Please put away all papers and electronic devices except for a calculator. Show enough work that it is clear how you arrived at your answer. Answers can be given as fractions or as decimals rounded to 4 decimal places, unless otherwise instructed. Box/circle your final answers. Good luck!

1. A 2019 Ford Fiesta has an average fuel economy of 31 miles per gallon (mi/g). The average price of gasoline in New York State is $2.75 per gallon (USD/g). Using these rates, answer the following questions.

   (a) (8 points) How far can you drive on $1 worth of gasoline?

$$1 \text{ usd} \cdot \frac{1 \text{ g}}{2.75 \text{ USD}} \cdot \frac{31 \text{ mi}}{1 \text{ g}} = \boxed{11.2727 \text{ mi}}$$

   (b) (8 points) How much does the gasoline cost to drive 1 mile?

$$1 \text{ mi} \cdot \frac{1 \text{ g}}{31 \text{ mi}} \cdot \frac{2.75 \text{ USD}}{1 \text{ g}} = \boxed{.0887 \text{ USD}}$$

2. (8 points) A box-shaped cargo conatiner measures 8 ft wide, 8.5 ft tall, and 40 ft long. Find the volume of the cargo container in cubic-yards, i.e. yd$^3$. (Note: 1 yd = 3 ft.)

$$(1 \text{ yd})^3 = (3 \text{ ft})^3$$

Volume = LENGTH × WIDTH × HEIGHT

$$= (40 \text{ ft})(8 \text{ ft})(8.5 \text{ ft}) \cdot \left( \frac{1 \text{ yd}^3}{27 \text{ ft}^3} \right)$$

$$= 2720 \text{ ft}^3 \cdot \frac{1 \text{ yd}^3}{27 \text{ ft}^3}$$

$$= \boxed{100.7407 \text{ yd}^3}$$

3. (8 points) A 200 watt lightbulb is turned on for 1 week. How many kilowatt-hours (kw-hr) of energy does this use? (Note: 1 kw = 1000 watts)

$$200 \; w \cdot \frac{1 \; kw}{1000 \; w} = .2 \; kw$$

$$1 \; week \cdot \frac{7 \; DAYS}{1 \; WEEK} \cdot \frac{24 \; HRS}{1 \; DAY} = 168 \; HRS$$

$$(.2 \; kw)(168 \; HRS) = \boxed{33.6 \quad KW-HRS}$$

4. Your favorite bakery has recently increased the price of one bagel from $0.75 to $0.95.

   (a) (8 points) Find the absolute change in the price of one bagel.

   ABSOLUTE CHANGE = NEW VALUE - ORIGINAL VALUE

   $$= \$0.95 - \$0.75$$

   $$= \boxed{\$0.20}$$

   (b) (8 points) Find the relative change (i.e. percent change) in the price of one bagel.

   $$RELATIVE \; CHANGE = \frac{NEW \; VALUE - ORIGINAL \; VALUE}{ORIGINAL \; VALUE} \times 100\%$$

   $$= \frac{\$0.20}{\$0.75} \times 100\%$$

   $$= \boxed{26.6667\%}$$

5. The average rent for an apartment is Queens is \$2,586. The average rent for an apartment in Brooklyn is \$2,940.

(a) (8 points) Use relative difference (i.e. percent difference) to compare rent in Queens to rent in Brooklyn.

$$\text{RELATIVE DIFFERENCE} = \frac{\text{COMPARED VALUE} - \text{REFERENCE VALUE}}{\text{REFERENCE VALUE}} \times 100\%$$

$$= \frac{\$2586 - \$2940}{\$2940} \times 100\% = \boxed{-12.0408\%}$$

THE RENT IN QUEENS IS 12.0408% CHEAPER THAN BROOKLYN.

(b) (8 points) Use relative difference (i.e. percent difference) to compare rent in Brooklyn to rent in Queens.

$$\frac{\$2940 - \$2586}{\$2586} \times 100\% = \boxed{13.6891\%}$$

THE RENT IN BROOKLYN IS 13.6891% MORE EXPENSIVE THAN QUEENS.

6. Suppose the price of a particular stock increased by 20% in the first year, increased by 45% in the second year, and then decreased by 55% in the third year.

(a) (8 points) Over all three years, what was the relative change (i.e. percent change) experienced by this stock price? (Note: It does not matter what price the stock started at, only that was not zero.)

$$\overset{\text{1ST YEAR}}{(1+.20)} \overset{\text{2nd YEAR}}{(1+.45)} \overset{\text{3rd YEAR}}{(1-.55)}$$

$$(1.2)(1.45)(.45) = .783 = 1 - .217$$

$$\boxed{-21.7\%}$$

(b) (4 points) Would your answer to part (a) change if the price decreased by 55% in the first year, increased by 20% in the second year, and increased by 45% in the third year? (Note: these are the same relative changes, only applied in a different order.)

NO, THIS ONLY CHANGES THE ORDER OF MULTIPLICATION AND THIS DOES NOT CHANGE THE RESULT.

7. Write the following numbers using scientific notation.

   (a) (6 points) 58,656.02

   $$5.865602 \times 10^{4}$$

   (b) (6 points) 0.000000048341

   $$4.8341 \times 10^{-8}$$

8. Let $A$ and $B$ be the two numbers given below using scientific notation.

   $$A = 6.4 \times 10^{-58}$$
   $$B = 3.8 \times 10^{77}$$

   Express your answers to the following question using scientific notation.

   (a) (6 points) Find $A \times B$.

   $$6.4 \times 10^{-58} \times 3.8 \times 10^{77}$$

   $$6.4 \times 3.8 \times 10^{-58} \times 10^{77}$$

   $$24.32 \times 10^{19}$$

   $$2.432 \times 10^{1} \times 10^{19} = \boxed{2.432 \times 10^{20}}$$

   (b) (6 points) Find $A \div B$.

   $$\frac{6.4 \times 10^{-58}}{3.8 \times 10^{77}} = \frac{6.4}{3.8} \times \frac{10^{-58}}{10^{77}}$$

   $$= \boxed{1.6842 \times 10^{-135}}$$