BRITISH COLUMBIA COLLEGES

Junior High School Mathematics Contest, 2002

Final Round, Part B

May 3, 2002

1. $PQRS$ is a rectangle inscribed in a circle. The circle has centre O and radius r. The angle POQ is $120°$.

   (a) Draw a diagram.

   (b) Find the degree measure of angle POS.

   (c) Find the length of side PS in terms of r.

   (d) Find the length of side PQ in terms of r.

   (e) Find the ratio of the circumference of the circle to the perimeter of the rectangle.

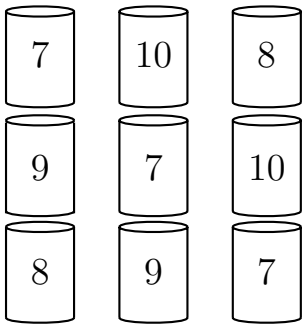
2. Write 58 as the sum of four positive integers so that if 1 is added to the first number, 2 is subtracted from the second, 3 multiplied by the third, and 4 divided into the fourth, the results are all equal. Find the four numbers.

3. Two circles have radii m and n, where $m > n$. The distance between their centres is k.

   (a) State the condition(s) relating m, n, and k that guarantee that the circles intersect in exactly one point.

   (b) State the condition(s) relating m, n, and k that guarantee that the circles intersect in exactly two points.

4. At a carnival game, you see nine paint cans stacked and numbered as shown below. You get three throws, and you must knock down one, and only one, can per throw. Further, a can may only by knocked down after the one(s) directly above it have been knocked down on a previous throw. Your first throw scores the number on that can, the second throw scores twice the number on that can, and the third throw scores triple the number on that can. To win a prize you must score exactly 50 points, no more, no less. Determine all of the possible combinations of throws that win a prize.



5. The diameter AD of a circle is perpendicular to side BC of the equilateral triangle ABC with D lying on BC. If the length of BC is 4, find the area of the shaded part of the circle that is outside the triangle.