Math Clinic 2025

The Arthur Lok Jack Global School of Business

Saleem Kamaludin

Session 1 - Wednesday 3rd September 2025

What is the Math Clinic?

What is the Math Clinic?

Purpose
A short, two-session refresher designed to bring everyone up to speed on the essential mathematics you'll need in some of your upcoming courses but not limited to:

- Operations for Competitiveness
- Microeconomics for Management Decision-Making
- Cost & Financial Accounting

What is the Math Clinic?

Purpose
A short, two-session refresher designed to bring everyone up to speed on the essential mathematics you'll need in some of your upcoming courses but not limited to:

- Operations for Competitiveness
- Microeconomics for Management Decision-Making
- Cost & Financial Accounting

Why we are doing this

- Many students arrive with different mathematical backgrounds.
- Quantitative skills are crucial for success in graduate business study.
- This clinic is ungraded: a safe space to practise, ask questions, and rebuild confidence.

Why Numeracy Matters for Managers

Strategic decisions are quantitative decisions.
Pricing, budgeting, KPIs, break-even targets, and risk analysis all reduce eventually to disciplined manipulation of numbers.

Why Numeracy Matters for Managers

Strategic decisions are quantitative decisions.
Pricing, budgeting, KPIs, break-even targets, and risk analysis all reduce eventually to disciplined manipulation of numbers.

But effective managers first cultivate judgment.
Estimate the scale, *compute* precisely, then *interpret* the figure in context.

Why Numeracy Matters for Managers

Strategic decisions are quantitative decisions.
Pricing, budgeting, KPIs, break-even targets, and risk analysis all reduce eventually to disciplined manipulation of numbers.

But effective managers first cultivate judgment.
Estimate the scale, *compute* precisely, then *interpret* the figure in context.

Session 1 objective (next 120 min): restore fluency with core arithmetic ideas (percent change, ratios, mark-up vs. margin, weighted averages).

Pedagogical contract for today
We will work in three moves: **Estimate** → **Compute** → **Interpret**.

Quick Diagnostic — Worked Solutions

Q1. A price rises from \$80 to \$92. The change is \$92 - \$80 $=$ \$12. When that increment is compared with the *original* amount the relative change is $\frac{12}{80} = 0.15$, which we read as a **15%** increase. (If we were talking about interest rates we would say the rate rose by 15 *percent*, not 15 percentage points.)

Quick Diagnostic — Worked Solutions

Q2. A unit costs \$60 and sells for \$75, so the profit per unit is \$15. The *margin* answers the question "what fraction of the selling price is profit?": $\frac{\$15}{\$75} = 0.20 = 20\%$. The *mark-up* answers "by what fraction is cost scaled to reach price?": $\frac{\$15}{\$60} = 0.25 = 25\%$. Thus margin is 20% while mark-up is 25%; the two figures differ because they measure the same \$15 against different bases.

Quick Diagnostic — Worked Solutions

Q3. Successive discounts of 25% and 10% do *not* sum to 35% because the second cut applies to an already-reduced price. After the first reduction the customer owes only 75% of the list price; the second leaves 90% of that amount. Multiplying the two retention factors gives $0.75 \times 0.90 = 0.675$, so the customer ultimately pays 67.5% of the original price. Equivalently, the single discount factor that replaces the two is 0.675, corresponding to one overall discount of $100\% - 67.5\% = 32.5\%$.

Try Yourself Q1 — Percent Change

A supplier raises the unit price of a component from \$48 to \$54. What percentage increase does that represent?

Try Yourself Q1 — Percent Change

A supplier raises the unit price of a component from \$48 to \$54. What percentage increase does that represent?

Solution

The absolute increase is \$54 - \$48 = \$6. To express that gain relative to the original price, divide by \$48:

$$\frac{6}{48} = 0.125 = 12.5\%.$$

Hence the price rose by **12.5 %**. *Notice we always measure the change against the starting value, never the ending one, when reporting a percentage increase.*

Try Yourself Q2 — Reverse Percentage

After a seasonal promotion the sale price of a jacket is \$85, which the retailer states is *15 % below* the original price. What was the original price before the discount?

Try Yourself Q2 — Reverse Percentage

After a seasonal promotion the sale price of a jacket is \$85, which the retailer states is *15 % below* the original price. What was the original price before the discount?

Solution

A reduction of 15 % means the customer pays 85 % of the original tag:

$$\textit{Sale price} = 0.85 \times \textit{Original price.}$$

Solving for the unknown gives

$$\textit{Original price} = \frac{\$85}{0.85} = \$100.$$

So the jacket originally listed for **\$100**. *Working "backwards" from a percentage change always requires dividing by the retention factor, not subtracting the percentage from the sale price.*

Try Yourself Q3 — Stacked Discounts

An online store offers two successive discounts on a laptop: 20 % during checkout and a further 15 % for students. What single overall discount is equivalent to applying both in sequence?

Try Yourself Q3 — Stacked Discounts

An online store offers two successive discounts on a laptop: 20 % during checkout and a further 15 % for students. What single overall discount is equivalent to applying both in sequence?

Solution

*A 20 % discount leaves 80 % of the list price (*0.80*). Applying a further 15 % discount leaves 85 % of whatever remains (*0.85*). Multiplying the two retention factors gives*

$$0.80 \times 0.85 \; = \; 0.68.$$

Thus the customer ends up paying 68 % of the original price, which is the same as receiving a $100\% - 68\% = 32\%$ *overall discount. Because each reduction works on the current price, the correct approach is multiplication, never simple addition.*

Try Yourself Q4 — Mark-Up vs Margin

A retailer buys a gadget for \$40 and wishes to operate with a *margin* of 25 %.

(a) What selling price achieves that margin?

(b) What is the corresponding mark-up percentage on cost?

Try Yourself Q4 — Mark-Up vs Margin

A retailer buys a gadget for \$40 and wishes to operate with a *margin* of 25 %.

(a) What selling price achieves that margin?

(b) What is the corresponding mark-up percentage on cost?

Solution

(a) *Margin compares profit with selling price. If the margin target is 25 %, then profit must be one quarter of the selling price:*

$$\textit{Margin} \;=\; \frac{P - C}{P} \;=\; 0.25, \qquad \textit{where } C = \$40.$$

Solving, $P - 40 = 0.25\,P \implies 0.75\,P = 40 \implies P = \frac{40}{0.75} = \$53.33\overline{3}.$

(b) Mark-up compares profit with *cost*. The profit here is $P - C = 53.33\overline{3} - 40 = 13.33\overline{3}.$ Hence

$$\text{Mark-up} \;=\; \frac{13.33\overline{3}}{40} \;=\; 0.333\overline{3},$$

or **33.3 %**. Notice: a 25 % margin corresponds not to a 25 % mark-up, but to roughly a 33 % mark-up because the two ratios use different bases.

Extra Q5 — Percent Decrease

A raw-material index falls from 250 points to 212 points over one quarter. By what percentage did the index decline?

Extra Q5 — Percent Decrease

A raw-material index falls from 250 points to 212 points over one quarter. By what percentage did the index decline?

Solution

The absolute drop is $250 - 212 = 38$ *points. Because percentages always compare to the starting level, we divide by 250:*

$$\frac{38}{250} = 0.152 \;=\; 15.2\%.$$

Hence the index experienced a **15.2 % decrease**. *Stating "15%" instead of "38 points" communicates the scale of the move independently of the index's arbitrary base.*

Extra Q6 — Reversing a Percentage Increase

After commodity prices rose 12% this month, a tonne of steel now costs \$56. What was the price per tonne before the increase?

Extra Q6 — Reversing a Percentage Increase

After commodity prices rose 12% this month, a tonne of steel now costs \$56. What was the price per tonne before the increase?

Solution

A 12% *rise means the new price is* 112% *of the old one, i.e. a retention factor of* 1.12. *Let* P_{old} *be the pre-rise price. Then*

$$1.12 \times P_{old} = \$56.$$

Dividing by 1.12 *isolates the unknown:*

$$P_{old} = \frac{\$56}{1.12} = \$50.$$

Therefore the steel cost \$**50 per tonne** *before the market moved. Note that we divide by the factor because we are working in reverse.*

Extra Q7 — Connecting Mark-Up and Margin

A boutique purchases designer headphones for \$120 apiece and applies a *mark-up* of 30% on cost.

(a) What selling price results?

(b) What profit *margin* (as a percentage of selling price) does this generate?

Extra Q7 — Connecting Mark-Up and Margin

A boutique purchases designer headphones for \$120 apiece and applies a *mark-up* of 30% on cost.

(a) What selling price results?

(b) What profit *margin* (as a percentage of selling price) does this generate?

Solution

(a) Selling price. *A 30% mark-up enlarges cost by the factor* $1 + 0.30 = 1.30$*:*

$$P = 1.30 \times \$120 = \$156.$$

(b) Margin. *Profit per unit is* $P - C = 156 - 120 = \$36$*. Margin measures profit relative to the selling price, so*

$$Margin = \frac{36}{156} \approx 0.2308 = 23.08\%.$$

Thus a 30% mark-up on cost corresponds to about a **23 % margin** *on selling price. Managers must be fluent in both ratios, noting that margin is always the smaller figure because profit is compared with the larger base* P*.*

Percentage Points vs Percent — Core Idea i

Two different yardsticks for change.

A *percentage point (pp)* is an *absolute* difference between two quoted rates. Example: moving from 3.5% to 4.2% is a gain of 0.7 pp — the subtraction uses the same unit (%) for both endpoints.

A *percent change* is a *relative* difference that scales the increment by a reference level:

$$\text{Percent change} = \frac{\text{new} - \text{old}}{\text{old}} \times 100\%.$$

Using the same example we obtain $\frac{0.7}{3.5} = 0.20 = 20\%$.

Why the distinction matters.

Regulators quote interest-rate moves in **percentage points**; portfolio managers report year-on-year growth in **percent**.

Percentage Points vs Percent — Core Idea ii

A change "from 1.0% to 2.0%" doubles the rate (a $+100\%$ move) yet is only a $+1$ pp shift; confusing the two can exaggerate or understate risk.

Mnemonic. $\boxed{\text{point} = \text{subtract}}$; $\boxed{\%\ \text{change} = \text{divide by old}}$

Avoiding Pitfalls — Practical Guidelines i

Frequent errors.

- Summing raw % changes across periods (should multiply factors).
- Calling a $+2$ pp rise in VAT "a 2% increase" when the base rate is 12% — in fact that raises tax by $\frac{2}{12} \approx 16.7\%$.
- Mixing bases: applying a percent discount to a net price instead of the list price.

Managerial checklist.

Three questions before quoting any change

- What is the *base* or *denominator*? (Old value? Total revenue? GDP?)
- Am I describing an *absolute* shift (points) or a *relative* shift (percent)?
- If stakeholders compare multiple changes, are they all measured on the same base?

Avoiding Pitfalls — Practical Guidelines ii

Rule of thumb. Use **percentage points** whenever the underlying quantity is itself a rate, ratio, or percentage (interest, margin, penetration). Use **percent change** for everything else (prices, costs, volumes, revenues).

Adapted from Haeussler, Paul & Wood (2013), Ch. 2, and common financial reporting standards.

Q8 — Percentage Points versus Percent

A loan's annual interest rate rises from 3.5% to 4.2%.

Task. Report *both* the absolute change in *percentage points* and the relative change expressed as a *percent*.

Q8 — Percentage Points versus Percent

A loan's annual interest rate rises from 3.5% to 4.2%.

Task. Report *both* the absolute change in *percentage points* and the relative change expressed as a *percent*.

Solution

The old rate is 3.5%; *the new rate is* 4.2%.

Percentage-point change. Subtract the two quoted rates directly:
$4.2\% - 3.5\% = 0.7$ *percentage points.*

Percent change. Compare the increment with the starting rate:

$$\frac{4.2 - 3.5}{3.5} = \frac{0.7}{3.5} = 0.20 = 20\%.$$

Hence the rate increased by **0.7 pp** *(percentage points) or, equivalently, by* **20 %** *relative to its original level. Managers must quote both figures correctly: percentage points for movements between two rates, percent for proportional growth.*

Q9 — Reversing a Percentage Change

After a 12% discount, a conference fee is now quoted at $308.

Task. Recover the original list price before the discount.

Q9 — Reversing a Percentage Change

After a 12% discount, a conference fee is now quoted at \$308.

Task. Recover the original list price before the discount.

Solution

A 12% *reduction leaves* 88% *of the original value. Mathematically,*

$$0.88 \times \textit{Original price} = \$308.$$

Dividing both sides by the retention factor 0.88 *isolates the unknown:*

$$\textit{Original price} = \frac{\$308}{0.88} = \$350.$$

Thus the fee was ***\$350*** *before the promotional cut. Working "backwards" always involves division by* $1 -$ *discount rate; subtracting \$308 from something or adding* 12% *to \$308 would mis-handle the base.*

Q10 — Combining Successive Discounts Correctly i

A retailer advertises " 20% off inventory *plus* an extra 25% end-of-season coupon."

Task.

(a) Calculate the single combined discount factor (the fraction of the list price that the customer finally pays).

(b) Translate that factor into one overall percent discount.

Q10 — Combining Successive Discounts Correctly ii

Solution

(a) Multiplying retention factors. *After the first markdown the customer pays* 80% *of list* (0.80)*. The second coupon slices away* 25% *of the current price, leaving* 75% *of that remainder* (0.75)*. Multiplying gives a combined retention factor:*

$$0.80 \times 0.75 = 0.60.$$

Hence the shopper ultimately owes **60%** *of the sticker price.*

(b) Converting to a single discount rate. *Paying* 60% *is equivalent to receiving a discount of* $100\% - 60\% = \mathbf{40}\%$.

Managerial note. Because each concession applies to an already-reduced base, the proper operation is multiplication, not simple subtraction of the percentage figures.

Q11 — Scaling a Ratio to a Required Total i

A beverage company must maintain a production ratio of Drink A : Drink B $= 5 : 2$. Market demand this week is exactly **350** total bottles.

Task. Determine how many bottles of each drink must be produced.

Solution

The ratio "5:2" can be interpreted as "5 parts of A for every 2 parts of B," making a total of $5 + 2 = 7$ *equal parts.*

First find the size of one part:

$$\textit{One part} = \frac{\textit{Total bottles}}{\textit{Total parts}} = \frac{350}{7} = 50.$$

Now scale each drink by that one-part value:

$$\textit{Drink A: } 5 \times 50 = 250 \qquad \textit{Drink B: } 2 \times 50 = 100.$$

Therefore the plant should bottle **250 units of Drink A** *and* **100 units of Drink B**. *Starting with "one part first" prevents accidental rounding errors and keeps the original 5 : 2 relationship intact.*

Q12 — Productivity per Worker–Hour

A fulfilment centre ships 180 parcels in 6 hours using a crew of 4 workers.

Task. Express productivity as "parcels per worker–hour."

Q12 — Productivity per Worker–Hour

A fulfilment centre ships 180 parcels in 6 hours using a crew of 4 workers.

Task. Express productivity as "parcels per worker–hour."

Solution

A worker–hour is one person working for one hour. Total worker–hours in the scenario are

$$4 \textit{ workers} \times 6 \textit{ hours} = 24 \textit{ worker–hours}.$$

Divide total output by total worker–hours to obtain the unit rate:

$$\frac{180 \textit{ parcels}}{24 \textit{ worker–h}} = 7.5 \textit{ parcels per worker–h}.$$

Hence each worker, on average, processes **7.5 parcels per hour***. Quoting productivity in this form allows fair comparisons across shifts of different sizes or durations.*

Q13 — Ratio Reasoning with Currency Conversion i

A raw material costs 22 USD per kilogram. The current exchange rate is $1\ \text{USD} = 6.8\ \text{XCD}$ (Eastern Caribbean dollars).

Task. Compute the cost in XCD per kilogram, and then state the *unit rate* in XCD per gram.

Q13 — Ratio Reasoning with Currency Conversion ii

Solution
First convert the unit cost from USD to XCD:

$$22\ USD/kg \times 6.8\ \tfrac{XCD}{USD} = 149.6\ XCD/kg.$$

A kilogram contains 1 000 *grams, so divide by* 1 000 *to obtain the unit rate per gram:*

$$\frac{149.6\ XCD}{1\,000\ g} = 0.1496\ XCD/g.$$

Rounded sensibly, the material costs ≈ **149.6 XCD per kilogram** *or* ≈ **0.15 XCD per gram**. *Expressing the price per gram helps procurement compare suppliers who might quote at different package sizes.*

Mark-Up vs Margin — Formula Cheat-Sheet

Symbol		Meaning
C	$=$	Cost per unit (what the firm pays)
P	$=$	Selling price per unit (what the customer pays)
m	$=$	*Mark-up* on cost, $m = \dfrac{P - C}{C}$
M	$=$	*Profit margin*, $M = \dfrac{P - C}{P}$

Connecting the two ratios. Starting from m we can solve for M:

$$M = \frac{m}{1 + m}, \qquad m = \frac{M}{1 - M}.$$

Rule of thumb: Mark-up is always the larger percentage because its denominator (cost) is smaller than the denominator for margin (price).

Q14 — From Mark-Up to Price & Margin

A boutique buys a scarf for \$32 and applies a *mark-up* of 40%.

Task.

(a) Compute the selling price.

(b) Determine the resulting *profit margin*.

Q14 — From Mark-Up to Price & Margin

A boutique buys a scarf for \$32 and applies a *mark-up* of 40%.

Task.

(a) Compute the selling price.

(b) Determine the resulting *profit margin*.

Solution

(a) Price. *A* 40% *mark-up enlarges cost by the factor* $1 + 0.40 = 1.40$*:*

$$P = \$32 \times 1.40 = \$44.80.$$

(b) Margin. *Profit per unit is* $P - C = 44.80 - 32 = \$12.80$. *Margin therefore is*

$$M = \frac{\$12.80}{\$44.80} \approx 0.2857 = 28.57\%.$$

Hence a 40% *mark-up on cost converts to a* **28.6 % margin** *on selling price. Note how the conversion aligns with the formula* $M = \frac{m}{1+m} = \frac{0.40}{1.40} \approx 0.2857$.

Q15 — Targeting a Margin to Back-Solve Cost

A wholesaler wishes to sell an appliance for exactly \$250 while maintaining a *margin* of 35%.

Task.

(a) What cost per unit can the wholesaler afford?

(b) What mark-up percentage does that imply?

Q15 — Targeting a Margin to Back-Solve Cost

A wholesaler wishes to sell an appliance for exactly \$250 while maintaining a *margin* of 35%.

Task.

(a) What cost per unit can the wholesaler afford?

(b) What mark-up percentage does that imply?

Solution

(a) Cost. *Margin satisfies* $M = \frac{P-C}{P}$. *Insert* $M = 0.35$ *and* $P = \$250$*:*

$$0.35 = \frac{250 - C}{250} \implies 250 - C = 0.35 \times 250 = 87.5 \implies C = 250 - 87.5 = \$162.50.$$

(b) Mark-up. *Mark-up compares the same \$87.50 profit with cost:*

$$m = \frac{87.5}{162.5} \approx 0.5385 = 53.85\%.$$

So achieving a 35% *margin at a* \$250 *price tag demands that the unit cost not exceed* \$162.50, *and it corresponds to a* ≈ **54 % mark-up** *on cost.*

Q16 — Rapid Conversion without Re-Computing

A financial report lists a gross margin of 22% for a product line.

Task. Without knowing price or cost, state the mark-up percentage implied by that margin.

Solution

Use the algebraic bridge $m = \frac{M}{1-M}$.

$$m = \frac{0.22}{1-0.22} = \frac{0.22}{0.78} \approx 0.2821.$$

Thus the mark-up is $\approx$ **28.2%**. *The conversion confirms that a modest-sounding 22% margin translates into a noticeably higher mark-up, underscoring why finance teams must specify which ratio they are quoting.*

Weighted Average Cost — Conceptual Pitfall

Key principle. When combining two (or more) costs, *weight* each cost by the quantity purchased. A simple arithmetic mean is valid only when the purchase quantities are equal.

Formula. If q_i units are bought at cost c_i for $i = 1, \ldots, n$,

$$\text{Weighted Avg. Cost} = \frac{\sum_{i=1}^{n} q_i\, c_i}{\sum_{i=1}^{n} q_i}.$$

Excel insight. ‘$= SUMPRODUCT(costrange, qtyrange)/SUM(qtyrange)$‘ does the numerator and denominator in one line.

Common mistake. Averaging percentages (e.g. margins of two product lines) without weighting by revenue or units can mislead management by overstating performance.

A factory orders 300 units of a component at \$10 each from Supplier A, and 200 units at \$13 each from Supplier B.

Task. Compute the weighted average cost per unit for the combined shipment.

Q17 — Blending Costs from Two Suppliers ii

Solution
Compute the total spend for each source, then divide by the total quantity received.

$$Spend_A = 300 \times \$10 = \$3\,000, \quad Spend_B = 200 \times \$13 = \$2\,600.$$

$$Total\ spend = 3\,000 + 2\,600 = \$5\,600, \quad Total\ units = 300 + 200 = 500.$$

$$Weighted\ Avg.\ Cost = \frac{5\,600}{500} = \$11.20.$$

Therefore, every unit in the blended lot carries a **weighted cost of \$11.20**.
Notice the lower \$10 price has greater influence because it covers more units.

Q18 — Combining Margins the Right Way i

A retailer sells two SKUs this quarter:

SKU X: 60 units, unit margin 25%.

SKU Y: 40 units, unit margin 15%.

Task. Report the overall margin for the blended sales mix.

Q18 — Combining Margins the Right Way ii

Solution

Plainly averaging 25% *and* 15% *would give* 20%, *but that ignores the fact that more units were sold at the higher margin.*

Use quantities as weights:

$$\textit{Weighted Margin} = \frac{(0.25 \times 60) + (0.15 \times 40)}{60 + 40}.$$

$$= \frac{15 + 6}{100} = 0.21 = 21\%.$$

Hence the correct blended margin is **21 %**. *Weighting by units (or by revenue, if prices differ) preserves economic reality, whereas a naïve average would understate profitability here.*

Break-Even Quantity — Numerical Intuition i

Contribution per unit (sometimes called unit contribution):

$$\boxed{\text{Contribution} = P - VC}$$

The amount each extra sale contributes toward covering *fixed* cost.

Break-even quantity (BEQ).

$$\boxed{BEQ = \frac{FC}{P - VC}}$$

Solve for the sales volume at which total contribution exactly absorbs fixed cost. *Interpretation*: below BEQ the firm runs at a loss; one unit beyond BEQ produces the first dollar of operating profit.

Whole-unit rule. Because you cannot sell 0.3 of a unit, always round BEQ up to the next whole unit. Example: if $FC/(P - VC) = 857.14$, the manager must plan for **858** units.

Q19 — Baseline Break-Even

A start-up sells its single product at $P = \$30$ per unit. Variable cost is $VC = \$18$ per unit. Monthly fixed cost is $FC = \$12{,}000$.

Task. Compute the break-even quantity and interpret the result.

Solution

Contribution per unit:

$$P - VC = 30 - 18 = \$12.$$

Break-even quantity:

$$BEQ = \frac{FC}{P - VC} = \frac{12\,000}{12} = 1\,000 \textit{ units.}$$

Interpretation. The enterprise must sell **at least 1 000 units** *each month in order to cover every dollar of its \$12,000 fixed overhead. Unit* 1 001 *would produce the first \$12 of operating profit.*

Q20 — "What-If" Scenario: Price Increase

Keeping $VC = \$18$ and $FC = \$12{,}000$ unchanged, management considers raising the unit price to $P = \$32$.

Task. Recalculate the break-even quantity. Apply the whole-unit rule.

Solution

New contribution per unit:

$$P - VC = 32 - 18 = \$14.$$

$$BEQ = \frac{12\,000}{14} \approx 857.14.$$

Since a fraction of a unit cannot be sold, round up to the next whole number:

$$\boxed{BEQ = 858 \ units}.$$

Interpretation. By adding \$2 to the price the firm can meet overhead roughly 142 *units sooner (*$1\,000 \to 858$*), but must evaluate whether the market will tolerate the higher tag.*

Q21 — "What-If" Scenario: Cost Reduction

Instead of raising price, suppose process improvements reduce variable cost to $VC = \$16$ while price stays at $P = \$30$; fixed cost remains $FC = \$12{,}000$.

Task. Compute the new break-even quantity and compare with the baseline.

Solution

Revised contribution:

$$P - VC = 30 - 16 = \$14.$$

Break-even quantity:

$$BEQ = \frac{12\,000}{14} \approx 857.14 \implies 858 \textit{ units (rounded)}.$$

Comparison. Cutting VC by \$2 produces the same BEQ as raising P by \$2 (both scenarios lift contribution from \$12 to \$14). This symmetry clarifies that either lever — price or variable cost — influences break-even through the identical contribution formula.

Exit Ticket (3 items, 5 min silent)

Please answer *quietly and independently*. When you finish, place a $\star$ next to one topic you would like reviewed briefly at the start of Session 2.

(1) A selling price rises by 12% to reach \$84. What was the original price?

(2) An item sells for \$120 at a profit margin of 30%. Find the

(a) unit cost $\$C$,
(b) mark-up percentage m.

(3) A café faces fixed costs $FC = \$8\,400$. The sandwich price is \$24 and variable cost is \$15. Compute the break-even quantity.

Exit Ticket — Solutions & Preview i

Solution

(1) Reverse a percentage increase. *A* 12% *rise means the new price equals* 1.12 *times the original:*

$$1.12 \times P_{old} = \$84 \quad \Rightarrow \quad P_{old} = \frac{84}{1.12} = \$75.$$

Exit Ticket — Solutions & Preview ii

Solution

(2a) Unit cost at a 30 % margin. *Margin satisfies* $0.30 = \frac{P-C}{P}$. *With* $P = \$120$*:*

$$120 - C = 0.30 \times 120 = 36 \;\Rightarrow\; C = 120 - 36 = \$84.$$

(2b) Corresponding mark-up. *Profit is \$36 on a \$84 cost base, so* $m = \frac{36}{84} \approx 0.4286 = 42.86\%$.

(3) Break-even quantity. *Contribution per unit is* $P - VC = 24 - 15 = \$9$. *Break-even:*

$$BEQ = \frac{8\,400}{9} \approx 933.33 \textit{ units} \Longrightarrow \boxed{934 \textit{ units}}$$

(after rounding up to the next whole sandwich).

Preview of Session 2. *We will turn these numerical skills into simple algebra and straight-line graphs: solving for a target margin, locating the break-even point visually, and reading slope and intercept in clear business language.*