

MATHWORKS FOR RECYCLING
Percentages in Solid Waste Management
From the Steel Recycling Institute

Looking at growth or reduction in percentages is useful for evaluating the effectiveness of a recycling program. Percentages help us to compare information from year to year, and provide a basis by which to measure progress toward achieving goals. To calculate percentage increases or decreases, find the difference between the two percentages, divide the difference by the initial percentage, and multiply by 100.

Example:

The town of Smithville landfilled 90 percent of its solid waste in 1994. Because of improvements in its recycling program, Smithville landfilled 85 percent of its solid waste in 1995. By what percent did Smithville reduce the solid waste sent to the landfill?

First, find the difference between the two percentages by subtracting the smaller from the larger number: $90 - 85 = 5$. The difference between the two percentages is the *points*.

Divide the points (5) by the initial percentage (90): $5/90 = 0.06$. (See reverse for more information on initial percentage.) If we are measuring change from one year to the next, for instance, the initial percentage is that of the earliest year.

Multiply this number by 100 to obtain the percent reduction: $0.06 \times 100 = 6\%$.

Information on percentages and answers to the questions are on the reverse side of this page.

Question 1

- A. The town of Somerton has been recycling for a long time. Last year, it landfilled only 85 percent of its solid waste. This year, it landfilled 82 percent. By how much did it reduce its percentage of waste landfilled?
- B. If Somerton landfilled 85 percent of its waste last year, we can assume that it recycled 15 percent. Based on this assumption, how much did it recycle this year? And by what percent did it increase its recycling?

Question 2

Use the data in the table to answer the following questions.

Steel Can Recycling Rates	YEAR	1988	1989	1990	1991	1992	1993	1994	1995
	RATE	15.0%	17.9%	24.6%	34.0%	40.9%	48.0%	53.0%	55.9%

- A. By what percentage did the steel can recycling rate increase from 1992 to 1993?
- B. By what percentage did the steel can recycling rate increase from 1988 to 1993? How many points was this?
- C. If the Steel Recycling Institute increases the can recycling rate by 36 percent between 1994 and 1996, what will the 1996 recycling rate be?

Discussion of Percentages

Percentages are really fractions based on a factor of 100. This helps to "standardize" them as comparative units. Imagine how difficult it would be to compare 19/54's of something to 37/68's of something else. A lengthy calculation would be needed to figure it out. But comparing 35 percent to 54 percent is much easier.

Why do we calculate percentages this way? It may seem that if solid waste landfilled was 90 percent the first year and 85 percent the second year, then it decreased by 5 percent. But that's not so. *Remember*, we're looking at how much it changed from one year to the next, not at how much it changed from a base of 100.

When we look at how much it changed from a base of 100, we are looking at percentage *points*. Points are an indication of the direction of change, as well as a way of finding the new rate. If we know that a percentage rate of 66 went up 29 points, then we know the new percentage rate is 95. But this doesn't tell us the percent increase.

When looking at percent increase or reduction, we have to consider what the change is *from* and *to*. We cannot always assume a base of 100.

Why Use Percentages?

Percentages are helpful because they help us learn *how much* as compared to the whole. For instance, you would be impressed to learn that 16.4 billion steel cans were recycled in 1993. But you would not be able to evaluate how that number relates to the total number of steel cans used that year or have any idea of how much recycling was really being done. Is the steel industry recycling a lot? Or is there room for improvement? For steel cans, percentages help us understand how the number of cans *recycled* compares to the number *produced*, which is the same as looking at *how much* as compared to the whole.

The same applies to the landfilling questions on the other side of this sheet. Information regarding how much solid waste was not sent to the landfill is important, but information on how this compares to the solid waste generated helps us evaluate how much is actually recycled.

Percentages also provide a basis of noting progress or of comparing the recycling of different materials, regardless of the volume of those materials. An extension to the activities provided here would be to contact various recycling organizations, assess their annual container recycling rates and determine percentage growth.

Recycling and landfilling percentages are usually expressed in whole numbers or with one decimal place. This might require rounding when performing calculations of percent increase or reduction. A rule is to round down numbers less than five, and round up numbers greater than or equal to five. For example, 6.23 percent would be rounded down to 6.2 percent. Conversely, 6.27 percent would be rounded up to 6.3 percent. In terms of rounding for whole numbers, the 1994 appliance recycling rate was 70.2 percent. Rounded to whole numbers, it would be 70 percent.



ANSWERS:
• 1.A 3.53 percent • 1.B 18 percent; 20 percent
• 2.A 17 percent • 2.B 220 percent; 33 points • 2.C 72 percent

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