BRITISH COLUMBIA SECONDARY SCHOOL MATHEMATICS CONTEST, 2008

Senior Preliminary

Wednesday, March 5

1. In a student council election, Samantha received 60% of the votes and Jason received all the rest. Samantha received 55 more votes than Jason. The number of students who voted was:

   (A) 110 (B) 220 (C) 275 (D) 550 (E) 240

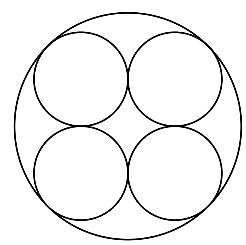
2. Consider the parabola with equation $y = 5x^2 - 4x + c$. The value of the real number c for which such a parabola touches the x-axis exactly once is:

   (A) $-\frac{4}{5}$ (B) 0 (C) $\frac{2}{5}$ (D) $\frac{4}{5}$ (E) $\frac{\sqrt{5}}{4}$

3. Hermione has three times as many nickels as dimes and six more pennies than she has dimes. If the total value of the coins is \$8.38, the number of dimes Hermione has is:

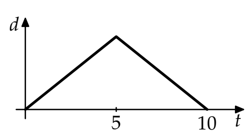
   (A) 32 (B) 33 (C) 38 (D) 39 (E) 46

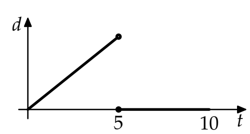
4. Four identical circles are fit inside a unit circle without overlapping. The circles can touch each other and the unit circle. (See the diagram.) The radius of each small circle is:

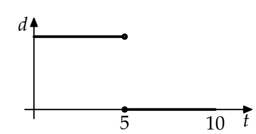
   

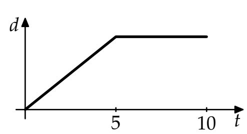
   (A) $\frac{1}{\sqrt{2}}$ (B) $\sqrt{2} - 1$ (C) $\frac{1}{\sqrt{2} - 1}$ (D) $\sqrt{2} + 1$ (E) $\frac{\sqrt{2} + 1}{\sqrt{2}}$

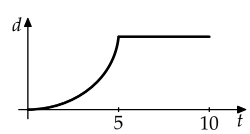
5. Joe walked directly away from his house at a constant speed for 5 minutes. Then he sat down on a bench and rested for 5 minutes. Suppose that d is the distance from Joe's house and t is the time in minutes. Among the graphs below the one that best represents Joe's movements over the 10 minute period is:

   (A) 

   (B) 

   (C) 

   (D) 

   (E) 

6. A woman walks one kilometre east, then one kilometre northeast, then another kilometre east over a flat field. The total distance, in kilometers, between the woman's starting position and her final position is:

   (A) $\sqrt{5 + \sqrt{2}}$ (B) $\sqrt{5 + 2\sqrt{2}}$ (C) $\sqrt{3 + 2\sqrt{2}}$ (D) $\frac{5}{2}$ (E) $\sqrt{10}$

7. Antonino is thinking of a number. He states "There are exactly 100 positive integers strictly less than my number that are divisible by 9 or 11, but not both. My number is the largest such integer." Antonino's number is:

   (A) 495 (B) 523 (C) 530 (D) 550 (E) 558

8. Tom and Jerry have six different CDs that they want to divide between them. The number of ways in which the CDs can be divided so that each of Tom and Jerry receives at least one CD is:

(A) 30 (B) 34 (C) 36 (D) 50 (E) 62

9. The sum

$$\sin^2(10^\circ) + \sin^2(20^\circ) + \cdots + \sin^2(170^\circ)$$

has a value of:

(A) 1 (B) 3 (C) 5 (D) 9 (E) 10

10. Garfield the cat sits at the center of a circle around which are placed seven lasagnas, one of which has extra cheese. Garfield will choose one lasagna to eat first, and then count clockwise around the circle until he has counted seven lasagnas from those remaining, starting from the lasagna next to the one he just ate. He then will eat the seventh lasagna. He will continue in this way until he has eaten all of the lasaganas. Garfield numbers the lasagnas from one to seven clockwise, with the lasagna with extra cheese being number one. If he wants to eat the lasagna with extra cheese last, the number of the lasagna he should eat first is:

(A) 2 (B) 3 (C) 4 (D) 5 (E) 7

11. Suppose we have a cube of side 4 cm. Let Q be the intersection point of two diagonals on one of the six faces. Let R be one of the vertices opposite the face containing point Q. The length $\overline{QR}$, in centimetres, is:

(A) 5 (B) $2\sqrt{6}$ (C) $3\sqrt{2}$ (D) $2\sqrt{5}$ (E) $\frac{5\sqrt{2}}{2}$

12. Four positive integers a, b, c, and d, not necessarily different, have the property that their product $abcd$ equals 2008. The number of possible values for the sum $a + b + c + d$ is:

(A) 1 (B) 3 (C) 4 (D) 7 (E) 8