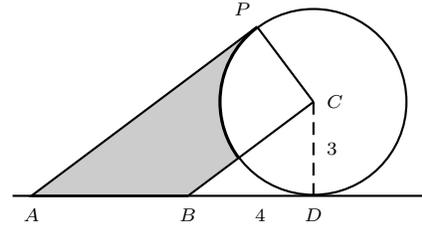# BRITISH COLUMBIA COLLEGES

Junior High School Mathematics Contest, 2003

Final Round, Part B

Friday May 2, 2003

1. In the diagram, the circle centered at C has radius $r = 3$, line segment AP is tangent to the circle at the point P, line segment BC is parallel to AP, and $\overline{BD} = 4$. Find the area of the shaded region.

2. Marvin's digital alarm clock displays the time in 12-hour format, but the " **:** " between the hours and the minutes is missing, so that when he goes to bed at 10 pm the night before the math contest the display appears to show the number 1000. That night Marvin is restless and keeps waking up and checking the clock. When he gets up the next morning at 7 am he realizes that every time he woke up and checked the clock, the display showed exactly a power of two, i.e., a number of the form 2^n where n is a non-negative integer, and that he saw every possible power of two that could be displayed. Find the maximum number of minutes that Marvin slept continuously that night.

3. A student walks to school 4 blocks north and 4 blocks east of her home. Her mother tells her that she must never go north of the diagonal line from her home to the school, though she can go through an intersection on the diagonal. (All of the blocks in the neighborhood are square.) Find the number of possible walks of minimum distance from her home to school.

4. A square has vertices $A(0,0)$, $B(0,5)$, $C(5,5)$, and $D(5,0)$. A line passing through the point $E(0,2)$ divides the square $ABCD$ into two congruent parts. Determine the equation of the line.

5. A 3-metre ladder stands vertically against a wall. It starts to slide down the wall keeping both the foot end and the top end of the ladder in contact with the floor and the wall, respectively. Find the length of the path followed by the midpoint of the ladder as it slides from the vertical position to the horizontal position.