Quantitative Skills and Mental Maths

Interview preparation summary · FP track

IN THIS SUMMARY

- Numbers under pressure
- Probability and judgement with numbers

INT.FQ.1.a · Numbers under pressure

Separate a percentage change from a percentage-point change, and work out stacked discounts, reverse percentages and changes in share by hand.

Interviewers open with percentages because finance teams talk in them all day and small slips are expensive. Three habits matter. First, separate a percentage-point change from a percentage change: a margin that moves from 14% to 16% has risen by 2 percentage points, which is a relative rise of about 14%, and saying 'up 2%' without the word points leaves the listener unsure which you mean. Second, always say what the percentage is of: an overspend is measured against the budget, not against the actual. Third, successive percentages multiply rather than add, so a 10% discount followed by a 5% discount is 14.5% in total, not 15%, and a price quoted including 20% sales tax is divided by 1.2 to get the net price, not cut by 20%. A good answer names the base, does the arithmetic aloud in short steps, checks the result against a rough estimate and then chooses the clearer wording. The usual mistakes are adding percentages that should be multiplied and dividing by the wrong base.

WORKED EXAMPLE: FENWICK FOODS: A MARGIN THAT ROSE FROM 31.0% TO 33.5%

Fenwick Foods is an invented food manufacturer. Revenue rose from 240.0m to 252.0m and gross margin rose from 31.0% to 33.5%. Describe the margin move in two ways, work out gross profit in both years and say how fast gross profit grew. Figures are in GBP m.

Answer: The margin rose by 2.5 percentage points, a relative rise of 8.1%. Gross profit rose from 74.4m to 84.42m, which is growth of 13.5%.

> **Interview tip:** Say 'percentage points' for differences between two percentages and 'per cent' for relative changes, and then give the money figure, because it settles any doubt about which one you meant.

INT.FQ.1.b · Numbers under pressure

Calculate a compound annual growth rate, project growth forward and explain why an average of growth rates can mislead.

Growth rates compound, so they cannot be averaged like ordinary numbers. The compound annual growth rate is the end value divided by the start value, raised to the power of one over the number of periods, minus one, where the number of periods is the gaps between data points: 2021 to 2025 is four periods, not five. Dividing the total growth by the number of years overstates the rate, because it ignores growth on growth. Two other tools are worth knowing by heart. The rule of 72 says that a quantity growing at r% a year doubles in about 72 divided by r years, which is a fast way to test a plan. And a rise of 10% followed by a fall of 10% leaves you 1% below where you started, because the second percentage applies to a larger base. Interviewers want the formula, the right number of periods, a sense check using the rule of 72 and a sentence on what drives the growth. The usual mistake is to take a simple average of yearly growth rates.

WORKED EXAMPLE: CALDER SOFTWARE: ANNUAL RECURRING REVENUE OF 18.0M TO 26.5M IN FOUR YEARS

Calder Software is an invented company. Annual recurring revenue (ARR) was 18.0m four years ago and is 26.5m today. Find the compound annual growth rate, compare it with a simple average, project ARR three years ahead at the same rate and estimate the doubling time. Figures are in GBP m.

Answer: The compound annual growth rate is 10.2%, not the 11.8% simple average. At that rate ARR would reach about 35.4m in three years and double in roughly 7.1 years.

> **Interview tip:** Say how many periods you used and quote the compound rate first. Then say what you would need to believe about customers and price for the same rate to continue.

INT.FQ.1.c · Numbers under pressure

Use ratios, margins and price changes quickly: choose the right base, weight averages by size, and estimate answers from a table by sensible rounding.

Finance interviews test whether you can do a ratio, a margin or a price change in your head and state it with the right base. Margin is profit over revenue and markup is profit over cost, so a product costing 60 and selling at 75 has a 20% margin and a 25% markup. An average across products must be weighted by size, so two lines with margins of 45% and 25% do not blend to 35% unless they have equal sales. A price change interacts with volume: a 5% price rise with a 4% volume fall lifts revenue only slightly, but because the cost per unit does not change, profit rises by much more, since profit per unit rises by a larger percentage than the price. For estimates, round to two significant figures, keep track of which way you rounded, and say the answer is about so much. The usual mistakes are using revenue as the base for a cost ratio and quoting a precise-looking answer from loose rounding.

WORKED EXAMPLE: MOSSGROVE TOOLS: A 5% PRICE RISE WITH A 4% FALL IN VOLUME

Mossgrove Tools is an invented company. It sells 250,000 units a year at a price of 40.0 with a unit cost of 26.0. A proposal is to raise the price by 5% and accept that volume will fall by 4%. Unit cost is unchanged. Work out the effect on revenue and on gross profit.

Answer: Revenue rises 0.8% to 10.08m, and gross profit rises 9.7% from 3.50m to 3.84m, provided volume falls no more than 4%.

> **Interview tip:** Lead with the combined effect on profit, not revenue. Then say how far volume could fall before the rise stops paying, which shows you understand the trade-off.

INT.FQ.2.a · Probability and judgement with numbers

Calculate an expected value from scenarios and probabilities, and judge a decision when the average hides a loss the company cannot absorb.

Expected value is the probability-weighted average of the possible outcomes: multiply each outcome by its probability and add. It is not the most likely outcome and it is not a prediction for one trial; it is what you would average over many similar decisions. Finance teams use it to compare tenders, product launches, credit exposures and forecast scenarios. Costs that are paid whatever happens, such as the cost of preparing a bid, come off the weighted total and are not themselves weighted. Costs already spent and unrecoverable are ignored. Probabilities must add to 100%, and the answer is only as good as the probabilities, so a strong candidate also asks how the result changes if the probability is lower, and finds the break-even probability. Finally, an average can hide a loss that the company cannot absorb, so the answer ends with the size and chance of the downside, not just the mean. The usual mistakes are forgetting to weight, including sunk costs and ignoring the range.

WORKED EXAMPLE: LOWMOOR ENERGY: CHOOSING BETWEEN TWO TENDER PRICES

Lowmoor Energy is an invented services company. Preparing a tender costs 0.5m whatever happens. At a high price it has a 30% chance of winning and would earn 5.2m of profit before the bid cost. At a lower price it has a 45% chance of winning and would earn 3.4m before the bid cost. Ignore tax and timing. Which price has the higher expected value, and is the choice clear-cut?

Answer: The expected values are 1.06m for the high price and 1.03m for the lower price. The choice is too close to call on the numbers alone.

> **Interview tip:** Give both expected values, say the gap is small compared with the uncertainty in the probabilities, and then say what extra evidence on win chances you would collect.

INT.FQ.2.b · Probability and judgement with numbers

Find a break-even point from fixed costs and contribution, and test how profit responds to a change in price, cost or volume.

Break-even analysis separates costs that move with volume from costs that do not. Contribution is price less variable cost, per unit or as a percentage of revenue, and the break-even volume is fixed costs divided by contribution per unit. For a profit target, add the target to the fixed costs before dividing. The margin of safety is the gap between expected sales and break-even, usually shown as a percentage of expected sales, and it tells you how much sales can fall before the project makes a loss. Sensitivity then asks which assumption matters most. Because fixed costs do not move, a 5% change in price falls

straight through to profit while a 5% change in volume only moves contribution, so price is usually the most sensitive input and operating profit changes by a larger percentage than sales. Interviewers want the formula, one clear sentence of interpretation and a rank of the risks. The usual mistake is to treat all costs as fixed or all as variable.

WORKED EXAMPLE: MARLOW PACKAGING: A NEW FILLING LINE

Marlow Packaging is an invented company. A new filling line has fixed costs of 1.80m a year, a selling price of 12.0 per unit and a variable cost of 7.5 per unit. Expected sales are 480,000 units a year. Find the break-even volume and the margin of safety, then test a 5% lower price and a 5% higher variable cost, one at a time.

Answer: Break-even is 400,000 units and the margin of safety is 16.7%. A 5% lower price lifts break-even to 461,538 units and a 5% higher variable cost lifts it to 436,364 units.

> **Interview tip:** Quote the formula, give the number and the margin of safety, and then say which assumption you would check first and why.

INT.FQ.2.c · Probability and judgement with numbers

Read a chart or table aloud in a clear order, and sense-check a figure against a rough estimate, a typical range and the other numbers on the page.

Interviewers often hand over a chart or a table and ask what you see. A good reading has an order: say what the chart shows and the units, give the headline in one sentence, describe the shape (trend, seasonality, outliers), quantify one or two points, and end with the so-what or the question you would ask next. Before trusting any picture, check the axis: a vertical axis that starts above zero makes small changes look large, and a pie that does not add to 100% or a bridge that does not add to its end point signals an error. Sense-checking works the same way for your own figures. Compare the answer with a rough estimate, with a typical range for that kind of ratio, and with related numbers: if costs rose 3% while cost per unit fell 5%, volumes must have risen. When something looks off, say so, check the inputs and units before presenting. The usual mistakes are reading every bar in turn and presenting a number that you did not sanity check.

WORKED EXAMPLE: HARTWELL DAIRY: READING A QUARTERLY REVENUE CHART ALOUD

Hartwell Dairy is an invented company. A bar chart shows quarterly revenue in GBP m for this year and last year: this year 21.0, 22.4, 20.1, 26.5, last year 19.8, 21.0, 19.2, 23.9, for the first to fourth quarter. Describe the chart aloud in under a minute and give one check on the figures.

Answer: Revenue grew 7.3% to 90.0m, with a strong fourth quarter at 10.9% growth that I would investigate.

> **Interview tip:** Keep the order: what it is, the headline, the shape, one number, one question. Stop when you have given your next step instead of describing every bar.

Summary of the Charta interview-preparation topic. Companies and figures in the examples are invented. Draft content, not yet expert reviewed.