palette of problems

Matt B. Roscoe and Stephan Pelikan

1. A car gets 30 mpg on the highway with 1 passenger, in addition to the driver. With each additional passenger, the car loses 1 1/3 mpg. How many gallons of gas would the car use to travel 25 miles on the highway with 3 passengers (and the driver)?

2. Caroline opened a café near Central Park. A small cup of coffee sells for $3.00, and a medium cup of coffee sells for $4.00. On the first day, 158 coffees were sold. Caroline took in $570.00. How many cups of each size were sold?

3. Mike and his sister want to go swimming in their new pool. However, first they need to fill it with water. It takes one hose 24 hours to fill the pool; it takes another hose 16 hours to fill the pool. How long will it take to fill the pool if both hoses are running at the same time?

4. For his 10th birthday, John's grandpa gave him a bag of marbles. There were 8 red marbles, 11 green marbles, 4 yellow marbles, and 9 blue marbles in the bag. If John reaches into the bag and randomly selects a marble, what is the probability that the marble is neither red nor yellow?

5. If two marbles are randomly drawn, one after the other, from the same bag described in problem 4, what is the probability that no red or yellow marbles appear in the two-marble draw?

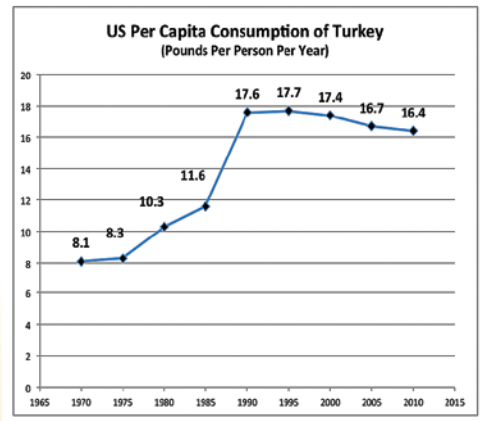
BLUE MARBLE: MARK PENNY/THINKSTOCK; GREEN MARBLE: JOHN_BRUESKE/THINKSTOCK

6. At Matt's house, it takes 23 seconds for hot water to reach the faucet after the water is turned on. How many gallons of water are wasted each year if it takes 4 seconds to fill an 8-ounce cup of water and Matt "waits for hot water" 3 times a day? (Hint: There are 128 ounces in a gallon.)

7. If the toppings on a 24-inch diameter pizza cover a 20-inch diameter circle, what percentage of the pizza's area is not covered in toppings?

8. Stephan considers the pizza in problem 7. He wonders if an 18-inch diameter pizza, whose toppings cover a 14-inch diameter circle, will have more, less, or the same percentage of area not covered in toppings. Help him find the answer.

9. Using the graph, determine which 5-year period saw the largest increase in per capita consumption of turkey. What was the percentage increase for the period?



Source: National Turkey Foundation (http://www.eatturkey.com/why-turkey/stats)

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10. From U.S. census figures, in 2000, the U.S. population was estimated to be 282.2 million people. In 2010, the estimate rose to 309.3 million people. Using the graph provided in problem 9, determine in which year more pounds of turkey were eaten.

11. How many four-digit numbers are possible in which the leftmost digit is odd, the rightmost digit is even, and all four digits are different?

12. The graphs of the equations $y = 2x$, $y = 1$, and $y = 1 + x$ bound a triangle T. What is the area of T?

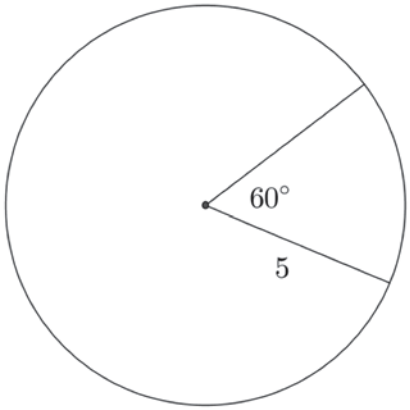
13. An 8.5 in. × 11 in. piece of paper is cut into 2 pieces by one straight cut.

- What is the shortest possible length of this cut?
- What is the longest possible length of this cut?
- If the perimeters of the resulting pieces sum to 61 inches, how long is the cut?

14. The right triangle S has area 8 and hypotenuse $\sqrt{20}$. Triangle R is similar to S and has hypotenuse 1. What is the area of R?

15. Find the collections of 3 consecutive integers with the property that their product is 21 times their sum.

16. A central 60 degree sector is removed from a circle of radius 5 cm. The straight edges are taped together to make a right circular cone. How high is the cone?



(Answers on page 254)

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