Returns and Deal Maths

Interview preparation summary · PE track

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INT.RD.1.a · Time value and return metrics

Use the rule of 72 and doubling shortcuts to estimate growth rates and time horizons in your head.

Compounding questions are usually solved with doubling, not a calculator. The rule of 72 says the years to double are roughly 72 divided by the annual percentage rate, and the rate needed to double in n years is roughly 72 divided by n. Chain doublings for larger multiples: 4x is two doublings, 8x is three. The rule is most accurate for rates of about 6% to 12%; at very high rates it gives a doubling time that is a little too short, and at very low rates a little too long. Real returns are approximately nominal return minus inflation, which is accurate enough for a quick answer but not exact. Always state the approximation you are using and, if time allows, say how far off it could be. Interview point: say the shortcut aloud, give the answer, and add one sentence on its accuracy, because interviewers are marking the reasoning as much as the number.

WORKED EXAMPLE: DOUBLING A HOLDING AT 12 PERCENT A YEAR

A sponsor owns a company worth 30m and expects its value to grow at 12% a year, compounding, with no cash paid out. An interviewer asks: how long until it is worth 120m, how reliable is your shortcut, and if inflation is 3% a year, what is the real growth rate? Use the rule of 72 and give the approximate answers.

Answer: It takes about 12 years (exactly about 12.2) to reach 120m, and real growth is about 9% a year (exactly 8.7%).

> **Interview tip:** Say the rule, the doublings and the answer in that order, then add one sentence on accuracy. The interviewer is listening for you to name the approximation and its likely error without being prompted.

INT.RD.1.b · Time value and return metrics

Compare IRR and money multiple for a deal and explain when each one misleads.

The money multiple (MOIC) is total cash returned divided by cash invested; it ignores timing. IRR is the single annual rate that sets the net present value of all cash flows to zero; it rewards speed. Two deals with the same 2.0x can have very different IRRs if one is held three years and the other six. A quick IRR check is the multiple raised to one over the years, so 2.5x over 5 years is about 20% a year. IRR misleads when interim cash flows are reinvested at a lower rate than the IRR, when a small early return flatters a deal that makes little profit in absolute terms, and when cash flows change sign more than once, which can give several IRRs. Multiples mislead by hiding a long hold. Interview point: quote both, say which one the situation favours, and name what each hides.

WORKED EXAMPLE: TWO EXITS WITH DIFFERENT MULTIPLES AND SPEEDS

A fund compares two exits with no interim cash flows. Deal A: 50m invested, 125m returned after five years. Deal B: 50m invested, 100m returned after two years. An interviewer asks: give me the money multiple and IRR of each, say which you prefer, and tell me what each measure hides.

Answer: A is 2.5x at about 20% and B is 2.0x at about 41%; B is better if the 100m can be redeployed above about 7.7%, otherwise A.

> **Interview tip:** Quote both numbers for both deals, then say which you prefer and under what condition. The interviewer is listening for what each measure hides, not just which deal wins.

INT.RD.2.c · Leverage and ownership

Show how debt magnifies equity returns and losses, and say when leverage helps and when it hurts.

Leverage raises the equity return when the return on the whole asset exceeds the after-tax cost of debt, and lowers it when it does not. Equity return equals the asset return plus debt over equity times the gap between the asset return and the cost of debt. The same maths works on the downside: a fall in enterprise value is borne first by equity, so with half the price funded

by debt a 10% fall in value costs equity 20% before interest. Because interest is tax-deductible, the after-tax cost of debt is the interest rate times one minus the tax rate. A fall in earnings and a lower exit multiple together can remove most of the equity even when value falls by less than the debt share. Interview point: show the upside, then the downside, and name the risk of covenant breach.

WORKED EXAMPLE: GEARING ON A 200M BUYOUT

A sponsor buys a business for 200m, funded with 100m of debt and 100m of equity. Interest is 8% and the tax rate is 25%. Over one year the business value rises 12%; debt is not repaid and there are no fees. What is the equity return? What if value falls 10%? And when would the debt not help?

Answer: Equity earns 18% if value rises 12% and loses 26% if value falls 10%, and leverage helps only when the asset return beats 6%.

> **Interview tip:** Give the upside, then the downside straight after it, and name the break-even rate. The interviewer is listening for you to bring up the downside and covenant risk without being asked.

INT.RD.2.d · Leverage and ownership

Work out ownership, share price and dilution after a funding round, including the effect of an option pool.

Post-money valuation equals pre-money valuation plus the new money, and the new investor's ownership is the new money divided by the post-money valuation. The price per share is the pre-money valuation divided by the shares outstanding before the round (including any pool created before the money arrives). Existing holders are diluted pro rata: if new investors take 20% of the company, every existing percentage is multiplied by 80%. An option pool created before the round and counted in the pre-money lowers the effective pre-money valuation seen by the founders, because the pool's value comes out of their side. Always state whether the pool is counted pre-money or post-money. Interview point: use percentages of the post-money company rather than share counts, and say which basis you are using.

WORKED EXAMPLE: OPTION POOL INSIDE THE PRE-MONEY

A start-up with no outside investors is valued at 40m before a round in which a new investor puts in 10m. The investor requires an option pool of 10% of the post-round company, created before the money arrives and counted inside the 40m. The founders hold 7m shares. Find post-money value, each party's ownership, the price per share and the founders' effective pre-money.

Answer: Post-money is 50m, the investor owns 20%, the pool 10% and the founders 70%, at 5 per share, so the founders' effective pre-money is 35m, not 40m.

> **Interview tip:** Work in percentages of the post-money company and say where the pool sits before you start. The interviewer is listening for you to notice that the pool in the pre-money lowers the founders' effective price.

INT.RD.3.e · Deal arithmetic

Test whether an acquisition is accretive or dilutive to earnings per share and find the synergies needed to break even.

A deal is accretive if pro-forma earnings per share are higher than the acquirer's standalone figure. Build pro-forma net income as acquirer income plus target income, less the after-tax interest on any new debt, plus after-tax synergies. Divide by acquirer shares plus any new shares issued, where new shares equal the stock consideration divided by the acquirer's share price. A quick test: an all-stock deal is accretive when the acquirer's price-to-earnings ratio exceeds the price-to-earnings ratio paid for the target; a debt-funded deal is accretive when the target's earnings yield exceeds the after-tax cost of debt. To find break-even synergies, work out the after-tax earnings gap and divide by one minus the tax rate. Interview point: say the shortcut first, then confirm with the numbers, and state your tax and synergy assumptions.

WORKED EXAMPLE: DEBT-FUNDED PURCHASE AND BREAK-EVEN SYNERGIES

An acquirer earns 100m after tax on 50m shares, so earnings per share are 2.00. It buys a target earning 20m after tax for 400m, paid wholly with new debt at 8% interest. The tax rate is 25%. Ignore fees and debt repayment. Is the deal accretive, and what pre-tax synergies are needed to break even?

Answer: The deal is dilutive, with EPS of 1.92 against 2.00, and needs about 5.3m of pre-tax synergies to break even.

> **Interview tip:** Give the shortcut first, then confirm it with the pro-forma numbers and state your tax assumption. The interviewer is listening for the after-tax cost of debt and for dividing by one minus the tax rate at the end.

INT.RD.3.f · Deal arithmetic

Do percentage, growth-rate and margin arithmetic quickly and without common slips.

Quick arithmetic in deals rests on a few habits. Percentage growth is the change divided by the starting value, so a rise from 80 to 100 is 25%, not 20%. Successive changes multiply rather than add: a 25% rise followed by a 20% fall leaves you where you started. A margin is a profit measure divided by revenue, and changes in margins are quoted in percentage points, which is different from a relative change. Growth in profit is approximately revenue growth plus margin expansion, but the exact figure multiplies the two. Where costs are partly fixed, a fall in revenue causes a larger percentage fall in profit, known as operating leverage. A compound annual growth rate is the end value over the start value raised to one over the years, minus one. Interview point: say which base you are using before you divide.

WORKED EXAMPLE: GROWTH, MARGIN AND CAGR IN ONE ANSWER

A company's revenue rises from 200m to 240m while its EBITDA margin improves from 15% to 17%. An interviewer asks: what is revenue growth, how would you describe the margin change, how much does EBITDA grow, and if that EBITDA growth took three years, what is the annual growth rate? Do it without a calculator.

Answer: Revenue grew 20%, margin rose 2 percentage points, EBITDA grew 36% (from 30m to 40.8m) and the three-year CAGR is about 10.8%.

> **Interview tip:** State the base before dividing and keep 'percentage points' separate from 'percent'. The interviewer is listening for whether you multiply growth and margin changes instead of adding them.

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