

A.P.E.S. Summer Review of Basic Mathematical Skills

Percentage

$$17\% = 17/100 = .17$$

- Remember that “percent” literally means divided by 100.
- Percentage is a measure of the part of the whole, or part divided by whole.
- Ex. 15 million is what percentage of the US population? $15 \text{ million} / 300 \text{ million} = .05 = 5\%$
- What is 20% of this \$15 bill so that I can give a good tip? $\$15 \times .20 = \$15 \times 20/100 = \$3$

Rates

$$\begin{array}{ccc} \text{Rise} & \frac{Y_2 - Y_1}{X_2 - X_1} & \text{slope} \\ \text{Run} & & \end{array} \quad \text{slope} \quad \frac{\text{change}}{\text{time}} \quad y = mx + b \quad \frac{dX}{dt}$$

- All of the above are ways to look at rates. The second equation is the easiest way to calculate a rate, especially from looking at a graph. Rates will often be written using the word ‘per’ followed by a unit of time, such as cases per year, grams per minute or miles per hour. The word ‘per’ means to divide, so miles per gallon is actually the number of miles driven divided by one gallon.
- Rates are calculating how much an amount changes in a given amount of time.

Scientific Notation

$$\begin{aligned} \text{Thousand} &= 10^3 = 1,000 \\ \text{Million} &= 10^6 = 1,000,000 \text{ (people in the US)} \\ \text{Billion} &= 10^9 = 1,000,000,000 \text{ (people on Earth)} \\ \text{Trillion} &= 10^{12} = 1,000,000,000,000 \text{ (National debt)} \end{aligned}$$

- When using very large numbers, scientific notation is often easiest to manipulate. For example, the US population is 300 million people or 300×10^6 or 3×10^8
- When adding or subtracting, exponents must be the same. Add the numbers in front of the ten and keep the exponent the same.
- When multiplying or dividing, multiply or divide the number in front of the ten and add the exponents if multiplying or subtract the exponents if dividing
- Online tutorial: <http://www.chem.tamu.edu/class/fyp/mathrev/mr-scnot.html>

$$\text{Ex.} \quad 9 \times 10^6 / 3 \times 10^2 = (9/3) \times 10^{(6-2)} = 3 \times 10^4$$

Dimensional Analysis

You should be able to convert any unit into any other unit accurately if given the conversion factor. Online tutorials are available:

http://www.chemprofessor.com/dimension_text.htm
<http://www.chem.tamu.edu/class/fyp/mathrev/mr-da.html>

Prefixes

$$\begin{aligned} \text{m (milli)} &= 1/1000 = 10^{-3} \\ \text{c (cent)} &= 1/100 = 10^{-2} \\ \text{k (kilo)} &= 1000 = 10^3 \\ \text{M (mega)} &= 1,000,000 = 10^6 \\ \text{G (giga)} &= 1,000,000,000 = 10^9 \\ \text{T (tera)} &= 1,000,000,000,000 = 10^{12} \end{aligned}$$

Quick tutorial here: <https://youtu.be/pEDVddQvimI>

Long Division and Multiplication

You should be able to do these calculations by hand, including values with decimals and scientific notation. Many students struggle in this area because calculators are not allowed on the AP exam. Online tutorials are available:

<http://www.mathsisfun.com/dividing-decimals.html>
<http://www.tutors4you.com/tutorialondecimals.htm>

Math Problems

NAME _____

Answer the questions. Use a separate sheet of paper to show all work.

- 1) What is ten thousand times one hundred million? Show your work in scientific notation. Give the answer in scientific notation and in words.

- 2) A population of deer had 325 individuals. If the population grows by 16% in one year, how many deer will there be the next year?

- 3) One year I had 124 AP Environmental Science students and the next year I had 87 Environmental Science students. What percentage did the population of APES students decrease by (round to the nearest tenth)?

- 4) Electricity costs 7 cents per kilowatt hour. In one month one home uses 1.8 megawatt hours of electricity. How much will the electric bill be? (be sure to look at the prefixes chart on the previous page for the conversion of kilo to mega)

- 5) Your car gets 21 miles to the gallon and your friend's car gets 28 miles to the gallon. You decide to go on a road trip to the University of Virginia, which is 175 miles away. If gas costs \$4 per gallon and you decide to split the gas money, how much money will each of you save in gas by driving your friend's car?

- 6) Virginia Beach is about 20 miles wide and 28 miles long. If one inch of rain falls on Virginia Beach, how many cubic feet of rain fell on Virginia Beach? (Hint: convert all units to feet first).

- 7) The concentration of mercury in a water supply changes from 10ppm (parts per million) to 56ppm over a ten-year period. What is the percentage change of the mercury concentration?

- 8) Consider a wind turbine that is rated at 1.5 MW (megawatts) per hour. This means that with sufficiently high winds, it will produce 1.5 MW or 1,500 kW (kilowatts) of power. If this wind turbine runs at its rated power of 100% of the time for a full year, how much energy would it produce in a year? Give your answer in kWh/year (kilowatt hours per year). (3pts)

- 9) Show your work for the following multiplication and division problems. You can use a calculator to check your work, but I want to see that you understand how to solve these problems by hand.
Just like on the AP exam, no credit is given if you don't show your work.
 - a. 75.3×16.9
 - b. $1964 \times .0718$
 - c. $5.80 \times 10^{-3} \times 2.17$
 - d. $2362 / 71.9$
 - e. $0.08 / .0094$
 - f. $4.60 \times 10^4 / .0530$