Charta | LESSON NOTES

Graphics interpretation: read the chart, then the blanks

Data Insights

1 What the question gives you

- A chart with a title, axes and units
- A sentence with two blanks, each with options
- Blanks ask for a value, a change, a count or a pattern
- The options are close together: read carefully

IN THE LESSON

- A graphics interpretation question has two parts.
- The first is a chart, with a title, labelled axes and units.
- The second is a statement with two blanks, and each blank has a drop down list of options.
- Your job is to pick the option that makes each sentence true.
- The blanks are usually about different skills.
- One blank may ask you to read a value, such as the revenue in a quarter.
- Another may ask for a change, such as a percentage rise.
- A third may ask you to find the biggest jump, or to count the points above a line.
- The options are chosen to be close together, so a careless read of the chart picks a wrong, tempting number.

2 The method: read, decide, measure, match

Chart first, then the blanks

1. Read the chart	title, axes, units	**read**
2. Read each blank	value, change, ratio, count?	**decide**
3. Take the numbers	to the nearest gridline	**write**
4. Measure	change from the start value	**work**
5. Match	nearest option, sentence true?	**check**

IN THE LESSON

- Here is the method.
- First, read the chart before the blanks: the title, what each axis measures, and the units, such as thousands.
- Second, read the sentence and decide what each blank asks for: a value, a change, a ratio, a share, a count or a pattern.
- Third, read the numbers you need from the chart, taking each point to its nearest gridline, and write them down on your scratch board.
- Fourth, measure: do the small calculation that the blank asks for, with the right starting point for any change.
- Fifth, match your answer to the nearest option, and then ask whether it makes the whole sentence true.
- Work one blank at a time, and never guess from the shape of the chart alone.

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3 What each chart is good for

Match the chart to the skill

Chart	What you read from it
Bar chart	values, and comparisons
Line graph	trend, change, where lines cross
Scatter plot	pattern, and dots in a region
Pie chart	shares of one whole

IN THE LESSON

- Different charts answer different kinds of blank.
- In a bar chart, the height of each bar is its value, so you read values and compare them.
- Always check that the bars start at zero.
- In a line graph, the points are joined, so the slope shows the change: steep means a big change, flat means little change.
- Where two lines cross, the order of the two series changes.
- In a scatter plot, each dot is one item with two values, so you look for a pattern: rising dots mean a positive relationship, falling dots a negative one, and a shapeless cloud, none.
- You also count the dots in a region, or above a line.
- And in a pie chart, each slice is a share of one whole.

4 The traps to watch for

- Percent change: divide by the starting value
- Units: thousands mean thousands
- In either direction: compare sizes, ignore the sign
- Read points to the gridline, not by eye

IN THE LESSON

- Here are the traps.
- The first is the wrong starting point.
- When the sentence says percent higher than the first quarter, the first quarter is the base, so you divide by it.
- Dividing by the new value is the classic error.
- The second is the wrong unit.
- A chart in thousands means a bar marked fifty stands for fifty thousand.
- The third is mixing up the raw change and the percentage change.
- The fourth is the words in either direction, which means a fall counts as much as a rise, so compare the sizes, ignoring the sign.
- The fifth is reading a point by eye instead of to the gridline.
- And the sixth is picking an option only because it is close, without checking that it makes the whole sentence true.

5 Percent change: the starting value

The same gap of 20, two different percents

Rise from 80 to 100	change 20, divide by 80	**+25%**
Fall from 100 to 80	change 20, divide by 100	**-20%**
Rule	(new - old) / old	**from what?**

IN THE LESSON

- Percent change deserves its own slide, because it decides more blanks than anything else.
- The rule: subtract the old value from the new value, divide by the old value, and multiply by one hundred.
- The old value is the one the sentence says it is compared with.
- Watch what happens with the same two numbers.
- Sales go from eighty to one hundred: the change is twenty, divided by eighty, which is a rise of twenty five percent.
- Now go the other way, from one hundred back to eighty: the change is twenty again, but divided by one hundred, which is a fall of twenty percent.
- The same gap of twenty gives two different percentages, because the starting value is different.
- Always ask, from what?

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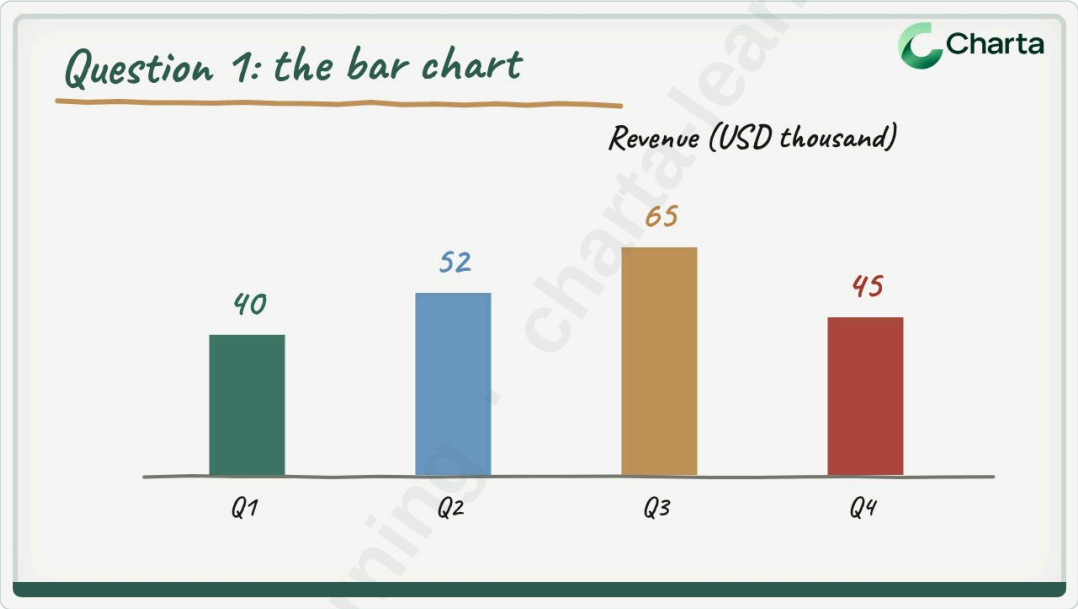
6 Reading a point to its gridline

- Follow your eye to the axis, along a gridline
- Points on a gridline are meant to be exact
- Line graph: read at the point, not between
- Write each value with its unit

IN THE LESSON

- Reading values is the foundation, so practise it.
- Find the point you need, and then follow your eye across to the vertical axis, ideally along a gridline.
- Most exam charts are drawn so that important points sit exactly on a gridline, which is a hint that the value is meant to be read exactly.
- If a point sits between two gridlines, read it to the nearer half, and notice that the options are usually far enough apart to forgive a small error.
- On a line graph, read the value at the point itself, and not at the line between the points.
- On a scatter plot, read both coordinates of the dot.
- And always write the value with its unit, so thousands do not turn into units.

7 Question 1: the bar chart



IN THE LESSON

- Our first chart is a bar chart of the quarterly revenue of a camping equipment shop, in thousands of dollars.
- Read it as the method says.
- The title is quarterly revenue, the unit is thousands of dollars, and the bars start from zero.
- The first quarter is forty.
- The second quarter is fifty two.
- The third quarter is sixty five.
- And the fourth quarter is forty five.
- Notice the shape: revenue rises for the first three quarters, and then falls in the last.
- Write the four numbers on your scratch board.
- They are everything we need for both blanks, and we do not need to measure anything else from the chart.

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8 Question 1: the two blanks

- Revenue in Q3 was closest to [1] percent higher than revenue in Q1,
- and the largest change in revenue between consecutive quarters,
- in either direction, occurred between [2].
- [1]: 25, 63, 100, 160
- [2]: Q1 and Q2, Q2 and Q3, Q3 and Q4

IN THE LESSON

- Now the sentence.
- Revenue in the third quarter was closest to blank one percent higher than revenue in the first quarter.
- And the largest change in revenue between consecutive quarters, in either direction, occurred between blank two.
- The options for blank one are twenty five, sixty three, one hundred and one hundred sixty.
- The options for blank two are, the first and second quarters, the second and third, and the third and fourth.
- Decide what each blank wants.
- Blank one wants a percentage change, so it needs a starting value, which is the first quarter.
- Blank two wants the biggest change in either direction, so it needs the size of each step, and the sign does not matter.

9 Question 1: solve each blank

Q3 against Q1, then the biggest step

Change Q1 to Q3	65 - 40	**25**
Percent, base Q1	25 / 40 = 62.5%	**63**
Step Q1 to Q2	52 - 40	**+12**
Steps Q2 to Q3, Q3 to Q4	+13 and 45 - 65	**+13, -20**
Biggest step in size	20, Q3 to Q4	**Q3 and Q4**

IN THE LESSON

- Blank one.
- The change from the first quarter to the third is sixty five take away forty, which is twenty five.
- Now the base.
- The sentence says higher than the first quarter, so divide by forty.
- Twenty five over forty is five eighths, which is sixty two and a half percent.
- The nearest option is sixty three.
- Notice the traps.
- Twenty five is the raw change, not the percentage.
- One hundred sixty is the ratio of sixty five to forty, which is more than one hundred.
- Blank two.
- The three steps are plus twelve, plus thirteen and minus twenty.
- The largest in size is twenty, the fall from the third quarter to the fourth.
- So the answer is the third and fourth quarters.
- The key is sixty three, and the third and fourth quarters.

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10 Question 2: two lines



IN THE LESSON

- The second chart is a line graph of the monthly output of two bottling plants, in thousand litres, from January to June.
- Plant A is the green line and Plant B is the gold line.
- Read every point to its gridline.
- Plant A produced forty, sixty, sixty, eighty, one hundred and one hundred.
- Plant B produced eighty, eighty, eighty, forty, forty and twenty.
- Write the two rows of numbers side by side, one for each plant.
- Notice what the picture tells you before any arithmetic.
- Plant A climbs, and Plant B falls, so the two lines must cross somewhere between March and April.
- That crossing is exactly what the first blank is about.

11 Question 2: the two blanks

- The first month in which Plant A produced more than Plant B was [1],
- and in June, Plant A's output was [2] times Plant B's output.
- [1]: February, March, April, May
- [2]: 5, 7.5, 10

IN THE LESSON

- Now the sentence.
- The first month in which Plant A produced more than Plant B was blank one.
- And in June, Plant A's output was blank two times Plant B's output.
- The options for blank one are February, March, April and May.
- The options for blank two are five, seven point five and ten.
- Decide what each wants.
- Blank one is a pattern question about the crossing of the two lines: we need the first month where the green number is higher than the gold number.
- Blank two is a ratio, and a ratio of A to B means A divided by B, with Plant B's output on the bottom.
- Be careful that more than means strictly more, and a tie does not count.

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12 Question 2: solve each blank

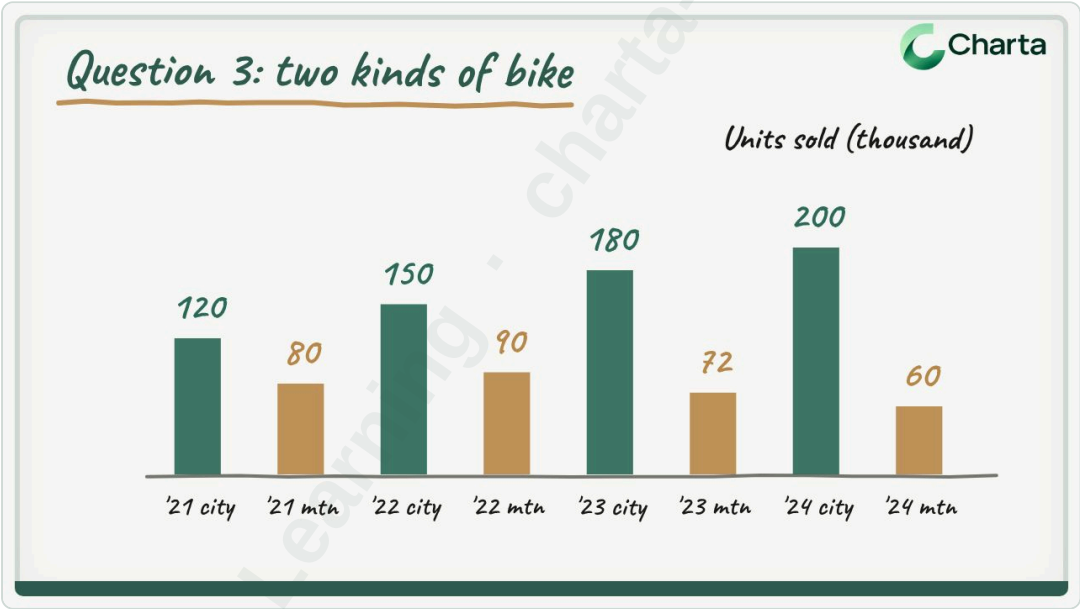
Month by month, then A over B in June

Jan, Feb, Mar: A against B	40, 60, 60 against 80	**A lower**
April	80 against 40	**A higher**
First month A is higher	April	**April**
June ratio, A over B	100 / 20	**5**

IN THE LESSON

- Blank one.
- Go month by month, comparing the two numbers.
- January, forty against eighty: A is lower.
- February, sixty against eighty: lower.
- March, sixty against eighty: still lower.
- April, eighty against forty: A is higher, for the first time.
- So the answer is April.
- Notice that in March Plant A did not even tie.
- Blank two.
- In June, Plant A is one hundred and Plant B is twenty.
- The ratio of A to B is one hundred divided by twenty, which is five.
- The options include ten, which is what you would get if you misread Plant B as ten, and seven point five, which has no meaning here.
- When a ratio is asked, put the second named quantity on the bottom.
- The key is April, and five.

13 Question 3: two kinds of bike



IN THE LESSON

- The third chart is a bar chart with two kinds of bike, sold by a bicycle maker from twenty twenty one to twenty twenty four, in thousands of units.
- For each year there is a bar for city bikes, in green, and a bar for mountain bikes, in gold.
- City bikes: one hundred twenty, one hundred fifty, one hundred eighty, and two hundred.
- Mountain bikes: eighty, ninety, seventy two, and sixty.
- Read both series.
- City bikes rise every year.
- Mountain bikes rise once, and then fall twice.
- Those two trends are different, and the sentence will ask about both.
- Write all eight values on your scratch board, in two rows, one for each kind of bike, so that a year lines up with its two bars.

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14 Question 3: the two blanks

- In 2024, city bikes made up approximately [1] percent of all bikes sold,
- and mountain bike sales in 2024 were [2] percent lower than in 2022.
- [1]: 70, 77, 83, 88
- [2]: 33, 40, 50, 67

IN THE LESSON

- The sentence reads: in twenty twenty four, city bikes made up approximately blank one percent of all bikes sold, and mountain bike sales in twenty twenty four were blank two percent lower than in twenty twenty two.
- The options for blank one are seventy, seventy seven, eighty three and eighty eight.
- For blank two they are thirty three, forty, fifty and sixty seven.
- Decide what each wants.
- Blank one is a share: the city bikes divided by all the bikes in twenty twenty four, so the whole is the two bars added.
- Blank two is a percent change, lower than twenty twenty two, so the starting value is the twenty twenty two mountain bike bar.
- Two blanks, two different bases.

15 Question 3: solve each blank

Share of 2024, then fall from 2022

All bikes, 2024	200 + 60	**260**
City share	200 / 260 = 76.9%	**77**
Fall in mountain bikes	90 - 60	**30**
Percent, base 2022	30 / 90 = 33.3%	**33**
The trap: base 2024	30 / 60 = 50%	**wrong**

IN THE LESSON

- Blank one.
- In twenty twenty four the city bikes are two hundred and the mountain bikes are sixty, so the whole is two hundred sixty.
- The share is two hundred over two hundred sixty, which is ten thirteenths, about seventy seven percent.
- A check by estimate: two hundred sixty times three quarters is one hundred ninety five, so seventy seven is sensible.
- Blank two.
- Mountain bikes fell from ninety in twenty twenty two to sixty in twenty twenty four, a drop of thirty.
- The sentence says lower than twenty twenty two, so divide by ninety.
- Thirty over ninety is one third, about thirty three percent.
- If you divided by sixty you would get fifty percent, which is on the list as a trap.
- The key is seventy seven, and thirty three.

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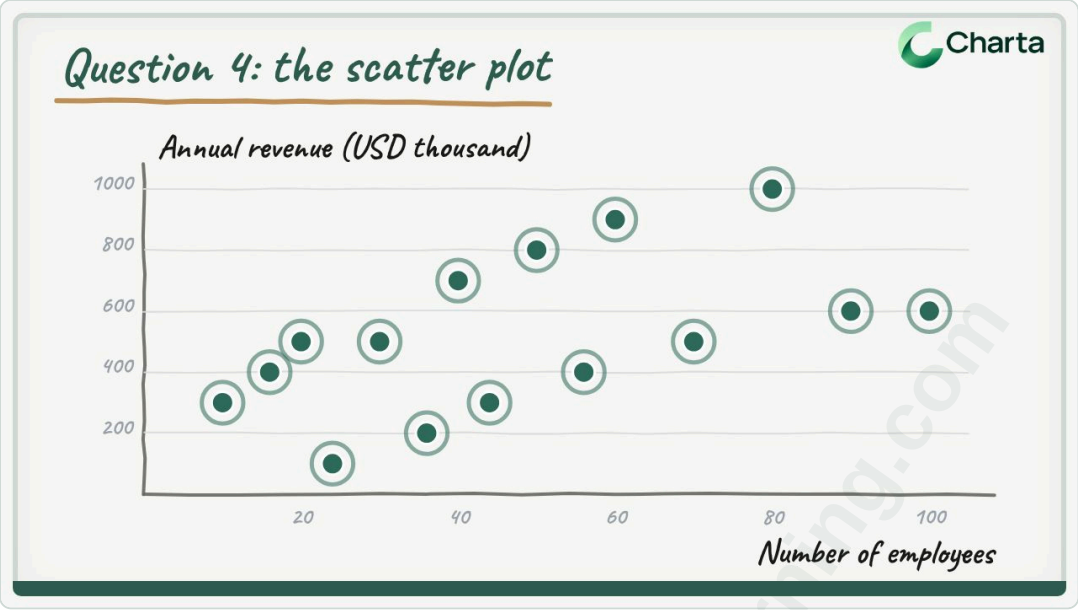
16 Question 4: the scatter plot



IN THE LESSON

- The fourth chart is a scatter plot of fifteen bakery shops.
- Each dot is one shop.
- Along the bottom is the number of employees, and up the side is the annual revenue in thousands of dollars.
- Read a few dots.
- The dot at ten employees is at three hundred thousand.
- The dot at forty employees is at seven hundred.
- The rightmost dot has one hundred employees and six hundred thousand.
- Look at the overall pattern: the dots climb to the right, but they are scattered, and some big shops earn less than small ones.
- Do not try to read all fifteen dots yet.
- First see what the two blanks ask, and then decide how to read only what you need.

17 Question 4: the two blanks

- Of the 15 shops, [1] have annual revenue per employee greater than USD 10 thousand,
- and the shop with the most employees has annual revenue per employee closest to USD [2] thousand.
- [1]: 4, 5, 6, 7, 8
- [2]: 2, 3, 4.5, 6

IN THE LESSON

- Now the sentence.
- Of the fifteen shops, blank one have annual revenue for each employee greater than ten thousand dollars, and the shop with the most employees has annual revenue for each employee closest to blank two thousand dollars.
- The options for blank one are four, five, six, seven and eight.
- For blank two they are two, three, four point five and six.
- The words for each employee tell you to divide revenue by staff.
- Blank one is a count, but counting fifteen divisions would be slow, so find a smarter test.
- Blank two needs only one dot: the rightmost one.
- A smart reader asks, what is the quickest test for revenue per employee above ten?

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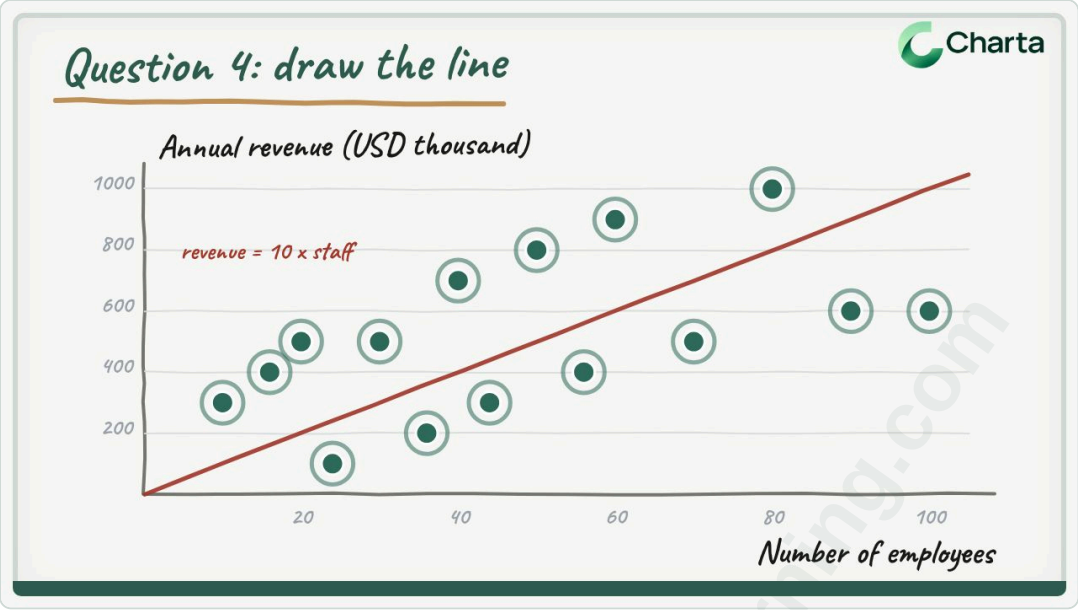
18 Question 4: draw the line



IN THE LESSON

- Here is the smart test.
- Revenue per employee above ten means revenue above ten times the number of employees.
- So draw the line where revenue is exactly ten times employees.
- At twenty employees it is two hundred, at fifty it is five hundred, and at one hundred it is one thousand.
- Any shop above that red line earns more than ten thousand dollars per employee, and any shop below it earns less.
- Now count the dots above the line.
- The shops with ten, sixteen, twenty and thirty employees are above.
- So are those with forty, fifty, sixty and eighty employees.
- That makes eight.
- The other seven are below.
- So blank one is eight.
- One line replaced fifteen divisions.

19 Question 4: solve each blank

Above the line: revenue greater than 10 times staff

10, 16, 20, 30 staff	all above the line	**4 shops**
40, 50, 60, 80 staff	all above the line	**4 shops**
The other seven shops	all below the line	**7 shops**
Blank 1	4 + 4	**8**
Blank 2: 100 staff, 600	600 / 100	**6**

IN THE LESSON

- Let us check the count properly, as the hard questions reward care.
- A shop is above the line when its revenue is more than ten times its staff.
- Ten employees: three hundred is more than one hundred, above.
- Sixteen: four hundred against one sixty, above.
- Twenty: five hundred against two hundred, above.
- Twenty four: one hundred against two forty, below.
- Thirty: five hundred against three hundred, above.
- Then forty, fifty, sixty and eighty are above, and the other shops are below.
- Eight in all.
- Blank two.
- The shop with the most employees has one hundred, and six hundred thousand of revenue, so revenue per employee is six hundred divided by one hundred, which is six.
- The key is eight, and six.

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20 Estimate first, then match

- Estimate the answer before the exact sum
- Rule out options that are far away
- Twenty five of forty: over half, under two thirds
- A wrong base usually lands on a ruled out option

IN THE LESSON

- Estimation is your safety net.
- After you have read the numbers, do a rough calculation before an exact one, and see which options survive.
- In question three, city bikes were two hundred of two hundred sixty.
- That is close to four fifths, so the share must be a little under eighty percent.
- Of the options seventy, seventy seven, eighty three and eighty eight, only seventy seven fits.
- In question one, twenty five out of forty is more than half but under two thirds, so sixty three is right and one hundred is far too big.
- The estimate does not replace the exact work.
- It catches slips such as dividing by the wrong number, because the wrong answer usually lands on an option your estimate has already ruled out.

21 Accurate and quick

- Title, axes and units first
- Write down only the numbers you need
- Say aloud the starting value before dividing
- Scatter counts: draw a line, do not divide fifteen times
- About two minutes, then decide

IN THE LESSON

- Now habits that save time without losing accuracy.
- First, read the title, axes and units before the sentence, every time.
- A bar marked fifty in a chart of thousands is fifty thousand.
- Second, write down the handful of numbers you need on scratch paper, instead of looking back at the chart.
- Third, for every change, say aloud which value is the starting value, before you divide.
- Fourth, when a blank asks for a count in a scatter plot, look for a line or a region that does the work for you, instead of calculating each dot.
- Fifth, check each blank against the options, and ask whether the whole sentence is true.
- Sixth, spend about two minutes.
- If one blank is slow, answer the other first.

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22 Quick check

1. Sales 80 in March, 100 in April: percent rise?
   Answer: 20 / 80 = 25 percent: the base is March.
2. A point on the 60 gridline of a chart in thousands?
   Answer: Sixty thousand, not sixty.
3. Scatter: shops earning over $5 thousand per employee?
   Answer: Draw revenue = 5 x staff; count the dots above.

IN THE LESSON

- Now a quick check.
- Pause after each question and answer it yourself.
- Question one.
- Sales were eighty in March and one hundred in April.
- By what percent did sales rise?
- The answer: twenty over eighty is twenty five percent, because March is the starting value.
- Question two.
- A line graph in thousands shows a point on the sixty gridline.
- What number is that?
- The answer: sixty thousand, not sixty.
- Question three.
- A scatter plot shows revenue and staff for several shops.
- How can you test quickly which shops earn more than five thousand dollars per employee?
- The answer: draw the line where revenue equals five times staff, and count the dots above it.

23 Recap: the graphics interpretation method

- Chart first: title, axes, units
- Name what each blank asks for
- Percent change: divide by the starting value
- Scatter counts: draw the test line
- Check the whole sentence

IN THE LESSON

- Let us recap the technique.
- Read the chart first: the title, the axes and the units.
- Then read each blank and decide what it asks for: a value, a change, a ratio, a share, a count or a pattern.
- Read the numbers you need to the nearest gridline and write them down.
- Measure carefully.
- A percent change is divided by the starting value, a share is divided by the whole, and a ratio is divided by the second named quantity.
- In either direction means you compare sizes and ignore the sign.
- For a count in a scatter plot, draw the line that does the test.
- Finally, match the nearest option, and check that the whole sentence is true.

Summary notes for the Charta whiteboard lesson. Figures are from the lesson's made-up examples.

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