



## Arrowhead Center

### **How do I calculate a Percent Change and a Percent?**

One of the most basic measures of economic success or failure is the percent change in some key figure such as Gross Domestic Product (GDP), Real Gross Domestic Product (RGDP), or GDP per capita (Per Capita means per person). We also use percents when examining variables such as the unemployment rate (UR), the Labor Force Participation Rate (LFPR), and various measures of inflation. Everyone needs to understand how to calculate various percentages. So, even though calculating a percent is something you should have learned in high school or earlier, this little guide is designed to help you with percents.

### **Calculating a Percent Change**

A formula for calculating the percent change of a variable X from one time period to another is:

$$\text{Percent Change in } X = \left[ \frac{(\text{New Value of } X - \text{Old Value of } X)}{\text{Old Value of } X} \right] \text{ times } 100$$

Or, using a little more mathematical notation,

$$\% \Delta X = \frac{(X_t - X_{t-1})}{X_{t-1}} * 100.0$$

The following example should help you to understand the formula.

	X
2004	1,000
2005	1,100

In this example,

$X_t$  is the (new) value of X in 2005 (that is, 1,100)

$X_{t-1}$  is the (old) value of X in 2004 (that is, 1,000)

What is the percent change in X (also denoted as  $\% \Delta X$ ) from 2004 to 2005?

$$\% \Delta X = \frac{(1,100 - 1,000)}{1,000} \times 100 = \left[ \frac{100}{1,000} \right] \times 100 = \left[ \frac{1}{10} \right] \times 100 = 10.0 \text{ percent}$$

In this case the value of X increased by 10 percent from 2004 to 2005. Note that this process is not reversible. That is the percent change from 2005 to 2004 is not the same as the percent change from 2004 to 2005.

Now, you try it. Here are some numbers.

Year	U.S. Real GDP (Billions of Dollars)	Percent Change
2003	10,320.6	Not applicable
2004	10,755.7	

So, how do I do this? Take the difference between the 2004 value of USRGDP (10,755.7) and the 2003 value of USRGDP (10,320.6) and divide by the 2003 value of USRGDP (10,320.6). When you have finished that, multiply your answer by 100. If you want more data to work with visit the website of the Bureau of Economic Analysis –the agency that compiles the GDP data. The web address (for both GDP and RGDP) is: <http://www.bea.gov/bea/dn/gdplev.xls>

Keep reading and I will eventually give you the answer to check with your own work. I will refer to the answer as the answer to problem A. By the way, *if after reading this small document, you can't calculate a percent change, please contact your instructor immediately.*

Now, try some additional problems. The Consumer Price Index or CPI (see text for an explanation) is a common measure of inflation. The CPI is an index number. Calculate the year to year percent change in the CPI from the following data.

Year	CPI	Percent Change
1996	156.9	Not Applicable
1997	160.5	
1998	163.0	
1999	166.6	
2000	172.2	

### Calculating a Percent

Of course, not all percentages are percent changes. Sometimes a percent represents a proportion –as in the unemployment rate.

$$\text{The Unemployment Rate (UR)} = \left[ \frac{\text{the number of unemployed persons}}{\text{the number of persons in the labor force}} \right] \times 100.$$

The number of persons in the labor force equals the number of unemployed plus the number of employed persons. The definition of the labor force excludes many people (the very young and very old and many other groups –see your text for a complete definition)

So, if there are 4,000 unemployed people and 96,000 employed people, what is the unemployment rate? Unless you read carefully, this can be a tricky question.

Finally, what is the answer to problem A? The answer is 4.2 percent. And, the unemployment rate in the above problem is 4.0 percent.