1: Note: this problem also appeared in week 7. Let's look at the steps:

- A: Setup variables for the info (drunk, sober, crashes) given in the problem
- B: Find x and y in terms of these variables
- C: Simplify x/y
- D: Plug in for the simplified fraction using the given percentages
- E: Simplify into a numerical fraction

A: Suppose you are a driver on the road at no particular time. Let D, S, C be the events of being a drunk driver, sober driver, causing a fatal car crash respectively.

B: Since x is the probability of causing a crash if you're drunk, we have $x = P(C|D)$. Similarly, $y = P(C|S)$.

C: Rewrite $x = P(D|C)P(C)/P(D)$, $y = P(S|C)P(C)/P(S)$ using Bayes' Theorem. Substituting into the fraction x/y and canceling terms, we get $x/y = [P(D|C)P(S)]/[P(S|C)P(D)]$

D: Since 68% of all fatal car crashes are caused by sober drivers, we have $P(S|C) = 0.68$. Drivers are exactly one of drunk or sober, so $P(D|C) = 1 - P(S|C) = 0.32$. Surveys say only 3% of drivers are drunk, so $P(D) = 0.03$ and $P(S) = 1 - P(D) = 0.97$. We get $x/y = (0.32*0.97)/(0.68*0.03)$

E: Clean up decimals by multiplying by 10^4 to get $(32*97)/(68*3) = (8*97)/(17*3) = 776/51$. This is ≈15.2, quite a reminder of how much worse drinking makes drinking.

2: (x, y, z) = (6, -2, 3). Row reduction steps may vary by student. Talk to a mathematician if you are experiencing difficulty finishing a problem for more than 4 hours. To check your work for systems of equations problems, plug your final answer back into the initial equations.

3: After row reduction and solving for x, y, z, you should get x, y, z as fractions with a denominator of 7k+47. This means any $k \neq -47/7$ works. If $k = 47/7$, there are no solutions because the row reduction will reveal a row of the form $[0\ 0\ 0 \mid c]$ for some $c \neq 0$.

4: (a) False. You are not allowed to multiply a row by 0, which means that the "replacing … constant multiple of itself" is not allowed when that constant happens to be 0.

(b) True. If there was a solution (x,y,z) we'd have $a = 0*x+0*y+0*z = 0$, which is impossible.

(c) False. The system {x=0, y=0, x=y} represents 3 different lines, with the unique solution (0,0).

(d) False. The system {x=0, y=0, x+y+0*z=1} has no solution and no two planes are parallel