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Computer Quandary

You are planning on buying a new laptop at Computers 'R' Us. The original price of the laptop was \$2,000. There is a 20% off sticker on the laptop. You have received a coupon in the mail to receive an additional 30% off your entire order (which includes any previous discounts). When you check out you are charged \$1,000 for the laptop before taxes. Were you charged the correct price for the laptop? If you were not charged the correct price, were you over or under charged? Describe the steps you used to determine your answer below (you may write on the back if necessary).

Answer: The 20% off sticker on the laptop would initially reduce the price by $0.2 * \$2000 = \400 , bringing the price of the laptop to $\$2000 - \$400 = \$1600$. The 30% off entire order coupon would then be applied to the \$1600. $30\% \text{ of } 1600 = 480$. The final price of the laptop would be $\$1600 - \$480 = \$1120$. Therefore, no; I was not charged the correct price for the laptop. I was undercharged by \$120.

Birthday Boggler

How many people would have to be in a room together in order to be certain that at least two people in the room have the same birthday? Describe the steps you used to determine your answer below (you may write on the back if necessary).

Answer: Since a year contains at most 366 distinct days, it could take as many as 367 people to guarantee a match between two of them. *Note:* Far fewer people are required, if one is willing to settle for it being "likely" that two people in the room have the same birthday, rather than being absolutely "certain" about it.

Bloody Calculations

What is the volume of all the human blood in the world? The average adult male has about 1.5 gallons of blood, an adult female has slightly less, and children considerably less. We can estimate that each person on earth has roughly one gallon of blood. The population of the world is currently estimated at about 7 billion. There are roughly 7.5 gallons per cubic foot. Using this information, estimate how much human blood is in the world. Use descriptors such as enough blood to fill the Durham Bulls Park, or just enough to fill an Olympic size swimming pool. (Neither of these is correct.) Describe the steps you used to determine your answer below (you may write on the back if necessary).

Answer: Using the estimates that each person has 1 gallon of blood and world population of 7 billion, there are roughly 7 billion gallons of blood in the world. For example, since there are about 7.5 gallons per cubic foot, that converts to $7,000,000,000 \text{ gallons} / 7.5 \text{ gallons per cubic foot} = 933,333,333.3$ cubic feet of blood.

From here, answers will vary, depending on what example is used to describe the 7 billion gallons or the 933,333,333.3 cubic feet.

Examples:

- a 45 foot steel shipping container has about a 3026 cubic foot capacity. If the world's blood supply were stored in these containers, we would need about 300,000 of them—enough to stretch end to end from Roxboro to Los Angeles.
- the flow over Niagara Falls is estimated to be around 6,000,000 cubic feet per minute (<http://www.niagaraparks.com/media/geology-facts-figures.html>). Dividing 933 million cubic feet by 6 million cubic feet per minute gives us about 155 minutes. So, it would take about 2 and a half hours for the world's blood to cascade over Niagara Falls. (Note: the time is dependent upon the Niagara flow rate estimate used.)

Cupcake Madness

The QR4U Club decided to make cupcakes for a campus celebration. The president of the club was responsible for bringing the cake mix, pans, and other supplies to the campus kitchen where the cupcakes would be baked. When it was time to mix the cupcake batter, the QR4Uers decided they needed to use exactly 5 cups of cake mix. The president had brought a large amount of cake mix, but no measuring cups. In the kitchen, they found two containers—one was a 7-cup container and the other was a 3-cup container. True to the QR4U Club's mission to apply math, the bakers figured out how to use the two containers to measure out exactly 5 cups of mix. How did they do it? Describe the steps you used to determine your answer below (you may write on the back if necessary).

Answer: Fill up the 3-cup container and pour its contents into the 7-cup container. Repeat. The 7-cup container now holds six cups of mix. Fill up the 3-cup container and use its contents to fill the 7-cup container. The 3-cup container now holds two cups of mix. Empty the 7-cup container. Pour the two cups of mix from the 3-cup container into the 7-cup container. Refill the 3-cup container and add its contents to the 7-cup container. The 7-cup container now holds exactly five cups of mix.

Squared Off

How many squares of all different sizes (1x1, 2x2, 3x3, ...) are on an 8x8 checkerboard? (It's ok for the squares to overlap one another; there will be more than 64 squares.) Describe the steps you used to determine your answer below (you may write on the back if necessary).

Answer: One approach to this problem might be to analyze smaller checkerboards, to see if some pattern emerges in counting the squares. For example:

- a 1 x 1 checkerboard would have one 1x1 square, giving us 1 square in all
- a 2 x 2 checkerboard would have one 2x2 square and four 1x1 squares, giving us $1 + 4 = 5$ squares in all
- a 3 x 3 checkerboard would have one 3x3 square and four 2x2 squares and nine 1x1 squares, giving us $1 + 4 + 9 = 14$ squares in all
- a 4 x 4 checkerboard would have one 4x4 square and four 3x3 squares and nine 2x2 squares and sixteen 1x1 squares, giving us $1 + 4 + 9 + 16 = 30$ squares in all

At this point, one might notice the pattern of adding perfect squares: 1, 4, 9, 16, 25, 36, 49... to obtain the number of total squares. That is, for an $n \times n$ checkerboard, there would be $1 + 4 + 9 + \dots + n^2$ squares.

For an 8×8 checkerboard, there are $1 + 4 + 9 + 16 + 25 + 36 + 49 + 64 = 204$ total squares.