



Samples of Our Problems

The Math Forum's PoWs provide non-routine constructed response problems. This document contains samples for every level—primary, math fundamentals, pre-algebra, algebra, geometry, and upper level mathematics. <http://mathforum.org/pow/>

Primary: Sweet Dreams

People dream an average of 5 times a night.

At that average, about how many dreams might you have in a week?

About how many dreams might your whole class have in one average night?

Tell how you solved the problem.



Math Fundamentals: Zoo Trip

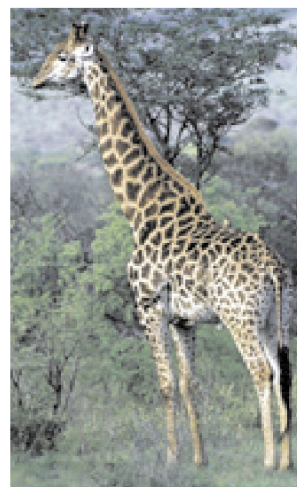
The zoo has a train that carries people between exhibits. One morning the first passengers got on at Monkey House. At Alligator Pond the number of people who got on was 3 more than got on at Monkey House.

The train made 4 more stops at Tiger Thicket, Panda Playground, Giraffe Savannah, and Big Cats. At each of these stops, 3 more passengers boarded the train than at the previous stop. At Big Cats 20 people got on the train.

How many passengers in all boarded the train?

Be sure to explain how you solved the problem and show how you know you are right.

Extra: What is the minimum (fewest) number of train cars that it would take to hold all those passengers at once, if each car holds 12 passengers?

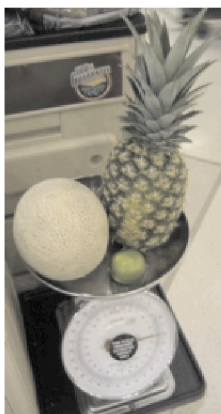


Pre-Algebra: Measuring Melons

Jerson is selling fruit at the Farmers' Market. To attract customers to his booth, he has made up a contest! He has these photos of combinations of fruit on display. His contest is to find out how much each fruit weighs.

Melanie looks at his photos and tells him, "I know how much one melon weighs."

How might Melanie have figured out how much one melon weighs? How much does each type of fruit weigh?



8.25 lbs.



9.5 lbs.



11.5 lbs.

Note: Assume that both of the melons weigh the same, both of the pineapples weigh the same, and both of the limes weigh the same.

Algebra: Marathon Mitch

My nephew Mitch loves to run. Recently he participated in the Midtown Mini-Marathon, a road race in a small Kansas town near where he lives.

During the race, he paced himself in the following way:

- He ran the first 50% of the distance at his normal running speed.
- For the next third of the distance he increased his speed by 25%.
- For the final 3 km of the race he again increased his speed, this time by 20%.



Given that he finished the race in 1 hour and 19 minutes, what is his normal running speed in kilometers per hour?

Extra: Mitch will run this same race again next year, and wants to train for it so he can better his time. If he will use the same pacing strategy, by what percent must Mitch increase his normal speed in order to finish the race in exactly 1 hour and 15 minutes?

Geometry: Dendrochronology

Dendrochronology is the study of the growth rings of trees.

Each ring represents one year of growth. You can always tell the age of a tree by cutting it down and counting the rings, but to figure out the age of a standing tree, you can guess based on the tree's diameter and the typical growth of the particular species.

In the picture below, Tom and Susan's hands are touching on the backside of this yellow birch. Tom's armspan is 72.5", and Susan's is 62.5", and their front hands are about 2 feet apart. If the average width of a growth ring of a yellow birch is $\frac{1}{8}$ ", about how old is this tree?



Upper Level: Squares Inside Squares

A few weeks ago I was Christmas shopping in my favorite toy store. I wandered through the aisles and noticed a toy made of boxes inside of boxes. As I looked at the toy, I noticed that the top view was a set of nested squares. It looked as if the original square was 6 inches long on one side. It also looked as if the corners of the next smaller square were at the midpoints of the original square (see diagram below).

1. Find the sum of the perimeters of the three squares in the figure.
2. Imagine that the process of nesting squares continues forever. The sum of the perimeters approaches a finite number. What is that number?

