Show enough work that it is clear how you arrived at your answer. Correct answers with no work shown will not receive full credit. Box/circle your final answers. Good luck!

5 pts 1. Draw a carefully labeled Venn diagram representing the premises below and tate whether the argument is valid or invalid.

Premise: All pro athletes go to training camp.
Premise: Bruce Wayne doesn't go to training camp.
Conclusion: Bruce Wayne is not a pro athlete.

VALID

5 pts 2. A Boeing 747's fuel efficiency is approximately 0.2 miles per gallon. A Prius plug-in hybrid's fuel efficiency is approximately 50 miles per gallon. The distance from New York City to Miami is 1,091 miles. If the Boeing 747 carries 568 people and the Prius carries 2 people from New York City to Miami, calculate the gallons of fuel burned per person for each vehicle.

BOEING 747: $\dfrac{1 \text{ g}}{.2 \text{ mi}} \cdot 1{,}091 \text{ mi} = 5455 \text{ g}$

$\dfrac{5455 \text{ g}}{568 \text{ PEOPLE}} \approx \boxed{9.6039 \text{ g/PERSON}}$

PRIUS: $\dfrac{1 \text{ g}}{50 \text{ mi}} \cdot 1091 \text{ mi} = 21.82 \text{ g}$

$\dfrac{21.82 \text{ g}}{2 \text{ PEOPLE}} = \boxed{10.91 \text{ g/PERSON}}$

5 PNTS 3. If the bus fare in a certain city rose from 1.75 to 2.00, what percent increase would that be?

$$\text{PERCENT CHANGE} = \frac{\text{NEW} - \text{OLD}}{\text{OLD}} = \frac{2.00 - 1.75}{1.75} = \frac{.25}{1.75} = \frac{1}{7}$$

$$\approx .1429 \longrightarrow \boxed{14.29\%}$$

4 PNTS 4. Suppose you purchase a bag of coffee beans with a retail price of $11.99. The local sales tax rate is 8.875%. What is the final cost? Round to the nearest cent.

$$\text{PRICE INCREASES BY } 8.875\% \longrightarrow \text{MULTIPLY BY } 1.08875$$

$$11.99 \times 1.08875 = 13.0541 \approx \boxed{\$13.05}$$

5 PNTS 5. If the value of a pension fund rose 20% one year, and fell 8% the next, what was the net percentage increase over the 2-year period?

INCREASE BY 20%   DECREASE BY 8%

MULTIPLY BY 1.20   MULTIPLY BY .92

MULTIPLY BY BOTH   MULTIPLY BY

$$(1.20)(.92) = 1.104$$

$$\downarrow$$

INCREASE BY $\boxed{10.4\%}$

6. A waiter earns $400 per month (pre-tax) from an hourly wage and the rest of his pay is from tips. On average, he gets 20% of what a customer is charged in tips.

5 PNTS (a) Find a function that gives his total pay in a month as it varies with the total amount his customers are charged in that month.

LET x = TOTAL AMOUNT CUSTOMERS CHARGED

y = TOTAL PAY

$$y = 400 + .2 \, x$$

3 PNTS (b) If his customers are charged a total of $5,500 in a month, what is his total (pre-tax) pay for that month?

LET $x = 5500$

$$y = 400 + .2 \, (5500)$$
$$= 400 + 1100 = \boxed{\$1500}$$

3 PNTS (c) If he wants to make $1,700 per month (pre-tax), how much does he need his customers to be charged per month?
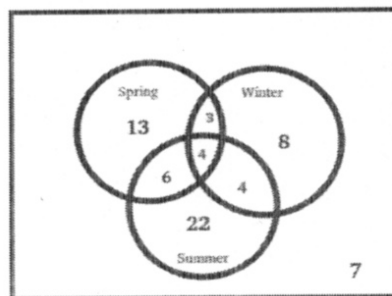
LET $y = 1,700$

$$1,700 = 400 + .2 \, x$$
$$1300 = .2 \, x$$
$$\frac{1300}{.2} = x$$

$$x = \boxed{\$6,500}$$

7. In a recent survey people were asked if the took a vacation in the summer, winter, or spring in the past year. The results are summarized in the following Venn diagram.

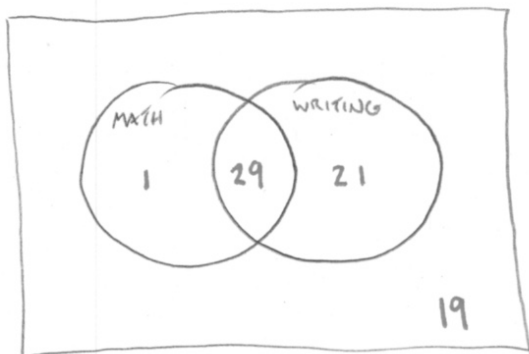**2 PNTS** (a) How many people took a vacation in only in the Summer? **22**

2 PNTS (b) How many people took more than one vacation? $3 + 4 + 6 + 4 = \boxed{17}$

2 PNTS (c) How many people did not take a vacation during the Winter? $13 + 6 + 22 + 7 = \boxed{48}$

5 Pts 8. Draw a carefully labelled Venn diagram to represent the following data and answer to the following scenario.

In a survey of 70 first-year students, 30 were enrolled in a math course and 50 were enrolled in a writing course. Of those enrolled in the writing course, 21 weren't enrolled in a math course.

How many students in the survey were enrolled in neither a math course nor a writing course?

$$50 - 1 - 29 - 21 = 19$$

5 Pts 9. The Consumer Price Index for the year 1970 was 38.8 and for the year 2012 was 229.6. If someone needed a \$30,000 annual salary to maintain a certain standard of living in 1970, how much would be needed to maintain the same standard of living in 2012?

$$30,000 \ \frac{\$}{1970} \cdot \frac{229.6 \ \$_{2012}}{38.8 \ \$_{1970}} = \boxed{177,525.77 \ \$_{2012}}$$

4 Pts 10. In October 2013, the national debt reached 17,075 billion dollars. Rewrite that amount in scientific notation.

$$1.7075 \times 10^4 \ \text{BILLION} = 1.7075 \times 10^4 \times 10^9$$

$$= \boxed{1.7075 \times 10^{13}}$$

4 PNTS 11. A person earns 6 times as much now as in the person's previous job. By what percent have their earnings increased?

$$\boxed{500\% \text{ INCREASE}}$$ e.g. $\dfrac{6-1}{1} \times 100\%$

4 PNTS 12. Identify at least one potential source of bias in the following study and explain your answer clearly.

To determine what percentage of New Englanders are Republicans, a political science researcher polls students at the University of Vermont.

UNIVERSITY OF VERMONT STUDENTS ARE NOT REPRESENTATIVE

OF THE POPULATION OF NEW ENGLANDERS.

SELECTION BIAS.

5 PNTS 13. The pass rate in one math course went from 60% last year to 70% this year. What was the relative change in pass rates?

$$\dfrac{70-60}{60} \times 100\% \approx \boxed{16.67\%}$$

5 PNTS 14. Peru's population is about 30.4 million in 2019 and its yearly growth rate was approximately 1.25%. If the growth rate stays constant, what will Peru's population be in 2100?

$y = 30.4 \cdot 1.0125^{x}$ $x = \#$ YEARS FROM 2019

2100 $\rightarrow$ $x = 81$

$y = 30.4 \cdot 1.0125^{81} \approx \boxed{83.1517 \text{ MILLION}}$

83,151,700

8.31517×10^{7}

5 pts   15. Rubidium-82 has a half-life of 75 seconds. How much of a 5000 gram sample remains after 10 minutes?

$$10 \text{ min} \cdot \frac{60 \text{ sec}}{1 \text{ min}} = 600 \text{ sec}$$

$$y = A\left(\frac{1}{2}\right)^{x/T_{1/2}} \rightsquigarrow y = 5000\left(\frac{1}{2}\right)^{600/75} = \boxed{19.53125 \text{ g}}$$

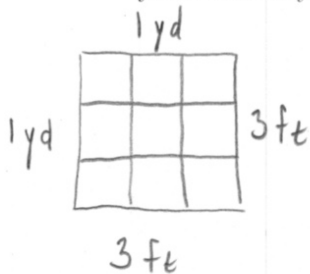16. Suppose gas costs \$3.40 per gallon, and your car averages 30 miles per gallon.

3 pts   (a) How far can you go on \$150 worth of gas?

$$\$150 \cdot \frac{1 \text{ g}}{\$3.40} \cdot \frac{30 \text{ mi}}{1 \text{ g}} = \boxed{1{,}323.5294 \text{ mi}}$$

3 pts   (b) How much would it cost you to drive 3,000 miles to California?

$$3000 \text{ mi} \cdot \frac{1 \text{ g}}{30 \text{ mi}} \cdot \frac{\$3.40}{1 \text{ g}} = \boxed{\$340}$$

5 pts   17. How much would it cost to carpet an 6 foot by 11 foot room with carpeting that costs \$25 per square yard? Round your answer to the nearest dollar.

1 yd

1 yd   3 ft

3 ft

$$1 \text{ yd}^2 = 9 \text{ ft}^2$$

$$\text{Area} = 6 \text{ ft} \times 11 \text{ ft} = 66 \text{ ft}^2$$
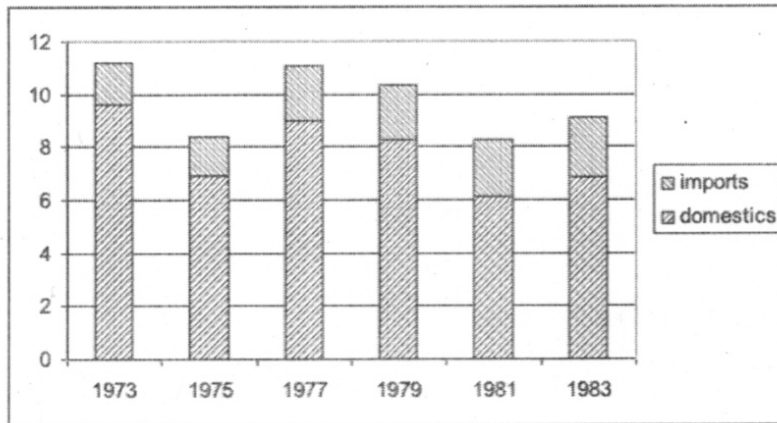
$$66 \text{ ft}^2 \cdot \frac{1 \text{ yd}^2}{9 \text{ ft}^2} \cdot \frac{\$25}{1 \text{ yd}^2} = \boxed{\$183.33}$$

5 PNTS 18. An amoeba cell is about 2.5×10^{-4} meters in length. If you were to line up 7 billion amoeba end-to-end, what is the total length? You must convert all numbers to scientific notation, calculate the length and leave the final answer in scientific notation, correct to two decimal places.

$$(2.5 \times 10^{-4}) \times (7 \times 10^{9}) = (2.5 \times 7) \times (10^{-4} \times 10^{9})$$

$$= 17.5 \times 10^{5} = (1.75 \times 10) \times 10^{5}$$

$$= \boxed{1.75 \times 10^{6} \text{ m}}$$

19. Consider the chart below depicting automobile sales (in millions) in the US for several years. Show the figures and calculations you're using to answer each question.

2 PNTS (a) In 1977, domestic sales represented what percent of total sales?

$$\approx 80\%$$

2 PNTS (b) Comparing 1973 and 1983, in which year did imports represent a greater percent of total sales?

1983

2 PNTS (c) In which two-year period did total sales decrease the most? By what percent?

1973 - 1975

$\approx$ 20-25% DECREASE

$$\frac{8.2 - 10.6}{10.6} \times 100\%$$

$$\approx \boxed{-22.64\%}$$