INFOGRAPHHUB SERIES · 8 PARTS · AGES 11–16

Percentages

Eight infographics that take percentages from 'out of 100' to price changes, percentage points and the traps in between.

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Each part is one printable infographic. Work through them in order, or use the part you need. The quiz answers are printed upside down at the foot of the quiz. Sources for every part are listed on its page at infographhub.com.

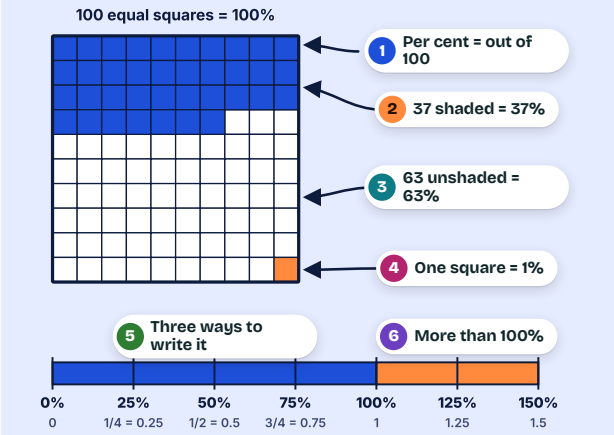
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PERCENTAGES PART 1 OF 8 · AGES 11–16

Percentages Explained

Per cent means 'out of 100'. One grid of 100 squares shows what a percentage is and how it links to fractions and decimals.



1 Per cent = out of 100

Per cent comes from the Latin per centum, 'by the hundred'. A percentage counts parts out of 100 equal parts of a whole.

2 37 shaded = 37%

37 of the 100 squares are shaded, so 37% of the grid is shaded. As a fraction that is 37/100; as a decimal it is 0.37.

3 63 unshaded = 63%

The parts of a whole add up to 100%: 37% + 63% = 100%. If 37% of a class walk to school, the other 63% do not.

4 One square = 1%

1% is one hundredth of the whole: 1/100 or 0.01. Ten squares make 10%, which is one tenth of the whole.

5 Three ways to write it

Fractions, decimals and percentages can show the same amount: 1/4 = 0.25 = 25% and 3/4 = 0.75 = 75%.

6 More than 100%

100% is the whole amount. A plant that grows from 40 cm to 60 cm is now 150% of its old height, because 60 ÷ 40 = 1.5.

Percentages make comparisons fair

18 out of 24 and 30 out of 40 look different, but both are 75%. Turning scores into percentages puts different totals on the same scale of 100.

NEXT IN THE SERIES
2. Finding a Percentage of an Amount: Worked Examples

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PERCENTAGES PART 2 OF 8 · AGES 11–16

Finding a Percentage of an Amount

Three ways to find a percentage of a number: two in your head and one on a calculator, each worked step by step.

1 Build it from 10% and 5%

Find 35% of 260 kg without a calculator.

1. 10% of 260 = 260 ÷ 10 = 26
2. 30% = 3 × 26 = 78
3. 5% is half of 10%: 26 ÷ 2 = 13
4. 35% = 30% + 5% = 78 + 13 = 91

ANSWER **35% of 260 kg = 91 kg**

2 Build it from 10% and 1%

Find 23% of 850 m without a calculator.

1. 10% of 850 = 85, so 20% = 2 × 85 = 170
2. 1% of 850 = 850 ÷ 100 = 8.5
3. 3% = 3 × 8.5 = 25.5
4. 23% = 20% + 3% = 170 + 25.5 = 195.5
5. Check: 25% of 850 is about 212; 23% is a bit less

ANSWER **23% of 850 m = 195.5 m**

3 Calculator: change it to a decimal

A phone plan gives 12 GB of data a month. You have used 68% of it. How much data have you used?

1. Change the percentage to a decimal: 68 ÷ 100 = 0.68
2. Multiply the amount by the decimal: 0.68 × 12
3. 0.68 × 12 = 8.16
4. Check: 68% is about 2/3, and 2/3 of 12 is 8

ANSWER **You have used 8.16 GB**

Swap it round

x% of y is always the same as y% of x. 8% of 50 looks awkward, but 50% of 8 is easy: it is 4. So 8% of 50 is 4 too.

NEXT IN THE SERIES
3. Percentage Increase and Decrease: Step by Step

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PERCENTAGES PART 3 OF 8 · AGES 11–16

Percentage Increase and Decrease

Change any amount by a percentage in one calculation. Follow a bike priced 240 as it goes up and down by 15%.

1

Start at 100%

The original amount is always 100%. Here a bike costs 240, and its price is going to rise by 15% or fall by 15%.

2

Add or take away the change

A rise of 15% leaves you with 100% + 15% = 115% of the original. A fall of 15% leaves 100% − 15% = 85%.

3

Turn it into a multiplier

Divide by 100: 115% becomes 1.15 and 85% becomes 0.85. This one number, the multiplier, does the whole change.

4

Multiply the original

Increase: 240 × 1.15 = 276. Decrease: 240 × 0.85 = 204. One calculation each, with no separate adding or subtracting.

5

Check the direction

A multiplier above 1 makes an amount bigger and one below 1 makes it smaller. 276 is more than 240 and 204 is less, so both make sense.

6

Or: find the change, then add or subtract

15% of 240 is 24 + 12 = 36. Then 240 + 36 = 276 and 240 − 36 = 204: the same answers, in two steps instead of one.

Watch the zeros

An increase of 5% is × 1.05, not × 1.5 (that is a 50% increase). A decrease of 3% is × 0.97, not × 0.7 (that is a 30% decrease).

NEXT IN THE SERIES
4. Percentage Change and Reverse Percentages: The Rules

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PERCENTAGES PART 4 OF 8 · AGES 11–16

Percentage Change Rules

How to measure a change as a percentage, and how to work backwards to the value before the change.

Percentage change

change ÷ original × 100	**The rule** Divide the change by the original value, the one before the change, then multiply by 100.
12 ÷ 80 × 100 = 15% increase	**Percentage increase** A price rises from 80 to 92. The change is 92 − 80 = 12, and the original is 80.
60 ÷ 250 × 100 = 24% decrease	**Percentage decrease** A bus fleet shrinks from 250 to 190 buses. The change is 250 − 190 = 60, and the original is 250.
92 ÷ 80 = 1.15, so up 15%	**Multiplier shortcut** Divide the new value by the original. Above 1 is a rise and below 1 is a fall.
10 ÷ 40 × 100 = 25% profit	**Percentage profit** Use the cost price as the original. Buy something for 40 and sell it for 50: the profit is 10.

Reverse percentages

original = new value ÷ multiplier	**Find the original** Write the new value as a percentage of the original, turn that into a multiplier, then divide by it.
63 ÷ 0.7 = 90	**After a decrease** After 30% off, a jacket costs 63. That is 100% − 30% = 70% of the original price.
1,500 ÷ 1.25 = 1,200	**After an increase** After a 25% pay rise, a wage is 1,500 a month. That is 100% + 25% = 125% of the old wage.
90 × 0.7 = 63 and 1,200 × 1.25 = 1,500	**Check forwards** Multiply your answer by the multiplier. You should get back the value you were given.

Divide by the original

In a percentage change the original value always goes on the bottom. In a reverse percentage the original is the unknown, so you divide by the multiplier instead.

NEXT IN THE SERIES
5. Percentage vs Percentage Points: What Is the Difference?

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PERCENTAGES · PART 5 OF 8 · AGES 11–16

Percentage vs Percentage Points

When a percentage itself goes up or down, there are two ways to describe the change. Both are correct, but they are not the same.

% points	VS	% change
WHAT IT MEASURES		
The plain gap between two percentages on the 0–100 scale.		How big that gap is compared with the starting percentage.
HOW TO WORK IT OUT		
New percentage − old percentage.		(New − old) ÷ old × 100.
INTEREST RATE 4% → 5%		
Up 1 percentage point: 5 − 4 = 1.		Up 25%: 1 ÷ 4 × 100 = 25.
VOTE SHARE 40% → 44%		
Up 4 percentage points: 44 − 40 = 4.		Up 10%: 4 ÷ 40 × 100 = 10.
PASS RATE 80% → 60%		
Down 20 percentage points: 80 − 60 = 20.		Down 25%: 20 ÷ 80 × 100 = 25.
SMALL RATE 2% → 3%		
Up just 1 percentage point: 3 − 2 = 1.		Up 50%: 1 ÷ 2 × 100 = 50. The same change sounds much bigger.

Small rates, big headlines

A risk that rises from 0.1% to 0.2% has doubled: a 100% increase. Yet it is up only 0.1 of a percentage point. Look for both numbers before deciding how big a change is.

NEXT IN THE SERIES
6. Common Percentage Mistakes and How to Avoid Them

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PERCENTAGES PART 6 OF 8 · AGES 11–16

Common Percentage Mistakes

Six slips that catch students and adults alike, each with the wrong working, the right working and the reason.

1 Dividing by the new amount

WRONG

~~A price goes from 50 to 60. 10 ÷ 60 × 100 ≈ 16.7%, so it rose by 16.7%.~~

RIGHT

10 ÷ 50 × 100 = 20%, so the price rose by 20%.

A percentage change is always compared with the value before the change, so the original goes on the bottom.

2 Adding successive percentages

WRONG

~~Up 20%, then up 30%: 20% + 30% = 50% increase.~~

RIGHT

1.2 × 1.3 = 1.56, so a 56% increase overall.

The second rise is 30% of the new, bigger amount, not of the original. Multiply the multipliers instead of adding the percentages.

3 50% off, then 50% off, is not free

WRONG

~~50% + 50% = 100% off, so the item is free.~~

RIGHT

0.5 × 0.5 = 0.25: you pay 25% of the price, a 75% discount.

The second 50% comes off the already halved price. A price of 80 drops to 40, then to 20.

4 Reversing a percentage the wrong way

WRONG

~~After a 20% rise a price is 72. Take 20% off: 72 × 0.8 = 57.60.~~

RIGHT

72 is 120% of the original, so 72 ÷ 1.2 = 60.

The 20% was 20% of the original price, not of 72. Divide by the multiplier to undo a change, then check: 60 × 1.2 = 72.

5 Comparing percentages of different totals

WRONG

~~60% of class A passed and 50% of class B passed, so more students passed in A.~~

RIGHT

Class A: 60% of 20 = 12.
Class B: 50% of 40 = 20.
More passed in B.

A percentage gives the share, not the number. A bigger share of a smaller group can be fewer people.

6 A fall of more than 100%

WRONG

~~The price of a ticket fell by 150%.~~

RIGHT

A fall of 100% takes a price to zero, so a price can fall by at most 100%.

Increases have no upper limit, but you cannot take away more than all of something. A '150% fall' usually means someone divided by the new value.

Ask: a percentage of what?

Before you calculate, say what the 100% is: the original price, the new price or the whole group. Most percentage mistakes come from using the wrong one.

NEXT IN THE SERIES
7. Percentages in Everyday Life: 8 Real Examples

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PERCENTAGES PART 7 OF 8 · AGES 11–16

Percentages in Everyday Life

From the shops to the news, percentages are everywhere. Here is the maths behind eight of them.

Sale discounts

25% off trainers priced 64 means you pay the other 75%:
64 × 0.75 = 48. You save
64 − 48 = 16.

VAT, GST and sales tax

Many countries add a value added tax (VAT), a goods and services tax (GST) or a sales tax. With an 8% tax, an item priced 35 costs 35 × 1.08 = 37.80.

Tips

Where tipping is expected, find 10% and halve it to get 5%. A 15% tip on a bill of 42 is
4.20 + 2.10 = 6.30.

Interest on savings and loans

At 3% a year, 500 earns 15 in the first year. Leave it in and the next 3% is of 515, so it earns 15.45. Loans charge interest the same way.

Food labels

US labels give a % Daily Value: 5% or less is low and 20% or more is high. UK and EU labels may show a % of the Reference Intake.

Statistics in the news

'Cases up 50%' could mean 2 cases rising to 3. A percentage hides the size of the numbers, so look for the real counts too.

Phone battery

At 20% charge, a phone that lasts about 15 hours on a full charge has roughly 0.2 × 15 = 3 hours left, if you keep using it the same way.

Test and exam scores

54 marks out of 60 is
54 ÷ 60 × 100 = 90%.
Percentages let you compare tests that have different totals.

Quick maths at the till

Find 10% by dividing by 10, then build what you need: double it for 20%, halve it for 5%. 10% of 64 is 6.40, so 25% is
6.40 + 6.40 + 3.20 = 16.

NEXT IN THE SERIES
8. Percentages Quiz: Test Yourself

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PERCENTAGES PART 8 OF 8 · AGES 11–16

Percentages Quiz

Ten questions on the whole series. Answer them all, then turn the page round to check.

1 Which of these is the same as the decimal 0.6?

- A 6%
- B 60%
- C 0.6%
- D 600%

2 What is 18 out of 24 as a percentage?

- A 18%
- B 66%
- C 75%
- D 80%

3 What is 15% of 80?

- A 8
- B 12
- C 15
- D 1.2

4 Which multiplier decreases an amount by 15%?

- A 0.15
- B 1.15
- C 0.85
- D 0.015

5 Increase 60 by 5%.

- A 60.5
- B 63
- C 65
- D 90

6 A price rises from 40 to 50. What is the percentage increase?

- A 10%
- B 20%
- C 25%
- D 50%

7 After a 20% discount a coat costs 96. What was the original price?

- A 76.80
- B 115.20
- C 120
- D 116

8 An interest rate rises from 2% to 3%. Which statement is true?

- A Up 1 percentage point, a 50% rise
- B Up 1 percentage point, a 1% rise
- C Up 50 percentage points
- D Up 1%, a 33% rise

9 A price is cut by 50%, then the new price is cut by 50% again. What is the total discount?

- A 100%
- B 75%
- C 50%
- D 25%

10 A headline says sales rose by 200%. Last year 50 were sold. How many were sold this year? Show your working.

ANSWERS

1. B: 60% (0.6 × 100 = 60)
2. C: 75% (18 ÷ 24 = 0.75)
3. B: 12 (10% is 8 and 5% is 4)
4. C: 0.85 (100% − 15% = 85%)
5. B: £63 (£60 × 1.05; 90 would be a 50% increase)
6. C: 25% (10 ÷ 40 × 100; 20% divides by the new price)
7. C: £120 (£96 ÷ 0.8; £115.20 wrongly adds 20% to the sale price)
8. A: up 1 percentage point, which is a 50% rise in the rate (1 ÷ 2 × 100)
9. B: 75% (you pay 0.5 × 0.5 = 0.25 of the price)
10. 150: a 200% rise means 100% + 200% = 300% of 50, so 50 × 3 = 150

SERIES COMPLETE

All 8 parts free at infographhub.com/series/percentages/

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