

Percents: math lesson, Grade 6 – download the PDF

Sale tags, battery icons, quiz scores and sports statistics all use percents. A percent lets you compare any two amounts on the same scale of 100. In this chapter you will learn what a percent really means, how to switch between fractions, decimals and percents, how to find a percent of a number, and how to work backward to find the whole.

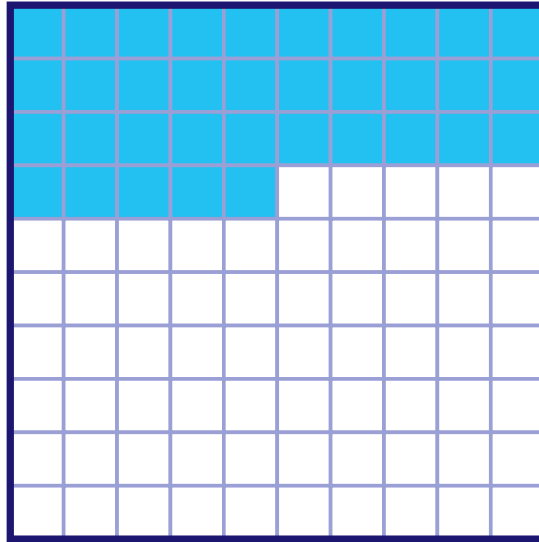
1. A percent is a rate per 100

D Definition: percent

A **percent** is a rate per 100. The symbol % means “out of 100.” So

$$1\% = \frac{1}{100} = 0.01 \text{ and } 35\% = \frac{35}{100}.$$

A hundred grid is the best picture of a percent. Each little square is **1%** of the whole grid. If 35 squares are colored, then 35% of the grid is colored.



35 out of 100

E

Example 1: reading a percent

A box holds 100 crayons. Of these, 62 are new and the rest are used. New crayons:

$\frac{62}{100} = 62\%$. Used crayons: $100 - 62 = 38$, so 38% . The two percents add up to 100% , which is the whole box.

P

Property: percents and fractions

For any number p , $p\% = \frac{p}{100}$. A percent equal to 100% is the whole, and a percent greater than 100% is more than the whole.

A percent can also describe a part of a group that does not have exactly 100 items. “40% of the class” means 40 out of every 100 students, or equivalently 4 out of every 10, or 2 out of every 5.

2. Fractions, decimals and percents

A fraction, a decimal and a percent are three names for the same number. Percents are just fractions whose denominator is 100.

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Method: converting

1. **Percent to decimal:** divide by 100, which moves the decimal point 2 places left.
 $7\% = 0.07$.
2. **Decimal to percent:** multiply by 100, which moves the decimal point 2 places right.
 $0.6 = 60\%$.
3. **Fraction to percent:** if the denominator divides 100, build an equivalent fraction with denominator 100. Otherwise divide the numerator by the denominator, then multiply by 100.

Fraction	Decimal	Percent
$\frac{1}{2}$	0.5	50%
$\frac{1}{4}$	0.25	25%
$\frac{3}{4}$	0.75	75%
$\frac{1}{5}$	0.2	20%
$\frac{1}{10}$	0.1	10%
$\frac{1}{20}$	0.05	5%

E**Example 2: fraction to percent**

(a) $\frac{7}{20} = \frac{7 \times 5}{20 \times 5} = \frac{35}{100} = 35\%$.

(b) $\frac{3}{8}$: divide $3 \div 8 = 0.375$, then $0.375 \times 100 = 37.5$, so $\frac{3}{8} = 37.5\%$.

(c) $125\% = 1.25 = \frac{5}{4}$. A percent greater than 100% means more than one whole.

**Watch out**

0.5 is **50%**, not **0.5%**. And **5%** = **0.05**, not **0.5**. Always move the decimal point *two* places.

3. Finding a percent of a quantity

To find a percent of a number, turn the percent into a decimal (or fraction) and multiply. The word “of” means multiply.

M**Method: percent of a quantity**

1. Write the percent as a decimal.
2. Multiply it by the quantity.

Or use benchmarks: **10%** is dividing by 10, **1%** is dividing by 100, **50%** is half and **25%** is a quarter. Then add pieces.

E**Example 3: 35% of 60**

Decimal method: $0.35 \times 60 = 21$.

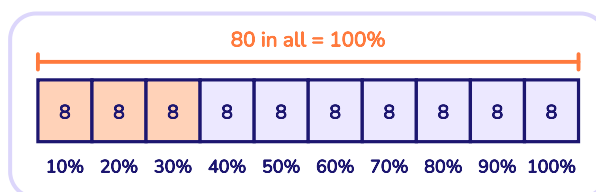
Benchmark method: **10% of 60 = 6**, so **30% = 18**. Half of 10% is **5% = 3**. Then **35% = 18 + 3 = 21**. Both methods agree.

E**Example 4: a hiking trail**

A trail is 16 miles (about 26 km) long. A group has hiked 25% of it. $25\% = \frac{1}{4}$, so $16 \div 4 = 4$. They have hiked 4 miles, about 6.5 km.

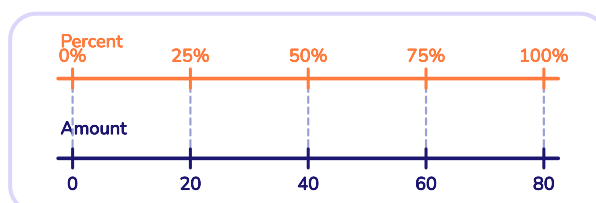
4. Tape diagrams for percents

A **tape diagram** is a strip cut into equal parts. When the whole strip is 100%, cutting it into 10 equal parts makes each part **10%**. It lets you see the percent and the amount at the same time.



Here the whole is 80. Ten equal parts means each part is $80 \div 10 = 8$. Three parts are shaded, so **30%** of 80 is $3 \times 8 = 24$.

A double number line shows the same idea. The top line shows percents and the bottom line shows the matching amounts.



Moving from 0% to 25% on top matches moving from 0 to 20 on the bottom, so **25%** of 80 is 20.

5. Finding the whole from a part and a percent

Sometimes you know a part and the percent it represents, and you must find the whole. The tape diagram works backward.

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Method: finding the whole

1. Draw a tape for 100% cut into equal parts.
2. Find how many parts match the given percent and what amount they hold.
3. Divide to get the value of one part, then multiply to get all the parts.

With an equation: $\text{part} = \text{percent} \times \text{whole}$, so $\text{whole} = \text{part} \div \text{percent}$ (as a decimal).

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Example 5: 18 is 30% of what number?

30% is 3 parts of a 10-part tape. Those 3 parts hold 18, so one part is $18 \div 3 = 6$.

The whole is $10 \times 6 = 60$.

Check with the equation: $0.30 \times 60 = 18$. It works.

!

Zyro's tip

On my planet we say: "Find one part first, then build the whole." Once you know 10%, the whole is just 10 copies of it!

6. Percent word problems

Many everyday problems are percent problems: discounts, sales tax, tips, test scores and growth. Read carefully to decide whether you are looking for the part, the percent or the whole.

Example 6: a discount

Sneakers cost \$60 and are 25% off. Discount: $0.25 \times 60 = 15$ dollars. Sale price: $60 - 15 = 45$ dollars. Shortcut: you pay $100\% - 25\% = 75\%$ of the price, and $0.75 \times 60 = 45$.

Example 7: more than 100%

A young tree is 5 feet tall (about 1.5 m). A year later it is 140% as tall as before. $1.4 \times 5 = 7$, so it is now 7 feet tall, about 2.1 m.

Watch out

“25% off” is not the price you pay. It is the amount taken away. You pay the other 75%.

7. Comparing with percents

Because every percent is out of 100, percents are a fair way to compare ratios with different totals. A score of 18 out of 20 and a score of 22 out of 25 are hard to compare as they stand.

Convert: $\frac{18}{20} = 90\%$ and $\frac{22}{25} = \frac{88}{100} = 88\%$. The first score is slightly better.

Key takeaways

- A percent is a rate per 100: $1\% = \frac{1}{100} = 0.01$.
- Percent to decimal: move the decimal point 2 places left. Decimal to percent: 2 places right.
- Fraction to percent: make the denominator 100, or divide then multiply by 100.
- Percent of a quantity: multiply the decimal by the quantity, or build it from 10% and 1%.
- Finding the whole: $\text{whole} = \text{part} \div \text{percent}$, or find one part on a tape diagram.
- A discount of $p\%$ means you pay $(100 - p)\%$ of the price.



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Speed drill for Grade 6: how many in 60 seconds?

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