

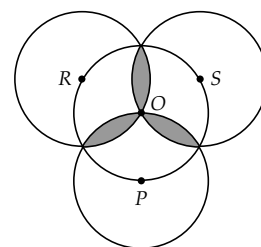
BRITISH COLUMBIA SECONDARY SCHOOL MATHEMATICS CONTEST, 2013

Senior Preliminary

Wednesday, April 3

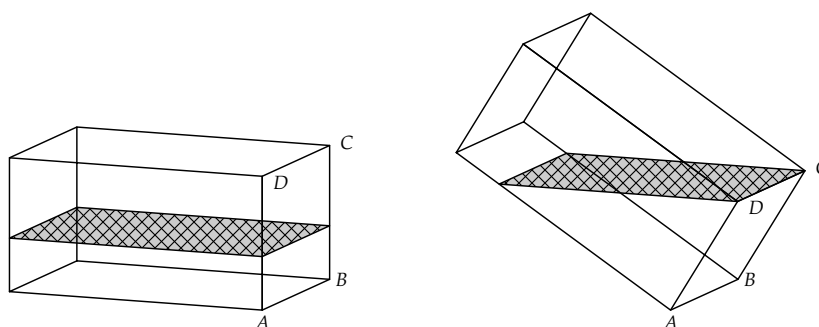
1. A rectangular box with no top has a volume of 70 cm^3 . The side lengths of the box are all integers greater than one. The largest possible value of the surface area of the box, measured in cm^2 is:
(A) 118 (B) 108 (C) 105 (D) 98 (E) 70
2. If $x^2 + x = 1$, then the value of the expression $x^3 + 2x^2 + 2013$ is:
(A) 2011 (B) $2012 - \sqrt{5}$ (C) $2013 - \sqrt{5}$ (D) 2013 (E) 2014
3. The number of ordered pairs, (x, y) , of positive integers x and y that are solutions to the equation $2x + 3y = 763$ is:
(A) 255 (B) 256 (C) 128 (D) 127 (E) 126
4. A death ray is mounted on top of a platform which rotates at a constant speed of one revolution per hour. Every 275 seconds the death ray fires a short burst. Let n be the number of times the death ray has been fired when the same spot is hit for the second time. The smallest possible value of n is:
(A) 47 (B) 48 (C) 144 (D) 145 (E) 150
5. Albert has sixteen quarters, one of which is counterfeit and heavier than the other coins. He only has a single balance scale that he can use to identify the counterfeit coin. The minimum number of weighings that will guarantee that Albert can identify the counterfeit coin is:
(A) 1 (B) 2 (C) 3 (D) 4 (E) 5
6. A gambler has k dollars at the beginning of his day of gambling. He pays \$5 admission to enter a casino. When he leaves the casino he has twice as much money as he had when he started gambling. He then pays \$5 for parking and drives to a second casino where he pays another \$5 for admission. When he leaves the second casino he has twice as much money as he had when he started gambling there. When he pays another \$5 for parking, he finds that he has no money left. The value of k is:
(A) 10.00 (B) 11.25 (C) 12.00 (D) 20.00 (E) 22.50

7. A circle of radius 1 has centre at point O . A second circle of radius 1 with centre at point P on the first circle passes through point O . Two other circles of radius 1 have centres at points R and S on the original circle. Each of these circles passes through point O and one of the points of intersection of the first two circles, and one of their points of intersection lies on the first circle at Q . The total area of the resulting shaded flower petal shaped region is:



- (A) $\frac{2\pi - 3\sqrt{3}}{2}$ (B) $\frac{4\pi - 3\sqrt{3}}{4}$ (C) $\frac{\pi - \sqrt{3}}{2}$
(D) $\frac{4\pi - 9}{4}$ (E) $\frac{2\pi - 3}{2}$

8. The number of values of x that satisfy the equation $||5x - 4| - 6| = 3$ is:
 (A) 0 (B) 1 (C) 2 (D) 3 (E) 4
9. Dawn goes into a bookstore and buys three items to help her do her crossword puzzles. The most expensive item is a dictionary and the least expensive is an eraser. She also buys a pencil. The total cost of the three items, before tax, is \$70.35. After leaving the store she notices that if she multiplies the costs, in dollars, of the three items, the product equals the before tax cost. The cost of the pencil, in dollars, is:
 (A) 0.15 (B) 0.21 (C) 0.35 (D) 3.00 (E) 5.00
10. An aquarium is 20 cm wide, 30 cm long and 15 cm deep. It is tilted along the edge AB until the water completely covers the end $ABCD$. At this point the water also covers $\frac{4}{5}$ of the base. The depth of the water, measured in centimetres, when the aquarium is level is:



- (A) 3 (B) 6 (C) 9 (D) 12 (E) 15
11. A positive integer p is prime if it is greater than 1 and is divisible only by 1 and itself. The number of prime numbers, p , for which $2p + 1$ is a perfect cube is:
 (A) 0 (B) 1 (C) 2 (D) 4 (E) Answer is infinite
12. Vancouver is known for its weather. Here is a meteorological report for the first 100 days in 2013 in Vancouver: on 90 of the days it was cold, on 80 of the days it was cloudy, on 75 of the days it rained, on 20 of the days it was cold and not cloudy. It was also noted that on days that were not cloudy it never rained, and on days it was cloudy and not cold it always rained. Using this information, the number of the first 100 days in 2013 when it was cold and it rained and it was cloudy was:
 (A) 35 (B) 45 (C) 55 (D) 65 (E) 75