APES Summer Review

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Name:_____

Math Review

Averages

To find an average, add all the quantities given and divide by the total number of quantities. Example: Find the average of 10, 20, 35, 45, and 105 Add: 10 + 20 + 35 + 45 + 105 and divide by 5 = 43

Practice:

Remember to show all of your work in the answer box below each problem. Please **highlight** your answer.

Find the average of 11, 12, 14, 15, 23, 29

Find the average of 124, 456, 788, 343

Find the average of 4.56, 0.0078, 23.45

Find the average of 4.3, 87.93, 3.4, 2.48

Percentages

Percents show fractions or decimals with a denominator of 100. Always move the decimal TWO places to the right to go from a decimal to a percentage or TWO places to the left to go from a percent to a decimal.

Example: 0.85 = 85%; 72% = 0.72

Part 1: Finding the Percent of a Given Number
To find the percent of a given number, change the percent to a decimal and MULTIPLY.

Example: 30% of 400

30% = 0.30 x 400 = 120

Part 2: Finding the Percent of a Number

To find what percentage one number is of another, DIVIDE the first number by the second, then convert the decimal answer to a percentage.

Example: What percentage is 12 of 25? 12/25 = .48
.48 = 48% (12 is 48% of 25)

Part 3: Finding Percentage Increase or Decrease
To find a percentage increase or decrease, first find the percent change, then add or subtract the change to the original number.

Example: Product X has dropped in price 18% from $139. What is the new price? $139 X 0.18 = $25
$139 - $25 = $114

Part 4: Finding a Total Value
To find a total value, given a percentage of the value, DIVIDE the given number by the given percentage.

Example: If taxes on a new car are 8% and the taxes add up to $1600, how much is the new car?
8% = 0.08
$1600 / 0.08 = $20,000

Practice:
Remember to show all of your work in the answer box below each problem. Please **highlight** your answer.

What is 45% of 900?

What percentage is 25 of 162.5?

Thirteen percent of a 12,000 acre forest is being logged. How many acres will be logged?

A water heater tank holds 280 gallons. Two percent of the water is lost as steam. How many gallons will remain to be used?

In a small oak tree, the biomass of insects makes up 3000 kilograms. This is 4% of the total biomass of the tree. What is the total biomass of the tree?

14,000 acres of a 40,000 acre forest burned in a forest fire. What percentage of the forest was damaged?

You have driven the first 150 miles of a 2000 mile trip. What percentage of the trip have you traveled?

Home prices have dropped 5% in the past three years. An average home in your area three years ago was $130,000. What's the average home price now?

35 is what percentage of 2800?

235 acres, or 15% of a forest is being logged. How large is the forest

The Greenland Ice Sheet contains 2,850,000 cubic kilometers of ice. It is melting at a rate of 0.006% per year. How many cubic kilometers are lost each year?

A teenager consumes 20% of her calories each day in the form of protein. If she is getting 700 calories a day from protein, how many calories is she consuming per day?

Metric Units

Kilo-, centi-, and milli- are the most frequently used prefixes of the metric system. You need to be able to go from one to another without a calculator. You can remember the order of prefixes by using the following sentence: *King Henry Died By Drinking Chocolate Milk*. Since the multiples and divisions of the base units are all factors of ten, you just need to move the decimal to convert from one to another.

Kilo- Hecto- Deka- **BASIC** Deci- Centi- Mlli-

1000 units 100 units 10 units **UNIT** 0.1 units 0.01 units 0.001 units

Example: 55 centimeters = ? kilometers
First - figure out how many places to move decimal (count the one you are going to, but not the one you are on). You will move the decimal 6 places. So, 55 centimeters = 0.00055 kilometers.

Practice:
Remember to show all of your work in the answer box below each problem. Please **highlight** your answer.

1200 kilograms = ? milligrams

670 hectometers = ? centimeters

0.078 kilometers = ? meters

14000 millimeters = ? meters

6544 liters = ? millileters

17 grams = ? kilograms

Scientific Notation

Scientific notation is a shorthand way to express large or tiny numbers. We will consider anything over 1000 to be a large number. Writing these numbers in scientific notation will help you to do your calculations much quicker and easier and will help prevent mistakes in conversions from one unit to another. Like the metric system, scientific notation is based on factors of 10. A large number written in scientific notation looks like this:

$1.23 \text{ X } 10^3$

The number before the “X” is called the coefficient. The coefficient must be greater than 1 and less than 10. The number after the “X” is the base number and is always 10. The number in superscript is the exponent.

Part 1: Writing Numbers in Scientific Notation
To write a large number in scientific notation, put a decimal after the first digit. Count the number of digits after the decimal you just wrote in. This will be the exponent. Drop any zeros so that the coefficient contains as few digits as possible.

Example: 573,000,000,000 becomes 5.73×10^{11}

Writing tiny numbers in scientific notation is similar. The only difference is the decimal is moved to the left and the exponent is negative. A tiny number written in scientific notation looks like this:

4.26×10^{-9}

To write a tiny number in scientific notation, move the decimal after the first digit that is not a zero. Count the number of digits before the decimal you just wrote in. This will be the exponent as a negative. Drop any zeros before or after the decimal.

Example: 0.00000000376 becomes 3.76×10^{-9}

Part 2: Adding and Subtracting Numbers in Scientific Notation

To add or subtract two numbers with exponents, the exponents must be the same. You can do this by moving the decimal one way or another to get the exponents the same. Once the exponents are the same, add (if it's an addition problem) or subtract (if it's a subtraction problem) the coefficients just as you would any regular math problem. The exponent will stay the same. Make sure your answer has only one digit before the decimal - you may need to change the exponent of the answer once you are finished.

Example: $1.35 \times 10^{6} + 3.72 \times 10^{5} = ?$

Step 1: Make sure both exponents are the same. It's usually easier to go with the larger exponent so you don't have to change the exponent in your answer, so let's make both exponents 6 for this example.

$3.72 \times 10^{5} \rightarrow .372 \times 10^{6}$

Step 2: Add the coefficients just as you would regular decimals. So 1.35 + .372 = 1.722

Step 3: Write your answer including the exponent, which is the same as what you started. So your answer would be 1.722×10^6.

Part 3: Multiplying and Dividing Numbers in Scientific Notation

To multiply exponents, multiply the coefficients just as you would regular decimals. Then add the exponents to each other. The exponents DO NOT have to be the same.

Example: $1.35 \times 10^6 \times 3.72 \times 10^5 = ?$

Step 1: Multiply the coefficients. So $1.35 \times 3.72 = 5.022$

Step 2:Add the exponents. So5+6=11

Step 3: Write your final answer → $5.022 \times 10_{11}$

To divide exponents, divide the coefficients just as you would regular decimals, then subtract the exponents. In some cases, you may end up with a negative exponent. Example: $5.635 \times 10^3 / 2.45 \times 10^6 = ?$

Step 1: Divide the coefficients. So 5.635 / 3.45 = 2.3

Step 2: Subtract the exponents. So 3-6 = -3

Step 3: Write your final answer → 2.3×10^{-3}

Practice:

Remember to show all of your work in the answer box below each problem. Please **highlight** your answer.

Write 145,000,000,000 in scientific notation Write 13 million in scientific notation

Write 435 billion in scientific notation

Write 135 trillion in scientific notation

$3X10^{3} + 4X10^{3}$

$7.89X10^{-6} + 2.35X10^{3}$

$2.9 \times 10^{11} - 3.7 \times 10^{13}$

Three hundred thousand plus forty-seven thousand

$1.32X10^{8} \times 2.34X10^{4}$

Three million times eighteen thousand

Write 0.000348 in scientific notation

Write 24 thousand in scientific notation

$4.67X10^{4} + 323X10^{3}$

$9.85X10^{4} - 6.35X10^{4}$

$1.278 \times 10^{13} - 1.021 \times 10^{-10}$

13 million minus 11 thousand

$3.78X10^3$ X $2.9X10^2$

One thousandth of seven thousand

Eight ten-thousandths of thirty-five million $3.45 X 10^9 / 2.6 X 10^3$

$1.98 X 10^{-4} / 1.72 X 10^{-6}$ Twelve thousand divided by four thousand

Dimensional Analysis

Dimensional analysis is a way to convert a quantity given in one unit to an equal quantity of another unit by lining up all the known values and multiplying. It is sometimes called factor-labeling. The best way to start a factor-labeling problem is by using what you already know. In some cases you may use more steps than a classmate to find the same answer, but it doesn't matter. Use what you know, even if the problem goes all the way across the page!

In a dimensional analysis problem, start with your given value and unit and then work toward your desired unit by writing equal values side by side. Remember you want to cancel each of the intermediate units. To cancel a unit on the top part of the problem, you have to get the unit on the bottom. Likewise, to cancel a unit that appears on the bottom part of the problem, you have to write it on the top.

Once you have the problem written out, multiply across the top and bottom and then divide the top by the bottom.

Example: 3 years = ? seconds

Step 1: Start with the value and unit you are given. There may or may not be a number on the bottom. I find it useful to put a "1" on the bottom if there isn't another number there to use as a placeholder.

3 years
1

Step 2: Start writing in all the values you know, make sure you can cancel top and bottom. Since you have years on top right now, you need to put years on the bottom in the next segment. Keep going, canceling units as you go, until you end up with the unit you want (in this case seconds) on the top.

3 years

365 days 24 hours 60 minutes 60 seconds : 1 year 1 day 1 hour 1 minute

Step 3: Multiply all the values across the top. Write in scientific notation if it's a large number. Write units on your answer.

$3X365X24X60X60=9.46X10^7$ seconds

Step 4: Multiply all the values across the bottom. Write in scientific notation if it's a large number. Write units on your answer if there are any. In this case everything was cancelled so there are no units.

1X1X1X1=1

Step 5: Divide the top number by the bottom number. Remember to include units. 9.46 X 10^7seconds / 1 = 9.46 X 10^7seconds

Step 6: Review your answer to see if it makes sense. 9.46 X 10^7 is a really big number. Does it makes sense for there to a lot of seconds in a year? Yes! If you had gotten a tiny number, then you would need to go back and check for mistakes.

In lots of APES problems, you will need to convert both the top and bottom unit. Don't panic! Just convert the top one first and then the bottom.

Example: 50 miles per hour = ? feet per second

Step 1: Start with the value and units you are given. In this case there is a unit on top and on bottom.

50 miles
1 hour

Step 2: Convert miles to feet first.
50 miles 5280 feet
1 hour 1 mile

Step 3: Continue the problem by converting hours to seconds.

50 miles 5280 feet 1 hour 1 minute
1 hour 1 mile 60 minutes 60 seconds

Step 4: Multiply across the top and bottom. Divide the top by the bottom. Be sure to include units on each step. Use scientific notation for large numbers.

50 X 5280 feet X 1 X 1 = 264000 feet
1 X 1 X 60 X 60 seconds = 3600 seconds 264000 feet / 3600 seconds = 73.33 feet/second

Practice:
Remember to show all of your work in the answer box below each problem. Include units and use scientific notation when appropriate. Please **highlight** your answer.

Conversions that you may not be familiar with:
1 square mile (mi_2) = 640 acres
1 hectare (Ha) = 2.47 acres
1 kilowatt-hour (kWh) = 3,413 BTUs
1 barrel of oil = 160 liters
1 metric ton = 1000 kg 1 ton = 2000 lb
1 lb = 16 oz
1 Km = 0.62 mi

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134 miles = ? inches

8.9×10^5 tons = ? ounces

1.35 kilometers per second = ? miles per hour

A city that uses ten billion BTUs of energy each month is using how many kilowatt-hours of energy?

A 340 million square mile forest is how many hectares?

If one barrel of crude oil provides six million BTUs of energy, how many BTUs of energy will one liter of crude oil provide?

Fifty eight thousand kilograms of solid waste is equivalent to how many metric tons?

Vocab

Define the following vocabulary words and provide an example of each.

Commensalism:

_____
_____
_____
_____

Parasitism:

_____
_____
_____
_____

Mutualism:

_____
_____
_____
_____

Predator-prey relationship:

_____
_____
_____
_____

Decomposer:

_____
_____
_____
_____

Omnivore:

_____
_____
_____
_____

Carnivore:

Herbivore:

Population:

Ecosystem:

Community:

Biome:

Pollution: