1. (16 pts) In a recent survey people were asked if they took a vacation in the Summer, Winter, or Fall in the past year. The results were the following: 73 took a vacation in the Summer, 51 took a vacation in the Winter, 27 took a vacation in the Fall, and 2 had taken no vacation. Also, 10 had taken vacations at all three times, 13 had taken both a Summer and a Winter vacation, but not the Fall, 18 had taken only a Winter vacation, and 5 had taken both a Summer and Fall but not a Winter vacation.

Using S for Summer, W for Winter, and F for Fall, construct a 3-set Venn diagram, and answer the following questions.

(a) How many people had been surveyed?

\[73 + 2 + 2 + 10 + 18 = 105\]

(b) How many people had taken Summer vacation only?

\[73 - (13 + 10 + 5) = 45\]

(c) How many people had taken Fall vacation only?

\[27 - (5 + 10 + 10) = 2\]
2. (12 pts) John earns 150% more than Sam. How many times larger is John’s income than Sam’s?

\[(150+100)\% = 250\% = 2.5.\]

3. (12 pts) How much money will you have in 30 years if you invest $10,000 now at an APR of 4.75%, assuming

(a) that you earn simple interest.

\[A = 10,000 + 0.0475 \cdot 10,000 \cdot 30 = 24,250.\]

(b) interest is compounded quarterly.

\[A = 10,000 \left(1 + \frac{0.0475}{4}\right)^{4 \cdot 30} = 41,231.\]

(c) What is the APY, if we assume the interest is compounded quarterly?

\[APY = \left(1 + \frac{0.0475}{4}\right)^4 - 1 = 0.0484 = 4.84\%\]

4. (12 pts) If you sleep an average of 7 hours per day, how many hours do you spend sleeping in 5 years? How many weeks is this?

\[
\begin{align*}
7 \text{hr.} & \quad 365 \text{days} \quad 5 \text{years} = 12,775 \text{hr} \\
1 \text{day} & \quad 1 \text{year} \\
12,775 \text{hr} & \quad \frac{1 \text{day}}{24 \text{hr}} \quad \frac{1 \text{week}}{7 \text{days}} = 76 \text{weeks}.
\end{align*}
\]
5. (12 pts) The average cost of a house in Salt Lake City increased from $176,000 in 2010 to $201,500 in 2014. Find the absolute and relative change. (Express the relative change in %.)

\[
\text{absolute change} = \frac{201,500 - 176,000}{176,000} = \frac{25,500}{176,000} = 0.145 = 14.5\%.
\]

6. (12 pts) You want to build a $70,000 college fund in 16 years by making regular, weekly deposits. Assuming an APR of 4%, and assuming weekly compoundings, calculate how much you should deposit every week. (1 year = 52 weeks.)

\[
7 \cdot 10^4 = \text{PMT} \left( \frac{(1 + \frac{0.04}{52})^{52 \cdot 16}}{\frac{0.04}{52}} - 1 \right)
\]

\[
7 \cdot 10^4 = \text{PMT} \cdot 1,164.82
\]

\[
\text{PMT} = \frac{7 \cdot 10^4}{1,164.82} = \$60.10.
\]

(b) How much of the financial value comes from actual deposits, and how much from interest?

\[
\text{Total deposits} = \$60.10 \cdot 52 \cdot 16 = \$50,003.20
\]

\[
\text{In interest} = \$70,000 - \$50,003.20 = \$19,996.80.
\]
7. (12 pts) If the natural gas costs 0.70 British Pounds per liter, how much does it cost in dollars per gallon? (1 gallon = 4 quarts, 1 liter = 1.057 quarts, 1 British Pound = $1.65.)

\[
\frac{0.70 \text{ £}}{1 \text{ litre}} \cdot \frac{1 \text{ gallon}}{1.057 \text{ litre}} \cdot \frac{4 \text{ £}}{1 \text{ gallon}} \cdot \frac{1 \text{ £}}{1 \text{ £}} = 4.37 \text{ £/gal}
\]

8. (12 pts) There are approximately 135 million births worldwide in a year. Express this quantity in births per second.

\[
\frac{1.35 \cdot 10^8 \text{ births}}{1 \text{ year}} \cdot \frac{1 \text{ year}}{365 \text{ days}} \cdot \frac{1 \text{ day}}{24 \text{ hours}} \cdot \frac{1 \text{ hour}}{60 \text{ minutes}} \cdot \frac{1 \text{ minute}}{60 \text{ seconds}} = 4.28 \text{ births/s}
\]