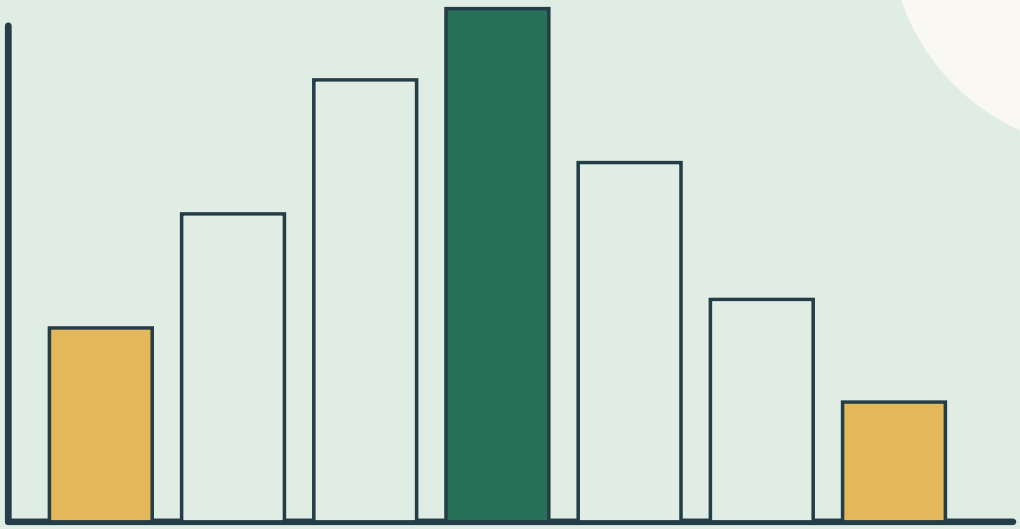
REFRESHABLE REPORT CHARTS

Linking Charts to Refreshable Report Data



DATA / REFRESH

OFFICE & ADMINISTRATION

Linking Charts to Refreshable Report Data

Learning outcomes

- Link a trend chart to the report rather than a static picture.
- Verify category expansion and values after a new period arrives.
- Keep period, unit and filter labels accurate after refresh.
- Specify and test the complete dependency path from receipt rows to a monthly chart.
- Distinguish new-category expansion from an existing-point value change.
- Build a documented formula-backed chart and compare its behavior with a PivotChart.
- Test missing periods, filter changes, late records, chart labels and saved snapshots independently.
- Record observed update evidence without claiming that a saved image proves live behavior.

Practical office learning with wholly fictional records. No certification, compliance opinion, or authorization to act on real records is implied.

Study the foundations, work through the applied units, complete the practice tasks, and then attempt the assessment. Use only the supplied fictional practice data. Keep your original inputs and your revised work separate.

Core concepts

Define the chart contract

A trend chart encodes an ordered sequence of measurements. Here the horizontal axis is calendar month and the vertical axis is summed resource units. It is not receipt count, cumulative usage or a forecast. Write those choices beside the chart. A line chart makes time order easy to read, but only if the month keys retain years and are sorted chronologically. Do not plot the grand-total row as another month. That extra point would create an artificial spike and change the meaning of the sequence.

Connect data and presentation

Create the monthly pivot from the named source and build its PivotChart, using the supported workflow for the installed Excel platform. A normal chart can also work if its source expands correctly, but a pasted picture is a snapshot. Inspect the selected object or source reference rather than deciding by appearance. Keep the pivot available for numeric verification. A linked series does not guarantee that manually typed titles or annotations update, so treat labels as separate dependencies. Prefer a stable title such as Monthly resource units, with a clearly maintained coverage note.

Run a controlled update

Before adding the new period, note the number of months and each plotted value. Add the new rows to the source table, refresh the report and check the pivot before checking the chart. Confirm the new month appears once, its value agrees, the axis is still ordered and any scope annotation reflects the wider range. Compare a deliberately saved picture to the live object to demonstrate the difference. Export only after the chart and its numeric companion agree; a visually plausible trend can still omit the latest category.

Worked example

Scenario: A mini-report has July 12 and August 18. September arrives with quantities 4 and 7.

Walkthrough

After source expansion and refresh, September must appear as 11. The chart should contain three chronological points, not a fourth grand-total point of 41. A picture made before refresh still has two points. Updating the source does not repair a title that was manually typed as July-August.

Foundation practice

ReceiptID	UsedOn	Department	ResourceType	Quantity
U01	2025-12-02	Design	Guide	4
U02	2025-12-14	Support	Guide	3
U03	2025-12-20	Design	Template	2
U04	2026-01-03	Support	Template	5
U05	2026-01-07	Design	Guide	6
U06	2026-01-09	Support	Guide	4
U07	2026-01-12	Design	Template	3
U08	2026-02-01	Support	Template	7
U09	2026-02-04	Design	Guide	5
U10	2026-02-11	Support	Guide	2
U11	2026-02-18	Design	Template	4
U12	2026-02-22	Support	Template	6

Context

Fictional learning-resource desk. One row records one receipt; Quantity counts resource units, not people. All dates are Gregorian ISO dates, with no time zone conversion.

Types

- text identifier
- date
- text category
- text category
- whole number of resource units

Append rows

Field 1	Field 2	Field 3	Field 4	Field 5
U13	2026-03-02	Design	Guide	8
U14	2026-03-04	Support	Template	12

Initial title: Monthly resource units, December 2025-February 2026

Chart faults to test

- A static picture copied before March
- A live chart with a manually typed old coverage title

Foundation tasks

- Create the month pivot and a linked trend chart; retain a labeled static snapshot for comparison.
- Append March, refresh and audit categories, values, title and filters.

Foundation capstone

Task: Deliver the live report and a before/after chart test.

Criteria

- March is included once and has the correct quantity.
- No grand total is plotted as a month.
- Axis and unit are explicit.
- The snapshot is labeled static and coverage wording is current.

01 A chart is the last link in a chain

A monthly trend is a claim about a sequence of populations. A point labeled February 2026 means that a defined set of February records contributed a defined measure. The line does not establish which rows were included. It only displays values supplied by another part of the workbook. To make that claim dependable, name the links: source records, typed fields, month assignment, summary calculation, chart series, and visible report wording. A failure at any link can leave a persuasive but incomplete picture.

This course uses a fictional equipment-learning desk. Each receipt records resource units issued on a calendar date. North and South are departments, not geographic measurements. Guide and Template are resource types, not separate unit systems. One receipt can represent several units, so receipt count and quantity sum are different measures. The workbook chart_lab.xlsx starts with twelve receipts from January through March 2026. The CSV chart_append.csv supplies two April receipts and one late February receipt. These additions deliberately test both category expansion and correction of an existing point.

A dependency test begins before editing. Record the source row count, date coverage, summary values, chart category count, series references and visible filter description. Then predict what a controlled edit should change. If an extra receipt in March changes the March summary but not the March point, investigate the summary-to-chart connection. If a new April receipt changes the raw total but April remains absent from the summary, investigate summary coverage before changing chart colors. This ordering reduces unnecessary rebuilding.

Distinguish a live workbook object from a publication copy. A chart that reads worksheet cells can respond to a changed value. A PNG or ordinary pasted picture records an appearance at a particular time. A PDF preserves a reporting state rather than a live series. None is inherently wrong. The mistake is describing a snapshot as if it will update. A useful package can include both a live object for continued work and a clearly labeled snapshot for comparison, provided the coverage and capture state are explicit.

The test is successful only when the intended change appears and unrelated meanings remain stable. After adding April, the unit must still be resource units rather than receipt count. The horizontal axis must still distinguish years. A numeric grand total must not become an extra month. A correct new point with an obsolete title remains an incomplete report. Treat these conditions as separate acceptance criteria rather than one vague instruction to check the chart.

Dependency	Evidence to inspect	Failure isolated
Raw records	Receipt IDs, dates and quantities	Missing or mistyped input
Monthly summary	One row per month and independent sums	Aggregation or coverage error
Series binding	Category and value references of equal length	Stale or shifted chart range
Visible wording	Period, unit and active population	Misleading title or filter note

E01-X1 Write a testable chart contract

For chart_lab.xlsx, write the measure, category key, population and two separate update tests. Use the stated January–March baseline and the April plus late-February append. Do not claim any result has already been observed.

Submit: A five-part contract and predicted effects.

02 Read the laboratory workbook and its cell map

The laboratory workbook has two sheets. Raw contains the editable receipt table. Monthly contains a formula-backed summary and a standard line chart. It is intentionally not delivered as a prebuilt PivotTable. This gives you a visible, small calculation path that can be compared with a PivotChart you create in your own Excel installation. The two implementations should describe the same population, but their update mechanisms are not identical. Save a working copy before experimenting and keep the original as the baseline comparison.

Raw row 1 contains headers. Rows 2 through 13 contain C01 through C12. Columns A through E are input fields; column F is MonthKey. Dates are typed Excel date values displayed as yyyy-mm-dd, not text labels that merely look like dates. Quantities are whole numbers. ReceiptID is text. MonthKey uses yyyy-mm text generated from the date, which sorts chronologically for these four-digit years and two-digit months. The formula is a calendar grouping key, not a conversion of units or an inference about missing data.

Monthly row 1 contains MonthKey, All units, North units and South units. A2:A4 holds 2026-01, 2026-02 and 2026-03. B2:D4 contains bounded SUMIFS formulas looking at Raw rows 2 through 200. Those bounds are intentional: they make the exercise easy to inspect and permit a small append without changing every formula. They are not a universal capacity guarantee. A source record below row 200 would require an explicit boundary change and another test. The initial chart uses A1:B4 only, so adding a new source month does not automatically create a new summary row or extend this chart.

A second source boundary exists in the named table Receipts. At baseline it spans Raw!A1:F13. When appending, confirm that the table expands through row 16 and that every new MonthKey formula exists. The bounded summary can sometimes include a row outside the named table if its helper is filled, while a PivotTable sourced from Receipts will not include that row. Such disagreement is useful diagnostic evidence. Do not conclude that all consumers share a boundary because they occupy one workbook.

Keep worksheet coordinates distinct from business identifiers. Raw!A9 refers to a cell whose occupant can change after sorting. C08 refers to a receipt. In an evidence log, record both when helpful: C08, currently Raw row 9. Use the identifier to discuss inclusion and the address to reproduce a formula or inspect a boundary. This small distinction makes later troubleshooting readable when the same records are reordered.

Location	Purpose	Initial extent or convention
Raw!A1:F13	Named Receipts table	Twelve records plus header
Raw!B2:B13	UsedOn	Numeric dates displayed yyyy-mm-dd
Raw!F2:F13	MonthKey helper	=TEXT(B2,"yyyy-mm") copied down
Monthly!A1:D4	Monthly numeric companion	Three months; no grand-total row
Monthly!F2:M16	Standard line chart	One series from A1:B4

Location	Purpose	Initial extent or convention
Monthly!A18:B21	Context and independent controls	Text labels and formula totals

```
Raw!F2 =TEXT(B2,"yyyy-mm")
Monthly!B2 =SUMIFS(Raw!$E$2:$E$200,Raw!$F$2:$F$200,A2)
Monthly!C2 =SUMIFS(Raw!$E$2:$E$200,Raw!$F$2:$F$200,A2,
 Raw!$C$2:$C$200,"North")
Monthly!D2 =SUMIFS(Raw!$E$2:$E$200,Raw!$F$2:$F$200,A2,
 Raw!$C$2:$C$200,"South")
```

03 Validate types before grouping dates

A refreshable chart depends on reliable field types. A date such as 2026-02-03 can be stored as a typed date value or as text. Both may look similar on screen, yet date grouping and date arithmetic can behave differently. In this laboratory the workbook already contains typed date values. The CSV assets contain ISO date strings because CSV does not preserve workbook types. Import UsedOn as a date and Quantity as a whole number. Keep ReceiptID as text so future identifiers with leading zeros are not altered.

A month key should identify the year as well as the month. The text Jan is inadequate across multiple years. In the supplied layout, TEXT(B2,"yyyy-mm") produces a compact ordered label such as 2026-01 from a valid date. An alternative is DATE(YEAR(B2),MONTH(B2),1), stored as a numeric month-start date and displayed mmm yyyy. That alternative is particularly useful for true date axes. Do not mix the two key representations in one criterion range without understanding how the comparison is evaluated. A typed date value is not equal to the string 2026-01 merely because its display resembles it.

Validate errors before suppressing them. If a newly imported date is unrecognized, replacing every error with zero can put the record in an unintended period or make its absence invisible. Preserve the input, flag the invalid date and pause publication until its period is established. Likewise, a quantity written as text may be counted as a record but omitted from arithmetic in some operations. A complete raw-row count does not prove the measure is numeric. Inspect one normal date, the year boundary and one intentionally malformed test value in a disposable copy.

A record date and a refresh timestamp answer different questions. UsedOn assigns a receipt to its business month. A refresh timestamp records when the workbook processed an extract. The late-February receipt in chart_append.csv is processed during the April update but still belongs to February. Moving it into April because that is the update month changes the metric. A report can therefore have a latest source activity date in April while revising a February point. Preserve both facts in the update log.

The input contract for this laboratory excludes negative quantities and missing dates. A zero quantity, if explicitly entered for a valid receipt, remains a real observation and contributes zero to the sum. A blank quantity is unresolved input, not an automatic zero. These are exercise rules, not assumptions to impose on every organization. State them before testing

so that rejection of a malformed row is reproducible rather than an undocumented cleanup choice.

Test input	Interpretation	Required treatment
2026-01-03 as typed date value	Valid calendar date	MonthKey 2026-01
2026-02-30 as CSV text	Impossible calendar date	Flag; do not invent a replacement
UsedOn blank	No month established	Hold row out of published measure pending resolution
Quantity 0	Known zero resource units	Keep valid receipt; sum contribution 0
Quantity blank	Quantity unknown	Flag; do not relabel as zero
ID 0007	Text identifier	Preserve leading zeros

E03-X1 Classify imported fields

A separate test batch contains Q1/2026-12-31/2, Q2/2027-01-01/0 and Q3/2027-02-30/4. IDs are text, dates are supplied strings and quantities are numeric. Apply the laboratory rules. State which monthly contributions are established and which row needs correction.

Submit: An ID-level type and month decision.

04 Build and reconcile the numeric companion

Before inspecting a line, establish the numbers it should encode. The twelve laboratory receipts form three monthly groups. January contains quantities 8, 5, 3 and 4; February contains 6, 7, 5 and 2; March contains 9, 4, 7 and 5. The monthly totals are 20, 20 and 25. Their sum is 65. North contributes 11, 11 and 16; South contributes 9 in each month. The fact that two months share a total is not a duplicate error. It is an ordinary repeated measurement.

A numeric companion is a compact table containing the exact categories and values used by the chart. It allows a reviewer to check a point without estimating its height against gridlines. Keep the table near the chart or in a clearly named sheet. Do not hide the only available detail behind an image. For this course the monthly table contains a total series and two department subtotals, but the initial chart displays only All units. That choice is part of the contract, not evidence that the department columns are unused.

Use an independent arithmetic check rather than comparing a chart with its own cached labels. For January, add the four source quantities directly or filter the raw records and inspect the contributing IDs. Then compare that result with Monthly!B2 and the first plotted point. Verify the raw total separately with SUM(Raw!E2:E200). If the summary is 65 and the raw total is also 65, you have one useful control, but not proof of correct month allocation. A date moved from January to February can preserve the grand total while changing two points.

The department columns supply a second partition check. For each month, North units plus South units must equal All units under the stated two-department population. If a new third department appears, this equation would fail unless the report's population or presentation is deliberately expanded. That failure should expose a changed assumption, not trigger an automatic deletion of the new records. Controls are most valuable when they reveal that a formerly complete set of categories is no longer complete.

Avoid using the monthly grand total as another chart category. The numeric companion may include a separately labeled total below the monthly area, but the series range must exclude it. January 20, February 20 and March 25 are comparable measurements over three months. Total 65 is an aggregate over all three and has a different grain. Appending it as a fourth point invents a time event and makes the final rise look like a trend. Keep totals visually separate from the ordered monthly rows.

Month	North units	South units	All units	Contributing IDs
2026-01	11	9	20	C01–C04
2026-02	11	9	20	C05–C08
2026-03	16	9	25	C09–C12
Control only	38	27	65	All twelve, not a chart category

E04-X1 Catch an offsetting date error

In a disposable copy, move C04, quantity 4, from January 29 to February 1 without changing anything else. Predict the three monthly totals, the overall total and the department check that changes. Then state why checking only 65 would miss the defect.

Submit: Three totals and a causal comparison.

05 Inspect a standard chart binding

A standard chart has category references and one or more value-series references. In the supplied workbook, the category labels come from Monthly!A2:A4 and the All units values come from Monthly!B2:B4. The series name comes from the header. A valid binding uses matching category and value lengths in the same intended order. The ranges are inspectable evidence. A familiar-looking line and a title saying Live chart are not evidence of any particular connection.

In desktop Excel, selecting the chart and inspecting its data source is a useful way to discover those references. Exact commands differ by platform, so use the available source-selection interface rather than copying a shortcut blindly. Changing a source value within the referenced range should alter the corresponding point after calculation. Adding a category outside the range is a different event: the fixed reference may remain unchanged. The laboratory intentionally uses a three-month range to make that boundary observable.

A shifted range can be more dangerous than an obviously broken reference. If categories remain A2:A4 but values accidentally use B3:B5, January can display February's quantity and March can display an empty or unrelated cell. All points may still be numeric. Check the first and last category-value pairs and one interior pair, not only the length of the line. Equal range lengths prevent one class of error; they do not prove alignment. Source row meaning must still agree.

Series order and category order are separate. If North and South are added as series, their legend order does not determine the chronological order of months. Sorting the summary by All units to make the largest point appear first would change a time trend into a ranked-category display. That might answer another question, but it would violate this chart's contract. Maintain chronological month keys even when adjacent values are equal or the sequence crosses December to January.

Use a small perturbation test in a disposable copy. Increase C01 from 8 to 9, recalculate, and expect January All units to increase by one. Restore C01 to 8 and verify that the value returns. This demonstrates sensitivity within an existing category. It still does not demonstrate support for an additional category, a newly introduced series, a changed filter or a corrected label. State precisely which behavior the test establishes and which behaviors remain to be tested.

```
Initial category reference: Monthly!$A$2:$A$4
Initial All units reference: Monthly!$B$2:$B$4
After adding April summary row:
Category reference: Monthly!$A$2:$A$5
All units reference: Monthly!$B$2:$B$5
Keep a total control outside these ranges.
```

06 Compare PivotChart and formula-backed paths

A PivotChart presents the results of its associated PivotTable. That association can reduce the need to maintain ordinary chart ranges manually, but it does not remove source, filter or refresh dependencies. A PivotTable can still read an old source boundary. A date field can still be grouped incorrectly. A filter can still exclude the new month. Treat the PivotChart as one implementation of the contract rather than an automatic guarantee of correctness.

To compare implementations, create a new PivotTable from the Receipts table in your working copy. Put MonthKey in Rows and Quantity in Values, summarized by Sum. Keep Department and ResourceType available as filters, initially showing all items. Confirm the numeric companion before inserting the linked chart. The expected baseline rows are 2026-01=20, 2026-02=20 and 2026-03=25. A Count of Quantity result of 4 for each month indicates an aggregation choice that answers receipt frequency, not units issued.

The creation route depends on the installed platform. Microsoft documents separate Windows, Mac and web workflows. Use the supported option for your installation and retain the resulting PivotTable so its numbers can be inspected. The learning outcome is not a memorized ribbon sequence. It is a chart whose categories and values follow a verified monthly summary after the source is expanded and refreshed. Record the platform used

when reporting observed behavior because another installation may expose different controls.

Compare the two update chains explicitly. The standard-chart path here is Raw, MonthKey helper, SUMIFS summary, fixed chart range. The PivotChart path is Receipts table, PivotTable aggregation and filters, PivotChart. A row beyond the table but inside the bounded SUMIFS ranges can affect one path without affecting the other. A new month absent from Monthly column A can be present in a refreshed pivot but absent from the standard chart. Such differences point to the first boundary that fails, not to a mathematical disagreement about addition.

Keep a small comparison log rather than continually rebuilding both reports. Baseline agreement establishes a starting state. Agreement after an existing-point correction tests updated values. Agreement after April tests expanded categories. Agreement under North-only filtering tests population selection. If you cannot execute one platform's workflow, mark it not run and preserve the predicted values separately. A static inspection of workbook XML or formula text cannot substitute for an observed PivotTable refresh in Excel.

Path	Automatic relationship	Still needs evidence
Standard chart in this lab	Series reads bounded summary cells	New summary rows and range expansion
PivotChart	Chart follows associated pivot layout/data	Correct source table, aggregation, filter and refresh
PNG snapshot	None after capture	Explicit capture state and static label
Formula summary	Formulas read selected Raw ranges	Valid helpers, matching criteria and capacity bounds

E06-X1 Locate the first failed dependency

After an append, the Receipts table ends at row 13, Raw rows 14–16 have valid helper formulas, the standard monthly summary includes April, and its series has been extended. The standard chart totals 86 but a refreshed PivotChart still totals 65. Identify the first likely failure and the two checks needed before claiming repair.

Submit: A diagnosis with a targeted repair test.

07 Run the append as a controlled experiment

The append file contains three rows, not a replacement extract. C13 and C14 introduce April. C15 is a late February receipt. Do not replace the original twelve rows and do not append the file twice. Before importing, compare receipt identifiers with the current table. The expected state transition is twelve to fifteen receipts. An increase to eighteen indicates that the same three-row batch may have been applied twice. A correct-looking latest month does not rule out that duplication.

Append the three records beneath C12 in Raw. Ensure UsedOn imports as typed date values and Quantity as whole numbers. Fill MonthKey through row 16, extend the named table if it did not expand, and inspect each new row. The intended new keys are 2026-04, 2026-04 and 2026-02. Record which workbook state the append created before refreshing dependent reports. This prevents an ambiguous log entry such as refreshed data when the actual action was only pasting source rows.

Next inspect the existing monthly formula rows. January remains 20. February should become 23 because C15 contributes 3. March remains 25. The existing three-row summary now totals 68 even though the raw total is 86. The difference is the 18 April units whose category is not yet represented in Monthly. This is a purposeful intermediate state. It demonstrates why an updated February point is insufficient evidence of full category coverage.

Add 2026-04 to Monthly!A5 and copy B4:D4 down to row 5 so relative month criteria use A5. The four-month summary should now reconcile to the raw total. Then extend both category and value references of the standard chart through row 5. Do not extend only the values or accidentally include a total control. Inspect the last point and its label. The final point is April 18, not the overall total and not the late receipt count.

Refresh the comparison PivotTable only after confirming that Receipts includes all fifteen rows. Inspect the pivot numerically before inspecting the chart. If either display differs, preserve the faulty state long enough to record its range, filter and summary settings. Repair the first failing dependency and rerun the same test. Repeatedly clicking Refresh All without an expected result can make a log look active while leaving the actual cause untouched.

ID	UsedOn	Department	ResourceType	Quantity	MonthKey
C13	2026-04-02	North	Guide	10	2026-04
C14	2026-04-12	South	Template	8	2026-04
C15	2026-02-25	South	Guide	3	2026-02

E07-X1 Predict the intermediate and final states

Apply chart_append.csv once to the initial laboratory data. Before creating April in Monthly, calculate the three-row summary total and its gap against Raw. Then give all four final monthly totals, final North and South totals, and source count.

Submit: An intermediate-state row and a final reconciliation.

08 Test filtering without changing the measure

A filter changes the population of records that contributes to a report. It should not silently change the measure, units or meaning of the category labels. A North-only trend still measures summed resource units by calendar month, but it describes North rather than all departments. Its title or visible scope note must say so. If an audience sees the all-department title with North-only values, the numbers can be perfectly calculated and still communicate the wrong claim.

In the formula-backed laboratory, North units and South units are separate explicit formulas. Filtering the Raw worksheet visually does not change SUMIFS into a visible-rows-only calculation. The formula still evaluates its referenced ranges according to its criteria. This is why a source filter dropdown is not sufficient evidence that the standard chart now represents a filtered population. Use the intended department series or a documented selector-based formula, then test the resulting values.

After the append, North's sequence is 11, 11, 16 and 10. South's sequence is 9, 12, 9 and 8. Adding the two sequences month by month reproduces All units: 20, 23, 25 and 18. These are useful comparison controls because the departments are disjoint and exhaustive under the laboratory's current records. For this measure, department quantities are additive. That should not be generalized to distinct counts in another report, where overlapping entities can make subtotals nonadditive.

A PivotChart linked to a department-filtered PivotTable should follow that pivot's active population. Verify the filter selection and numeric values together. A slicer that looks active may not be connected to every PivotTable in a workbook. In a multi-chart workbook, one chart can show North while another still shows all departments. Name the target chart and inspect its associated summary rather than assuming that a visible slicer governs the whole page.

Decide what to do when a department has no records in a month. Absence from a filtered event list does not by itself distinguish known zero activity from an incomplete extract. The baseline January–March population is complete for this exercise. The appended April records are supplied-to-date observations only; April is not declared a closed month. Later units introduce an explicit coverage record to separate these states. Until that rule is supplied, do not fill absent months with zero merely to produce a smooth, complete line. Population and completeness are part of the meaning, not decorative notes.

E08-X1 Audit two department views

After the append, an analyst labels a standard chart North only but keeps its values bound to Monthly!B2:B5. Give the currently plotted values, the required North values and the exact value-range repair. Explain whether hiding South rows in Raw would repair this SUMIFS-based chart.

Submit: A range correction and two four-value sequences.

09 Treat coverage wording as another dependency

A title is not necessarily connected to a chart's series. The initial laboratory coverage note names January–March 2026. Extending a value range through April can leave that text unchanged. This produces an internal contradiction: the last point says April while the title stops at March. A reviewer should not have to guess which element is authoritative. Maintain the coverage note as deliberately as the numeric series.

Separate stable and variable wording. Monthly resource units is a stable measure title. A nearby cell can state Coverage: January–April 2026; all departments; Guide and Template. If you link a title or text box to a formula cell in a supported Excel workflow, inspect the resulting link. A formula that mentions the maximum raw date alone can still misdescribe a filtered chart or an incomplete summary. Derive the label from the plotted population or explicitly reconcile it with that population.

The initial workbook keeps context in Monthly!A18:B21. A18:B18 identifies the population, A19:B19 the source period, A20:B20 a receipt count and A21:B21 the raw unit control. These cells are outside the chart's data range. Their location prevents a text note or a control total from becoming an accidental category. They are not automatically updated narrative fields. When you add April, revise the coverage text after the numeric and category checks pass. Do not use the time at which you opened the file as the activity period.

A title can also overstate completeness. Data through April 12 means the latest receipt in this batch is dated April 12. It does not establish that the full month of April has closed. The laboratory's April values are the supplied-to-date observations. A fair note is Receipts supplied through April 12, including a late February receipt. If the publication requires completed calendar months only, April should be excluded by a stated rule rather than silently mixed with completed months. The chart's contract determines the acceptable choice.

Annotation is especially important when a historical value changes. The late February record revises February from 20 to 23. A short update note explains that change without labeling it as February growth caused by April. A capture date, a latest business date and a covered month range are three different pieces of information. Include the ones needed to interpret the chart, and avoid compressing them into one ambiguous As of label.

E09-X1 Repair misleading wording

A final chart plots January 20, February 23, March 25 and April 18. It is titled January–March closed-month resource units and a footer says Refreshed April 15. The supplied records extend to April 12, and April is not declared closed. Write corrected title and scope text without claiming a refresh you did not execute.

Submit: Two display strings and one evidence statement.

10 Distinguish a missing month from zero activity

A continuous calendar has months even when no receipt rows exist. A report generated only from observed records may omit such a month completely. That omission can make two observations look adjacent when a period lies between them. Before deciding how to display the gap, determine what the missingness means. The chart cannot decide whether no records means no activity, an incomplete extract, or an excluded population.

Consider a separate teaching case with January=12 and March=15. February has no rows. Coverage record A says all February receipts were supplied and the desk issued no resources. Under that evidence, a February value of zero is appropriate. Coverage record B says February extraction failed. Under B, a zero would claim knowledge the source does not provide. Keep February represented as unavailable and explain the missing extract. The same sparse event table can therefore require different chart treatment depending on coverage evidence.

A calendar scaffold is a complete list of expected periods. It gives the summary one row per month even when the event table has none. In a formula summary, SUMIFS over an absent month commonly returns zero, but that numerical result only means no matching numeric contributions were found. It is not independent evidence that extraction was complete. Pair the computed sum with a coverage status. For a verified-complete period use the sum; for an incomplete period show an explicit unavailable state.

Excel chart treatment of blank cells and #N/A depends on chart type and available settings. Microsoft documents choices such as gaps, zeros or connecting across gaps for supported chart types. A formula returning an empty string is not always interchangeable with a genuinely empty cell. Test the actual chosen representation in the target application. Do not rely on a screenshot from another platform to establish how your workbook handles missing points.

Connecting across an unavailable month implies continuity but does not supply a measured value. It may be acceptable when clearly labeled, yet it can be misleading if the audience reads the segment as a known monthly trend. A visible gap and an adjacent data-status table are usually easier to explain. The requirement is semantic accuracy: a known zero, an unavailable value and a filtered-out period must not be collapsed into one visual state without disclosure.

Period	Recorded units	Coverage	Display decision
2026-01	12	Complete	Plot 12
2026-02	No receipt rows	Complete; confirmed no activity	Plot 0
2026-02	No receipt rows	Extract failed in alternative case	Show unavailable, not 0
2026-03	15	Complete	Plot 15

E10-X1 Choose a missing-period treatment

In case B above, a reviewer wants February filled with 0 so the line is continuous. State the defensible three-row numeric companion and the evidence needed before changing February to zero. Also give the corresponding sequence under case A.

Submit: Two clearly distinguished sequences and an evidence requirement.

11 Choose an axis that preserves the question

The category axis determines the order and spacing of observations. A monthly line chart can use equally spaced month labels because the comparison unit is a calendar month. With keys formatted yyyy-mm, lexical order also follows chronology for the years used here. If a report instead plots irregular daily dates, a text axis may give a one-day gap and a forty-day gap equal visual spacing. That could misrepresent the time pattern. Choose spacing intentionally for the analytical question.

Do not confuse sorting by label with grouping by month number. January 2026 and January 2027 must remain different categories. A pivot grouped only by Month can combine them unless year context is preserved. In the laboratory, the full MonthKey already contains the year. The expected order after the append is 2026-01, 2026-02, 2026-03, 2026-04. A separate boundary test can use 2026-12 and 2027-01 to verify that rollover works as intended.

Value-axis choices also affect interpretation. Resource units are nonnegative counts in this exercise. A line chart can use a narrowed value range to inspect small changes, but the axis bounds must be visible and stable enough for the intended comparison. If two department panels use different scales, the same visual slope does not represent the same numerical change. A shared scale makes magnitude comparison easier; a separate scale may reveal within-department variation but must be labeled.

The laboratory's January and February totals are initially equal at 20, so the segment between them should be level. After the append, February becomes 23, giving changes of +3, +2 and -7 across the four-month sequence. These differences are arithmetic facts, not evidence of causes. The chart does not show why March exceeded February or whether April's lower value represents reduced demand. April is partial, so comparisons with closed months need that limitation stated.

Inspect labels at the final display size. Month labels can wrap, disappear at automatic intervals or truncate when the chart is made smaller. Missing labels are not missing categories, but they can still confuse the reader. Use a visible numeric companion to retain precise month-value pairs. If every label cannot be read clearly, revise chart dimensions or label formatting rather than shrinking text until the chart merely fits.

Sequence	Valid interpretation	Invalid inference
20 → 23	February exceeds January by 3 units	The late receipt proves demand grew in April

Sequence	Valid interpretation	Invalid inference
23 → 25	March exceeds revised February by 2 units	The chart alone explains the cause
25 → 18	April-to-date is 7 lower than March	April closed-month demand fell by 28%
2026-12 → 2027-01	Two consecutive calendar months	Both belong to one January category

12 Keep the chart simple while its data grows

A chart that is readable with three points can become crowded after twelve monthly updates. Refreshability therefore includes a presentation boundary as well as a data boundary. Decide how many months the report is intended to show, whether old periods remain visible, and how labels should behave as the sequence grows. An expanding all-history chart and a rolling twelve-month chart are different products. Neither should be substituted for the other without changing the contract.

For an all-history design, add periods without dropping earlier ones. Verify the first and last categories after expansion. For a rolling window, define the cutoff mathematically: for example, the latest twelve calendar month keys including the newest covered month. A twelve-row limit alone is not enough if some months are absent. The window must be based on calendar meaning, not whichever twelve records happen to remain after a sort. A coverage scaffold helps make that distinction explicit.

Avoid adding every available field as a series. The laboratory supports All units, North units and South units, but plotting all three together can double-present the same quantities because the total is the sum of the two departments. That is not double counting in the source; it is a presentation choice that may invite readers to add the lines. If the question is total activity, one All units series is sufficient. If it is department comparison, use North and South with an explicit statement that they partition the total.

A stacked display changes the visual question. It can show contribution to total, but individual series not resting on the baseline are harder to compare across months. A standard two-series line chart emphasizes each department's trajectory. Select the chart form after stating what the reader must compare. Do not choose a more elaborate visual solely because a refresh added categories. The numeric companion should remain authoritative regardless of presentation.

Formatting changes should not conceal a failed update. Removing the April label, switching to a smoothed line or hiding zeros can make a chart look cleaner while reducing evidence. First preserve correct categories, values and scope. Then choose readable widths, legend labels and number formats. A polished object with a stale range is not a partial success; its polish makes the underlying mistake harder for a reader to notice.

E12-X1 Define a rolling window

A proposed chart shows monthly keys from 2025-11 through 2026-12, with no gaps, and must display the latest twelve calendar months including December 2026. State the retained first and last keys, the two removed keys, and why sorting by quantity before selecting twelve rows is wrong.

Submit: A precise category-selection rule.

13 Separate a changed value from a new category

A robust update test contains more than one kind of change. An edit to an existing quantity, a new receipt in an existing month, and a receipt in a new month each stress different dependencies. A changed quantity requires recalculation or refresh of the affected summary. A new receipt requires source membership. A new month additionally requires category coverage. Testing only the easiest case can leave the most consequential failure undetected.

Use a test matrix with inputs, expected affected cells, expected unchanged cells and restoration steps. For example, changing C01 from 8 to 9 should affect January All units and North units by +1, but not January South or any later month. Appending C15 affects February All units and South units by +3. Appending C13 and C14 introduces April with North 10, South 8 and All 18. Each result can be predicted from the row facts without looking at the chart.

A delete or replacement test is also useful, but distinguish the operation carefully. If a corrected extract replaces all current rows, retaining old rows and appending the new extract would double count. The laboratory append file is explicitly an append, so its operation differs from a replacement extract. State the batch mode in the evidence log. A report cannot infer whether two files are successive snapshots or additive transactions just from their names.

Duplicate application is a boundary condition worth testing in a disposable copy. Applying the laboratory append twice produces eighteen rows and a quantity total of 107. January remains 20, February becomes 26, March remains 25 and April becomes 36. The April point looks like a plausible increase, yet it represents repeated batch application. An identifier uniqueness check and row-count transition reveal the error. Do not remove repeated quantities merely because they are equal; identify the repeated receipt IDs.

Restore all temporary changes before delivering the current report. A test log should say whether a mutation was reverted and which state was retained. If a test cannot be executed in the available engine, write expected rather than passed. The strongest evidence combines independent arithmetic, inspected references and observed application behavior. Each covers a different failure class, and none should be mislabeled as the others.

Test	Source transition	Expected effect	Unchanged check
C01 8→9	Edit one value	January All 21, North 12	South January 9
Append C15 only	12→13 receipts	February All 23, South 12	January 20; March 25

Test	Source transition	Expected effect	Unchanged check
Append C13/C14 only	12→14 receipts	April All 18	February remains 20
Append all three twice	12→18 receipts	Total 107; duplicate C13–C15	January 20; March 25

E13-X1 Detect a repeated batch

A report shows January 20, February 26, March 25 and April 36 after importing chart_append.csv. The source has eighteen rows. Identify the likely operation error, list affected IDs and give the correct final sequence after removing only the repeated batch copy.

Submit: A cause, ID list and corrected sequence.

14 Diagnose failures by the first disagreement

Troubleshooting is faster when the comparison order follows the data flow. Start with the source's intended membership and types. Then inspect the summary population and aggregation. Then inspect the chart's source ranges or pivot association. Finally inspect wording and presentation. This does not mean the last layer is unimportant. It means you avoid repairing a display that is faithfully drawing the wrong numeric result.

Suppose Raw totals 86, Monthly totals 68 and the chart also totals 68 across three points. The chart is consistent with its summary, so the first disagreement is summary coverage. Adding April to the summary is the primary repair; editing chart colors is irrelevant. After that repair, if Monthly totals 86 but the chart still has three points, the first remaining disagreement is chart range coverage. A multi-step defect can therefore require more than one repair, verified in sequence.

If the chart has four points and the correct values but its title still says January–March, the numerical path is healthy and the wording dependency is stale. Record this as a label defect, not a numeric mismatch. If North-only values appear with an all-department scope note, inspect both the filter and the wording to determine which state was intended. The correct repair depends on the contract: either restore all-department values or accurately label the authorized filtered report.

If totals agree but categories differ, compare month-value pairs rather than their sum. A swapped January and February label can preserve total 86. A duplicate category and an omitted category can sometimes offset numerically. A complete test therefore includes category identity, order, uniqueness and endpoints. Grand-total agreement is necessary under the full-population contract, but it is not sufficient for a time-series report.

Keep corrective actions reversible until their effect is understood. Save the faulty binding or record its references before changing it. Use one controlled edit where possible. After repair, rerun the originally failing case and a nearby case that previously passed. This guards against a repair that fixes April by inadvertently dropping January. A short log of cause,

changed dependency and observed result is more valuable than a long narrative of every click.

Observed state	First likely disagreement	Focused next check
Raw 86; summary 68; chart 3 points	Missing summary category	Does Monthly include April?
Summary 86; chart 3 points	Fixed chart range	Do both references extend to row 5?
Four points correct; title stops March	Stale narrative field	Is title manual or linked?
Pivot 65; formula summary 86	Different source membership	Does Receipts include rows 14–16?
Total 86; months out of order	Category order	Inspect full yyyy-mm keys, not month names

15 Capture evidence that another person can repeat

A reproducible evidence record names the workbook state, source batch and action. Before update: twelve receipts, January–March, total 65. After appending chart_append.csv once: fifteen receipts, January–April with a February revision, total 86. Include the table extent, summary extent and chart references because they explain how the result was produced. A screenshot alone may omit all three.

Record predicted and observed results in different columns. A predicted value comes from the supplied source facts and your calculation. An observed value comes from the actual workbook or rendered output after the operation. If Excel was unavailable, leave the native refresh observation as not run rather than copying the prediction into the observed column. An independent script can verify arithmetic and an OOXML inspection can verify stored ranges, but those checks do not establish how a particular Excel version refreshes its PivotChart.

For a working report, include a compact numeric companion in the exported copy. At minimum it should show period and units, plus the active population and coverage limitation. This makes a printed or static chart interpretable without access to source formulas. Do not export a private scratch area or an intentionally broken test chart as if it were current. Keep the broken comparison only when it is clearly labeled as a teaching example or pre-update snapshot.

Use concrete assertions. Four chronological categories, ending 2026-04, is stronger than chart updated. February 23 including C15 is stronger than old months checked. No grand-total row in either reference is stronger than graph looks normal. Each assertion tells another person what to inspect and permits a clear pass, fail or not-run status. Avoid a single green status that conceals unperformed checks.

The evidence should be proportionate to the report's risk and size. This fifteen-row laboratory permits complete arithmetic inspection. A larger workflow may need automated controls, sampled source traces and a carefully defined acceptance record. The principle is unchanged: predictions are derived independently, actual outputs are observed, and limitations remain visible. Do not claim that the absence of an error message establishes the correctness of category membership or business meaning.

E15-X1 Write an honest acceptance record

You independently calculated 20,23,25,18, inspected saved chart references through row 5, and viewed a non-Excel rendered preview. You have not opened the workbook in Excel or refreshed a PivotTable. Write four evidence lines that distinguish established checks from remaining tests.

Submit: Four status lines with no inflated execution claim.

16 Design an independent chart audit

The final independent exercise uses chart_independent.csv. It contains six receipts from November 2026 through January 2027: two for November, one for December and three for January. Unlike the main lab, this case crosses a year boundary and includes a zero-quantity receipt. The records are deliberately small enough to verify by hand. Build a new monthly companion rather than copying the main lab's hard-coded month labels.

The supplied records are I01, November 2, East, 6; I02, November 19, West, 4; I03, December 5, East, 3; I04, January 2, West, 7; I05, January 14, East, 0; and I06, January 20, East, 2. Each row is a distinct receipt. The extraction is declared complete for those three months. East and West replace North and South for this case. Do not reuse a department criterion that excludes the new categories while still producing numeric zeros.

Create an ordered month key, an All units summary and a live standard chart or supported PivotChart. State the series source and the complete category list. Keep a separate receipt count so the zero-quantity receipt remains visible in membership. A total-quantity check alone cannot show whether I05 is retained because adding zero does not change the sum. This is a simple example of why count and sum controls complement each other.

Then model a late correction: I03's quantity changes from 3 to 5. This is replacement of one value on an existing receipt, not a new receipt. Record the expected changes before editing. The corrected total increases by 2, the December point increases by 2, and the receipt count remains unchanged. Restore the baseline or label the corrected version clearly. An audit must identify which version its chart represents.

A successful independent submission includes the source records, formulas or pivot layout, a numeric companion, chart bindings, coverage note and before/after correction log. Keep the source and the chart in the same workbook for this exercise so external-link permissions or file locations do not complicate the test. If you choose another implementation, it must preserve the same key, population, measure and reproducible update behavior.

ReceiptID	UsedOn	Department	Quantity
I01	2026-11-02	East	6
I02	2026-11-19	West	4
I03	2026-12-05	East	3
I04	2027-01-02	West	7
I05	2027-01-14	East	0
I06	2027-01-20	East	2

E16-X1 Build the independent year-boundary report

Using chart_independent.csv, build the three-month chart and numeric companion. Give receipt counts and quantity sums by month. Replace I03 quantity 3 with 5 in a disposable copy and record the corrected results. State why I05 remains included.

Submit: A baseline and corrected output table plus an update record.

17 Review the final dependency contract

A final review should be conducted from the reader's perspective and from the maintainer's perspective. The reader needs to know what the chart measures, which periods and population it covers, and whether any period is partial or unavailable. The maintainer needs to know where inputs belong, how month keys are formed, which summaries feed the chart, and what must be updated when a new period arrives. A report that satisfies only one perspective remains fragile.

Read the chart without using hidden workbook knowledge. Can you identify the unit from visible wording? Can you distinguish April-to-date from a closed month? Can you recover exact values from the numeric companion? Can you tell that the before-update image is static? If not, revise the presentation. Then inspect the technical path: source count, table boundary, helper formulas, summary rows, series references, filter state and labels. These two reviews should support the same interpretation.

The laboratory's correct final full-scope state has fifteen receipts and 86 resource units. The monthly sequence is 20,23,25,18. The new category is April; the revised historical category is February. North totals 48 and South 38. These facts are related but not interchangeable. A chart with four points can still have the wrong February value. A chart totaling 86 can still swap month labels. A chart with correct points can still describe an incorrect population.

Document the next boundary before handing over the workbook. The formulas inspect Raw rows 2 through 200, while the named table and standard-chart range require their own expansion checks. If the workbook is redesigned around structured references, a calendar scaffold or a PivotChart, rerun the same append, correction, filtering and missingness tests. Changing the implementation does not eliminate the need to demonstrate the contract. It changes which dependencies are inspected.

Retain only the intended final state in the current report. Keep disposable mutations in separate copies, and avoid distributing an unlabeled broken chart alongside the valid one. The current report and the test evidence can live together if their roles are explicit. The objective is a report that can be refreshed, explained and checked by another person without relying on the original author's memory.

Assessment

Choose one best answer per question. Questions 1–10 check the foundation concepts; questions 11–20 apply the extended study units. Complete and submit the practical tasks separately. A strong quiz score does not replace correct practical work.

1. For the foundation resource-desk chart, what should the vertical values measure?

A. Receipt count per month

B. Summed resource units per month

C. Cumulative resource units to date

D. Average units per receipt

2. In the foundation append, March receipts contain 8 and 12 units. Which March point is correct?

A. 10

B. 2

C. 71

D. 20

3. The foundation initially covers December 2025 through February 2026. March is appended. How many month categories should the chart have?

A. 4

B. 5

C. 14

D. 3

4. Why must a monthly series exclude the grand-total row?

A. Its value duplicates the last month exactly

B. It must always appear on a second axis

C. It combines months rather than representing one month

D. It prevents the source table from expanding

5. Two objects look identical before refresh. One is a normal pasted picture. What distinguishes it from the live chart?

A. The picture has a different numerical total

B. The picture lacks the live series link to refreshed cells

C. The picture cannot display month labels

D. The picture always has a fixed number of colors

6. The foundation pivot has March=20 but the chart still ends in February. What should be inspected first?

A. The chart association or category range

B. The sum of every already-correct March receipt

C. The original December receipt dates

D. The number format of all quantities

7. A live series expands through March. Which item can still need separate maintenance?

A. The receipt count must necessarily stay unchanged

B. Every pivot value must necessarily be stale

C. The source Quantity field must become text

D. A manually typed December–February title

8. Which order preserves the foundation monthly trend?

A. February, January, March, December

B. 20,24,18,9 ordered by quantity

C. 2025-12, 2026-01, 2026-02, 2026-03

D. December 2025, March 2026, January 2026, February 2026

9. After changing the source and refreshing, what should be verified before diagnosing chart styling?

A. Numeric monthly summary values and scope

B. Legend order alone

C. Title font size alone

D. The previous exported image alone

10. Which evidence best supports completion of the foundation update?

A. The chart and its old screenshot look similar

B. The live chart and summary agree after a controlled new-month append

C. The title includes the word refreshed

D. The workbook can be opened without an error dialog

11. The laboratory Raw total becomes 86, but Monthly still has only January–March and totals 68. What explains the gap?

A. A missing 3-unit February correction

B. A repeated 21-unit append

C. The 18 April units lack a summary category

D. A 65-unit baseline duplication

12. Which final All units sequence follows one correct laboratory append?

A. 20,20,25,21

B. 20,23,25,18

C. 20,26,25,36

D. 20,23,25,86

13. Raw rows are filtered visually to North, but the chart still reads All units SUMIFS formulas. What is true?

A. The chart must show North only

B. All South source values have been deleted

C. The chart becomes a snapshot

D. The formulas can still include South because their criteria did not change

14. A new source row has a valid date and quantity 0. Under the laboratory rules, what should happen?

A. Retain it in receipt count with zero sum contribution

B. Drop it because every plotted point must be positive

C. Treat its quantity as missing

D. Replace 0 with the previous receipt quantity

15. Which evidence establishes February=0 rather than February unavailable?

A. No February rows appear

B. The neighboring months are complete

C. The February extract is verified complete and no activity occurred

D. The line looks smoother with zero

16. The category range is A2:A5 but values are B3:B6. Both have four cells. What is the main risk?

A. The workbook must fail to open

B. Every date is automatically converted to text

C. The formula total must double

D. Month labels are paired with the wrong values

17. C01 changes from 8 to 9 in the initial laboratory. Which result is expected?

A. January All 21 and North 12; January South remains 9

B. January All 20 and North 11

C. All three monthly totals increase by 1

D. January receipt count increases by 1

18. In the independent case, I03 changes from 3 to 5 without adding a row. What is the corrected quantity total and receipt count?

A. 22 units and 6 receipts

B. 24 units and 7 receipts

C. 27 units and 7 receipts

D. 24 units and 6 receipts

19. A saved chart binding and non-Excel preview were inspected, but Excel was not run. Which statement is justified?

A. Native PivotChart refresh passed

B. Every Excel version will render identically

C. Stored binding and preview were checked; native refresh remains untested

D. Refreshing is unnecessary because XML exists

20. What should a latest-twelve-month window ending December 2026 retain?

A. November 2025 through December 2026

B. January 2026 through December 2026

C. The twelve months with greatest quantities

D. The latest twelve receipt rows

Sources and further reading

Create a PivotChart
https://support.microsoft.com/en-us/excel/get-started/create-a-pivotchart

Refresh PivotTable data
https://support.microsoft.com/en-us/excel/refresh-pivottable-data

Using structured references with Excel tables
https://support.microsoft.com/en-us/excel/using-structured-references-with-excel-tables

Update the data in an existing chart
https://support.microsoft.com/en-us/excel/get-started/update-the-data-in-an-existing-chart

Display empty cells, null values and hidden data in a chart
https://support.microsoft.com/en-us/excel/display-empty-cells-null-n-a-values-and-hidden-worksheet-data-in-a-chart