

Cambridge supplies *no formula sheet* for 9609 – a calculator and nothing else. Papers 2 and 3 are where the arithmetic sits, and the marks are rarely for the answer alone: a formula stated, the numbers substituted, the answer with its *unit or percentage sign*, and then one sentence saying what it means for the business. Learn each formula with its denominator, because that is where almost every lost mark is. 剑桥不提供公式表, 以下全部需要背诵; 计算题的分数在 “公式 – 代入 – 单位 – 解读” 四步上, 而非只看答案。

Two rules that earn more marks than the formulae do

Always show the formula before the numbers. If the arithmetic goes wrong you still keep the method mark, and an answer with no working keeps nothing.

先写公式, 再代入数字。

Always finish with a unit or a percent sign, and then one sentence of interpretation. “Capacity utilisation is 80\%” is a number; “at 80\% there is spare capacity to take the new order without extra fixed costs” is an evaluation mark.

答案必须带单位或百分号, 并用一句话解释其含义。

A ratio is meaningless alone. Compare it with last year, with a competitor, or with the industry norm – that comparison is what the analysis marks are for.

比率必须与往年、同行或行业标准比较才有意义。

Marketing and the market

Market share 市场份额 — $\text{firm's sales} \div \text{total market sales} \times 100$. Use value or volume consistently – a firm can gain share by value while losing it by volume.

Market growth 市场增长率 — $(\text{this period's market size} - \text{last period's}) \div \text{last period's} \times 100$. The denominator is the OLD figure, always.

Sales revenue 销售收入 — $\text{selling price} \times \text{quantity sold}$. Revenue is not profit and not cash.

Price elasticity of demand (PED) 需求价格弹性 — $\% \text{ change in quantity demanded} \div \% \text{ change in price}$. It is normally NEGATIVE; quote the sign and then judge by the size: greater than 1 in size is elastic, less than 1 is inelastic.

Income elasticity of demand (YED) 需求收入弹性 — $\% \text{ change in quantity demanded} \div \% \text{ change in consumer income}$. Positive for a normal good, negative for an inferior good, above +1 for a luxury.

Promotional elasticity 促销弹性 — $\% \text{ change in quantity demanded} \div \% \text{ change in promotional spending}$. Positive, and used to judge whether a campaign paid for itself.

Cross elasticity of demand (XED) 需求交叉弹性 — $\% \text{ change in quantity of A} \div \% \text{ change in the price of B}$. Positive means substitutes, negative means complements.

I Price rises from \$2.00 to \$2.20 and weekly sales fall from 500 to 440 units. Find PED and say what happens to revenue.

$\text{PED} = -12 \div 10 = -1.2$: demand is price elastic, and revenue FALLS from \$1000 to \$968.

$\% \text{ change in price} = 0.20 \div 2.00 \times 100 = +10\%$

$$|\% \text{ change in quantity}| = -60 \div 500 \times 100 = -12\%$$

$$PED = -12 \div 10 = -1.2, \text{ elastic because } 1.2 > 1$$

$$\text{Revenue before} = 2.00 \times 500 = \$1000; \text{ after} = 2.20 \times 440 = \$968$$

Operations and productivity

Labour productivity 劳动生产率 — output per period $\div$ number of employees. Output per WORKER, so the unit is “units per worker per week”, not a percentage.

Capacity utilisation 产能利用率 — actual output $\div$ maximum possible output $\times 100$. High utilisation spreads fixed costs thinly; above about 90\% it also means no slack for a rush order or for maintenance.

Unit cost (average cost) 单位成本 — total cost $\div$ output. It falls as output rises while fixed costs are spread – that is what an economy of scale looks like in a number.

Added value 增加值 — sales revenue – cost of bought-in materials and components. Not the same as profit: wages, rent and marketing have still to come out of it.

Inventory turnover 存货周转率 — cost of sales $\div$ average inventory, giving the number of times a year stock is used and replaced. In days it is average inventory $\div$ cost of sales $\times 365$.

People in organisations

Labour turnover 员工流动率 — number of staff leaving during the year $\div$ average number employed $\times 100$. The numerator counts LEAVERS, not vacancies.

Absenteeism rate 缺勤率 — number of staff days lost $\div$ total staff days that could have been worked $\times 100$.

I A firm employs an average of 240 people and 18 leave during the year. Find labour turnover and comment.

Labour turnover = 7.5%, which is low and suggests stable, experienced staff – but it may also mean few promotion opportunities and little new thinking.

$$\text{Labour turnover} = 18 \div 240 \times 100$$

$$= 7.5\%$$

Costs, contribution and break-even

Total cost 总成本 — fixed costs + variable costs. Fixed costs do not change with output in the short run; variable costs are per unit.

Contribution per unit 单位贡献 — selling price per unit – variable cost per unit. It is what one unit contributes towards fixed costs, NOT profit.

Total contribution 总贡献 — contribution per unit $\times$ units sold, or total revenue – total variable costs.

Profit 利润 — total contribution – fixed costs. This is why a contribution-costing question never subtracts fixed costs twice.

Break-even output 盈亏平衡产量 — fixed costs $\div$ contribution per unit. The denominator is contribution, never the selling price.

Break-even revenue 盈亏平衡收入 — break-even output $\times$ selling price.

Margin of safety 安全边际 — actual (or budgeted) output – break-even output. Measured in UNITS unless the question asks for a percentage, when it is that difference $\div$ actual output $\times 100$.

Output for a target profit 目标利润产量 — (fixed costs + target profit) $\div$ contribution per unit. The target profit joins the fixed costs on the top line.

I Fixed costs are \$48\,000, the selling price is \$20 and the variable cost is \$12 per unit. The firm plans to make 7500 units. Find the break-even output, the margin of safety and the profit.

Break-even is 6000 units (\$120\,000 of revenue), the margin of safety is 1500 units, and the profit is \$12\,000.

$$\text{Contribution per unit} = 20 - 12 = \$8$$

$$\text{Break-even} = 48\,000 \div 8 = 6000 \text{ units}$$

$$\text{Break-even revenue} = 6000 \times 20 = \$120\,000$$

$$\text{Margin of safety} = 7500 - 6000 = 1500 \text{ units}$$

$$\text{Profit} = 7500 \times 8 - 48\,000 = \$12\,000$$

The income statement, line by line

Gross profit 毛利 — revenue – cost of sales.

Operating profit 营业利润 — gross profit – overheads (expenses). This is the profit figure ROCE uses.

Profit before tax 税前利润 — operating profit + finance income – finance costs.

Profit for the year 本年利润 — profit before tax – tax. Also called profit after tax, and it is the figure dividends come out of.

Retained earnings for the year 本年留存收益 — profit for the year – dividends paid. It is an internal source of finance and costs nothing to raise.

Working capital 营运资本 — current assets – current liabilities. A positive figure in dollars, unlike the current ratio, which is the same comparison as a ratio.

Depreciation, straight line 直线折旧 — (cost – residual value) $\div$ expected useful life. The same charge every year.

Depreciation, reducing balance 余额递减折旧 — a fixed percentage of the net book value at the start of the year, so the charge falls each year.

Ratio analysis – learn the denominator

Gross profit margin 毛利率 — gross profit $\div$ revenue $\times 100$. Moved by the cost of sales, so by suppliers and by the selling price.

Operating profit margin 营业利润率 — operating profit $\div$ revenue $\times 100$. If this falls while the gross margin holds, the problem is overheads.

Profit margin 净利率 — profit for the year $\div$ revenue $\times 100$.

Return on capital employed (ROCE) 资本回报率 — operating profit $\div$ capital employed $\times 100$, where capital employed = total equity + non-current liabilities (equivalently total assets – current liabilities). The single most-used ratio in the subject.

Current ratio 流动比率 — current assets $\div$ current liabilities, quoted as “ $x : 1$ ”. Around 1.5 to 2 is usually comfortable; much higher means cash or stock sitting idle.

Acid test (liquid capital) ratio 速动比率 — (current assets – inventory) $\div$ current liabilities. Inventory is removed because it is the current asset hardest to turn into cash quickly.

Gearing 负债比率 — non-current liabilities $\div$ capital employed $\times 100$. Above about 50% the business is highly geared: cheaper than equity while trading is good, dangerous when interest rates rise.

Trade receivables days 应收账款周转天数 — trade receivables $\div$ revenue $\times 365$. The average number of days customers take to pay.

Trade payables days 应付账款周转天数 — trade payables $\div$ cost of sales $\times 365$. Note the different denominator from receivables days.

Earnings per share (EPS) 每股收益 — profit for the year $\div$ number of issued ordinary shares.

Dividend yield 股息收益率 — dividend per share $\div$ current market price per share $\times 100$. The market price, not the nominal or par value.

Dividend cover 股息保障倍数 — profit for the year $\div$ total dividends, equivalently EPS $\div$ dividend per share. Below 1 the firm is paying out more than it earned.

Price/earnings ratio 市盈率 — market price per share $\div$ earnings per share. A high figure means the market expects growth.

I A company earns \$450\,000 for the year on 1.5 million shares, pays \$270\,000 in dividends, and its shares trade at \$3.60. Find EPS, dividend per share, dividend yield, dividend cover and the P/E ratio.

EPS \$0.30, dividend per share \$0.18, yield 5%, cover 1.67 times, P/E 12.

$$EPS = 450\,000 \div 1\,500\,000 = \$0.30$$

$$Dividend\ per\ share = 270\,000 \div 1\,500\,000 = \$0.18$$

$$Dividend\ yield = 0.18 \div 3.60 \times 100 = 5\%$$

$$Dividend\ cover = 450\,000 \div 270\,000 = 1.67\ times$$

$$P/E = 3.60 \div 0.30 = 12$$

Investment appraisal

Payback period 投资回收期 — the time until cumulative net cash inflow equals the initial cost. Within the final year, months = amount still outstanding $\div$ that year's inflow $\times 12$.

Average rate of return (ARR) 平均回报率 — average annual profit $\div$ initial capital cost $\times 100$, where average annual profit = (total net cash inflows – initial cost) $\div$ number of years. Subtracting the cost is what turns inflow into PROFIT, and forgetting it roughly doubles the answer.

Discounted cash flow 现金流折现 — present value = net cash flow $\times$ discount factor for that year. The factors are given in the question; never invent them.

Net present value (NPV) 净现值 — sum of the discounted net cash inflows – initial cost. Accept the project if NPV is positive; between two projects, take the higher NPV.

Internal rate of return (IRR) 内部收益率 — the discount rate at which NPV is exactly zero. Compare it with the cost of borrowing: worth doing when IRR exceeds it.

A machine costs \$200\,000 and returns \$60\,000 a year for five years. Discount factors at 10\% are 0.909, 0.826, 0.751, 0.683 and 0.621. Find the payback period, the ARR and the NPV.

Payback 3 years 4 months, ARR 10\%, NPV +\$27\,400 – so on the NPV criterion the machine is worth buying.

After 3 years, cumulative inflow = $3 \times 60\,000 = \$180\,000$, leaving $\$20\,000$

Months = $20\,000 \div 60\,000 \times 12 = 4$, so payback = 3 years 4 months

Total inflow = $5 \times 60\,000 = \$300\,000$; total profit = $300\,000 - 200\,000 = \$100\,000$

Average annual profit = $100\,000 \div 5 = \$20\,000$, so ARR = $20\,000 \div 200\,000 \times 100 = 10\%$

Sum of discount factors = 3.790, so present value = $60\,000 \times 3.790 = \$227\,400$

NPV = $227\,400 - 200\,000 = +\$27\,400$

Forecasting, networks and decision trees

Moving average 移动平均 — the mean of a fixed number of consecutive periods, moved along one period at a time. With quarterly data use a four-quarter average and centre it between two quarters.

Seasonal variation 季节性变动 — actual value – trend value for that period. Average the variations for each season across the years before using them.

Forecast from a time series 时间序列预测 — extrapolated trend + average seasonal variation for that quarter. State one reason the forecast may be wrong – extrapolation assumes the past continues.

Expected value 期望值 — $\sum (\text{probability} \times \text{payoff})$ at a chance node. Net gain = expected value – the cost of taking that route, and it is the NET figure that is compared.

Critical path – earliest start time 最早开始时间 — work forwards: EST of an activity = the largest EST + duration of the activities leading into it.

Critical path – latest finish time 最晚完成时间 — work backwards from the end: LFT = the smallest LFT – duration of the activities that follow.

Total float 总浮动时间 — LFT – duration – EST. An activity with zero float is on the critical path, and delaying it delays the whole project.

Numbers that are not formulae, and are marked as if they were

Capital employed has two equivalent definitions – total equity + non-current liabilities, and total assets – current liabilities. Use whichever the question's figures make easy, and say which you used.

已动用资本有两种等价算法, 任选其一并说明。

Receivables days uses REVENUE as its denominator while payables days uses COST OF SALES. The two look symmetric and are not.

应收天数用收入, 应付天数用销售成本。

A percentage change always divides by the ORIGINAL value. A fall from 80 to 60 is a 25% fall; a rise

from 60 to 80 is a 33.3% rise. They are not the same number.

百分比变化永远除以原值。

Round money to two decimal places and percentages to one, unless the question says otherwise – and never round in the middle of a calculation, only at the end.

金额保留两位小数, 百分比保留一位; 中间步骤不要四舍五入。