

# **A Brief Guide to Arithmetic for Advocacy**

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## How to Calculate a Percentage

"Percent" means per 100; 25 percent means 25 out of 100. 100 percent means everybody or everything; 0 percent means nobody or nothing.

**To calculate a percentage, you need just two pieces of information:**

- 1. the number in the entire (or total) group, and**
- 2. the number in the part of the group you are interested in (the "subgroup").**

**Divide the number in the subgroup by the number in the total group, then multiply by 100:**

$$\text{(Number in subgroup} \div \text{Number in total group)} \times 100$$

There are 1,257 students in a high school. Of them, 137 are in advanced science classes. You determine what percentage are in the advanced classes this way:

$$\begin{aligned} (137 \div 1,257) \times 100 &= 0.109 \text{ (rounded)} \times 100 \\ &= 10.9\% \end{aligned}$$

Use the same approach when dealing with budget figures rather than people.

If a social services agency with a budget of \$2,500,000 for the year plans to spend \$64,598 on child care, what percentage of the budget will be spent on child care?

$$\begin{aligned} (64,598 \div 2,500,000) \times 100 &= 0.026 \text{ (rounded)} \times 100 \\ &= 2.6\% \end{aligned}$$

## How to Calculate a Rate

"Rate" simply means the number of things per some other number, usually 100 or 1,000 or some other multiple of 10. A percentage is a rate per 100. Infant mortality rates are calculated per 1,000.

To calculate a rate, you need three pieces of information:

1. the number in the total group (for example, the total number of babies born in a given year);
2. the number in the subgroup you are interested in (such as the number of infants that died that year); and
3. the "per" number — per 100, or 1,000, or 100,000. The "per" number is called a multiplier.

The formula for calculating a rate is:

$$\text{(Number in subgroup} \div \text{Number in total group)} \times \text{multiplier}$$

In 2003, 135,979 babies were born in Georgia. In that same year, 1,151 infants died in the state. The infant mortality rate is the number of infant deaths per 1,000 births. You calculate Georgia's 2003 infant mortality rate this way:

$$\begin{aligned} (1,151 \div 135,979) \times 1,000 &= 0.00846 \text{ (rounded)} \times 1,000 \\ &= 8.46 \end{aligned}$$

To calculate the rate, you must work with numbers that are large enough to be meaningful. People who regularly work with numbers use this general rule: if the number of people or events or things is less than 30, *do not calculate a rate*. This is because rates based on such small numbers can vary tremendously from year to year and are not considered stable. For example, if there were 17 infant deaths in your county last year, do not calculate an infant mortality rate.

## How to Calculate a Ratio

A ratio is one number divided by another. A ratio tells you how much bigger or smaller one number is compared to the other.

For example, in 2003 the infant mortality rate among Blacks was 14.01; the rate among Whites was 5.72. The ratio of the Black rate to the White rate is:

$$14.01 \div 5.72 = 2.449 \text{ (or 2.45 rounded)}$$

You can compare any two numbers this way, provided you have the same measure for two groups for the same year (as in the infant mortality example above) or for one group in two different years (such as the unemployment rate in your state in 2004 compared with the 2000 rate).

## How to Calculate Change Over Time

When you have data from two or more points in time, you can calculate how much change there was between the first and second times. Sometimes all you need to know is whether the number went up or down or stayed the same. Usually you will want to know the size of the change — that is, the percent by which the number changed. It is very simple to calculate this "rate of change."

**You need only two numbers to calculate change over time:**

- 1. the number from the earlier point in time, and**
- 2. the number from the later point in time.**

**The rate of change is:**

$$\mathbf{[(\text{Number at later time} \div \text{Number at earlier time}) - 1] \times 100}$$

The easiest way to do this is with a calculator. That way you will automatically see if the resulting number is positive (meaning there was an increase over time) or negative (meaning there was a decrease).

The infant mortality rate in New Mexico was 8.4 in 1993 and 5.8 in 2003. Calculate the change this way:

$$\begin{aligned} 5.8 \div 8.4 &= 0.69048 \\ 0.69048 - 1 &= -0.30952 \\ -0.30952 \times 100 &= -30.95\% \text{ (or } -31.0\%, \text{ rounded)} \end{aligned}$$

This means that the infant mortality rate in New Mexico decreased by 31.0 percent between 1993 and 2003.

## How to Rank Numbers

Why is it useful to rank numbers? Ranking allows you to say whether one state's children are faring better than another state's, or to say that there are, for example, 17 states with lower infant mortality rates than yours.

Ranking should be done only when you can compare the same measure of data for each of the geographic areas or groups you are studying.

**Ranking involves two steps:**

- 1. putting the numbers in order, and**
- 2. assigning a rank to each based on its place in the order.**

Numbers can be ordered from largest to smallest or from smallest to largest. To rank numbers, order them from "best" to "worst." The "best" number can be assigned a rank of 1, with rank 2 going to the second best, and so forth down the list. The worst number would be assigned the lowest rank. "Best" and "worst" are determined by the specific number. The largest value would be best for median income, whereas the smallest value would be best for infant mortality.

When two or more numbers in the list are the same, it does not make sense to give them different ranks. Give them the same rank and skip the next rank. If three numbers are the same, give them the same rank and skip the next two ranks.

## Converting Proportions and Percentages

Data can be communicated in a number of ways. If you think your audience might have trouble understanding or feeling moved by percentages, for example, you can use less formal (but still accurate) terms. Here are some common conversions:

Proportion	Percent	Converts to
.10	10%	1 in (or out of) 10
.111	11.1%	1 in 9
.125	12.5%	1 in 8
.143	14.3%	1 in 7
.167	16.7%	1 in 6
.20	20%	2 in 10 or 1 in 5
.222	22.2%	2 in 9
.25	25%	1 in 4
.286	28.6%	2 in 7
.30	30%	3 in 10
.333	33.3%	1 in 3
.375	37.5%	3 in 8
.40	40%	4 in 10 or 2 in 5
.429	42.9%	3 in 7
.444	44.4%	4 in 9
.50	50%	5 in 10, or 1 in 2
.556	55.6%	5 in 9
.571	57.1%	4 in 7
.60	60%	6 in 10 or 3 in 5
.625	62.5%	5 in 8
.667	66.7%	2 in 3
.70	70%	7 in 10
.714	71.4%	5 in 7
.75	75%	3 in 4
.778	77.8%	7 in 9
.80	80%	8 in 10 or 4 in 5
.833	83.3%	5 in 6
.857	85.7%	6 in 7
.875	87.5%	7 in 8
.889	88.9%	8 in 9
.90	90%	9 in 10