Problem with Percents? Self-Help Guide!

Understanding Percents Part 3 (Percent Change)

Percent change involves an increase or decrease in some quantity over time, represented as a percentage. Although the calculations can produce a negative number, percent change is shown as a positive number with a positive result indicating a percent *increase* and a negative result indicating a percent *decrease*. Formulas typically include absolute value bars to ensure positive values.

Percent change is found by comparing the change in some quantity to the original amount. To find the change, subtract the original value from the new value. Divide the change in values by the absolute value of the original value which will produce a decimal. Rewrite the decimal as a percentage, recalling that a percent is the number of parts per hundred.

$$\frac{\text{change in values}}{\text{original value}} = \frac{(\text{new value} - \text{original value})}{\text{original value}}$$

Note: Formulas for percent change typically include multiplying by 100 to convert the decimal to a percentage. To simplify the process, that conversion is listed as a separate step and absolute value bars have not been included in the following examples with positive original values.

Example #15: What is the percent change from 100 to 120?

Original New

Find the change in values: New value – Original value

$120 - 100 = 20$

Compare the change in values to the original value: $\frac{20}{100} = 0.20$

Convert decimal to percent by moving the decimal point two place values to the right. $0.20 = .20.\% = 20\%$

The percent change from 100 to 120 is a 20% increase.

Example #16: What is the percent change from 40 to 10?

Original New

Find the change in values: New value – Original value

$10 - 40 = -30$

(A negative value indicates a decrease.)

Compare the change in values to the original value: $\frac{-30}{40} = -0.75$

Convert decimal to percent by moving the decimal point two place values to the right. $-0.75 = -.75.\% = -75\%$

The percent change from 40 to 10 is a 75% decrease.

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It is often possible to use the knowledge of percent change to determine the answer using "mental math" as shown in the following example.

Example #17: What is the percent change from 30 to 60?

Original New

Note that the original amount doubled which indicates an increase of 100%.

To confirm this "mental math" calculation, use the formula previously given:

Find the change in values: New value – Original value

$60 - 30 = 30$

Compare the change in values to the original value: $\frac{30}{30} = 1 \text{ or } 1.00 = 100\%$

(Recall that a percent is the number of parts per hundred.)

The percent change from 30 to 60 is a 100% increase.

What if the amount tripled or quadrupled? Is it necessary to use the formula? What if the original amount remained the same over time? Obviously, 0% change! It is also possible to use "mental math" skills to determine the percent decrease as shown in the example below.

Example #18: What is the percent change from 120 to 60?

Original New

Note that the original amount decreased by half its value which indicates a percent decrease of 50%.

To confirm this "mental math" calculation, use the formula previously given:

Find the change in values: New value – Original value

$60 - 120 = -60$

(A negative value indicates a decrease.)

Compare the change in values to the original value: $\frac{-60}{120} = -0.5 = -50\%$

The percent change from 120 to 60 is a 50% decrease.

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Of course, the numbers are typically not as "nice" and often a calculator must be used. However the process is the same as shown in the following three applications.

Example #19: In 2020, the school population was 2730 students. This year, the school population is 6006 students. What is the percent change in the population?

Find the change in values: New value – Original value

$$6006 - 2730 = 3276$$

Compare the change in values to the original value: $\frac{3276}{2730} = 1.20 = 120\%$

(Recall that a percent is the number of parts per hundred.)

The percent change in population is 120% increase.

Example #20: Last year 90 students scored an A+ on the Chemistry final exam. This year, only 30 students scored an A+ on that same exam after technology restrictions were implemented. What is the percent change in the score?

Find the change in values: New value – Original value

$$30 - 90 = -60$$

Compare the change in values to the original value: $\frac{-60}{90} = -0.666\ldots \approx -66.7\%$

(Recall that a percent is the number of parts per hundred.)

The percent change is approximately 66.7% decrease.

Example #21: The temperature today in the city is 20° C. With the arrival of a cold front, the temperature is predicted to drop to –10° C. What is the percent change in temperature?

Find the change in values: New value – Original value

$$-10 - 20 = -30$$

Compare the change in values to the original value: $\frac{-30}{20} = -1.50 = -150\%$

(Recall that a percent is the number of parts per hundred.)

The percent change in temperature is 150% decrease.

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The following example involves a negative original value to illustrate the need for absolute value bars in the denominator when this occurs.

Example #22: If today's temperature was –25° C and tomorrow's temperature is predicted to be 15° C, what is the predicted percent change in temperature?

Find the change in values: New value – Original value

$$15 \quad - \quad (-25) \quad = \quad 40$$

Compare the change in values to the original value: $\dfrac{40}{|(-25)|} = \dfrac{40}{25} = 1.60 = 160\%$

(Recall that a percent is the number of parts per hundred.)

The percent change in temperature is 160% increase.

Because the temperature increased from – 25 to 15, this is definitely a percent increase. If the absolute value bars had not been included, the answer would have been negative, incorrectly indicating a percent decrease.

It may be necessary to find the new value or the original value given the percent change. To simplify the process, rewrite the percent change as a decimal and then set up an equation to solve for the appropriate value.

Again, if the original value is negative, it would be necessary to place the denominator in absolute value bars. Because the following examples involve positive original values, absolute value bars have not been included to simplify the process.

Example #23: If there is an expected 25% increase in the price of gasoline which currently costs $4.15 per gallon, what will the new price be?

Use the equation: $\dfrac{(\text{new value} - \text{original value})}{\text{original value}} = \text{percent change}$ (rewritten as a decimal)

Substitute values: $\dfrac{x - 4.15}{4.15} = 0.25$ (Represent 25% increase as a decimal.)

Multiply both sides by 4.15: $x - 4.15 = 1.0375$

Add 4.15 to both sides: $x = 5.1875 \approx \$5.19$ per gallon

The new price of gasoline will be approximately $5.19 per gallon.

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Example #24: Sam's new hourly wage of \$18 per hour represents a 20% wage increase. What was his original rate?

Use the equation: $\dfrac{(\text{new value} - \text{original value})}{\text{original value}} = \text{percent change}$ (rewritten as a decimal)

Substitute values: $\dfrac{\$18 - x}{x} = 0.20$ (Represent 20% increase as a decimal.)

Multiply both sides by x: $18 - x = 0.20x$

Add x to both sides: $18 = 0.20x + x$

Combine like terms: $18 = 1.2x$

Divide both sides by 1.2: $15 = x$

Sam's original rate was \$15 per hour.

Example #25: The sale price of \$60 per bushel represents a 25% decrease in the price of apples. What was the original price?

Use the equation: $\dfrac{(\text{new value} - \text{original value})}{\text{original value}} = \text{percent change}$ (rewritten as a decimal)

Substitute values: $\dfrac{\$60 - x}{x} = -0.25$ (Represent 25% decrease as a decimal.)

Multiply both sides by x: $60 - x = -0.25x$

Add x to both sides: $60 = -0.25x + x$

Combine like terms: $60 = 0.75x$

Divide both sides by 0.75: $80 = x$

\$80.00 was the original price of a bushel of apples.

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