Problem Set #1

Problem # 2) A martian farmer looks out into the barnyard and sees tribbles (4 legs) and chalkas (7 legs). She says to her son, "I count 97 heads and 436 feet. How many tribbles and how many chalkas are out there?"

Strategy ~ Although there may be several ways to approach this problem I think that a drawing may be more effective than just guessing randomly. So the problem tells me that there are 97 heads so there are 97 animals. I need to figure out how many of the 97 animals are 7-legged chalkas and how many are 4-legged tribbles. If I draw 97 tribbles with 4 legs each, I will have accounted for 388 feet. 

\[ \text{97 tribbles} \times \frac{4 \text{ feet each tribble}}{388 \text{ feet on 97 tribbles}} \]

There are a total of 436 feet and I have accounted for 388 of them. In order to figure out how many feet are unaccounted for I want to subtract 388 from 436.

\[ \begin{align*}
436 \text{ feet} &- 388 \text{ feet} \\
48 \text{ feet remaining}
\end{align*} \]
So, there are 48 feet remaining. I know that chalkas have 7 feet each.

All of the 97 animals currently have 4 feet each (tribbles) and in order to turn them into chalkas 3 feet must be given to each animal.

Chalkas: 7 feet
Tribbles: 4 feet
3 additional feet on chalkas.

In order to figure out how many sets of 3 feet we have, we need to divide the total number of feet remaining by 3.

48 feet remaining ÷ 3 = 16 sets of 3

So, we can add 16 sets of 3 feet to the current 4-footed tribble population.

So there will be 16 chalkas with 7 feet and the remaining will be tribbles.

97 total animals
-16 chalkas
= 81 tribbles

So there are 16 chalkas and 81 tribbles in the barnyard.

√work correct!

To check the answer we can add up the heads and feet one last time.

218 chalka feet
+ 388 tribble heads
97 heads

436 total feet
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A martian farmer has 97 animals: --
Trikkles, with 4 legs
Chalkkos, with 7 legs.
Altogether the animals have 436 feet.
How many of each animal does the farmer have?

Assumed: - Martian animals have one head.
Derive these variables.
The sum of all animals (Trikkles + Chalkkos) is 97
\[ T + C = 97 \quad 0 \]

The sum of all feet (Trikkles \times 4 + Chalkkos \times 7) is 436
or \[ 4T + 7C = 436 \quad 2 \]

Since \( T \) and \( C \) are the same for each equation they can be used simultaneously.

From equation one we can represent the value of \( T \) in terms of \( C \):
\[ T + C = 97 \]
\[ T = 97 - C \]

We can now substitute the value of \( T \) in terms of \( C \) into equation two:
\[ 4T + 7C = 436 \]
becomes \[ 4(97 - C) + 7C = 436 \]
\[ 388 + 3C = 436 \]
so \[ 3C = 436 - 388 \]
\[ C = \frac{48}{3} = 16 \]
There are 16 chalkas in the barnyard.

We can now substitute the number of chalkas for the term 'c' in the first equation:

\[ t + c = 97 \]
\[ t + 16 = 97 \]
\[ \therefore t = 97 - 16 \]
\[ t = 81 \]

There are 81 tripkles in the barnyard.

If these values are correct, then substituting the numbers into the second equation should give the correct number of feet:

\[ 4t + 7c = 436 \]
\[ (4 \times 81) + (7 \times 16) = 436 \]
\[ 324 + 112 = 436 \]
\[ 436 = 436 \text{ good} \]

\[ \therefore \text{The Martian farmer has 81 tripkles and 16 chalkas in her barnyard.} \]
I must begin my explanation of this problem by saying my solution is based on as much fact as I could offer, but ultimately was decided by a lot of approximation and imagination.

20. McDonald’s has sold “over 100 billion hamburgers.” If we were to stack these hamburgers, how high would the stack be?

Against all better judgment, I purchased a Mighty Kids Hamburger Meal from McDonald’s for my son last week. Before he devoured it, I took a ruler and measured the burger from the top bun to the underside of the bottom bun with the meat patty in the middle. The measurement came to approximately 1 inch.

What I know about McDonald’s...I have been to McDonald’s in cities all over the country. One thing you can count on is the consistency of the food from one location to another. I have had people tell me they ate at McDonald’s in other countries and the food still tasted and looked exactly the same.

Based on my assumption that a hamburger from the McDonald’s I just went to was going to be approximately the same size as any other McDonald’s hamburger, I will assume they are all around 1 inch thick.

Therefore, if we stacked—shall I say, if we could—stack 100 billion hamburgers, I approximate that the stack would be approximately 100 billion inches high.

100 billion inches can also be converted to 8.3 billion feet.

By dividing 8.3 billion by 5280 (how many feet in a mile) we get 1,571,970 miles (rounded from 1,571,969.69697)

100 billion McDonald’s hamburgers stacked would go approximately as high as 1,571,970 miles!
Problems

MacDonald's has sold "over 100 billion hamburgers." If we were to stack these hamburgers, how high would the stack be?

Since the information given in the question is quite vague, the assumed goal of the answer is to impress upon an observer just how vast a number "over 100 billion" really is by translating it into a more easily pictured representation. That being the goal, rather than accuracy, assumptions may be made based on common knowledge.

Assumed: The height of an actual McDonald's hamburger (rather than the ones in the pictures) is approx. 1/4 inches. The American value of a billion \(10^9\) is implied.

The value "100 billion" can be used, since advertisers would have rounded up higher if they could have.

Using the assumptions given, a stack of hamburgers would measure \(1/4"\) multiplied by 100 billion: \(1/4 \times 100,000,000,000\).

or \(1.25 \times 100,000,000,000\). To make the calculation easier by calculator!

This value, \(1.25 \times 10^9\) or \(125,000,000,000,000\) inches, is still meaningless, however. It would make greater sense to represent it in a larger unit. Since I believe that the final answer will be...
a number of miles. I can use my prior knowledge to convert the inches to miles:

\[
1,760 \text{ yards} = 1 \text{ mile} \\
36 \text{ inches} = 1 \text{ yard}
\]

\[
\therefore \text{ To convert } 125,000,000,000 \text{ into yards it must be divided by 36.} \\
= 3,472,222,222 \text{ yards}
\]

and to convert this to miles, the above figure must be divided by 1,760.

\[= 1,972,853.5 \text{ miles} \]

This could equally well be achieved by dividing 1.25" by (1,760 x 36), the number of inches in a mile.

The distance of 1,972,854 miles can be more impressively represented as "over 8 times the distance from earth to the moon"

\[
\left( \frac{1,972,854}{239,000} \right) \text{ miles} \\
\]

The ultimate answer will vary according to the assumed height of the hamburger, and can never be 100% accurate given the terms of the question. The enormity of the figure, however, is now fully represented.

MacDonald's has sold enough hamburgers to stretch to the moon over eight times.
38. Examine the following phrase made famous by Fred Flinstone: y a b b a d a b b a d o o. If this pattern is repeated over and over, what letter will be in the 275th position?

First, I wrote down the pattern and numbered it:

\[
\begin{array}{cccccccccccc}
1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 & 11 & 12 & 13 \\
y & a & b & b & a & d & a & b & b & a & d & o & o \\
\end{array}
\]

Since there are 13 letters in this pattern, I decided that I can multiply 13 by few numbers and find a number closest to 275 by trial and error.

\[13 \times 10 = 130; 13 \times 20 = 260; 13 \times 21 = 273.\]

273 is very close to the wanted position of 275th position. 273rd position is 0, because if we divide 273 by 13 steps, we'll get 13, which is a letter 0. Therefore, if we count from 273rd step, 274th step is y and 275th step is a.

275th position is the first letter @ in the pattern above.

OK
38) If the phrase \textit{yabba dabba doo} was repeated continuously, which letter will be in the 275th position?

First, I will write out the phrase a couple times to get a visual representation of the repeated phrase:

\[ 	ext{yabba dabba doo / yabba dabba doo / yabba dabba doo} \]

Then, I will count the number of letters in the repeated phrase. Total number of letters = 13.

From this, I understand that the letter at the 13th position will be the final 0 at the end of the phrase, then the phrase will start again until the final 0 at the end of the phrase in the 26th position, then the phrase will start again until the final 0 at the 39th position.

From this pattern, I see that every 13th place the phrase will end with an 0 and begin again. Thus, to find the number in the 275th position, rather than writing out 275 letters of a 13 letter repeating phrase, I should see if 275 is a multiple of 13. If it is, then I know that the letter is an 0 since
on the chart x being able to visualize it. From that, I guess the end of the 20th pattern is pretty close. Multiplying 20 x 13 = 260. From there it is easy to add 13 more, which equals 273 and then count 2 more 275. 275 lands on the 2nd position in the pattern of YabbaDabbaDoo so the letter answer is "A".

#42) If you start with 1.23 it is easy to list while scanning the mind, how many times in one day will the numbers be consecutive digits. Starting with 1.23, the next number can't be 1.34 so it must be 2.34. Seeing the pattern while working my way around the clock, next is 3.45, then 4.56. 5.08 is not possible due to 60 seconds being more than 1 minute in the minute holder spot. 7.89 is the same case and so on, until we reach midnight and can start again with 12:34. There is no 13:45. I believe on a digital clock unless you get a special military issue and were host in the military so lets assume no military time and no stopocks show! That leaves us with 5 times during one 12 hour period.
Problem set 1:  
#42) cont.

Shaving on a digital clock the numbers we see consecutive. There are 24 hours in one day so we need to double 5 to equal 10.  
5 (consecutive digits) × 2 (12 hour periods) = 10 times/24 hrs.  
There are 10 times digits are consecutive during one day.

b) What digit most often appears in one day? Looking at the clock below, digit 1 appears not only for an hour 1 am. and 1 p.m. but also 12 a.m., 12 p.m., 11 a.m., 11 p.m., 10 a.m., and 10 p.m.

This means during the times listed above the one is showing for the whole hour. There is no other number close to reaching the time one has in hours (It is 5 hours/12 hr. period. 5 × 2 (to make 24 hrs. total) = 10 hours.

Because 10 out of 24 hours is such a large amount of time, we don't need to add up the time including minutes. It is clear digit one appears most often in one day.