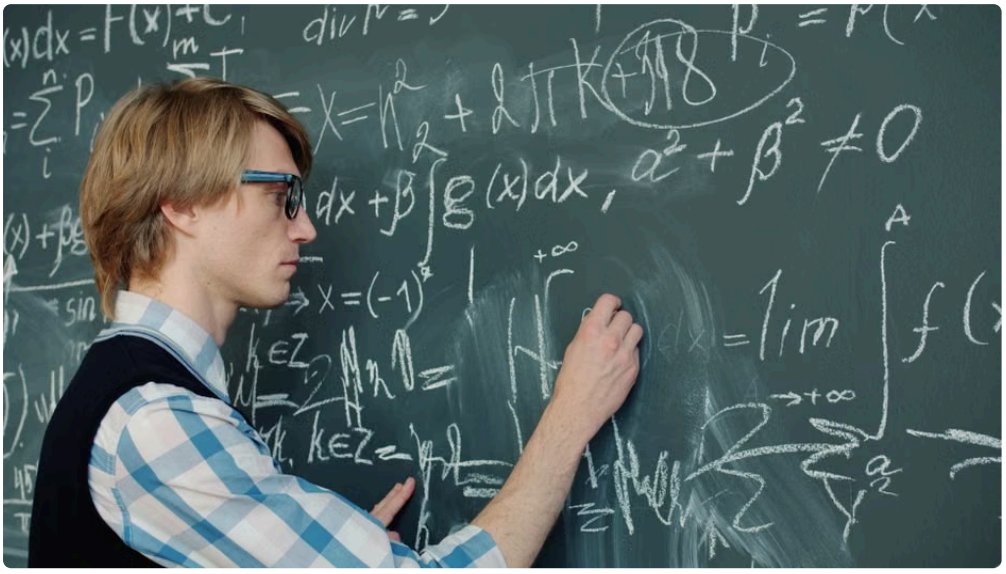
A straight segment between the points suggests a constant rate between the recorded times. Use that interpretation only if the data or the graph supports it. If the graph shows measurements only at separate timestamps, drawing a straight line between them can imply that the data changed smoothly in a way that was never actually measured.

In some operational dashboards, events happen in jumps—for example, a counter may update only when a delivery is logged or a sensor report arrives. In that case, a step graph can be more honest: the recorded total stays at one value until an update, then jumps to the next. Rainfall accumulation from a continuously operating gauge may be displayed as a continuously changing curve, but the plotted record is still based on measurements taken at particular times. Choose a graph style that matches what the data actually records.

Using MathJax and Runestone for Learning

When publishing an explanation online, MathJax can render the equations clearly in a web page, including units and fractions. For instance, the expression $6\ \textmm/h \times 2\ \texth = 12\ \textmm$ is easier to scan when the units are presented consistently. MathJax is a rendering tool: it displays mathematical notation; it does not decide whether the modeled rate or interval is appropriate.

Runestone is an interactive publishing platform that can support lessons with questions, feedback, and other learning activities. A short Runestone exercise could ask learners to identify the rate, elapsed time, and total in a rainfall scenario before submitting the calculation. That sequence encourages students to interpret the quantities rather than memorize “multiply the numbers.”



Whether reading a cumulative total MathJax equation or answering an interactive Runestone question, the same habits help: identify the recorded quantity, state the interval, match the units, and check whether the requested result is a rate or a total.

A Quick Checklist

When a question gives a rate and asks how much accumulated, use this checklist:

1. **Identify the quantity.** Is the question asking for rainfall depth, a rainfall rate, or an average rate?
2. **Set the interval.** What is the start time, end time, or duration?
3. **Check the units.** Do the time units in the rate and duration match?
4. **Choose the operation.** For a constant rate, use rate times time.

5. **Label the answer.** A rainfall total should be in millimeters, not millimeters per hour.

Information Value What it means Rainfall rate 6 mm/h Rainfall depth added per hour Elapsed time 2 h Length of the interval Accumulated rainfall 12 mm Total depth added during the interval

The Answer

At a steady rainfall rate of 6 mm per hour for 2 hours, the accumulated rainfall is:

$$ 6\ \frac\textmm\texth \times 2\ \texth = \boxed12\ \textmm $$

Answer: 12 mm of rain. The rate tells us how quickly rainfall accumulates; the two-hour interval tells us how long it accumulates; and the units confirm that the result is a total depth.