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FREE EBOOK

ACCOUNTING AND BUSINESS

Business Maths for Accounts

Percentages, profit and loss, discount, interest and ratios with shop examples

INSIDE THIS BOOK

- Percentages: the language of business
- Cost price, selling price, profit and loss
- Marked price and discount
- Simple interest
- Compound interest
- ...and 6 more chapters, practice questions and a glossary

Beginner

Commerce students and shop staff

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Business Maths for Accounts

The everyday maths of shops and offices, explained one idea at a time with worked examples in rupees. Learn percentages, profit and loss, discounts, simple and compound interest, EMLs, ratios, averages, tax-inclusive prices and break-even, plus quick mental tricks for the counter. More than sixty practice questions with answers help you check your progress.

WHO IT IS FOR	Commerce students and shop staff
LEVEL	Beginner
SUBJECT AREA	Accounting and business
WHAT IS INSIDE	11 chapters, practice questions with answers, and a glossary

HOW TO USE IT

Read one chapter at a time and try the examples as you go: on a computer, at your workbench or in your notebook. The boxes give tips, safety points and short activities. When you finish, test yourself with the practice questions and check your answers at the end. Words you may not know are explained in the glossary.



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What you will find inside

1	Percentages: the language of business	4
2	Cost price, selling price, profit and loss	5
3	Marked price and discount	7
4	Simple interest	9
5	Compound interest	11
6	EMI: paying back a loan in equal parts	13
7	Ratio, proportion and the unitary method	14
8	Averages	16
9	Prices with tax: inclusive and exclusive	18
10	Break-even: when a business stops losing money	19
11	Mental maths tricks for the counter	21
	Practice questions	23
	Answers	24
	Glossary	25

Percentages: the language of business

Every shop, bank and office talks in percentages. A discount is a percentage. Profit is often a percentage. Interest on a loan is a percentage. Once you are at ease with percentages, the rest of this book becomes easy.

Per cent means "out of a hundred". So 25% means 25 out of every 100. You can write it as a fraction, $25/100$, or as a decimal, 0.25. All three mean the same thing.

Finding a percentage of an amount

To find a percentage of an amount, multiply the amount by the percentage and divide by 100.

EXAMPLE

Farhan's electricity bill is ₹ 2,500. He pays 12% more in summer. How much more is that? $12\% \text{ of } ₹ 2,500 = ₹ 2,500 \times 12 \div 100 = ₹ 300$. So his summer bill is ₹ 2,800.

Turning marks or amounts into a percentage

To find what percentage one number is of another, divide the part by the whole and multiply by 100.

Priya scored 42 marks out of 60. Her percentage is $42 \div 60 \times 100 = 70\%$.

Percentage increase and decrease

When a price changes, find the change first. Then compare it with the **old** value, never the new one.

The rent of a shop in Lucknow went up from ₹ 8,000 to ₹ 8,600 a month.

1. Change = $8,600 - 8,000 = ₹ 600$.
2. Percentage increase = $600 \div 8,000 \times 100 = 7.5\%$.

A decrease works the same way. If a tablet's price falls from ₹ 15,000 to ₹ 12,000, the fall is ₹ 3,000, and $3,000 \div 15,000 \times 100 = 20\%$.

Finding the whole from a part

Sometimes you know the part and the percentage, and you need the whole. Suppose 15% of a number is 270. Then 1% is $270 \div 15 = 18$, and 100% is $18 \times 100 = 1,800$.

Useful fractions to remember

Percentage	Fraction	Percentage	Fraction
50%	$\frac{1}{2}$	10%	$\frac{1}{10}$
25%	$\frac{1}{4}$	5%	$\frac{1}{20}$
75%	$\frac{3}{4}$	12.5%	$\frac{1}{8}$
20%	$\frac{1}{5}$	$33\frac{1}{3}\%$	$\frac{1}{3}$

DID YOU KNOW

If a bank's interest rate rises from 10% to 12%, it has gone up by 2 **percentage points**, but by 20% of its old value ($2 \div 10 \times 100$). News reports mix these up often. Read carefully.

TRY THIS

1. Find 8% of ! 4,500.
2. Write 36 out of 48 as a percentage.
3. A price rises from ! 250 to ! 300. What is the percentage increase?

Answers: 1. ! 360. 2. 75%. 3. 20%.

CHAPTER 2

Cost price, selling price, profit and loss

Every trader asks one question at the end of the day: did I earn money or lose it? Two prices decide the answer.

- **Cost price (CP)** is what the trader paid for the goods. It also includes extra costs needed to make the goods ready for sale, such as transport or repairs.
- **Selling price (SP)** is what the customer pays.

If SP is more than CP, there is a **profit**: Profit = SP – CP. If SP is less than CP, there is a **loss**: Loss = CP – SP.

Profit and loss percentage

Profit and loss percentages are worked out on the **cost price**, unless a question says otherwise.

- Profit % = Profit ÷ CP × 100
- Loss % = Loss ÷ CP × 100

EXAMPLE

Ramesh, who runs an electrical shop in Jaipur, buys a ceiling fan for ₹ 1,600 and pays ₹ 100 to bring it to his shop. He sells it for ₹ 2,040. CP = 1,600 + 100 = ₹ 1,700. Profit = 2,040 – 1,700 = ₹ 340. Profit % = $340 \div 1,700 \times 100 = 20\%$.

Finding the selling price

Sunita buys sarees at ₹ 1,250 each and wants a profit of 16%. What price should she ask?

$$SP = CP \times (100 + \text{Profit } \%) \div 100 = 1,250 \times 116 \div 100 = ₹ 1,450.$$

For a loss, use $(100 - \text{Loss } \%)$. A shopkeeper who sells a ₹ 2,000 item at a 12% loss gets $2,000 \times 88 \div 100 = ₹ 1,760$.

Finding the cost price

If you know SP and the profit %, work backwards. An item sold for ₹ 1,380 at a 15% profit had a CP of $1,380 \times 100 \div 115 = ₹ 1,200$.

REMEMBER

Never take 15% off the selling price to find the cost. 15% of ₹ 1,380 is ₹ 207, and $1,380 - 207 = ₹ 1,173$, which is wrong. The profit was 15% of the cost, not of the selling price.

Margin and markup

In business talk, profit as a percentage of the **cost** is often called **markup**. Profit as a percentage of the **selling price** is called **margin**. For Ramesh's fan, the markup is 20%, but the margin is $340 \div 2,040 \times 100 = 16.67\%$. When someone tells you a percentage, ask which one they mean.

A common trap

A dealer in Surat sells two mobile phones for ₹ 12,000 each. He makes a 20% profit on one and a 20% loss on the other. Did he break even? No.

Phone	SP	CP	Result
First (20% profit)	₹ 12,000	$12,000 \times 100 \div 120 = ₹ 10,000$	₹ 2,000 profit
Second (20% loss)	₹ 12,000	$12,000 \times 100 \div 80 = ₹ 15,000$	₹ 3,000 loss
Total	₹ 24,000	₹ 25,000	₹ 1,000 loss

His overall loss is $1,000 \div 25,000 \times 100 = 4\%$.

TRY THIS

1. CP is ₹ 480 and SP is ₹ 552. Find the profit percentage.
2. An item sold for ₹ 690 gave a 15% profit. Find its cost price.
3. A cycle bought for ₹ 6,500 is sold for ₹ 5,850. Find the loss percentage.

Answers: 1. 15%. 2. ₹ 600. 3. 10%.

CHAPTER 3

Marked price and discount

Walk into any shop during a festival sale and you will see signs like "25% off". To understand them, you need two more words.

- **Marked price (MP)**, also called the list price, is the price printed on the tag.
- **Discount** is the amount taken off the marked price.

Discount = MP – SP, and Discount % = $\text{Discount} \div \text{MP} \times 100$.

Notice the difference from profit. **Discount is always worked out on the marked price**, while profit is worked out on the cost price.

DID YOU KNOW

On packaged goods in India you also see an **MRP**, or maximum retail price. A shop may sell below the MRP but must not charge more than it.

Working out a sale price

Shoes are marked ! 2,400 with 25% off.

1. Discount = $2,400 \times 25 \div 100 = ! 600$.

2. SP = $2,400 - 600 = ! 1,800$.

A quicker way: the customer pays 75% of the marked price, and $2,400 \times 75 \div 100 = ! 1,800$.

Setting the marked price

Anil buys a pressure cooker for ! 900. He wants a 20% profit even after giving a 10% discount. What should he mark it?

1. SP needed = $900 \times 120 \div 100 = ! 1,080$.

2. After a 10% discount, the customer pays 90% of MP. So 90% of MP = ! 1,080.

3. MP = $1,080 \times 100 \div 90 = ! 1,200$.

Successive discounts

"20% off, plus an extra 10% off" does not mean 30% off. The second discount is taken on the price that is already reduced.

On a ! 5,000 suitcase:

1. After 20% off: $5,000 \times 80 \div 100 = ! 4,000$.

2. After a further 10% off: $4,000 \times 90 \div 100 = ! 3,600$.

The total discount is ! 1,400, which is 28% of ! 5,000. A short formula gives the single equal discount for two discounts a% and b%:

$$a + b - (a \times b \div 100) = 20 + 10 - 2 = 28\%.$$

"Buy two, get one free"

If soap costs ₹ 60 a bar and the offer is "buy 2, get 1 free", you pay ₹ 120 for 3 bars. That is ₹ 40 a bar, a saving of ₹ 20 on ₹ 60, or $33\frac{1}{3}\%$.

TIP

When comparing offers, always work out the price of **one** item. "Buy 2, get 1 free" ($33\frac{1}{3}\%$ off) beats "30% off", but only if you really need three.

TRY THIS

1. MP is ₹ 1,500 and the discount is 12%. Find the SP.
2. An ₹ 800 item is sold for ₹ 680. Find the discount percentage.
3. Find the single discount equal to 10% followed by 5%.
4. What discount does "buy 3, get 1 free" give?

Answers: 1. ₹ 1,320. 2. 15%. 3. 14.5%. 4. 25%.

CHAPTER 4

Simple interest

When you borrow money, you pay the lender extra for using it. When you deposit money in a bank, the bank pays you extra. This extra is called **interest**.

- **Principal (P)** is the money borrowed or deposited.
- **Rate (R)** is the interest for every ₹ 100 for one year, written as a percentage "per annum" (per year).
- **Time (T)** is how long the money is used, in years.
- **Amount (A)** is the principal plus the interest.

In **simple interest (SI)**, interest is worked out only on the original principal, every year.

$$SI = P \times R \times T \div 100, \text{ and } A = P + SI.$$

EXAMPLE

Kavita lends ₹ 20,000 to her cousin at 9% per annum simple interest for 3 years. SI = $20,000 \times 9 \times 3 \div 100 = ₹ 5,400$. Amount = $20,000 + 5,400 = ₹ 25,400$.

When time is in months or days

Time must be in years. Divide months by 12.

₹ 15,000 at 8% for 9 months: $T = 9 \div 12 = 0.75$ years, so SI = $15,000 \times 8 \times 0.75 \div 100 = ₹ 900$.

For days, divide by 365. ₹ 36,500 at 10% for 73 days: SI = $36,500 \times 10 \times 73 \div (100 \times 365) = ₹ 730$.

Finding the rate, the time or the principal

Rearrange the formula. Each one comes from $SI = P \times R \times T \div 100$.

To find	Formula	Example	Answer
Rate	$R = SI \times 100 \div (P \times T)$	₹ 12,000 earns ₹ 2,880 in 4 years	6%
Time	$T = SI \times 100 \div (P \times R)$	₹ 8,000 at 7.5% earns ₹ 1,800	3 years
Principal	$P = SI \times 100 \div (R \times T)$	₹ 1,350 earned at 9% in 2 years	₹ 7,500

When does money double?

Money doubles when the interest equals the principal. In simple interest, that happens when $R \times T = 100$. At 8% per annum, $T = 100 \div 8 = 12.5$ years.

REMEMBER

The interest rates in this book are examples for practice. Real rates are set by each bank or lender and change from time to time. Always check the current rate before you decide anything.

TRY THIS

1. Find the SI on ! 6,000 at 10% for 2 years.
2. Find the SI on ! 25,000 at 6% for 6 months.
3. At what rate will ! 5,000 earn ! 1,000 in 4 years?

Answers: 1. ! 1,200. 2. ! 750. 3. 5% per annum.

CHAPTER 5

Compound interest

In **compound interest (CI)**, the interest of each year is added to the principal, and next year's interest is worked out on this bigger sum. You earn "interest on interest". Bank fixed deposits usually work this way.

Year by year

! 10,000 is deposited at 10% per annum, compounded yearly, for 3 years.

Year	Money at start	Interest (10%)	Money at end
1	! 10,000	! 1,000	! 11,000
2	! 11,000	! 1,100	! 12,100
3	! 12,100	! 1,210	! 13,310

$CI = 13,310 - 10,000 = ! 3,310$. Simple interest would have given only ! 3,000.

The formula

$A = P \times (1 + R \div 100)^n$, where n is the number of years. Then $CI = A - P$.

For the deposit above: $A = 10,000 \times 1.1 \times 1.1 \times 1.1 = ! 13,310$.

TIP

On a calculator, turn the rate into a multiplier first: 10% becomes 1.10, 6% becomes 1.06 and 12.5% becomes 1.125. Then multiply the principal by it once for each year.

Half-yearly compounding

Some deposits add interest every six months. Then you halve the rate and double the number of periods.

! 20,000 at 8% per annum, compounded half-yearly, for 1 year: use 4% for 2 periods. $A = 20,000 \times 1.04 \times 1.04 = ! 21,632$, so CI = ! 1,632. Yearly compounding would give ! 1,600.

For quarterly compounding, use a quarter of the rate and four times the periods.

Depreciation: value going down

Machines, vehicles and computers lose value as they get older. This loss is called **depreciation**. When the value falls by a fixed percentage of the value at the start of each year, use the same idea with a minus sign:

Value after n years = $P \times (1 - R \div 100)^n$

A machine bought for ! 1,00,000 that loses 10% of its value each year is worth $1,00,000 \times 0.9 \times 0.9 = ! 81,000$ after 2 years.

DID YOU KNOW

The **rule of 72** gives a quick estimate of how long compound interest takes to double your money: divide 72 by the rate. At 8%, that is about 9 years. The exact figure is very close: ! 100 grows to almost ! 200 in 9 years.

TRY THIS

1. Find the CI on ! 5,000 at 10% per annum for 2 years.
2. Find the amount on ! 40,000 at 5% per annum for 2 years, compounded yearly.
3. A scooter worth ! 80,000 loses 20% of its value each year. What is it worth after 2 years?

Answers: 1. ! 1,050. 2. ! 44,100. 3. ! 51,200.

EMI: paying back a loan in equal parts

Most people buy a house, a car or even a phone with a loan. They pay it back in equal monthly payments. Each payment is called an **EMI**, which stands for **equated monthly instalment**. "Equated" means made equal.

What happens inside an EMI

Every EMI has two parts: interest for that month, and a part that repays the loan itself. In the first months, most of the EMI is interest. Each month the loan left (the **balance**) gets smaller, so the interest part falls and the repayment part grows. This is called a **reducing balance** loan.

The EMI formula

$$\text{EMI} = P \times r \times (1 + r)^n \div [(1 + r)^n - 1]$$

- P is the loan amount.
- r is the **monthly** rate as a decimal: the yearly rate $\div 12 \div 100$.
- n is the number of monthly payments.

EXAMPLE

Deepak in Indore takes a loan of ₹ 1,00,000 at 12% per annum for 12 months. $r = 12 \div 12 \div 100 = 0.01$, and $n = 12$. (1.01) to the power 12 = 1.126825 (use a calculator). $\text{EMI} = 1,00,000 \times 0.01 \times 1.126825 \div 0.126825 = ₹ 8,884.88$, which is about ₹ 8,885.

The first three months

Month	Interest (1% of balance)	Repaid from loan	Balance left
1	₹ 1,000.00	₹ 7,884.88	₹ 92,115.12
2	₹ 921.15	₹ 7,963.73	₹ 84,151.39
3	₹ 841.51	₹ 8,043.37	₹ 76,108.02

A table like this for the whole loan is called a **repayment schedule**. Over 12 months Deepak pays $12 \times 8,884.88 = ₹ 1,06,618.56$, so the total interest is about ₹ 6,619. It is not ₹ 12,000, because he is not borrowing the full ₹ 1,00,000 for the whole year.

Flat rate versus reducing rate

Some lenders quote a **flat rate**: interest on the full loan for the full period. A flat 12% on ₹ 1,00,000 for one year means ₹ 12,000 interest and an EMI of $₹ 1,12,000 \div 12 = ₹ 9,333.33$. That costs far more than the reducing-balance loan above, even though both say "12%".

REMEMBER

Before taking any loan, compare the total amount you will pay back, not only the EMI. Ask about processing fees and other charges too. A "no-cost EMI" offer usually has conditions; read them.

TIP

In Excel, `=PMT(1%, 12, -100000)` gives the same EMI of ₹ 8,884.88. The minus sign shows that the loan is money received.

TRY THIS

1. What is the monthly rate (as a percentage) for a loan at 9% per annum?
2. How many EMIs are there in a 3-year loan?
3. Using Deepak's example, what is the EMI on ₹ 50,000 at 12% for 12 months?

Answers: 1. 0.75%. 2. 36. 3. ₹ 4,442.44 (half of ₹ 8,884.88).

CHAPTER 7

Ratio, proportion and the unitary method

Ratio

A **ratio** compares two amounts of the same kind. If a shop has 45 notebooks and 60 pens, the ratio of notebooks to pens is 45 : 60. Divide both by their highest common factor (15) to simplify it to 3 : 4.

Sharing in a ratio

Imran and Harpreet start a mobile repair shop in Ludhiana. Imran puts in ! 3,00,000 and Harpreet ! 2,00,000. They agree to share the year's profit of ! 75,000 in the ratio of their money, 3 : 2.

1. Total parts = $3 + 2 = 5$.
2. One part = $75,000 \div 5 = ! 15,000$.
3. Imran gets $3 \times 15,000 = ! 45,000$. Harpreet gets $2 \times 15,000 = ! 30,000$.

REMEMBER

Check your answer by adding the shares. ! 45,000 + ! 30,000 = ! 75,000, so the sharing is complete.

Proportion

Four numbers are in **proportion** when two ratios are equal, such as $2 : 5 = 6 : 15$. In a proportion, the product of the outer numbers equals the product of the inner ones: $2 \times 15 = 5 \times 6 = 30$. This lets you find a missing number. If $3 : 8 = 12 : x$, then $3x = 96$, so $x = 32$.

The unitary method

The **unitary method** means "find the value of one unit first". It solves most everyday problems.

EXAMPLE

12 kg of rice costs ! 780. How much will 20 kg cost? 1 kg costs $780 \div 12 = ! 65$. So 20 kg costs $65 \times 20 = ! 1,300$.

Inverse proportion

Sometimes, when one amount goes up, the other goes down. Six painters take 10 days to paint a godown. One painter would take $6 \times 10 = 60$ days. So 4 painters take $60 \div 4 = 15$ days. More workers, fewer days: this is **inverse proportion**.

Which pack is the better buy?

A 500 g packet of tea costs ! 45, and a 1.2 kg packet costs ! 102. Find the price per kg of each.

Packet	Price	Price per kg
500 g	! 45	$45 \times 2 = ! 90$
1.2 kg	! 102	$102 \div 1.2 = ! 85$

The bigger packet is cheaper per kg.

TRY THIS

1. Simplify 45 : 60.
2. Share ! 18,000 in the ratio 4 : 5.
3. 8 pens cost ! 96. What do 15 pens cost?
4. 5 taps fill a tank in 12 hours. How long will 3 such taps take?

Answers: 1. 3 : 4. 2. ! 8,000 and ! 10,000. 3. ! 180. 4. 20 hours.

CHAPTER 8

Averages

An **average** (also called the **mean**) is one number that stands for a whole group. Add all the values and divide by how many there are.

Average = Sum of values $\div$ Number of values

EXAMPLE

Gopal's tea stall in Kolkata took these amounts from Monday to Saturday: ! 2,450, ! 2,800, ! 2,150, ! 3,100, ! 2,700 and ! 3,400. Sum = ! 16,600. Average = $16,600 \div 6 = ! 2,766.67$ a day.

The average tells Gopal what a "normal" day looks like. He can compare it with his daily costs to see whether the stall is doing well.

Finding a missing value

The average sale over 5 days is ! 4,000. The first four days total ! 15,200. What was the fifth day's sale?

1. Total for 5 days = $5 \times 4,000 = ! 20,000$.

2. Fifth day = $20,000 - 15,200 = ₹ 4,800$.

Weighted average

When amounts come in different quantities, you cannot simply average the prices. You must give each price its proper weight.

A grocer buys 40 kg of sugar at ₹ 50 a kg and 60 kg at ₹ 55 a kg. The average price is **not** $(50 + 55) \div 2 = ₹ 52.50$.

Lot	Quantity	Rate	Cost
First	40 kg	₹ 50	₹ 2,000
Second	60 kg	₹ 55	₹ 3,300
Total	100 kg		₹ 5,300

Average price = $5,300 \div 100 = ₹ 53$ a kg. Accountants use this idea to value stock.

Average speed

A delivery van goes from a warehouse to a market at 60 km/h and comes back on the same road at 40 km/h. The average speed is not 50 km/h. Suppose the market is 120 km away. Going takes 2 hours and returning takes 3 hours. The van covers 240 km in 5 hours, so the average speed is 48 km/h.

TIP

Average speed is always total distance $\div$ total time. Never just average the two speeds.

TRY THIS

1. Find the average of 12, 15, 18, 21 and 24.
2. The average of four numbers is 30. Three of them are 25, 28 and 35. Find the fourth.
3. 30 kg of rice at ₹ 40 a kg is mixed with 20 kg at ₹ 60 a kg. Find the average price.

Answers: 1. 18. 2. 32. 3. ₹ 48 a kg.

Prices with tax: inclusive and exclusive

In India, most goods and services carry **GST**, the Goods and Services Tax. The shop collects it from the customer and pays it to the government. The rate depends on the item, and rates are changed from time to time.

REMEMBER

In this chapter we use example rates such as 18% and 12% only for practice. They are not a statement of the rate on any item. Always check the current rate on gst.gov.in or ask a qualified accountant.

A price can be shown in two ways:

- **Tax-exclusive:** the price before tax. Tax is added on top.
- **Tax-inclusive:** the price already includes the tax.

From exclusive to inclusive

A printer costs ₹ 2,000 before tax, and the example rate is 18%.

Tax = $2,000 \times 18 \div 100 = ₹ 360$. Price with tax = ₹ 2,360.

Shortcut: $2,000 \times 1.18 = ₹ 2,360$.

From inclusive back to the base price

A customer paid ₹ 2,360 including tax at 18%. What was the price before tax?

The ₹ 2,360 is 118% of the base price, so base price = $2,360 \times 100 \div 118 = ₹ 2,000$, and tax = ₹ 360.

NOTE

A very common mistake is to take 18% of the inclusive price. 18% of ₹ 2,360 is ₹ 424.80, which is wrong. The tax was 18% of the base, not of the total. In accounts, this mistake gives a wrong tax figure, so always divide by 118, not multiply by 18.

Splitting the tax

When a sale happens inside one state, the GST on the bill is split equally into two parts: **CGST** (central) and **SGST** (state). When goods go from one state to another, there is one tax called **IGST**. On a ₹ 2,000 sale inside Maharashtra at the example rate of 18%, the bill shows CGST ₹ 180 and SGST ₹ 180.

A small bill with a discount

Tax is worked out on the price **after** the discount shown on the bill.

Item	Qty	Rate	Value
Office chair	2	₹ 3,500	₹ 7,000
Less: 10% discount			– ₹ 700
Taxable value			₹ 6,300
Tax at example rate 12%			₹ 756
Total			₹ 7,056

TRY THIS

1. Add tax at an example rate of 12% to ₹ 750.
2. A price of ₹ 1,180 includes tax at 18%. Find the base price and the tax.
3. A sale inside one state is ₹ 5,900 including tax at 18%. Find the CGST and SGST.

Answers: 1. ₹ 840. 2. ₹ 1,000 and ₹ 180. 3. Base ₹ 5,000, tax ₹ 900, so CGST ₹ 450 and SGST ₹ 450.

CHAPTER 10

Break-even: when a business stops losing money

Every new business first spends money and only later earns it. The **break-even point** is the level of sales at which total income exactly equals total costs. Below it, the business makes a loss. Above it, the business makes a profit.

Two kinds of costs

- **Fixed costs** stay the same each month, however much you sell. Rent, a helper's monthly pay and loan EMIs are fixed costs.
- **Variable costs** go up with every item you make or sell. Raw material and packing are variable costs.

Contribution

Contribution per unit = Selling price – Variable cost per unit.

It is the money each sale "contributes" towards paying the fixed costs. Once the fixed costs are covered, the contribution becomes profit.

Break-even units = Fixed costs ÷ Contribution per unit

EXAMPLE

Neha runs a tiffin service in Pune. Her fixed costs are ₹ 30,000 a month. She sells each tiffin for ₹ 120, and the food and packing cost ₹ 70. Contribution = $120 - 70 = ₹ 50$ per tiffin. Break-even = $30,000 \div 50 = 600$ tiffins a month, or 20 a day in a 30-day month.

Profit at different sales levels

Tiffins sold	Total contribution (× ₹ 50)	Fixed costs	Profit or loss
400	₹ 20,000	₹ 30,000	₹ 10,000 loss
600	₹ 30,000	₹ 30,000	Nil (break-even)
900	₹ 45,000	₹ 30,000	₹ 15,000 profit

Planning for a target profit

If Neha wants ₹ 20,000 profit a month, she needs $(30,000 + 20,000) \div 50 = 1,000$ tiffins.

Break-even can also be stated in rupees: $600 \text{ tiffins} \times ₹ 120 = ₹ 72,000$ of sales a month.

DID YOU KNOW

Break-even shows why raising the price a little can change a business. If Neha charges ₹ 130, her contribution becomes ₹ 60, and break-even falls to $30,000 \div 60 = 500$ tiffins. But a higher price may also mean fewer customers, so owners think carefully before changing it.

TRY THIS

1. Fixed costs are ₹ 18,000. Each item sells for ₹ 250 and costs ₹ 160 to make. Find the break-even units.
2. In question 1, how many items give a profit of ₹ 9,000?
3. What is the break-even in rupees for question 1?

Answers: 1. 200 items. 2. 300 items. 3. ₹ 50,000.

CHAPTER 11

Mental maths tricks for the counter

A calculator is always useful, but quick mental maths helps you check a bill at a glance and spot mistakes. Practise these tricks for a few minutes every day.

Reading big numbers the Indian way

In India we group digits as thousands, lakhs and crores. One lakh is written 1,00,000 and one crore is 1,00,00,000. In the international system, one lakh is 100,000 (a hundred thousand) and one crore is 10,000,000 (ten million). Accounts books in India use the Indian commas, so learn to read both.

Quick percentages

- **10%:** move the decimal point one place left. 10% of ₹ 640 is ₹ 64.
- **5%:** half of 10%. 5% of ₹ 640 is ₹ 32.
- **15%:** $10\% + 5\%$. 15% of ₹ 640 is $64 + 32 = ₹ 96$.
- **1%:** move the decimal point two places left. 1% of ₹ 3,700 is ₹ 37.
- **Swap trick:** 8% of 50 is the same as 50% of 8, which is 4.

Quick multiplication

Trick	How it works	Example
$\times 5$	Multiply by 10, then halve	$48 \times 5 = 480 \div 2 = 240$
$\times 25$	Multiply by 100, then divide by 4	$36 \times 25 = 3,600 \div 4 = 900$
$\times 9$	Multiply by 10, then subtract the number	$37 \times 9 = 370 - 37 = 333$
$\times 99$	Multiply by 100, then subtract the number	$46 \times 99 = 4,600 - 46 = 4,554$
$\times 11$ (two digits)	Write the two digits apart and put their sum between	$43 \times 11 = 4 (4+3) 3 = 473$

For $\times 11$, if the middle sum is 10 or more, carry 1 to the first digit: $75 \times 11 = 7 (12) 5 = 825$.

Squares of numbers ending in 5

Multiply the first digit by the next number, then write 25 after it. For 35^2 , $3 \times 4 = 12$, so the answer is 1,225. For 65^2 , $6 \times 7 = 42$, so the answer is 4,225.

Adding by rounding

To add ! 298 and ! 467, add ! 300 and take away 2: $300 + 467 - 2 = ! 765$.

Giving change by counting up

A bill is ! 367 and the customer gives ! 500. Count up from the bill: ! 3 makes 370, ! 30 makes 400, and ! 100 makes 500. The change is $3 + 30 + 100 = ! 133$. Shopkeepers have used this method for generations because it is hard to get wrong.

TIP

Before you accept any total, make a rough estimate. If a bill for 4 items of about ! 200 each says ! 1,850, something is wrong.

TRY THIS

1. Find 15% of ₹ 860 in your head.
2. Work out 64×25 .
3. Work out 85^2 .
4. A bill is ₹ 1,262 and the customer pays with ₹ 2,000. What is the change?

Answers: 1. ₹ 129. 2. 1,600. 3. 7,225. 4. ₹ 738.

CHECK YOURSELF

Practice questions

1. Find 35% of ₹ 2,600.
2. Anjali scored 54 marks out of 75. What is her percentage?
3. The price of a gas cylinder rose from ₹ 800 to ₹ 860. Find the percentage increase.
4. 18% of a number is 540. Find the number.
5. A shopkeeper buys a kettle for ₹ 850 and spends ₹ 50 on transport. He sells it for ₹ 1,080. Find his profit percentage.
6. A trader wants a 25% profit on a watch that cost him ₹ 1,600. What should he sell it for?
7. A table was sold for ₹ 4,250 at a loss of 15%. What was its cost price?
8. A jacket marked ₹ 3,200 is sold at a 15% discount. Find the selling price.
9. A shop gives successive discounts of 25% and 10%. Find the single equal discount.
10. Ravi buys a mixer for ₹ 2,000. He wants a 26% profit after giving a 10% discount. What should he mark it?
11. Find the simple interest on ₹ 18,000 at 7% per annum for 3 years.
12. Find the simple interest on ₹ 24,000 at 9% per annum for 8 months.
13. In how many years will ₹ 4,000 earn ₹ 1,200 simple interest at 6% per annum?

14. Find the compound interest on ₹ 8,000 at 10% per annum for 3 years, compounded yearly.
15. Find the amount on ₹ 50,000 at 6% per annum for 1 year, compounded half-yearly.
16. A laptop bought for ₹ 60,000 loses 15% of its value each year. Find its value after 2 years.
17. A loan has an interest rate of 15% per annum. What monthly rate is used in the EMI formula?
18. Divide ₹ 96,000 between two partners in the ratio 5 : 3.
19. 15 metres of cloth cost ₹ 2,250. What will 22 metres cost?
20. 8 workers finish a job in 15 days. How many days will 12 workers take?
21. A cricket team's scores in five matches were 245, 198, 276, 230 and 251. Find the average score.
22. A grocer mixes 25 kg of dal at ₹ 96 a kg with 15 kg at ₹ 112 a kg. Find the average price per kg.
23. A fan costs ₹ 2,950 including tax at an example rate of 18%. Find the price before tax and the tax.
24. A candle maker's fixed costs are ₹ 12,000 a month. Each box sells for ₹ 90 and costs ₹ 50 to make. Find the break-even number of boxes.
25. Find 99×58 using the mental maths trick.

ANSWER KEY

Answers

- | | |
|--|--|
| 1. $2,600 \times 35 \div 100 = ₹ 910$. | 5. CP = ₹ 900, profit = ₹ 180, so the profit is $180 \div 900 \times 100 = 20\%$. |
| 2. $54 \div 75 \times 100 = 72\%$. | 6. $1,600 \times 125 \div 100 = ₹ 2,000$. |
| 3. Increase = ₹ 60, and $60 \div 800 \times 100 = 7.5\%$. | 7. $4,250 \times 100 \div 85 = ₹ 5,000$. |
| 4. 1% is $540 \div 18 = 30$, so the number is 3,000. | 8. $3,200 \times 85 \div 100 = ₹ 2,720$. |

9. $25 + 10 - (25 \times 10 \div 100) = 32.5\%$.
10. SP needed = $2,000 \times 126 \div 100 = ! 2,520$.
MP = $2,520 \times 100 \div 90 = ! 2,800$.
11. $18,000 \times 7 \times 3 \div 100 = ! 3,780$.
12. T = $8 \div 12$ years, so SI = $24,000 \times 9 \times 8 \div (100 \times 12) = ! 1,440$.
13. T = $1,200 \times 100 \div (4,000 \times 6) = 5$ years.
14. A = $8,000 \times 1.1 \times 1.1 \times 1.1 = ! 10,648$, so CI =
! 2,648.
15. Use 3% for 2 periods: $50,000 \times 1.03 \times 1.03$
= ! 53,045.
16. $60,000 \times 0.85 \times 0.85 = ! 43,350$.
17. $15 \div 12 = 1.25\%$ a month, which is 0.0125
as a decimal.
18. One part = $96,000 \div 8 = ! 12,000$, so the
shares are ! 60,000 and ! 36,000.
19. 1 metre costs $2,250 \div 15 = ! 150$, so 22
metres cost ! 3,300.
20. One worker takes $8 \times 15 = 120$ days, so 12
workers take $120 \div 12 = 10$ days.
21. Total = 1,200, so the average is $1,200 \div 5 =$
240.
22. Total cost = $2,400 + 1,680 = ! 4,080$ for 40
kg, which is ! 102 a kg.
23. Base = $2,950 \times 100 \div 118 = ! 2,500$, and the
tax is ! 450.
24. Contribution = ! 40 a box, so break-even =
 $12,000 \div 40 = 300$ boxes.
25. $58 \times 100 - 58 = 5,800 - 58 = 5,742$.

WORD LIST

Glossary

Amount

the principal plus the interest at the end of a period.

Average

the sum of a set of values divided by how many values there are; also called the mean.

Break-even point

the level of sales at which income equals total costs, so there is neither profit nor loss.

Compound interest

interest worked out on the principal plus the interest already added.

Contribution

the selling price of one unit minus its variable cost.

Cost price (CP)

what a trader pays for goods, including costs to make them ready for sale.

Depreciation

the fall in value of an asset, such as a machine, as it gets older.

Discount

the amount taken off the marked price.

EMI

equated monthly instalment, the equal monthly payment that repays a loan with interest.

Fixed cost

a cost that stays the same whatever the level of sales, such as rent.

GST

Goods and Services Tax, the tax collected on most goods and services sold in India.

Inverse proportion

a link between two amounts where one goes down as the other goes up.

Margin

profit as a percentage of the selling price.

Marked price (MP)

the price printed on the tag before any discount.

Markup

profit as a percentage of the cost price.

MRP

maximum retail price, the highest price at which a packaged item may be sold.

Percentage point

the plain difference between two percentages, such as from 10% to 12%.

Principal

the money borrowed or deposited, on which interest is worked out.

Ratio

a comparison of two amounts of the same kind, written as $a : b$.

Selling price (SP)

the price the customer pays.

Simple interest

interest worked out on the original principal only.

Tax-inclusive price

a price that already includes the tax.

Unitary method

solving a problem by first finding the value of one unit.

Variable cost

a cost that rises with every unit made or sold, such as raw material.

Weighted average

an average in which each value counts according to its quantity.



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