

MATH FOR JOURNALISTS – VIA NEWSU

RULES OF THUMB

These guidelines will help you reduce number clutter, increase the readability of your news report and help your audience better understand your story.

- **RULE 1: AVOID "NUMBER SOUP"**
Use no more than two or three numbers in a single paragraph; dates, times and spelled out numbers (e.g., "one") count.
- **RULE 2: SPREAD YOUR NUMBERS OUT**
Have no more than one or two paragraphs in a row containing numbers.
- **RULE 3: ROUND NUMBERS OFF** Avoid fractions, decimals and other hard-to-understand numbers when you can round off without sacrificing accuracy.
- **RULE 4: PRESENT NUMBERS GRAPHICALLY**
Numbers belong in graphics, including charts, tables and bulleted lists in break-out boxes.

COMMON MISTAKES

- **MISTAKE 1**
Miscalculating a percent
- **MISTAKE 2**
Mixing up percent and percentage points
- **MISTAKE 3**
Using large numbers that are meaningless to readers

To remedy the last mistake, consider comparing the abstract number to something that is more comprehensible to your local audience. appropriate size.

PERCENT

- Means a part of one hundred or part of a whole
- Often used to make things more accessible where the raw number may lack the necessary context
- Often used in election stories. For example: David Golonski received 62 percent of the vote. This is better than "7,542 of 12,165 votes."

- Can use approximations to make it even clearer. Golonski received about two-thirds of the votes cast.

PERCENT CHANGE

Interviewing data is very much like interviewing human sources — your goal is to find patterns that generate additional interview questions or story ideas.

One powerful math tool for interviewing data is percent change, which can reveal patterns in numbers between time frames such as years.

For example, a 200 percent change is the same as adding 200 percent (**which triples the original number**): If you start with 2, a 200 percent increase adds 200 percent of 2, which is 4. $2 + 4 = 6$ (which is triple the original number, 2).

PERCENT CHANGE FORMULA

A two-step formula, or "recipe," covers percent change:

- 1. $(\text{New} - \text{old}) / \text{old} = \text{decimal value}$
- 2. $\text{Decimal value} \times 100 = \text{percent change}$

OR

- 1. $\text{New} / \text{old} - 1 = \text{decimal}$
- 2. $\text{Decimal} \times 100 = \text{percent}$

1. $\text{New} / \text{old} - 1 = \text{decimal}$

2. $\text{Decimal} \times 100 = \text{percent}$

PERCENT OF TOTAL

Like percent change, percent of total is a powerful math tool for interviewing data. As always, your goal is to find patterns in the data.

Percent of total can show you patterns or disparities in sets of numbers.

For example, if you have a data set that tells you that state employees got a total of \$3.5 million in raises this year, and you know the governor's salary for this year and for last year, you can figure out what percent of the total in raises given out went to the governor, or to members of the state legislature.

PERCENT OF TOTAL FORMULA

Here's the three-step formula, or "recipe," for percent of total:

- 1. Calculate the total (the sum) for the category of numbers of your choice.
- 2. Divide the value of a particular case by the calculated total value.
- 3. Multiply the result by 100 to convert from decimal to percent form.

Don't forget to double-check your work. The percent of all totals should add up to 100 percent. Think of it this way: Take a piece of pie, divide by the whole pie, then multiply by 100 to get the percent.

PERCENTAGE POINT VS PERCENT

It's very easy to confuse percentage point difference with percent difference. These values are not interchangeable — even though they both can illustrate relative change in two numbers or change over time. Let's examine the similarities and differences using the following example:

- In 2014, police salaries were 15 percent of the city budget.
- In 2015, police salaries were 17 percent of the city budget.

Which tool should you use? Percentage point difference or percent difference? The short answer is "The one that most clearly describes what your story is trying to say."

PERCENTAGE POINT DIFFERENCE

To calculate percentage point difference, use subtraction to compare two percentages from two different times. Note: The percentage point difference math tool only works with percents.

Here's a one-step formula or "recipe" in detail:

- $\text{New percent} - \text{old percent} = \text{percentage point difference}$ or $17 - 15 = 2$

So, the difference in police salaries from one year to the next as a share of the city budget (or percent of total) is **an increase of 2 percentage points, not 2 percent.**

PERCENT DIFFERENCE

To calculate percent difference in the relative sizes of the police salaries' piece of the pie (the city budget) from last year to this year, use a combination of subtraction, division and multiplication.

Here's a two-step formula:

1. (New - old) / old = decimal or (17 - 15) / 15 = 0.1333

2. Decimal x 100 = percent difference or 0.1333 x 100 = 13.333

So, after rounding, the difference is an increase of 13 percent. That means that the share of the city budget devoted to police salaries is 13 percent larger this year than it was last year. It is also 2 percentage points greater.

Note: Percent difference (or percent change) is used to compare two numbers from two different times. Both numbers must be in the same form (e.g., percents or dollars or number of incidents).

MEAN

A basic **mean** (aka "straight average") is not always the most objective or even accurate math tool to use when calculating a typical value because it can be affected by extremely high or low numbers, or what statisticians call "outliers."

So why is it used? Because it's simple. Here's that formula:

1. Count the number of values in the collection

2. Total (sum) the values in the collection

3. The total (sum) of values / number of values = mean

MEDIAN

A median is a powerful math tool you can use to find or calculate the middle of a collection of numbers **containing an extreme high or low value.**

In fact, calculating both the mean and median will give you a choice and the ability to make a news judgement as to which number is a better measure for your story. **Having a choice will also help you been a more objective journalist.**

When a collection of numbers does contain extremely high or low values, the median is a good choice for describing a typical value or what some math types call "**central tendency.**"

However, when a group of numbers does not contain extreme values, it's more accurate to use the mean to measure the typical value because it considers all the values in the collection rather than just the one or two in the middle.

MEDIAN FORMULAS

Formula for calculating the median in a collection with an odd number of values:

1. **Sort the values in the collection (high to low or low to high)**
2. **The value in the middle is the median**

Formula for calculating the median in a collection with an even number of values:

1. **Sort the values in the collection (high to low or low to high)**
2. **Locate the middle two values and calculate their mean**

MODE

The mode is a math term used to describe the most frequently occurring value in a data collection.

The mode is rarely used in journalism, **but it can be handy when looking for patterns in large data collections or sets, such as campaign finance contributions.** In a statewide race, a list of campaign contributions can easily contain more than 30,000 individual checks or records, depending on the candidate's fundraising ability.

If the mode showed that a significant number of checks were being written **for the even amount of \$200**, that could be an interesting pattern. By the way, you get to decide how many checks out of 30,000 it takes to count as "interesting." An interesting pattern in data is worthy of at least one pointed interview question or possibly a story.

Could it be that the candidate's campaign is charging \$200 a plate for fundraising meals? If the dates on the checks show a clustering every one or two weeks, that could mean contributions are being "bundled" in the workplace. So, knowing the mode can help you interview the data in preparation for interviewing human sources.

RATIOS

Ratio is a way of explaining how two similar things relate. Ratios crop up in daily life all the time — in recipes, measurements — and in journalism in stories on elections, sports, education, health and much more.

For instance, in a city council race, Candidate Brown got 75,347 votes and Candidate Smith only got 24,994, you could accurately tell your audience that Candidate Brown won by a ratio of 3-to-1. That means that, for every vote that Smith got, Brown got 3 votes.

Order is important in expressing a ratio. If you were in a class that had 5 men and 15 women, you could say that the ratio of men to women was 5-to-15. Or that the ratio of women to men was 15-to-5. But it's crucial to keep the objects you are counting or measuring in the correct order.

ATTENTION CITIZENS!

A 1-to-3 ratio does not mean one-third. It means that, for every one man, there are three women.

Add them together to get the total population of four. Of the four, only one is a man. So, a 1-to-3 ratio actually means that men make up one-fourth of the total population.

CALCULATING A RATIO

In the election example above, how do we know that Candidate Brown won by a 3-to-1 margin? We calculate the ratio using simple arithmetic, in this case, division.

Divide the number of votes Brown got by the number that Smith got:

$$75,347 / 24,994 = 3.014 \text{ (rounded to 3)}$$

This tells us that Brown got three times as many votes as Smith or, for each vote Smith got, Brown got three. That can be expressed as a ratio: Brown beat Smith by a 3-to-1 margin.

RATE

Rate is a very handy math tool when you want to make a comparison between quantities of two things that are not alike.

Let's take an example: murder rates in U.S. cities in a given year. What do we need to know to apply the rate tool to this sort of data?

Since murders happen to people, we'll need to obtain (1) city population in that year and, (2) number of murders in that city in that year.

Here's a method for calculating a rate:

1a. Choose what is called your "base."

This is the number that represents the total. Using above example, the base would be the total population of each city.

1b. Choose the number that will be the point of your story or graphic.

In this case, we care about murders and we want to eventually know the murder rate, so our number is the number of murders in a given year.

2. Total murders in city A / total population in city A = murder rate for city A

You'll want to convert the rate to something that is easier for people to understand, such as murder rate per 100,00 residents. though.

3. Murder rate for city A x 100,000 = rate per 100,000

4. Round the rate to ZERO decimal places